BC
BEO CLEAN
ENERGY Ltd.
“BEO ČISTA ENERGIJA” doo

ENVIRONMENTAL IMPACT

ASSESSMENT STUDY
OF PROJECT: FACILITY FOR THE ENERGY UTILIZATION
OF MUNICIPAL WASTE AND LANDFILL GAS "VINČA" IN BELGRADE

Belgrade, September 2019

ENVIRONMENTAL IMPACT
ASSESSMENT STUDY
OF PROJECT: FACILITY FOR THE ENERGY UTILIZATION
OF MUNICIPAL WASTE AND LANDFILL GAS "VINČA"

PROJECT LEADER: **"BEO ČISTA ENERGIJA“** DOO
272 v Tošin Bunar Str.
11000 Belgrade

DEVELOPMENT OF THE STUDY: **"DVOPER“** DOO
11000 Belgrade
5 Dečanska Str.

INVOLVED DEVELOPERS: **NEBOJŠA POKIMICA,** B.Sc./Spec. in Toxicological Chemistry

PhD TANJA RADOVIĆ, B.Sc. in Tech. Engin. /PhD
license number: 371 M423 13

BRATISLAV KRSTIĆ, B.Sc in Techn. Engin.
license number: 371 C790 06

DOBRIVOJE DŽIPKOVIĆ, B.Sc in Mech. Engin.
license number 330 D733 06

PAVLE CVETIĆ, B.Sc. in Landscape Architecture and Horticulture

BOJANA LALOVIĆ, MSc Environmental Engineer

Belgrade, September 2019

GENERAL SHEETS

Република Србија
Агенција за привредне регистре

Search of economic entities

Back to search

Basic data

Business Name: Beo Čista Energija d.o.o.Belgrade Status:
Active company
Identification number: 21319775
Legal form: Limited Liability Company Seat: Municipality: Belgrade-Novi Beograd | City: Belgrade-Novi Beograd | Street and number: Tošin Bunar 272 v
Date of establishment: 12.09.2017
Tax ID: 110224482

Business data

Data of establishment

Registration date: 12.09.2017

Time of duration

Duration limited to: Unlimited

Main activity

Activity Code: 3821
Name of activity: Non-hazardous waste treatment and disposal

Other identification data

Tax Identification Number Tax ID: 110224482

Legal representatives

Natural persons

First name Last Name: Mitsuaki Harada
Position: Director
First name Last Name: Philippe Pierre Marie Auguste Thiel
Position: Director
First name Last Name: Vladimir Milovanović Position:
Director

Република Србија
Агенција за привредне регистре

Registry of Business Entities 5000131503543 BD 90335/2017

On 26.10.2017 Belgrade

Registrar of the Registry of Business Entities kept by the Business Registers Agency pursuant to Article 15, paragraph 1of the Law on Registration Procedure at the Business Registers Agency ("Official Gazette of RS", no.99/2011, 83/2014), deciding on the registration application for data change with Beo Čista Energija d.o.o.Belgrade, identification number:21319775, submitted by:

Name and surname: Iskra Lazić

adopts the

DECISION

The registration application, SHALL BE ADOPTED and a change of data is registered in the Registry of Companies at:

Beo Čista Energija d.o.o.Belgrade

Identification/registration number: 21319775

the following changes:

Change of legal representatives:
Natural persons:
The following is omitted:

- Name and surname: Belinda Faith Howarth
  Passport number and country of issue: 531723769 United
  Kingdom Position in the company: Director
  Mode of representation: jointly
  Restriction on the power of representation by co-signature:
  - A valid representation of the Company requires the signature of two directors.

- Name and surname: Stéphane Cédric Heddesheimer
  Passport number and country of issue: 07CF52294 France
  Position in the company: Director
  Mode of representation: jointly
  Restriction on the power of representation by co-signature:
  - A valid representation of the Company requires the signature of two directors.

- Name and surname: Jean-François Gagnaire
  Passport number and country of issue: 11AV09118 France
  Position in the company: Director
  Mode of representation: jointly
  Restriction on the power of representation by co-signature:

- A valid representation of the Company requires the signature of two directors.

The following is registered:

- Name and surname: Mitsuaki Harada
  Passport number and country of issue:TZ1237381
  Japan Position in the company: Director
  Representation mode: jointly
  Restriction on the power of representation by co-signature:
    - A valid representation of the Company requires the signature of two directors.

- Name and surname: Philippe Pierre Marie Auguste Thiel
  Passport number and country of issue:15FV32897 France
  Position in the company: Director
  Mode of representation: jointly
  Restriction on the power of representation by co-signature:
    - A valid representation of the Company requires the signature of two directors.

- Name and surname: Vladimir Milovanović
  Unique citizen's number:1002961710207
  Position in the business entity: Director
  Representation mode: jointly
  Restriction on the power of representation by co-signature:
    - A valid representation of the Company requires the signature of two directors.

Justification

On 25.10.2017, the applicant submitted the registration application for the change of data Number BD 90335/2017 and with the application it submitted the documentation specified in the certificate on the received registration application.

Verifying the fulfilment of the conditions for registration of the change of data prescribed by the provision of Article 14of the Law on Registration Procedure at the Business Registers Agency, the Registrar determined that the conditions for registration were fulfilled, and decided as in the operative part of the decision, in accordance with the provision of Article 16of the law.

The amount of the fee for conducting the registration procedure is determined by the Decision on fees for registration activities and other services provided by the Business Registers Agency ("Official Gazette of RS", no.119/2013, 138/2014, 45/2015 and 106/2015).

INSTRUCTIONS ON LEGAL REMEDIES:

An appeal may be lodged against this Decision to the Minister responsible for the position of companies and other forms of business, within 30 days from the day of their publication on the Agency's website, and through the Agency.

REGISTRATOR ___________________

Miladin Maglov

ИЗВОД О РЕГИСТРАЦИЈИ ПРИВРЕДНОГ СУБЈЕКТА	Република Србија Агенција за привредне регистре

8000041375268

ОСНОВНИ ИДЕНТИФИКАЦИОНИ ПОДАТАК

Матични / Регистарски број	20407441

СТАТУС

Статус привредног субјекта	Активно привредно друштво

ПРАВНА ФОРМА

Правна форма	Друштво са ограниченом одговорношћу
Извор средстава за оснивање и пословање задруге	улози

ПОСЛОВНО ИМЕ

Пословно име	DRUŠTVO ZA ZAŠTITU ŽIVOTNE SREDINE I ODRŽIVI RAZVOJ DVOPER DOO BEOGRAD (STARI GRAD)
Скраћено пословно име	DVOPER DOO BEOGRAD

ПОДАЦИ О АДРЕСАМА

Адреса седишта

Општина	Београд-Стари Град
Место	Београд-Стари Град
Улица	Дечанска
Број и слово	5
Спрат, број стана и слово	/ /

ПОСЛОВНИ ПОДАЦИ

Подаци оснивања

Датум оснивања	11. април 2008

Време трајања

Време трајања привредног субјекта	Неограничено

Претежна делатност

Шифра делатности	7120

Назив делатности	Техничко испитивање и анализе
Остали идентификациони подаци	
Порески Идентификациони Број (ПИБ)	105557340
Подаци о статуту / оснивачком акту	
Не постоји обавеза овере измена оснивачког акта	Датум важећег статута
	Датум важећег оснивачког акта

Законски (статутарни) заступници

Физичка лица

1. Име	Небојша	Презиме	Покимица
ЈМБГ	0101972780015		
Функција	Директор		
Ограничење супотписом	не постоји ограничење супотписом		

Директори / чланови одбора директора

Директори

Чланови одбора директора

1. Име	Небојша	Презиме	Покимица
ЈМБГ	0101972780015		

Прокуристи

Појединачна прокура

1. Име	Ратко	Презиме	Ђорђевић
ЈМБГ	0405943330077		

Чланови / Сувласници

Подаци о члану

Пословно име	DVOKUT-ECRO DOO
Регистарски / Матични број	00539651

Подаци о капиталу

Новчани

износ	датум
Уписан: 3.000,00 EUR, у противвредности од 247.026,90 RSD	

износ	датум
Уписан: 3.752.973,10 RSD	
Уплаћен: 3.000,00 EUR, у противвредности од 247.026,90 RSD	28. март 2008
Уплаћен: 3.752.973,10 RSD	4. март 2015

Сувласништво удела од износ(%) **100,00000**

Основни капитал друштва

Новчани

износ	датум
Уписан: 3.000,00 EUR, у противвредности од 247.026,90 RSD	
Уписан: 3.752.973,10 RSD	
Уплаћен: 3.000,00 EUR, у противвредности од 247.026,90 RSD	28. март 2008
Уплаћен: 3.752.973,10 RSD	4. март 2015

Регистратор, Миладин Маглов

EXCERPT ON THE REGISTRATION OF A BUSINESS ENTITY

BASIC IDENTIFICATION DATA

Registration / Identification number | 20407441

STATUS

Business entity status | Active company

LEGAL FORM

Legal form: Limited liability company

Source of funds for establishing and operating a cooperative:DEPOSITS

BUSINESS NAME

Business name DRUŠTVO ZA ZAŠTITU ŽIVOTNE SREDINE I ODRŽIVI

RAZVOJ DVOPER DOO BEOGRAD STARI GRAD

Short business name | DVOKUT DOO BELGRADE

ADDRESS DATA

Head Office address

Belgrade-Stari Grad Municipality

City | Belgrade-Stari Grad

Street Dečanska -

Number and letter 8 - -

Floor, apartment number and letter

BUSINESS DATA

Establishment information

Foundation date April 11, 2008

Duration

Duration of business entity Unlimited

Main activity

Activity code 7120

Activity name: Technical testing and analysis

Other identification information

Tax Identification Number (PIB) 1 | 105557340

Information on the statute/articles of association

There is no obligation to certify the changes

of acts of association

Date of valid statute

Date of the founding act in force

Legal (statutory) agents

Natural Persons

Name:Nebojša

Surname:Pokimica

Unique citizen's number (JMBG) 0101972780015

Position | Director

Co-signature restriction

there is no restriction by co-signature

by co-signature

Directors/members of the Board of Directors

Directors

Board members

First Name Nebojša Surname Pokimica

Unique citizen's number (JMBG) 0101972780015

Procurators

Individual procura

Name Ratko Surname Đorđević

Unique citizen's number (JMBG) 0405943330077

Members/Co-owners

Member information

Business name | DVOKUT-ECRO doo

Registration/

Identification number 00539651

Information on the capital

Payment amount

amount date

Subscribed:EUR 3,000.00, in counter value of RSD 247,026.90

Amount date

Subscribed:RSD 3,752,973.10

Paid:EUR 3,000.00, in counter value of March 28, 2008.

RSD 247,026.90

Amount date

Paid:RSD 3,752,973.10 March 4, 2015

Amount (%)

Co-ownership of the share of 100,00000

The share capital of the company

Cash

amount date

Subscribed:EUR 3,000.00, in counter value of

RSD 247,026.90

amount date

Subscribed:RSD 3,752,973.10

amount date

Paid:EUR 3,000.00, in counter value of

RSD 247,026.90

March 28, 2008

Amount date

Paid:RSD 3,752,973.10 March 4, 2015

ИНЖЕЊЕРСКА КОМОРА СРБИЈЕ

ЛИЦЕНЦА

ОДГОВОРНОГ ПРОЈЕКТАНТА

На основу Закона о планирању и изградњи и
Статута Инжењерске коморе Србије

УПРАВНИ ОДБОР ИНЖЕЊЕРСКЕ КОМОРЕ СРБИЈЕ
утврђује да је

Тања Т. Радовић

дипломирани инжењер технологије
ЛИБ 11580077263

одговорни пројектант

технолошких процеса

Број лиценце
371 М423 13

ПРЕДСЕДНИК КОМОРЕ

Милован Главоњић
дипл. инж. ел.

У Београду,
4. јула 2013. године

License

of the CHIEF DESIGNER

In accordance with Law on Planning and Construction

of the Statute of the Serbian Chamber of Engineers

BOARD OF DIRECTORS OF THE CHAMBER OF ENGINEERS OF SERBIA

establishes that

Tanja T.Radović

Graduate Engineer of Technology

LIB 11580077263

is the Chief Designer

of technological processes

License No.

371 M423 13

PRESIDENT OF THE CHAMBER

Chamber President

Milovan Glavonjić

B.Sc. El. Eng.

In Belgrade,

July 4, 2013

ИНЖЕЊЕРСКА КОМОРА СРБИЈЕ

ЛИЦЕНЦА

ОДГОВОРНОГ ПРОЈЕКТАНТА

На основу Закона о планирању и изградњи и
Статута Инжењерске коморе Србије

УПРАВНИ ОДБОР ИНЖЕЊЕРСКЕ КОМОРЕ СРБИЈЕ
утврђује да је

Братислав Б. Крстић

дипломирани инжењер технологије
ЈМБ 0708959710131

одговорни пројектант

технолошких процеса

Број лиценце

371 С790 06

SERBIAN CHAMBER OF ENGINEERS

LICENCE

of the CHIEF DESIGNER

У Београду,
26. јануара 2006. године

ПРЕДСЕДНИК КОМОРЕ

Милан Вуковић
дипл. грађ. инж.

In accordance with Law on Planning and Construction
of the Statute of the Serbian Chamber of Engineers

BOARD OF DIRECTORS OF THE CHAMBER OF ENGINEERS OF SERBIA
establishes that
Bratislav B. Krstić

Graduate Engineer of Technology
JMB 0708959710131

Chief Designer

of technological processes

License No.
371 C79006

Chamber President

Milan Vuković
BSc Cons. Eng.

In Belgrade,
January 26, 2006

Број: 12-02/336525
Београд, 14.02.2019. године

На основу члана 75. Статута Инжењерске коморе Србије ("СГ РС", бр. 88/05,16/09 и 27/16), а на лични захтев члана Коморе, Инжењерска комора Србије издаје

ПОТВРДУ

Којом се потврђује да је Братислав Б. Крстић, дипл.инж.техн.

лиценца број

371 C790 06

за

одговорног пројектанта технолошких процеса

на дан издавања ове потврде члан Инжењерске коморе Србије, да је измирио обавезу плаћања чланарине Комори закључно са 26.01.2020. године, као и да му одлуком Суда части издата лиценца није одузета.

М.П.

РЕПУБЛИКА СРБИЈА ИНЖЕЊЕРСКА КОМОРА СРБИЈЕ БЕОГРАД

Потпредседник Управног одбора
Инжењерске коморе Србије

ЛОбрадовић

Латинка Обрадовић, дипл. грађ. инж.

Number:12-02/336525
Belgrade, 14.02.2019

Pursuant to Article 75of the Statute of the Serbian Chamber of Engineers ("OG of RS", no.88/05, 16/09 and 27/16), and at the personal request of a Chamber member, The Serbian Chamber of Engineers issues

CERTIFICATE

Confirming that Bratislav B.Krstić, B.Sc.Tech.
licence No.

371 C790 06

for
the chief designer of technological processes

on the day of issue of this certificate is a member of the Serbian Chamber of Engineers, that he settled the obligation to pay the membership fee to the Chamber as of 26.01.2020.

and that his license had not been revoked by a decision of the Court of Honor.

Vice President of the Board of Directors

of the Chamber of Engineers

Latinka Obradović BSc Constr.Eng.

TERMS OF REFERENCE

In accordance with the positive legislation and the Decision on determining the scope and content of the Study on environmental impact assessment of the project for the construction of a new landfill with accompanying facilities at the Vinča site in Belgrade, Ministry of Environment, number 353-02-00815/2018-03 of 09.05.2019, prepare an ENVIRONMENTAL IMPACT ASSESSMENT STUDY: PLANT FOR THE ENERGY UTILIZATION OFMUNICIPALWASTE AND THE LANDFILL GAS "VINČA".

Belgrade, September 2018

INVESTOR

____

Pursuant to Article 128 of the Law on Planning and Construction ("Official Gazette of RS" No. 145/2014), the Law on Environmental Protection ("Official Gazette of RS" No. 14/2016 and 95/2018) and the Law on Environmental Impact Assessment ("Official Gazette of RS" No. 36/09), I adopt the following

DECISION
ON THE DESIGNATION OF THE CHIEF DESIGNER

For the production of the

ENVIRONMENTAL IMPACT ASSESSMENT STUDY OF PROJECT: PLANT FOR THE ENERGY UTILIZATION OF MUNICIPAL WASTE AND THE LANDFILL GAS "VINČA"

of Project Leader "BEO ČISTA ENERGIJA" DOO from Belgrade, the following shall be appointed as the Chief Designer:

PhD Tanja Radović, BSc in Tech. Eng./PhD

The appointed is obliged to do all the relevant documentation in accordance with the above laws, professional rules and engineering practice.

JUSTIFICATION

For the purposes of Article 128 of the Law on Planning and Construction, it is stipulated that the preparation of technical documentation is carried out by a responsible designer who must meet the prescribed conditions.

Belgrade, September 2018

Director

Nebojša Pokimica

Pursuant to Article 19of the Law on Environmental Impact Assessment ("Official Gazette of RS", No. 36/09), I adopt the following

DECISION

A multidisciplinary team is designated to draft the ENVIRONMENTAL IMPACT ASSESSMENT STUDY: PLANT FOR THE UTILIZATION OF MUNICIPAL WASTE AND LANDFILL GAS "VNČA", of Project Leader "BEO ČISTA ENERGIJA" DOO from Belgrade, in the following composition:

Chief Designer: PhD Tanja Radović, B.Sc.Tech./Ph.D.License number:371 M423 13

Team members: NEBOJŠA POKIMICA, BSc in Chemistry/ Spec. of Toxicological Chemistry BRATISLAV KRSTIĆ, BSc in Tech. Eng.
License number: 371 C790 06
DOBRIVOJE DŽIPKOVIĆ, BSc in Mech. Eng. *License number 330 D733 06*
NATAŠA ĐOKIĆ, BSc in Geol. Eng.
PAVLE CVETIĆ, BSc in Landscape Architecture and Horticulture BOJANA LALOVIĆ, Master Environmental Engineer

Appointees are required to comply with environmental legislation, technical norms, standards and professional rules when drafting the Environmental Impact Assessment Study.

Belgrade, September 2018

Director

Nebojša Pokimica

Based on the Law on Planning and Construction ("Official Gazette of RS" 145/2014) and the Law on Environmental Protection ("Official Gazette of the Republic of Serbia" No. 14/2016 and 95/2018)

I DECLARE

When drafting the

ENVIRONMENTAL IMPACT ASSESSMENT STUDY OF PROJECT: PLANT FOR THE ENERGY UTILIZATION OF MUNICIPAL WASTE AND LANDFILL GAS "VINČA"

I fully complied with:

- Terms of Reference
- Relevant legal regulations pertaining to the project in question - Rules of the profession regarding the solutions given in this project

In Belgrade, September 2019

Chief Designer:

PhD Tanja Radović,
B.Sc.Tech./Ph.D.License
number:371 M423 13

CONTENTS

Legend of abbreviations used

English		Serbian	
APC	Air Pollution Control	KZV	Kontrola zagađenja vazduha
APCR	Air Pollution Control Residue	KRZV	Kontrola rezidualnog zagađenja vazduha
BAT	Best available techniques	NRT	Najbolje raspoložive tehnike
BCE	Beo Čista Energija d.o.o.	BČE	Beo Čista Energija d.o.o.
BOD	Biological Oxygen Demand (5days)	BPK	Biološka potrošnja kiseonika(5 dana)
BREF	Best available techniques (BAT) Reference document developed under the IPPC Directive and the IED	NREF	Najbolje raspoložive tehnike (NRT) Referentni dokument razvijen pod IPPC Direktivom i DIE
CEMS	Continuous Emission Monitoring System	SKPE	Sistem kontinuiranog praćenja emisija
CHP	Cogeneration or combined heat and power	KTE	Kogeneracija kombinovane toplote i energije
City/CoB	City of Belgrade	Grad	Grad Beograd
CO	Carbon monoxide	CO	Ugljen monoksid
COD	Chemical Oxygen Demand	HPK	Hemijska potrošnja kiseonika
CPU	Central Processing Unit	CJP	Centralna jedinica za preradu
CV	Calorific Value	KV	Kalorijska vrednost
E&S	Environmental and Social	ZŽSSZ	Zaštita životne sredine i socijalna zaštita
EfW	Energy from Waste	EiO	Energija iz otpada
EMS	Elektromreža Srbije (Transmission Network Operator)	EMS	Elektromreža Srbije (Operater dalekovodne mreže)
EPS	Elektroprivreda Srbije (Distribution Network Operator)	EPS	JP Elektroprivreda Srbije
ESIA	Environmental and Social Impact Assessment Study	PUŽSSP	Procena uticaja na životnu sredinu i socijalna pitanja
EU	European Union	EU	Evropska Unija
FGT	flue gas treatment	TDG	tretiranje dimnog gasa
GC	Gradska čistoća Beograd	GČ	Gradska čistoća Beograd
GHG	Greenhouse gases	GSB	Gasovi staklene bašte
GWP	Global Warming Power	SGZ	Snaga globalnog zagrevanja planete Zemlje
HCl	Hydrochloric Acid	HCl	Hidrohlorna kiselina
HDPE	High-Density Polyethylene	PVG	Polietilen visoke gustine
HF	Hydrogen fluoride	HF	Vodonik fluorid
Hg	Mercury	Hg	Živa

HV	High Voltage	VN	Visoki napon
IBA	Incinerator Bottom Ash	PDI	Pepeo na dnu insineratora
IDP	Internally displaced people	IRL	Interno raseljena lica
LCV	Low Calorific Value	NKV	Niska kalorijska vrednost
LFG	Landfill Gas	DG	Deponijski gas
LHV	Low Heating Value	NTM	Niska toplotna moć
LP	Low Pressure	NP	Nizak pritisak
LRAP	Livelihood Restoration Action Plan	APOSŽ	Akcioni plan za obnavljanje sredstava za život
LTP	Leachate Treatment Plant	PPPV	Postrojenje za preradu procednih voda
LV	Low Voltage	NN	Nizak napon
m.a.s.l.	Meter Above Sea Level	m.n.m.	Metara iznad nivoa mora
MEP	Ministry of Environment Protection	MZŽS	Ministarstvo zaštite životne sredine
MP	Medium Pressure	UP	Umereni pritisak
MSW	municipal solid waste	KČO	komunalni čvrsti otpad
MV	Medium Voltage	SN	Srednji napon
NOx	Nitrogen Oxide	NOx	Azot oksid
O&M	Operation and Maintenance	RIO	Rad i održavanje
OHL	Overhead Transmission Line	VVPD	Vazdušni vod za prenos na daljinu
PPP	Private Public Partnership	JPP	Javno privatno partnerstvo
PUC	Public Utility Company	KP	Komunalno preduzeće
RAP	Resettlement Action Plan	APR	Akcioni plan za raseljavanje
RDF	Refuse Derived Fuel	GDO	Gorivo dobijeno iz otpada
RMW	Residual Municipal Waste	ZKO	Zaostali komunalni otpad
RO	Reverse Osmosis Unit	JRO	Jedinica za reverznu osmozu
RWD	Republic Water Directorate	RDV	Republička direkcija za vode
SNCR	Selective Non-Catalytic Reduction	SNR	Selektivna nekatalitička redukcija
SPV	Special-Purpose Vehicle	VSN	Vozilo specijalne namene
TOC	Total Organic Carbon	UOU	Ukupni organski ugljenik
WWT	Waste Water Treatment	PPOV	Postrojenje za prečišćavanje otpadnih voda
DRP	Detailed Regulation Plan	PDR	Plan detaljne regulacije
CiM	City Municipality	GO	Gradska opština
CaM	Cadastral Municipality	KO	Katastarska opština
RHSS	Republic Hydrometeorological Service of Serbia	RHMZ	Republički hidrometeorološki zavod
MCL	Maximum Continuous Load	MCR	Maksimalno kontinualno opterećenje

INTRODUCTION

The subject of this study is the environmental impact assessment of the construction and operation of the municipal waste and landfill gas energy utilization facility at the site of the Vinča landfill in the territory of the City of Belgrade as part of the municipal waste treatment and disposal complex at the site.

The site has been used for more than 40 years for municipal waste disposal and receives an average of 550,000 tonnes of municipal solid waste (MSW) each year, from 13 of the 17 Belgrade municipalities. A comprehensive project for the arrangement of the Vinča landfill site as well as the planned concept of waste management at this site involves the closure, rehabilitation and recultivation of the existing landfill body, construction of new facilities for energy utilization of municipal waste and landfill gas with other supporting facilities and infrastructure.

The project plans:

- cessation of active use of the existing landfill body - closure after remediation and stabilization (with introduction of treatment of leachate water from the landfill body and extraction and use of landfill gas), with final humus layer coverage;
- introduction of a modern system of treatment and disposal of municipal waste, on a site of approximately 60 ha, which is located within the existing complex of the Vinča landfill with the following basic facilities:
  - Facility for the treatment of municipal waste with energy utilization (Heat/Electric) – EfW Plant;
  - Landfill gas utilization plant;
  - Construction and demolition waste treatment plant (CDW);
  - Leachate treatment plant (LTP);
  - Landfill for non-energy-efficient municipal waste (unprocessed waste);
  - Landfill for disposal of residues from the EfW plant for energy utilization of municipal waste;
  - Landfill for inert waste;
  - Other ancillary facilities.

The whole project is carried out under a public-private partnership agreement concluded between the City of Belgrade and the special purpose company "Beo Čista Energija" doo.

1.0. PROJECT LEADER DATA

"BEO ČISTA ENERGIJA“ DOO

Business name:	"BEO ČISTA ENERGIJA" DOO Belgrade
Short business name:	"BEO ČISTA ENERGIJA“ DOO
Head office/address	272 v Tošin Bunar Str.
Name of business activity	Non-hazardous waste treatment and disposal
Activity Code	3821
Company Registration No.	21319775
TAX ID No.	110224482
Directors	Mitsuaki Harada Philippe Pierre Marie Auguste Thiel Vladimir Milovanović
Representative	Malik Kerker
Phone	011/715 88 84
Fax	011/715 88 86
E-mail:	*bce@bceenergy.rs*

2.0. LOCATION DESCRIPTION

Macro-location

The territory of Belgrade covers an area of 3,222 km^2which is administratively divided into 17 municipalities: Barajevo, Voždovac, Vračar, Grocka, Zvezdara, Zemun, Lazarevac, Mladenovac, Novi Beograd, Obrenovac, Palilula, Rakovica, Savski venac, Sopot, Stari grad, Surčin and Čukarica. According to 2011 census data, 1,659,440 inhabitants live in this territory .

The location of the Vinča landfill is located in the eastern part of Belgrade (approximately 12 km from the city center), in the settlement of Vinča.

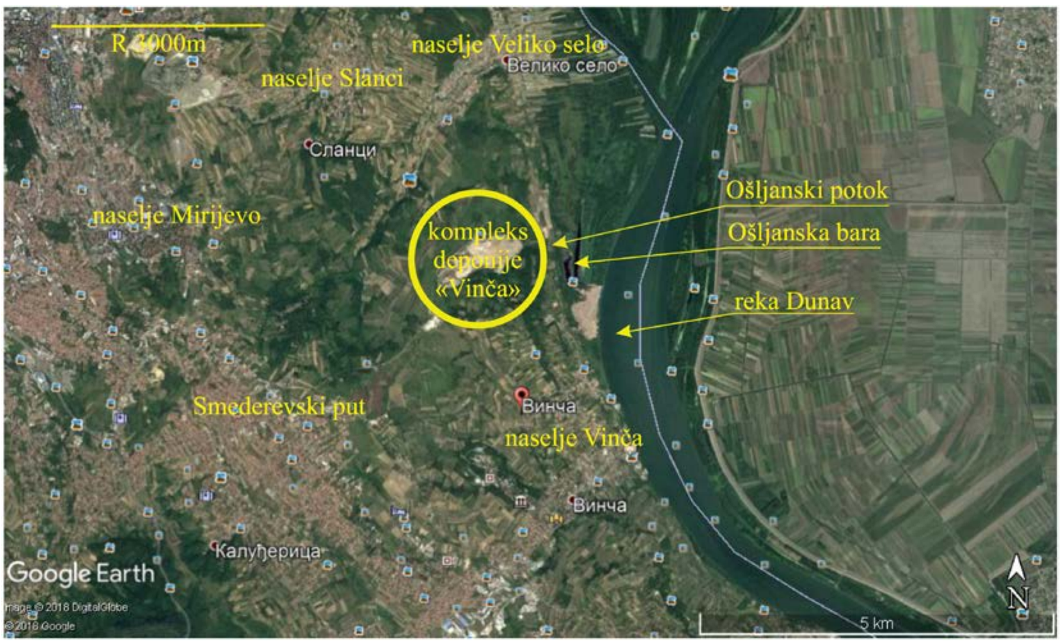


Figure 1 Macrolocation of the Vinča landfill complex

Micro-location

The location of the Vinča landfill is located on the right bank of the Danube River in the municipalities of Grocka, Palilula and Zvezdara.

The municipal waste landfill in Vinča covers an area of about 140 ha, located in the valley of the Ošljanski stream. The wider area of the landfill is characterized by hilly relief. The location of the terrain in question falls north-east, and is flanked by hills to the south and west. Below the body of the landfill flows the Ošljanki stream, which flows into Ošljanska pond. The access road from the main Smederevo road to the landfill complex is Beogradska Street, about 3 km long.

The wider area around the landfill is mainly used for agriculture (fruit and vegetable production), however some of the parcels are now abandoned (there is a succession of agricultural land). A smaller number of agricultural land is located next to the landfill. The forests are reduced to smaller forests and alluvial areas along the Danube River. The Danube River is located 1.5 km east of the landfill. About 3 km to the northeast is the Danube Channel - Dunavac, and north from it there are several river islands. In the area of gravel exploitation, located 1 km east of the landfill, the Danube River reaches almost 1 km in width.

In addition to the existing landfill (in the north) there is an informal settlement consisting of barracks with no basic infrastructure (water supply, sewerage). To the south, the nearest settlement is Vinča, whose center is located about 3 km from the landfill body, however parts of the settlement are located about 1.7 km from the landfill. In the north, the closest parts of Veliko Selo settlement are also located about 1.7 km from the landfill body. The first parts of the suburban settlements Kaluđerica and Mirijevo are located more than 2 km to the west. To the east, on the other side of the Danube, there is the suburban zone of Starčevo, 7 km from the landfill by air. The town of Pančevo, with its numerous industrial elements, is located 8 km northwest, by air, also on the other side of the Danube.

The distances (in the airline) of the Vinča landfill from the surrounding facilities are given in the table below:

Volatile facilities	**Distance, m**	**Orientation**
Old Vinča cemetery	900	SE
Gravel exploitation	1000	SE
the Danube River	1500	E
Nearest house in Vinča	1700	SE
The closest group of houses in Vinča	1700	S
Vinča Institute of Nuclear Sciences	2300	S
The closest group of houses in Kaluđerica	2500	W
Smederevo Road	3600	SW
The nearest house in Mirijevo	2800	NW
The nearest group of houses in Mirijevo	4000	NW
The closest house in Veliko selo	1600	N
The nearest group of houses in Veliki selo	1100	NE
Monastery of the Holy Archdeacon Stefan	1200	N

The above facilities are shown in Figure 2.

The Belo Brdo archaeological site is approximately 3 km away from the Vinča landfill complex, southeastward. The precise location of the Veteran's Villa was not determined by the competent Institute for Immovable Cultural Goods.

The Monastery of St. Archdeacon Stefan (Slanci Monastery) is located 1.2 km north of the existing landfill. On the south side it is visually separated by a thick forest and hill. The new complex was built in 1960 on the site of a historic monastery and is therefore protected as an archeological site. To the northeast of the monastery is the monastery cemetery, some 1.6 km away from the landfill.At 0.9 km southwest of the landfill is the old ("village") cemetery of Vinča. On the east side of the cemetery is a footpath connecting the villages of Vinča and Veliko Selo. The Church of the Holy Apostles Peter and Paul is located in the center of Vinča, ie. at a distance of about 3 km from the landfill. The largest cemetery in this area is the Lešće Cemetery, located about 4 km northwest of the landfill complex.

Schools and sacral buildings are located in all major settlements surrounding the landfill. The closest school is in Veliko Selo, about 2 km north of the landfill.

The Vinča Institute of Nuclear Sciences is surrounded by forests and partly separated from settlements. It is located southwest of the landfill, at a distance of 2.2 km.

The asphalt production plant is located southwest of the landfill body (at a distance of about 400 m).

Larger industrial areas are located in the western parts of Belgrade. They are 5 km southwest, west and northwest relative to the landfill. The high voltage substation is located about 3 km northwest of the landfill (by air line).

The most important industrial zone is located in the southern part of Pančevo, where complexes of oil refinery, chemical industry and river port are located. In relation to the landfill, by air line, these complexes are at a distance of about 8 km to the northeast.

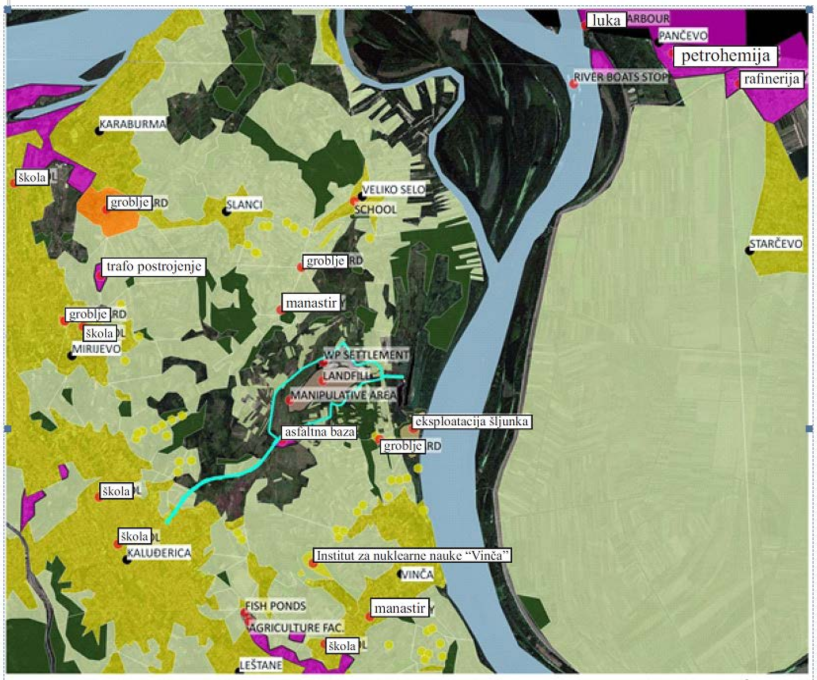


Figure 2 Overview of facilities in closer and wider surroundings from the Vinča landfill

The Vinča landfill was formed in 1978. In the mid-1990s, a decision was made to close all city dumps except the Vinča landfill. Starting from 1998, the landfill in Vinča is the only landfill in the city of Belgrade which currently receives around 2,000 tonnes of waste per day, making it the largest landfill in Serbia.

On the part of the complex of the existing "Vinča" landfill, a phase-out construction of a plant for energy utilization of municipal waste - TE-TO for municipal waste is planned (hereinafter referred to as EfW - **E**nergy **f**rom **W**aste Plant) and landfill gas - a cogeneration plant for generating electricity and/or heat from landfill gas (hereinafter referred to as BEP- **B**io Gas **E**ngine **P**lant), in the southwest part, on an area of about 4.8 ha.

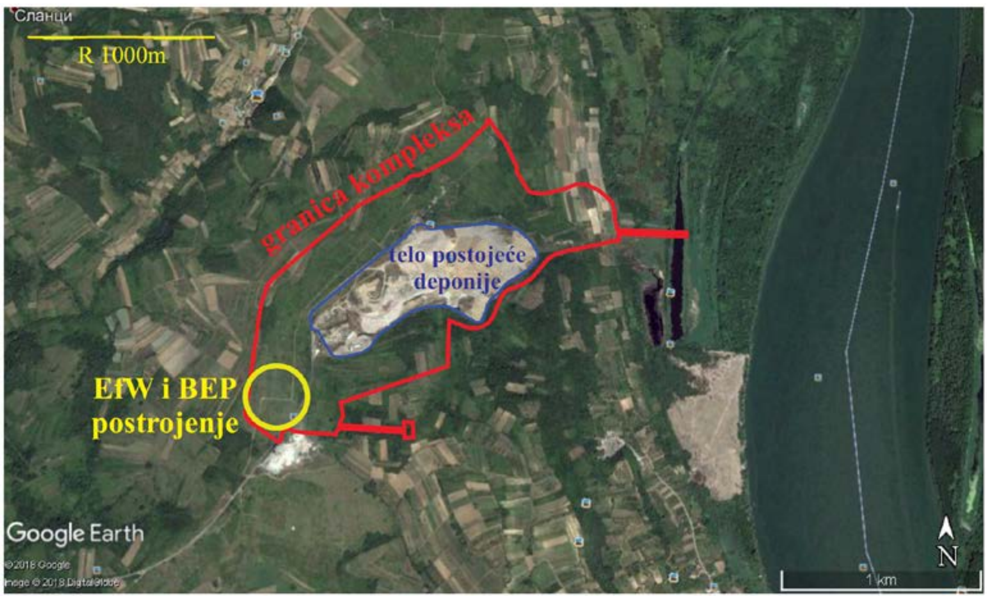


Figure 3 Microlocation of EfW and BEP plants

The surface of the whole Vinča complex is defined by the Amendments to the Plan of Detailed Regulation of the Vinča Landfill, Volume 1 (Belgrade Urban Planning Institute, 2018). The Vinča landfill complex is located in parts of the territory of 3 city municipalities (and 3 cadastral municipalities - CaM):

- CiM Grocka, CaM Vinča
- CiM Zvezdara, CaM Mali Mokri Lug and
- CiM Palilula, CaM Slanci

The PDR document on the complex of the existing Vinča landfill envisages the formation of 5 planning functional units (K1-K5):

K1 - surface for the construction of the facilities of the plant for municipal waste energy recovery;

K2 - platform for construction waste and construction waste treatment;

K3 - surface for the construction of a new sanitary landfill for municipal waste (new landfill body);

4 - reclaimed area (area of the existing landfill body), supporting structure and internal roads

K5 - facilities in the function of the sanitary landfill, municipal waste water treatment plants, inert waste landfill, internal roads and the protective green belt.

The construction of the EfW and BEP plant (the plant for energy utilization of municipal waste and landfill gas "Vinča") is planned within the planning functional unit K1, on the formed building parcel KP6-1.

2.1. CADASTRAL PARCELS ON WHICH THE PROJECT IS REALIZED

The construction of the plant for energy utilization of municipal waste and landfill gas “Vinča” is planned on the following cadastral parcels: 966/5, 967/4, 2693/10, 992/4, 966/1, 967/2, 992/2, 969 / 4, 969/3, 968/1, 990/3, 2693/1, 990/1, 991/6, 991/3, 991/2, 991/12, 1005/4, 1005/5, 1013/8, 1013/6, 979/1, 1108/3, 988, 987/2, 989/1, 990/4, 990/5, 1008/3, 1008/8, 2693/5, 989/4, all in CaM Vinča , CiM Grocka - City of Belgrade.

For the project in question, Location Conditions were obtained, number 350-02-00085/2019-14 of 25.04.2019, Ministry of Construction, Transport and Infrastructure.

2.2. LAND AREA DATA

The area covered by the Detailed Regulation Plan is 149.8 ha. The area of the Vinča complex is approximately 132 ha. An area of about 4.8 ha is planned for the EfW and BEP plants.

2.3. PREVIEW OF PEDOLOGICAL, GEOMORPHOLOGICAL, GEOLOGICAL AND HYDROGEOLOGICAL AND SEISMOLOGICAL CHARACTERISTICS OF THE TERRAIN

Pedology of the terrain

According to the pedological cover in the municipality of Grocka, two larger geomorphological units are distinguished. A valley part where fluvisol type land is represented in the area towards the Danube River at an altitude of 250-300 m. In the higher parts of the municipality, there is chernozem and a subtype of eroded chernozem over great deposits of loess. Vertisol is not much represented. For the Northeast Šumadija hills the characteristic soil is kambisol and kambisol in the process of podzolization with much less productive capacity than chernozem and fluvisol. Soil in the territory of Grocka municipality is characterized by very heterogeneous physical and chemical properties.

Topography and morphology of the terrain

In geomorphological terms, most of the surface of Belgrade is represented by hilly parts of the terrain, and a smaller part by flatlands. On the hilly, slightly undulant relief on which most of the city of Belgrade is located, as well as a number of suburban settlements, especially stands out Mount Kosmaj with an altitude of 626 m.a.s.l. from the geomorphological processes the most important role in the formation of the relief of this area was the role of the fluvial process. The following processes had or still have their share in the formation of the relief, karst, marine, proluvial, deluvial, and aeolian process. The most noticeable forms of the fluvial process are the alluvial planes of the Sava and Danube rivers and river terraces.

At the site of the Vinča landfill, the terrain is hilly and characteristic of the right bank of the Danube. Altitudes in the wider area range from 70 m along the Danube bank to 200-250 m.a.s.l. west of the Danube.

In terms of morphology, two units can be distinguished within the terrain in question: the Danube alluvial plain and its slopes, hilly hinterland. There are also two units in the sloping terrain. The first unit is the immediate part of the right Danube slope, while the second unit includes the slopes of the Ošljanski stream, which developed in the western hinterland of the Danube slope. The Danube slope is in the north-south direction, and in the landfill zone the width is 500-600 m, with a vertical rise of 80 to 170 m.a.s.l. The Danube sope south of the Ošljanski stream is 6-12°, even up to 30-40°, while its northern part is much milder and the gradient ranges from 4 to 15°. The slopes of the Ošljanski stream are relatively mild, with slopes of 6-9° (3.8-5.7%) on average, extremely amount to 5° (3.0%) and maximum 15-18° (9.5-11.0) %). The southern branch of the valley is much more winding than its western and northern parts.

Geological and hydrogeological characteristics of the terrain

In the area defined for the construction of the municipal waste and landfill gas utilization facility, “Designing of geological-geotechnical explorations for the purposes of the construction of the municipal waste energy recovery plant (EfW)” was carried out.

Design of exploration works (Source: Summary, Energoprojekt Hidroinženjering, 2017) defined the type and scope of exploration works to obtain geological, hydrogeological and geomechanical data necessary for the construction of the plant. Geological surveys include studies of the composition, properties and conditions of the geological medium, and in particular:

- Geological composition of the terrain: lithological composition, extent and characteristics of the rock mass, which is influenced by the effect of the atmosphere, structure;
- Activity of modern geological processes: endogenous (neotectonic activity) and exogenous processes (erosion, landslides, rocks, water supply);
- Hydrogeological conditions in the field: groundwater regimes, water levels in the course of projected excavations from the aspect of terrain stability;
- Physico-mechanical properties of soil and rock mass: identification-classification and structural properties, conditions for extrapolation of sample characteristics and areas of measurement points of rock mass.

As part of the exploration work, two piezometers (Pz 7 and 8) and four exploration wells (EP 11-14) were drilled. The basic information about these profiles is given in the table.

Table 1 Designed exploratory wells, piezometers and exploratory wells

Profile label	Type of exploratory work	Y	X	Depth, m
EP-11	exploratory well	7467806.77	4959556.47	25
EP-12	exploratory well	7467755.32	4959502.32	25
EP-13	exploratory well	7467750.34	4959553.80	25
EP-14	exploratory well	7467747.62	4959420.09	25
Pz-7	piezometer	7467878.28	4959578.82	30
Pz-8	piezometer	7467680.47	4959438.94	30

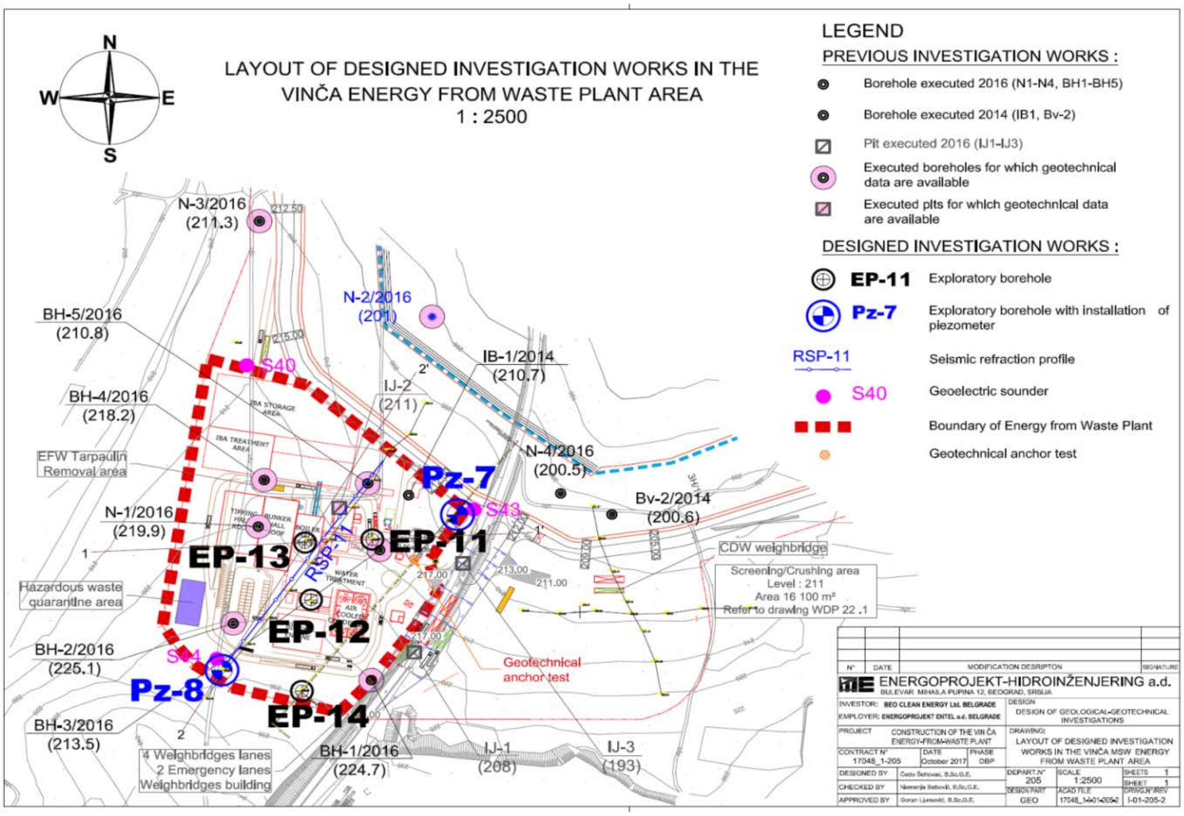


Figure 4 View of projected profiles - exploratory wells and piezometers

Hydrogeological characteristics were determined by determining the permeability coefficient and the filtration coefficient of the material in the field, porosity, compactness and mineralogical content, as well as measuring groundwater levels in piezometers.

Table 2 Overview of filtration characteristics and lithological description of profiles

Piezometer	Depths, (m)	Kf, (m/s)	Lithological description
Pz-7	4.00-5.00	5.76×10^{-9}	Diluvial deposits - Clay of medium plasticity (CI), hard, difficult to dry, of relatively homogeneous composition, of low water permeability, with impurities of fine carbonate concretions, of low moisture, brown color.
Pz-7	8.00-9.00	1.41×10^{-7}	Diluvial deposits - Low to medium plasticity (CL/CI) loessoid clay, of relatively homogeneous composition, of increased humidity, with rare impurities in the form of fine carbonate concretions, yellow.
Pz-7	12.00-13.00	1.10×10^{-7}	Diluvial deposits - Dusty clay of low plasticity (CL), of relatively homogeneous composition, fissile, with point-shaped Mn impurities and rare occurrence of small carbonate concretions, brown.
Pz-8	3.70-4.70	5.98×10^{-8}	Loess deposits - loess of clay-dust composition, low plasticity (CL), high humidity, with carbonate impurities in

Piezometer	Depths, (m)	Kf, (m/s)	Lithological description
			the form of powders and concretions, brittle and friable. Light yellow to dark yellow.
Pz-8	7.60-8.60	1.34×10^{-6}	Loess Deposits - Fossil Soils - Clay of medium plasticity (CI), medium compressibility, brown.
Pz-8	12.50-13.50	5.89×10^{-7}	Lake deposit - degraded marl clay, with many impurities in the form of powders and concretions up to 13 m. Deeply stratified with marl-sand clay, divided by cracks, twisted with thin leaf lamels. The predominant yellow and yellow-gray.

The loessoid deluvium hypsometrically covering the highest parts of the terrain with the function of a hydrogeological aquifer is vertically watertight. May contain small amounts of water. Based on the stacking and laboratory tests, the results of the filter coefficients for loessoid delvium in the range Kf = 1.34×10^{-6}–5.98×10^{-8} m/s were obtained. The possibility of accumulating significant amounts of groundwater in this medium should not be expected. The level of groundwater in loess platforms depends on the position of the base of erosion, i.e. drainage zones. These aquifers are mainly fed by precipitation. Water rapidly penetrates the loess deposits after rain or, in cases of high intensity rain, accumulates in shallow recesses and gradually penetrates from these temporary ponds deep into the lesions to the level of the aquifer. Fluctuations in the level of the aquifer in the lesion are not significant.

Groundwater level measurements in piezometers are shown in the table.

Table 3 Groundwater level in Pz-5, Pz-7 and Pz-8 piezometers

Piezometer	Altitude (m.a.s.l)	Groundwater level data (m.a.s.l)						Average relative water level, m
		25/11/2017	01/12/2017	13/12/2017	01/02/2018	07/03/2018	30/3/2018	
Pz-5	214.0	196.1	196.2	196.1	196.1	196.0	194.1	17.90
Pz-7	210.2	194.0	194.0	194.0	193.8	193.8	193.9	16.30
Pz-8	228.4	200.4	200.4	200.4	200.3	200.5	199.5	28.00

The table indicatively also shows the groundwater level in the Pz-5 piezometer outside the exploratory area, but is part of the "Geological-geotechnical testing for the design and construction of a new and remediation of the old Vinča landfill" (Energoprojekt Niskogradnja, November 2017).

Based on the stacking test, the upper layers are somewhat permeable (this applies primarily to loessoid deluviums and carbonate clays), and groundwater levels are formed there. The lower layers are of low permeability and are insulators, and the assumption is supported by groundwater levels measured in Pz-5 and Pz-7 piezometers (after level stabilization).

The analysis of the obtained data in the stacking test and the data obtained by measuring the groundwater level in the Pz-8 piezometer lead to the assumption that the groundwater level indicates a highly permeable rock mass (the rock is degraded and highly cracked).

The hydrogeological insulator (clay) was punched during drilling, and all the water from the upper aquifer was infiltrated through the marls into deeper layers. The groundwater level is at a depth greater than the bottom of the piezometer because on this occasion, the piezometer remained dry. This could indicate that the marls below the clay are degrading and bursting and that the water is infiltrated into deeper layers.

The opinion that the aquifer is at a depth deeper than the bottom of the drilled piezometers was confirmed by measuring the groundwater level in a well located at a nearby asphalt base. The groundwater level in the well, measured on November 11, 2017 was 120.00 m, Which is about 80 m below ground level and about 50 m below the bottom of drilled Pz 7 and 8 piezometers.

In the report on the exploratory works carried out, the Designer noted that he did not have data obtained over a long period of time in order to confirm the assumptions described above, and concluded that it was necessary to monitor groundwater levels in the piezometers for at least one hydrological year.

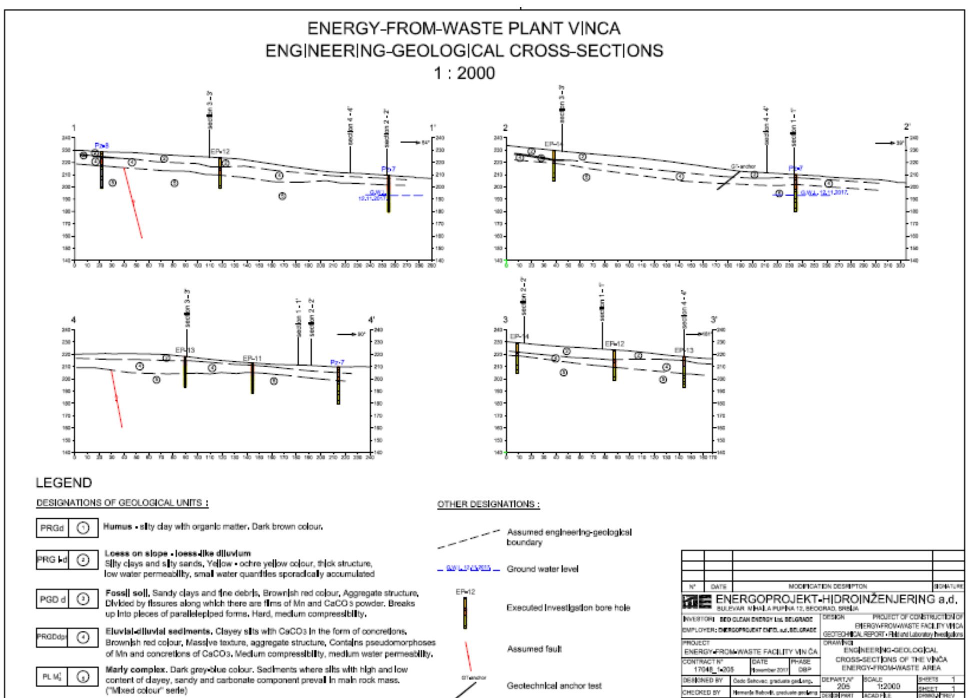


Figure 5 Geological profileand piezometers (Pz 7 and 8) and exploratory wells (EP 11-14)

Seismological characteristics of the terrain

According to the latest regional surveys of the Republic Seismological Institute of Serbia *(www.seismo.gov.rs*) seismicity parameters for the territory of the Republic of Serbia were determined. According to the seismic hazard map for the expected maximum horizontal acceleration on the base rock - Acc(g) and the expected maximum earthquake intensity - I_{max} in the units of the European Macro-seismic Scale (EMS-98), within the return period of 95, 475 and 975 years, the earthquakes of maximum intensity and acceleration can be expected shown in the table.

Table 4 Seismic parameters

Seismic parameters	Return time period (years)		
	95	475	975
Acc(g) max.	0.03-0.12	0.05-0.25	0.05-0.30
I_{max} (EMS-98)	V-VII	VI-VIII	VII-IX

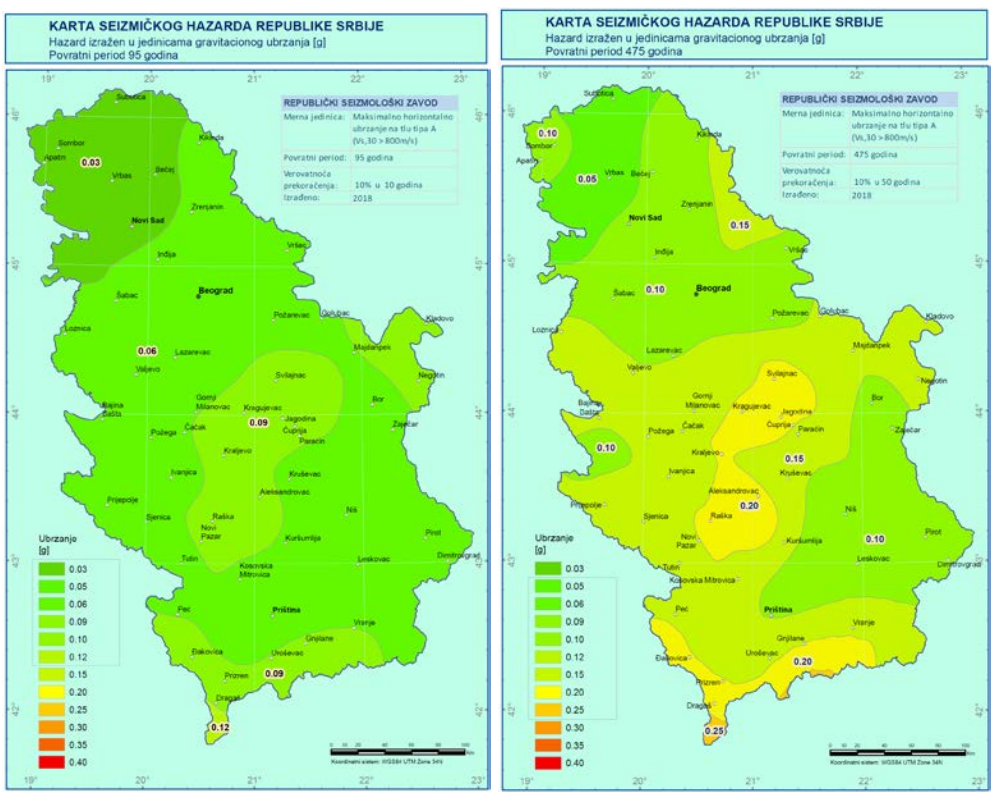


Figure 6 Seismic hazard map by horizontal acceleration parameter (return period 95 years (left) and return period 475 years (right)

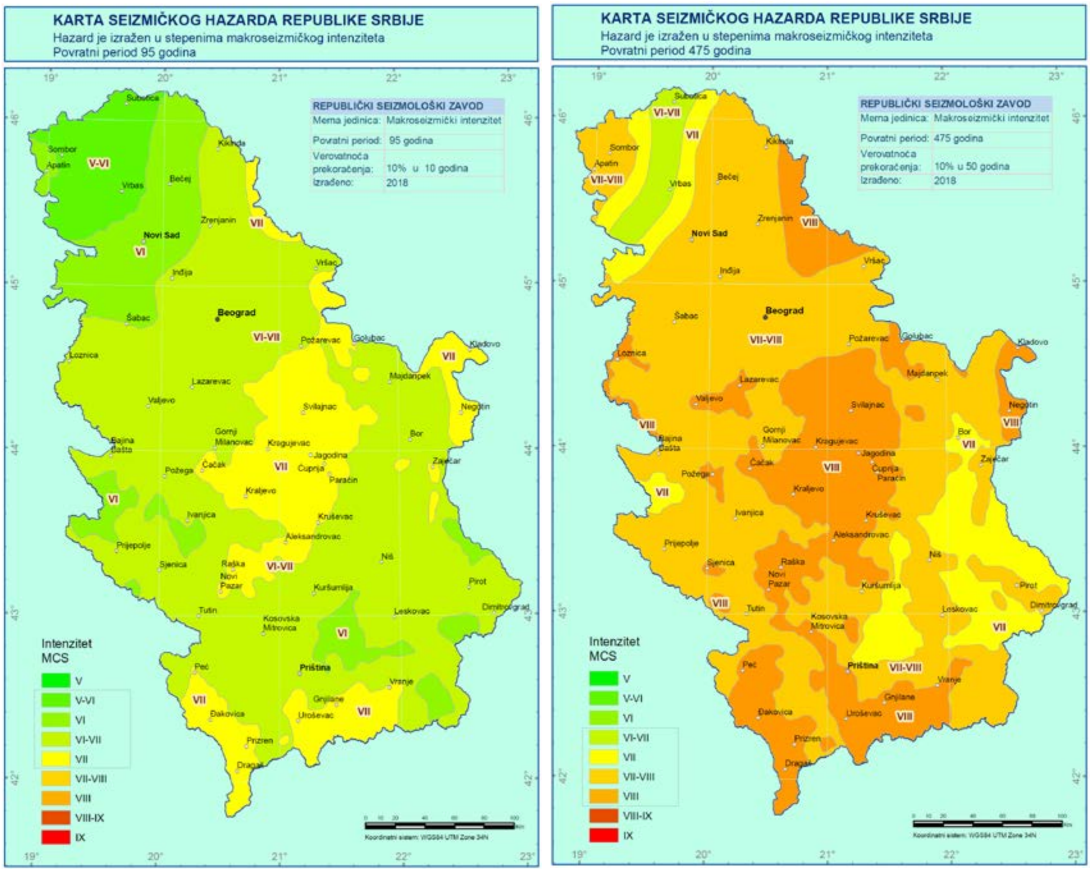


Figure 7 Seismic hazard map by macroseismic intensity parameter (return period 95 years (left) and return period 475 years (right)

Based on the presented seismic hazard maps (Source; www.seismo.gov.rs), according to the macroseismic intensity parameter, the territory of the city of Belgrade is in zone VI-VIII MCS (Merkalli scale).

2.4. DATA ON THE SOURCE OF WATER SUPPLY

Today, the Belgrade Water Supply System is a complex water management system and is made up of a complex of hydraulic structures:

- source,
- transportation of raw water,
- water treatment plants and
- distribution system:
  - primary transport (tunnel system),
  - water supply network,
  - pumping stations and
  - reservoirs.

The length of the water supply network is 3,263 kilometers, 25-2,500 millimeters in diameter. It has 135,000 main connections, 15,000 hydrants, 27 tanks of 240,000 cubic meters and 28 36-megawatt pumping stations.

Water is treated in 5 plants: Bela Voda, Banovo Brdo, Bežanija, Makiš and Vinča. The design capacity of the groundwater plant is 8,060 l s and the river water plant 3,580 l/s. There are production facilities in Makiš: "Makiš I" and "Jezero".

The Banovo Brdo, Bežanija plants and part of the Bela Voda plant treat groundwater. The following technological procedures are applied: aeration, retention, filtration and chlorination.

The second part of the Bele vode, Makiš and Vinča plants treat river water. The production facilities of Makiš and Jezero apply the modern technology of river water treatment with more complex technological processes, which besides clarification, sand filtration and final disinfection with chlorine, include ozonation and filtration of water with activated carbon filters.

The water supply system in Vinča was incorporated into the Belgrade water supply system in 1997. The water supply system supplies drinking water to some 15,000 inhabitants of Vinča and Leštane settlements, and the water that is treated is surface water in origin and is pumped from the Danube.

The project location is outside the protection zone of the Belgrade spring.

2.5. CLIMATE CHARACTERISTICS WITH METEROLOGICAL INDICATORS

According to its climatic characteristics, the study area belongs to the temperate continental climate zone, with warm summers and cold winters, as the main characteristics of this type of climate. The basic climatic characteristics of the exploratory area are conditioned by its geographical location, wide openness to the Pannonian Plain as well as relief. In addition, topographic and morphological features make Belgrade a "Košava" area. Summers are warm and temperatures over 30° C usually last on average 31 days a year, and temperatures over 25° C last on average 95 days. Winters are cold and snowy with an average of 21 days a year below 0° C.

Due to the complete openness to the north and northwest and the absence of more pronounced orographic obstacles, this area is often influenced by cold air masses that easily penetrate the north and central Europe. Northwest of Obrenovac, at a distance of 60 km in air line, there is a mountain massif, Fruška Gora (538 m.a.s.l), which is also the only orographic obstacle to these air currents. In order to determine the climatic characteristics of the exploratory area, the data of mean annual precipitation for the Belgrade rain gauge, as well as data of mean annual temperatures and humidity for the Belgrade meteorological station, were analyzed. Official data on climatic parameters were obtained from the Belgrade Meteorological Observatory (44° 48' NL and 20°28' EL, 132 m.a.s.l in Karađorđe Park) for the period 2000-2018.

Precipitation

The complete analysis and interpretation of precipitation amounts is one of the bases for the study of groundwater and other environmental parameters in the exploratory area. Precipitation amounts discharged to the exploratory area vary throughout the year and depend on relief, altitude, rainfall exposure, and rainfall is unevenly distributed throughout the year with values varying widely.

The data of the Republic Hydrometeorological Institute of Serbia for rain gauge stations Belgrade were used to determine the precipitation regime in the exploratory area. Average annual precipitation sums for the period 2000-2018 have been analyzed.

Table 5 Average monthly and annual precipitation (mm) for the weather station Belgrade for the period 2000-2018 (RHSS, Belgrade)

year/month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	TOTAL
2000	27.3	28.3	30.3	41.9	34.5	19.1	29.3	7.8	70.7	16.6	20.7	41.2	367.70
2001	35.3	27.2	65.6	157.9	47.0	186.0	19.7	56.7	183.7	16.7	63.4	33.9	893.10
2002	15.1	14.0	14.8	53.7	20.9	79.6	60.7	106.8	51.9	88.3	35.8	52.8	594.40
2003	62.9	26.5	11.4	23.1	39.5	33.4	111.8	6.4	57.6	115.2	23.4	36.7	547.90
2004	93.5	29.4	18.9	71.7	63.3	113.8	94.6	89.3	45.0	32.9	129.5	50.3	832.20
2005	52.2	84.2	33.9	54.7	47.4	95.1	91.4	144.3	54.1	28.6	23.5	78.8	788.20
2006	43.2	59.1	104.4	97.0	42.3	137.8	23.3	120.6	24.3	20.9	24.5	51.9	749.30

2007	49.3	56	99.6	3.8	79	107.6	17.5	72.5	84.1	103.6	131.5	34.5	839.00
year/month	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**	**TOTAL**
2008	44.6	8.3	79.7	34.9	60.6	43.3	53	45.6	68.5	18.4	51.0	79	586.90
2009	55.1	85.2	64.9	6.1	34.7	151	80	44.5	3.9	98.9	59.5	120.6	804.40
2010	91.6	112.8	47.2	43.7	86.4	181.7	41.4	53.5	51.8	48.8	45.2	36.1	840.20
2011	47.8	55.6	27.9	14.1	66.8	41.1	95	14.0	47.7	36.1	5.0	48	499.10
2012	87.2	61.5	2.4	66.9	127.9	16.0	39	4.5	30.7	44.9	28.1	55.1	564.20
2013	76.9	53.4	95.4	21.3	104.4	50±1	2.9	3.0	58/7	52	40	7.9	566.00
2014	24.1	19.9	48.7	85.3	280.4	60.3	250.6	63.5	126	61.2	8.8	66,3	1,095.10
2015	48.6	52.4	132.9	30.7	80.7	38.6	10.6	49.5	101.4	71.8	63.4	3.8	684.40
2016	46.3	38.5	102.6	53.9	71.3	152.2	35	60.8	47.8	76.8	71.8	2.6	759,6
2017	23.4	23.5	27	51.8	86.1	53	26.4	19.5	48.5	65.9	41.2	45,2	508.8
2018	29.3	58.1	64.8	39.7	56.2	121.6	53	44.8	11.2	18.6	35.3	60.7	603.3
Monthly precipitation (average)	**50.19**	**47.05**	**56.44**	**50.12**	**75.23**	**88.49**	**59.75**	**53.03**	**61.45**	**53.48**	**47.45**	**47.65**	**690.73**

As can be seen from the table above, the rainiest month for the analyzed period is June, while the least rainfall is discharged during February and November. The mean perennial precipitation for the exploratory area is 690.73 mm of water column. Due to the size of the exploratory area, as well as the different altitudes of individual parts of the city, the average annual rainfall varies from 367-1095.1 mm.

Air temperature

Air temperature is a direct indicator of the amount of solar energy which a given area receives, which is considered an important parameter in the estimation of water evaporation from the soil surface, that is, in determining the water balance. Measurement data from the meteorological station "Belgrade" for the period 2000-2018 were used to define the temperature regime, which are represented graphically.

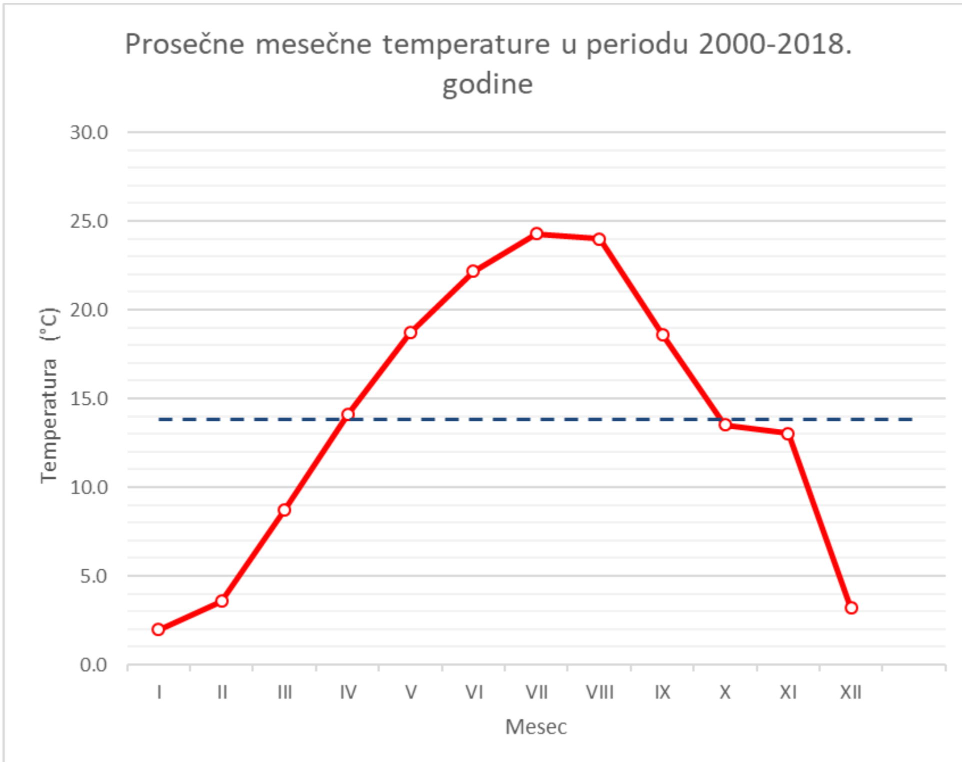


Figure 8 Diagram of mean monthly air temperatures for the weather station Belgrade (2000-2018)

Air temperatures in the given period record a continuous increase during the year from the coldest January to the warmest July, after which the tendency of the temperature drop to the month of December is recorded. The lowest average temperatures occur during January (2° C) and the highest during July (24.3° C). The mean perennial value of air temperature over the period considered is 13.8° C.

Relative air humidity

Knowledge of the relative humidity of the air is very significant because of its effect on the formation of fog, clouds and precipitation in a given area. Also, the magnitude of the relative humidity is inversely proportional to the air temperature, which means that as the temperature rises, the relative humidity decreases and vice versa.

Table 6 Average monthly and annual relative humidity for the Belgrade Weather Station for the period 2000-2018 (RHSS, Belgrade)

year/month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Annual
2000	78.6	67.6	61.6	57.3	54.5	47.3	50.9	44.9	66.3	67.3	68.0	78.3	61.9
2001	75.2	68.1	61.0	64.6	62.9	67.5	66.5	61.5	76.8	75.0	79.6	80.7	70.0
2002	75.9	62.8	55.1	62.8	57.3	57.0	61.8	68.0	69.8	72.2	68.1	77.0	65.7
2003	82.3	77.1	58.5	55.9	55.5	53.0	62.9	49.8	64.1	74.4	76.5	77.6	65.6
2004	80.3	73.8	64.3	67.2	65.0	68.4	62.4	69.1	69.7	75.3	76.0	81.2	71.1
2005	78.3	82.8	68.1	60.9	64.8	62.4	67.6	75.0	74.6	70.9	75.5	80.8	71.8
2006	74.1	77.6	68.4	66.3	61.1	68.7	55.9	70.7	65.1	64.8	69.6	81.0	68.6
2007	66.0	69.0	61.0	44.0	62.0	58.0	46.0	59.0	68.0	78.0	76.0	83.0	64.17
2008	75.0	64.0	63.0	63.0	58.0	61.0	57.0	55.0	67.0	69.0	69.0	76.0	64.75
2009	95.0	75.0	65.0	53.0	57.0	67.0	60.0	60.0	59.0	73.0	78.0	81.0	68.58
2010	80.0	76.0	63.0	67.0	67.0	73.0	66.0	61.0	70.0	73.0	68.0	79.0	70.3
2011	92.0	77.0	63.0	54.0	66.0	61.0	59.0	55.0	55.0	67.0	78.0	76.0	66.9
2012	76.0	75.0	50.0	59.0	66.0	52.0	50.0	41.0	53.0	69.0	72.0	79.0	61.8
2013	78.0	76.0	70.0	58.0	59.0	66.0	52.0	54.0	66.0	68.0	76.0	79.0	66.8
2014	75.0	68.0	66.0	69.0	67.0	61.0	65.0	66.0	73.0	72.0	74.0	80.0	69.7
2015	77.0	77.0	68.0	56.0	64.0	61.0	48.0	53.0	67.0	78.0	70.0	85.0	67.0
2016	76.0	68.0	68.0	57.0	63.0	66.0	59.0	66.0	63.0	76.0	72.0	76.0	67.5
2017	77.0	69.0	61.0	59.0	65.0	56.0	49.0	50.0	63.0	68.0	77.0	75.0	64.1
2018	75.0	79.0	72.0	56.0	59.0	68.0	69.0	61.0	58.0	60.0	74.0	80.0	67.6
Average	78.2	72.8	63.5	59.5	61.8	61.8	58.3	58.9	65.7	71.1	73.5	79.2	67.0

The mean perennial value of relative humidity for the observed period is 67.0%. The month with the highest values of average relative humidity is December, 79.2%, and with the lowest values is July, 58.3%.

Air currents

Like other climatic parameters, the wind rose is primarily influenced by relief, topography, city structure, that is, built structures, vegetation, pollution and more. In the case of Belgrade, the most influential factors are the Danube, Avala and Kosmaj and other parameters mentioned. Frequency of winds by directions, so-called "wind rose", obtained from data from the Vračar Meteorological Observatory (φ 4448 N λ 2028E m.a.s.l. 132), has a shape characteristic of the entire Košava region. It is dominated by two directions: southeast and west-northwest. The southeastern direction is commonly known as "košava" and the west-northwestern direction is called "gornjak". It is more accurate to look at these two directions as sectors, the first as a sector between east and south, and the second as a sector between west and northwest. This is because in the "košava process" the wind can vary from east to south in different situations. Gornjak varies from west to northwest.

Table 7 Relative wind frequencies by directions in ppm and mean wind speeds in m/s, (for the period 2000-2018)

	N	NE	E	SE	S	SW	W	NW	C
Relative frequencies (‰)	89.8	81.7	69.3	216.3	173.7	61.3	194.8	172.9	41.4
mean speeds (m/s)	2.3	2	2.1	3.4	3.0	1.9	2.3	2.4	-

Note: Wind frequency and velocity data at Belgrade Observatory station are not available in the RHSS Yearbook 2017 .

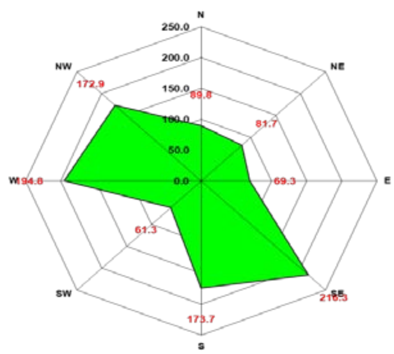


Figure 9 Relative wind frequencies by directions and silent periods in ppm and mean wind speeds in m/s,
(for the period 2000-2018)

Based on the aforementioned and the wind rose for the city of Belgrade, the air masses from the Vinča landfill complex will move, depending on the direction of blowing of the dominant wind, in the south-southeast/west-northwest direction, i.e. towards the villages of Vinča (in the south), i.e Slanci and Veliko Selo (in the northwest/north).

Fog and smog

Belgrade's complex topography is also reflected in the differences in the types of fog and smog in the individual topoclimatic zones of the city. Based on observations made at the Vračar Meteorological Observatory, according to the Atlas of the Yugoslav Climate for the period 1931-1960, the annual number of days with fog in Belgrade is 39. At Zeleno brdo Observatory, types and frequency of fog are like "mountain" stations. Fog on it is about 30% more frequent in winter than on Vračar, although it is far from the source of pollution. The cause of the more frequent winter fogs on Zeleno Brdo is that low clouds occur at this altitude ten to fifteen times a year, and at the site itself, the interior of the clouds registers as fog (Source: Belgrade Ecological Atlas, City Institute for Health Protection Belgrade, 2002).

2.6. DESCRIPTION OF THE FLORA AND FAUNA, NATURAL GOODS OF SPECIAL VALUE OF (PROTECTED) RARE AND THREATENED PLANTS AND ANIMAL SPECIES AND THEIR HABITATS AND VEGETATION

In Serbia, natural areas are protected under various legislative frameworks and international conventions:

- Protected Areas - defined by the following acts: Law on National Parks (Official Gazette of RS 33/93 and 44/93) and Law on Nature Protection (Official Gazette of RS, Nos. 36/09 and 88/10)
- The areas of the Emerald network are defined on the basis of the Berne Convention.
- Important Bird Areas (IBAs) - defined international organization by BirdLife International
- Important Areas for Plants (IPA) - defined by international organization Plantlife International
- Selected Areas for Daily Butterflies (PBA) - Defined by different criteria (such as Red Data Book, EU Habitats Directive 32/43, individual research, etc.).
- Ramsar sites - defined by the global organization Wetland International under the Ramsar Convention.

Serbia's Ecological Network consists of Areas of Special Ecological Importance (ASCI) and Ecological Corridors.

The planned project is not located in any of the above areas or networks. IPA, PBA or Ramsar sites are not located near (within 5 km) of the planned project area.
Within 5 km of the site, approximately 4.5 km southeast, on the opposite side of the river bank of the Danube, is the protected area Strict Nature Reserve Ivanovo.

The location of the Emerald Network candidate, "Pančevačke ade" RS0000056, is located at approx. 2.6 km north - northeast of the planned project area and only within 5 km of the site. "Pančevačke ade" are a complex system of river islands with well-developed wetland vegetation and associated wetland fauna.

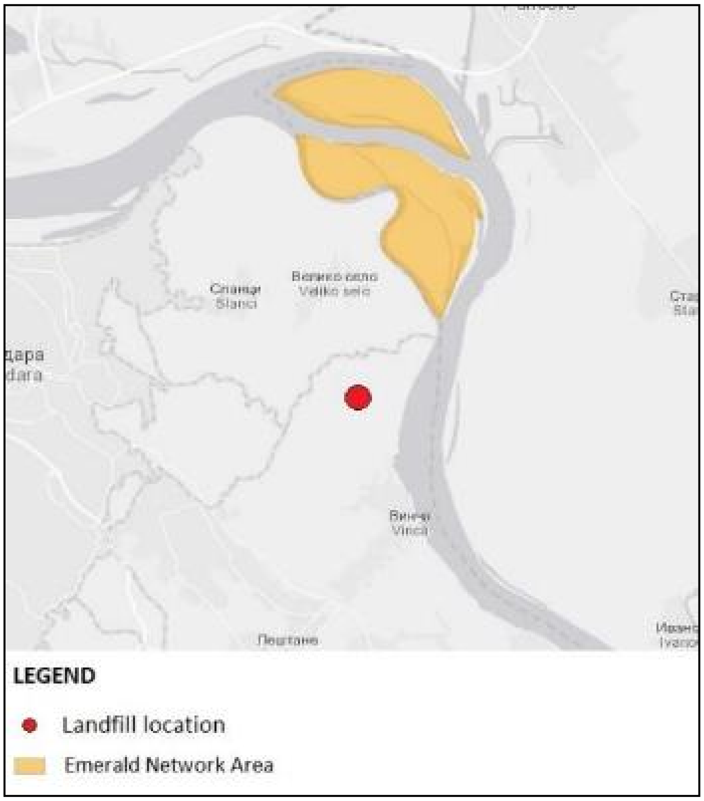


Figure 10 Emerald Network Area Near Landfill, Source: Official Online GIS Search Engine of the Council of Europe (http://emerald.eea.europa.eu/)

The following areas of the Ecological Network of Serbia are located near the landfill:

- Area of special ecological importance "the Sava estuary into the Danube" and
- Ecological corridor of international importance "the Danube and its enclosed/floodplain areas upstream and downstream".

Area of special ecological importance "the Sava estuary into the Danube" is located at the mouth of the Sava River and the Danube River. It is protected for its habitats in aquatic and wetland habitats that support a wide variety of animal species.

This area has the same boundaries as the Important Bird Areas (IBA) also referred to as the "the Sava estuary into the Danube" RS017IBA. Includes Protected Areas Land of Exceptional Features the Great War Island in Belgrade, part of the Land of Exceptional Features of the Forland Left Bank of the Danube near Belgrade and part of the Protected Habitat Area of Veliko Blato; all of these areas are located more than 9 km northwest of the planned project. It also includes the candidate area for the Emerald Network of "Pančevačke ade" RS0000056. The Ošljan oxbow lakes are part of the "Sava estuary into the Danube" area of special ecological importance.

The ecological corridor of international importance "Danube and its enclosed/floodplain areas upstream and downstream" is a large corridor that extends across the Danube River and part of its floodplain with stagnant water (ponds, oxbow lakes, etc.).

This area includes protected areas Special Nature Reserve "Bagremara", Nature Park "Begečka jama" and three nature monuments "Kamenički park", "Ivanovačka ada", "Ritske šume na Mačkovom sprudu". It also overlaps with the area in the process of designation as a protected area under the name "Ribarsko ostrvo", and the three areas planned to be protected in the future are "Bogojevački rit", "Rit između Plavne i Bačkog Novog Sela" and "Ritovi Podunavlja".

2.7. BASIC CHARACTERISTICS OF THE LANDSCAPE

Basic landscape features are defined by the terrain, natural conditions and human activities. In the wider area, which is roughly described as a 20 km buffer zone, there are four basic types of landscape:

- Agricultural landscape of Vojvodina. It is characterized by dense relief and intensive use of arable land. There is a negligible proportion of forests and natural areas, with the exception of those parts along the watercourse. The Danube River is the dominant water course. Visibility is limited due to the uniformity of the relief. The landscape character can be described as a predominantly anthropogenic agricultural landscape.
- River landscape - the Danube and Sava Rivers. They are the most important line elements of the landscape and an important determinant of the terrain movement. In some places along the river banks embankments have been built, but in a significant part one can find a natural state with the bay areas, river islands and wetlands.
- Intensive urbanized areas. Belgrade agglomeration stands out here with suburban areas and satellite cities (e.g. Požarevac). They carry the anthropogenic urban landscape. The landscape is mainly characterized by a dense population, large spatial range and numerous infrastructural and industrial elements.
- Southern mosaic areas. The landscape character is made up of a mountainous relief covered with a mosaic mixture of small agricultural land, small forests and suburban areas. The share of agricultural land is proportional to the growing distance from the city center. The area includes suburban settlements: Grocka, Voždovac, Barajevo, Sopot, Mladenovac, Lazarevac, Obrenovac and continues south.

The location of the project is at the intersection of the landscapes described. It is a hilly area between the agricultural landscape in the east and north and the urbanized area of Belgrade and Požarevac in the west and north. The southern suburbs are about 5 km away. Along the eastern and northern borders is the Danube with its natural wetlands.

A 5 km buffer zone can be considered a narrower area. This is an area of potentially significant visual contact with the components of the planned project. The narrower area is divided into basic landscape patterns and displayed as a map. This method provided the basis for a qualitative analysis of the structural elements of the landscape and the process that affects the state of the landscape.

The project location, e.g. the existing landfill, is the dominant landscape element. Compared to other areas, it has opposite visual and character features. It represents a spatial element that is seen as a negative phenomenon. The landfill is located on a gentle slope oriented east. It is visible from the immediate surroundings and from the east side of the buffer zone. These are the areas along the Danube River and the agricultural area on the east side of the Danube. The asphalt base is located southwest of the landfill, at the edge of the project boundary. Due to the proximity of the landfill and its industrial character, it can be considered as a negative spatial phenomenon.

The agricultural landscape with a mosaic structure surrounds the landfill. This is a mixture of small agricultural areas, which are mainly orchards, meadows and areas under various stages of natural succession. Agriculture is an important factor in the structure of the landscape. The appearance of agricultural plots, which in this case are shaped organically in relation to the relief, greatly influence the structure of the landscape and the visual dynamics.

Locally isolated buildings can be seen near densely populated areas (Belgrade suburban areas). As for the existing landfill, they are located at least 1.5 km away. These are locations south of Veliko selo and east of Mirijevo and Kaluđerica. There is also a monastery and cemetery about 1 km north of the landfill, and a cemetery 0.9 km south. The elements described do not occupy a significant area of space and are therefore not a significant factor of the landscape.

The visual contact of these settlements with the landfill was prevented due to the hilly relief, vegetation and microlocation of the landfill complex.

The Danube River with the bank is a landscape element of natural character. They represent a linear element of the landscape structure. On the east side of the Danube is a large area of intensive agriculture. The landscape picture consists of agricultural land and gravel roads in the flat relief. The urban structures of Starčevo and Pančevo are located on the north side. Due to the flat terrain, significant visual contact is stronger towards the hilly area to the west.

The industrial landscape of Pančevo is located outside the 5 km buffer zone and can be described as an anthropogenic landscape with a strong industrial character. As such, it is a spatial phenomenon that causes negative visual and symbolic connotations.

2.8. IMMOVABLE CULTURAL GOODS

Within the administrative district of Belgrade, which also covers the area of the city municipality of Grocka, there are approximately 350 protected immovable cultural goods. In addition, there are numerous cultural heritage sites at lower levels of protection. The highest concentration of cultural goods is located in the central part of Belgrade, and their number is decreasing towards peripheral areas.
Given the very favorable geographical position in the immediate vicinity of the Danube, the territory of the present municipality of Grocka has long been the perfect place for the formation of human settlements. The first and oldest traces of settlements in this area date back to the Neolithic - New Stone Age. The remains of settlements from this period have been found at several archeological sites in the settlements of Grocka municipality. Certainly, one of the most important, by which the whole culture is named, is the Belo Brdo archeological site in Vinča - cultural heritage - an archeological site that has a status of significance for the Republic of Serbia (Decision No. 653/5 of 10 November 1965, Cultural Resource of Extreme Importance, Decision, "Official Gazette of the FRS", No. 14/79). The Belo Brdo archaeological site in Vinča is located on the right bank of the Danube, close to the area covered by the Detailed Regulation Plan.

The impact of the project on cultural and historical facilities and sites (cultural goods) can be seen as direct and indirect. Considering the concept of the project in question and the possible effects on the elements of cultural heritage, 2 zones of influence have been defined.

- The direct impact is any physical destruction of facilities/sites in the project area, as well as any violation of the context of cultural heritage elements that are outside the project area boundaries. Given the nature of the project, a zone within 100 meters of the project boundaries is considered a zone of direct impact. Hereafter, the area of direct impact is designated as Zone 1.
- The violation of the integrity of the related area of cultural goods is considered to be an indirect impact, and this applies to the area from a distance of 100 meters to 2000 meters from the project boundaries. Taking into account the final appearance of the planned project and a clear view of the area, this is an area where negative impacts on the cultural context of archeological and ethnological sites and zones and historic urban, rural and religious complexes are possible. Hereinafter, the zone of indirect impact is designated as Zone 2.

There are no UNESCO protection sites in Zones 1 and 2 (www.srbija.com, Serbian UNESCO World Heritage Sites). The site of the Vinča landfill is part of the former borders of the Roman Empire.
Within Zone 1 (covered by project boundaries) there is a registered archaeological site "Ošljane", defined as a cultural property, enjoying prior protection under the Law on Cultural Goods. This place is in the valley of the Ošljanski stream, west of the village of Vinča - Veliko Selo, on a gentle slope on the right bank of the stream. The site is known to archaeologists for accidentally discovering Roman pottery. In 1975, the Museum of the City of Belgrade carried out small-scale exploratory research. Archaeological finds contain remains of the Veteran's Villa from the second to the third century.

It is also important to note that in the conditions issued by the Institute for the Protection of Cultural Monuments, the location of the archaeological site of Ošljane is spatially very inaccurately displayed, without a clearly defined location of the described building of the Veteran's Villa. The question is where the detected building is located within the defined zone.

Within Zone 2 is an archeological site at the site of the present-day Monastery of Saint Archdeacon Stefan (Slanci Monastery). It is located 1.2 km north of the existing landfill. The new complex was built in 1960. The site was once used for religious purposes, and on several occasions was completely destroyed due to the conquest of the site by the Ottoman Empire.

The monastery cemetery is located about 0.7 km northeast of the monastery. The monastery and cemetery do not have visual and functional contact with the project site due to the relief and vegetation obstacles. The old “village” cemetery in Vinča is located about 1 km south of the project boundary. This is a sacral element of local significance.

According to the Belgrade Master Plan 2021 ("Official Gazette of the City of Belgrade", No. 27/03, 25/05, 34/07, 63/09 and 70/14) there are two cultural goods (archeological sites) about 1 km northeast of the existing landfill, in the territory of Gornje Ošljane.

2.9. POPULATION AND CONCENTRATION OF POPULATION

According to the 2011 Census, the city of Belgrade had a population of 1,659,440. The total population increased by 5% in 2002-2011. The average population density for the City of Belgrade is 514 inhabitants/km^2 and is higher than the average population density in Serbia.

The municipality of Grocka covers an area of 289 km^2, which has a population of about 83,907 (2011 Census). According to the census, Vinča had a population of 6,779 (358 inhabitants/km^2).

There are 1831 households in Vinča and the average number of members per household is 3.18. The area covered by Vinča is 18.95 km^2.

An informal settlement was formed in the northern part of the planned landfill construction complex, adjacent to the existing landfill fence. Families who collect and sort the secondary raw materials at the landfill and then sell them to the purchasers live in this settlement.

In this area, 17 families (85 persons) were identified whose members were present in their homes between 2014 and 8 June 2016. Of these, 41 were men, 44 were women, 38 were minors (under 18 years), 47 were adults, and with the note that 6 persons did not have valid documentation to determine their age. The Action Plan provides for the resettlement of families living in an informal settlement at the site of the Vinča landfill, which is described in more detail in Chapter 5.1.

2.10. DATA ON EXISTING COMMERCIAL AND RESIDENTIAL BUILDINGS AND FACILITIES OF INFRASTRUCTURE AND SUPRASTRUCTURE

Of the economic facilities near the Vinča landfill complex, the asphalt base and the Vinča Institute of Nuclear Sciences are of significance for the project in question.

Larger industrial areas are located in the western parts of Belgrade. In relation to the landfill, they are approximately 5 km away in air line in the southwest, west and northwest direction. The high-voltage substation is located 3 km northwest of the landfill.

The most important industrial zone is located in the southern part of Pančevo, where the oil refinery, chemical industry and river port are located. In relation to the landfill, these zones are located at a distance of about 8 km in air line, to the northeast. Residential buildings are in the suburban settlements of Vinča, Veliko selo, Slanci and Mirijevo. The aforementioned settlements are of high residential density and the closest settled households are more than 1000 m away from the landfill complex in Vinča.

The traffic connection to the Vinča landfill has been realized through Beogradska Street from the point of turning off from Smederevo Road. According to the Belgrade Master Plan 2021 ("Official Gazette of the City of Belgrade", No. 27/03, 25/05, 34/07 and 63/09), Smederevo Road is categorized as a main road, and Beogradska Street and the road to the landfill belong to the streets of the second class. The total annual traffic from the landfill complex to public roads is about 135,348 vehicles.

Within the boundaries of the PDR, there are TS 10/0.4 kV "Beogradska bb, waste dump", underground cable of 10 kV, overhead and underground network of 1 kV, as well as public lighting installations. The existing electricity networks are built in free space, following the corridor of existing roads. For the existing overhead lines of 35 kV, a protective corridor of 30 m length (15 m each from the linear axis) was provided. The Vinča landfill complex is at a distance of about 2200 m from the existing water pipeline route Ø200, which is located in the substrate of the Smederevo Road. The traffic connection from Smederevo Road to the Vinča Landfill Complex has a Ø100 mm pipeline of about 450 m in length.

From Smederevo Road to the landfill complex, no sewage network was installed. There is no gas pipeline network and gas stations (GMRS, IAS, etc.) in the specified area. The landfill complex is connected to an automatic telephone exchange (ATE) "Kaluđerica". The access telecommunication network is made by underground cables.

Suprastructural facilities (hospitality facilities, galleries, exhibition, congress, entertainment facilities, etc.) are located more than 1000 m away in air line from the Vinča landfill complex.

2.11. HEALTH DATA IN SERBIA

According to data published by the Institute of Public Health of Serbia (Source: Health Statistical Yearbook of the Republic of Serbia 2016), the most common causes of death in 2016 in Serbia (excluding the Symptoms, Signs and Abnormal Clinical and Laboratory findings group (4.9%)), belong to the following disease groups:

- vascular disease 51.8%
- neoplasm disease 21.8%
- respiratory diseases 4.8%
- endocrine, nutritional and metabolic diseases 3.3%
- digestive tract disease 3.2%

In 2015, the most common causes of death in Serbia, excluding the Symptoms, Signs and Abnormal Clinical and Laboratory findings group (5.4%), belong to the following disease groups:

- vascular diseases 52.7%
- neoplasm diseases 20.6%
- respiratory diseases 5.3%
- digestive tract disease 3.2%
- injury, poisoning and certain other consequences of external causes 2.8%

Chronic non-communicable diseases: cardiovascular disease, malignant tumors, diabetes, obstructive pulmonary disease, injury and poisoning, mental health disorders and other chronic diseases have dominated decades in national pathology.

Cardiovascular disease and malignant tumors accounted for more than two-thirds of all deaths in Serbia in 2016. More than half of all fatal outcomes (51.7%) are due to death from vascular disease and nearly one in five people who died (21.3%) were victims of a malignant tumor.

In Serbia, 2.8% of the population died from injuries and poisoning, 3.1% as a result of complications of diabetes, while 2.6% died as a result of obstructive pulmonary disease. Between 2007 and 2016, a 2.6% slight increase in overall mortality was observed in Serbia due to increased mortality from leading chronic non-communicable diseases. In the observed period, the highest increase in mortality was associated with malignant disease (10.3%), diabetes (10.0%) and obstructive pulmonary disease (7.4%). The lowest mortality rate was recorded due to injuries and poisoning (22.7%) and vascular diseases (5.4%).

Although the increased mortality rate may partly be explained by better diagnosis and recognition of the cause of death, the fact is that the majority of the population in Serbia is suffering from and dying of coronary and heart disease. It is known that 75% of heart diseases are caused by conventional lifestyle risks - smoking, hypertension, high cholesterol, malnutrition, obesity and inactivity.

In addition, many socio-economic studies suggest a link between low socio-economic status and heart and coronary diseases.

In 2016, 52,102 people in Serbia died of cardiovascular disease. Cardiovascular diseases account for 51.7% of all causes of death and are the leading cause of death in Serbia. Women were more likely to die of cardiovascular disease (54.3%) than men (45.7%). Ischemic heart disease and cerebrovascular disease are the leading causes of death in this group of diseases.

Over the 10-year period, the mortality rate for cardiovascular disease in Serbia dropped from 780.4 to 738.2/100,000 inhabitants. Between 2007 and 2016, the death rate for women decreased by 5.2% and for men by 5.7%.

Between 2005 and 2014, the average number of people diagnosed with malignant diseases in Central Serbia was 25,834 per year, while 14,755 died of cancer per year. According to data from the Central Serbia Cancer Registry, in 2014, 26,362 new cases (422 malignant tumors) were registered and 15,152 died of cancer.

The City of Belgrade has one of the highest mortality rates (males 178.5/100,000, females 121.3/100,000).

According to cancer registry data, men were mostly diagnosed and died of bronchus and lung, colon and rectal cancers and prostate cancer. With women, the most common places of malignant tumors are breasts, bronchum and lungs, colon and rectum. At the same time, women were mostly victims of breast, bronchus and lung cancer, as well as colon and rectal cancer (Source: RS Health Yearbook, 2016).

3.0 PROJECT DESCRIPTION

In the southwestern part of the existing complex of the Vinča landfill, a phase construction of the plant for the energy utilization of municipal waste - TE-TO on municipal waste (EfW plant) and a cogeneration plant on landfill gas (BEP plant) is planned, on an area of about 4.8 ha .

The plant for the generation of energy from waste (EfW) with the cogeneration plant (combined, heat and electricity) includes:

- waste incinerator (with waste hopper and waste incineration system)
- boiler for heat recuperation and steam turbine generator (for the utilization of the obtained energy)
- plant for the treatment of the slag from the incinerator bottom (IBA zone)
- flue gas and flue gas residues (also referred to as flue gas treatment residues - APCR) treatment plant by stabilization and solidification processes.

Landfill gas cogeneration plant (BEP) for receiving energy from landfill gas from an existing landfill and a new landfill for untreated residual municipal waste includes:

- landfill gas extraction,
- plant for the energy utilization through the production of electricity
- flue gas treatment plant

The site for the construction of the EfW/BEP plant has the following infrastructure planned:

- collectors for dewatering and the collection of waste water (potentially polluted atmospheric water)
- access and interior roads
- operating / manipulation surfaces

The construction of EfW and BEP plants is planned within the planned functional unit K1, on the formed building parcel KP6-1. The planning functional unit K1 is divided into two sub-units through the preparation of technical documentation:

- *Functional unit/unit 1/1*: refers to EfW plant facilities and
- *Functional unit/unit 1/2*: refers to BEP plant facilities

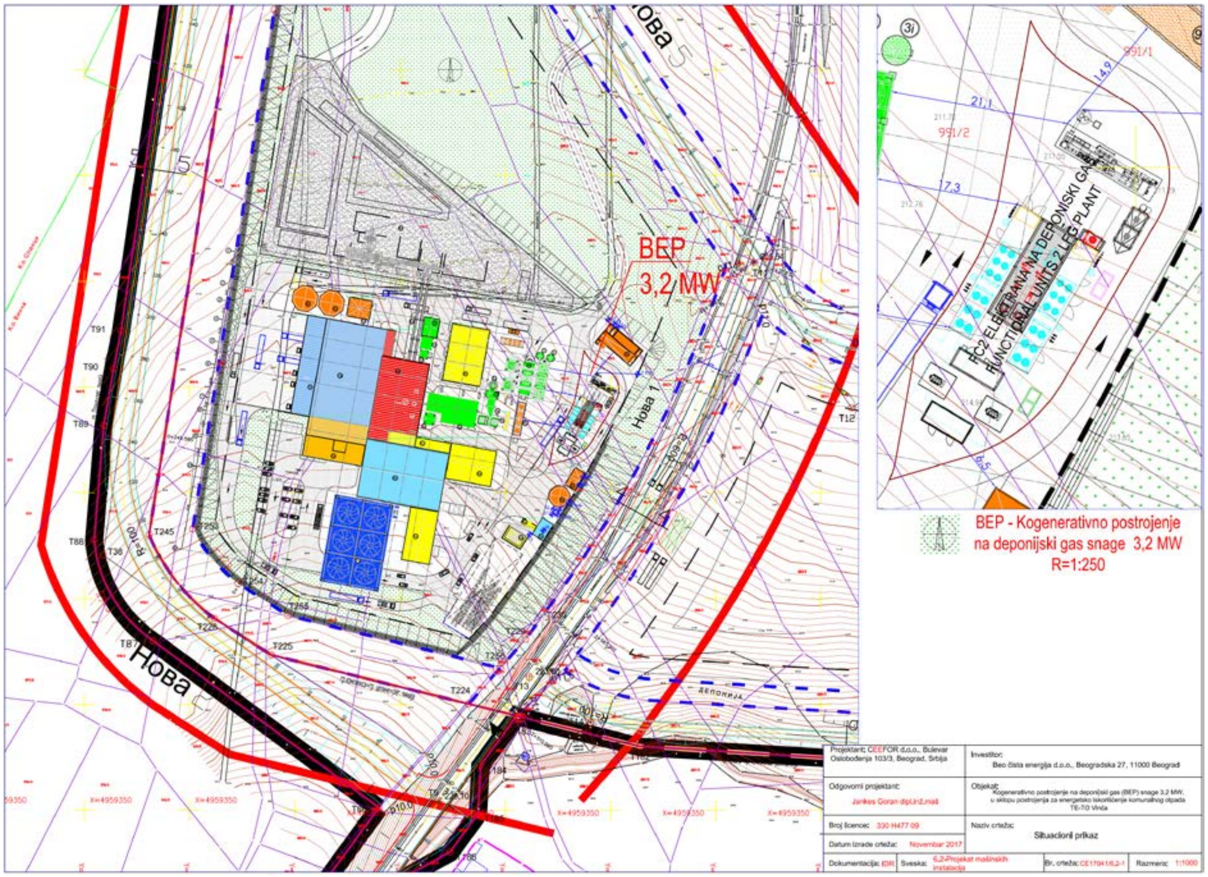


Figure 11 Layout view of the complex of the EfW and BEP plants
Source: Plant for the energy utilization of municipal waste, Sub-unit 1/1, IDP 0: Main Volume (Energoprojekt Entel ad, 2018)

Note: The detailed description of the project that follows is taken from the technical documentation, the list and description of which is given in Chapter 12.0.

3.1. DESCRIPTION OF PREVIOUS WORKS ON THE PROJECT

The preparatory work project (IDP, 10: Preparatory works project, "Energoprojekt Entel" ad, 2018) covers the planning (primary leveling) of the terrain as well as the construction of diaphragms in the area planned for the placement of the plant for energy utilization of municipal waste and landfill gas.

The primary leveling of the terrain is intended to bring the terrain angles approximately to the level of the final leveling of the plant and to prevent the foundation soil from soaking, as well as to allow access to the machinery for making the diaphragms.

Due to the unfavorable terrain configuration, and due to the technological requirements for the facilities to be at the same level, the construction of the diaphragms is envisaged in order to ensure the slope stability.

As the designed zero level of most facilities is +215.00 m.a.s.l, the planned terrain is envisaged at the same level. Some deviations from the stated level are conditioned by the requirement for mechanization in the diaphragm placement zone as well as the planned level of the plateau for unloading municipal waste.

In the course of the planning of the terrain, 3 traffic entrances to the location in question are foreseen from the existing road within the Vinča landfill complex. All 3 connections are temporary and their opening and closing will be adjusted to the dynamics and type of work.

Freight vehicles will not interfere with the functioning of traffic on the existing road, both from the aspect of flow and from the aspect of safety, when entering the access road.

In this regard, conditions for shaking materials from the wheels of transport vehicles and washing vehicles and wheels should be provided at the location concerned, in order to prevent the material from getting on the road and obstructing traffic.

The perimeter of the site in question provides for ground canals that will be connected to the final network of perimeter canals and will serve the final leveling of the EfW/BEP plant.

As detailed in Chapter 2.3, the terrain at the site of the future EfW/BEP plant is constructed from the following lithological soil layers:

- layer 1 - humus (up to a depth of 0.4-3.2 m)
- layer 2 - loessoid deluvium
- layer 3 - buried soil - sandy clay and fine crumbs
- layer 4 - eluvial-deluvial sediments

According to the recommendation of the geomechanical survey, the slope of the cuts and the slope of the embankment were adopted.

The calculation of the quantities of excavated and planned material was done on the basis of the cellular calculation using the “Gavran GCM” software tool. Based on the calculation, the following was obtained:

- excavation volume: 175.390 m^3
- embankment volume: 41.570 m^3

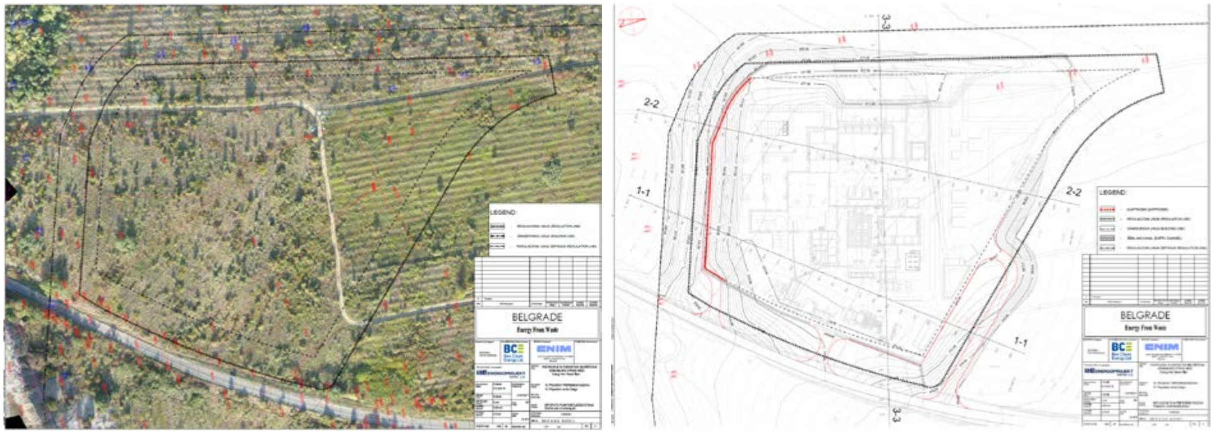


Figure 12 Planned area for the EfW/BEP plant

A concrete diaphragm of about 150 m in length on the south side of the plot is foreseen to secure the excavation of the main plateau. At a length of approximately 90 m, a diaphragm was analyzed for an average difference in terrain height of 6.26 m and 5.07 m, with a total height of 11.0 m. On the remaining length it successively decreases with the decrease in the difference in terrain levels on both sides of the diaphragm.

The reason for choosing the diaphragm is a big difference in the leveling of the terrain and since it is located on the building line itself, it was not possible to make the foundations for retaining walls beyond the boundary of the parcel. For other plateaus, standard retaining walls with foundations are provided to ensure slope stability.

The retaining wall (PZ1) is designed to provide a plateau for fire tanks, a fire pump station at level +215.00 and a road that accesses the unloading plateau from the terrain level (+215.00). The wall is 1.2 m taller than the terrain, as it is also a protective fence. The structure of the wall is divided into six dilated independent units. The length of each is approximately 14 m and in the middle of the segment there is another cascading change in height. Height of walls varies from 1.75 m to 6.6 m, thickness 200 mm or 300 mm and foundation level 214.0 m or 213.50 m. Where necessary, the walls have a foot of the width of 2.0, 2.5 or 3.5 m.

The retaining wall (PZ2) is located adjacent to the hopper building providing terrain towards the parking lot adjacent to the administration building. In structural terms, the PZ2 wall is the same as the end dilatation unit of the PZ1 wall.

A fence with the height of 2.5 m is foreseen around the plant complex and slag storage facilities. The fence is made of galvanized wire, supported by reinforced concrete columns at a maximum distance of 3 m. Along the protective diaphragm, the columns rest on the top of the diaphragm, and on the rest of the section, on block foundations.

3.2. DESCRIPTION OF THE FACILITIES, PLANNED PRODUCTION PROCESS OR ACTIVITIES, THEIR TECHNOLOGICAL AND OTHER CHARACTERISTICS

The plant for the energy utilization of municipal waste (EfW plant - functional unit 1/1) and the landfill gas utilization plant (BEP plant - functional unit 1/2) will be constructed on the building parcel KP1, in accordance with the Amendments to the Plan of detailed regulation of the Vinča sanitary landfill (2018). Both functional units will be connected to the rest of the landfill complex as follows:

- by connection to the internal road network within the waste management area, for municipal waste delivered from the City of Belgrade, which is burnt/incinerated within the functional unit 1/1, at which the waste receiving point, with measuring bridges, is located outside the building parcel KP1,
- by connection with the joint water supply of the Vinča landfill complex,
- by connecting the functional unit 1/2, through a manifold pipeline for supplying landfill gas to the gas collection system from the existing landfill and new landfills,
- disposal of the stabilized APCR generated during the municipal waste incineration process within the functional unit 1/1 is performed at a specially prepared landfill within the landfill complex. Removal and transportation of APCR from treatment facilities within the KP1 building parcel, to a specially prepared APCR landfill within the landfill complex, is performed by trucks via internal roads,
- the periodic excess wastewater (described in the following sections), which may occur on the KP1 building parcel, is treated in conjunction with the process waters from the municipal waste landfill (at the Leachate Treatment Plant (LTP)), located outside KP1.

The anticipated dynamics of the construction of the plant for energy utilization of municipal waste should allow its commissioning in 2021.

3.2.1. Description of facilities

The technical descriptions below are taken from preliminary designs made by Energoprojekt Entel ad from Belgrade, made in April 2018.

The planned area (Functional unit 1/1) for the construction of the EfW plant, consists of 9 zones (*(Source: IDP, 0: Main Volume)* with facilities which are given in the table:

ZONE 1: RECEIPT AND UNLOADING OF MUNICIPAL WASTE		
Waste hopper *Markup on layout plan: 1a* ***Unloading space*** *Markup layout plan: 1b*	Purpose:	Storage area for unloaded waste and unloading of vehicles delivering municipal waste
	Dimensions of the facility	Ground floor: 47.45 x 27.09 m First floor: 56.15 x 29.47 m
	Gross building surface: 1a + 1b	1397.41 m^2
Access plateau *Markup on the layout plan: 1c*	Purpose:	Plateau to access and maneuver vehicles delivering municipal waste
	Dimensions of the facility Gross area	LxBxH = 30.00x46.50m 1395.00 m2
ZONE 2: BOILER PLANT		
Boiler room *Markup on the layout plan: 2a*	Purpose:	Accommodation of boiler plant equipment
	dimensions:	LxBxH = 66.35x31.65x55.50m
	Gross area of the building	1859,18,10 m^2
DeNOx nitrogen oxide emissions control building *Markup on the layout plan: 2b*	Purpose:	Placement of nitrogen oxide control equipment and urea solution tanks
	dimensions:	LxBxH = 8.6x7.1x11.55m
	Gross area of the building	61.06 m2
ZONE 3: FLUE GAS PURIFICATION SYSTEMS		
Reactor bag filter *Markup on the layout plan: 3a*	Purpose:	Control of particulate pollution, acid and other pollutants in flue gas
	dimensions:	LxB = 24x9 (13) +3.5x7.5 m (steel staircase)
	Gross area of the building	330 m2
Recirculation silo *Markup on the layout plan: 3b*	Purpose:	Flow storage of separated waste in a closed process for removing pollutants from flue gas
	dimensions:	4.0x4.0m
	Gross area of the building	16 m^2

Silo for Ca(OH)$_2$ reagent *Markup on the layout plan: 3c*	Purpose:	Lime silo used in the flue gas purification process
	dimensions:	LxB = 6.0x6.0 m
	Gross area of the building	36.0 m^2
Reagent silo - Activated charcoal *Markup on the layout plan: 3d*	Purpose:	Activated charcoal silo used in the flue gas purification process
	dimensions:	LxB = 4.5x6.0m
	Gross area of the building	27.0 m^2
The foundation of the flue gas fan and other equipment Markup on the layout plan: 3e	Purpose:	Foundations for the foundation of technological-mechanical equipment
	dimensions:	LxB = 10.0x5.0 m
	Gross area of the building	50.0 m^2
Flue gas analyzer canopy Markup on the layout plan: 3f	Purpose:	Placement of the flue gas analyzer
	dimensions:	LxB = 5.2x9.5m
	Gross area of the building	50.0 m^2
Stack Markup on the layout plan: 3g	Purpose:	Release of purified flue gas into the atmosphere
	Altitude level ± 0.00 of the stack	215.5 m.a.s.l.
	dimensions:	60+0.50 = 60.5 m, Stack top level 275.5 m.a.s.l.
	Stack coordinates:	The stack will be located on cadastral parcel 990/1, Grocka Municipality, CaM Grocka
	Gross area of the building	15.0m^2
Thermogenic waste and additives silos with the mixing station and truck loading *Markup on the layout plan: 3h*	Purpose:	Silos for storage of thermogenic waste collected from flue gas purification plants, silos for accommodation of additives for solidification of thermogenic waste, accommodation of equipment for mixing additives with thermogenic waste and truck loading
	dimensions:	LxB = 5.2x3.5m
	Gross area of the building	19.0 m^2
Leachate tanks *Markup on the layout plan: 3i*	Purpose:	Storage area for wastewater used in the solidification process of thermogenic waste
	dimensions:	7.8x4.3m

	Gross area of the building	34 m^2
Mixing station and control room *Markup on the layout plan: 3j*	Purpose:	Stabilization of thermogenic waste
	dimensions:	LxBxH = 6.0x7.5 m
	Gross area of the building	45.0 m^2
Silos for cement and metallurgical slag *Markup on the layout plan: 3k*	Purpose:	Reagent storage used in thermogenic waste stabilization process
	dimensions:	5.3x12.4m
	Gross area of the building	66.0 m^2
Diesel generator *Markup on the layout plan: 3l*	Purpose:	Accommodation of diesel generator
	dimensions:	3.0x12.3m
	Gross area of the building	37.0 m^2
Pipeline bridge *Markup on the layout plan: 3m*	Purpose:	Pipeline support
	dimensions:	2.1x69.0m
	Gross area of the building	145.0 m^2
ZONE 4: ELECTRICAL FACILITIES AND SUPPORTING PLANTS		
Electrical building *Markup on the layout plan: 4a*	Purpose:	Accommodation of two 11/0.66kV and two 11/0.4kV transformers, 4000 kVA each, 10 kV plants, LV plants, rechargeable batteries, UPS and other electrical power equipment.
	dimensions:	LxBxH = (21.8x16.65 +5.1x16.7) x13.15 m
	Gross area of the building	809.91 m^2
Building for the 11kV plant *Markup on the layout plan: 4b*	Purpose:	Installation of the 11 kV plant for the connection of the generator to the landfill and the 110/11 kV transformer through which connection is made to the infrastructure for the connection to the 110 kV transmission network.
	dimensions:	LxBxH = 5.3x13.8x5.0 m
	Gross area of the building	73.40 m^2
Compressor station *Markup on the layout plan: 4c*	Purpose:	Production of compressed air
	dimensions:	LxBxH = 29.77x7.2 (4.85)x6.15 m
	Gross area of the building	174.09 m^2
HPW building *Markup on the layout plan: 4d*	Purpose:	Installation of the equipment for the chemical preparation of water
	dimensions:	LxBxH = 25.4x13.6x11.9 m
	Gross area of the building	346.12 m^2

Transformer 11/110kV *Markup on the layout plan: 4e*	Purpose:	Connecting the thermal power facility-heating plant to the 110 kV transmission system
	dimensions:	LxB = 7.0x7.54 m
	Gross area of the building	53.0 m^2
Raw water tank *Markup on the layout plan: 4e*	Purpose:	Raw water receiving tank
	dimensions:	Ø9.5m
	Gross area of the building	80.0 m^2
Raw water pumping station *Markup on the layout plan: 4g*	Purpose:	Placement of raw water pumps
	dimensions:	LxBxH = 6.0x11.0x5.1m
	Gross area of the building	66 m^2
110 kV connection plant *Markup on the layout plan: 4h*	Purpose:	The outdoor plant for connection to the transmission system via transmission line (connection line) 110 kV
	dimensions:	LxB = 15.0 x19.20 m
	Gross area of the building	290.0 m^2
Plateau of mobile diesel generators *Markup on the layout plan: 4i*	Purpose:	Space to accommodate temporary packages of mobile diesel generators (generators) which will only be leased and installed in cases of prolonged power failure from the distribution network
	dimensions:	LxB = 16.00mx25.00m
	Gross area of the building	400.0 m^2
ZONE 5: ADMINISTRATIVE BUILDING WITH CONTROL ROOM		
Administrative building *Markup on the layout plan: 5a*	Purpose:	Administrative building - offices, control room, PLC room and LV room
	dimensions:	LxBxH = 29.57x19.00x17.50(21.65)m
	Gross area of the building	2362.89 m2
ZONE 6: TURBINE BUILDING		
Turbine building *Markup on the layout plan: 6a*	Purpose:	Accommodation of the turbine, generator and other equipment
	dimensions:	LxBxH = 39.6x28.0x22.40 m
	Gross area of the building	2529.34 m2
ZONE 7: AIR-COOLED CONDENSER		
Air-cooled condenser	Purpose:	Cooling system
	dimensions:	LxB = 42.0x28.60m

Markup on the layout plan: 7a	Gross area of the building	1220.0 m2
ZONE 8: TRANSPORT, TREATMENT AND MATURING OF INCINERATOR SLAG		
Slag conveyors *Markup on the layout plan: 8a*	Purpose:	Transport of the slag from the boiler room to the space for treatment and maturation of the slag
	dimensions:	LxB = 3.36x53 m
	Gross area of the building	179.0 m^2
Plateau for slag treatment and maturing *Markup on the layout plan: 8b*	Purpose:	Accommodation of slag treatment equipment
	Gross area of the building	5350.0 m2
Settling basin and lagoon *Markup on the layout plan: 8c*	Purpose:	Wastewater settling from the slag treatment plateau
	Gross area of the building	350.0 m2
ZONE 9: EXTERNAL FACILITIES		
Workshop and warehouse *Markup on the layout plan: 9a*	Purpose:	Accommodation of machines, tools and spare parts
	dimensions:	LxBxH = 27.4x18.3x12.50 m
	Gross area of the building	652.12 m^2
Fire water tanks *Markup on the layout plan: 9b*	Purpose:	The accumulation of the required amount of water for fire protection
	dimensions:	2xØ11.0 m
	Gross area of the building	240 m^2
Pumping station for fire water *Markup on the layout plan: 9c*	Purpose:	Accommodation of pumps and other fire protection equipment
	dimensions:	LxBxH = 9.2x11.1x4.9 m
	Gross area of the building	102.12 m^2
Thermal energy meter facility *Markup on the layout plan: 9d*	Purpose:	Connection for future district heating pipeline of Belgrade and tariff measurement of heat supply
	dimensions:	LxBxH = 10.3x6.3.x15 m
	Gross area of the building	64.89 m^2
Wastewater pit *Markup on the layout plan: 9e*	Purpose:	Wastewater collection pit
	dimensions:	LxB = 9.10x 20.8m
	Gross area of the building	190.0 m^2

Liquid fuel tank with pump room and canopy *Markup on the layout plan: 9f*	Purpose:	Liquid fuel tank for the ignition of the boiler with a transshipment ramp for the unloading of fuel from tanker trucks
	dimensions:	LxB = 9.4x11.4m
	Gross area of the building	108.0 m^2
Oil pit *Markup on the layout plan: 9g*	Purpose:	Oil collecting pit from the 110/11 kV transformer
	dimensions:	LxB = 3.15x7.6m
	Gross area of the building	24.0 m^2

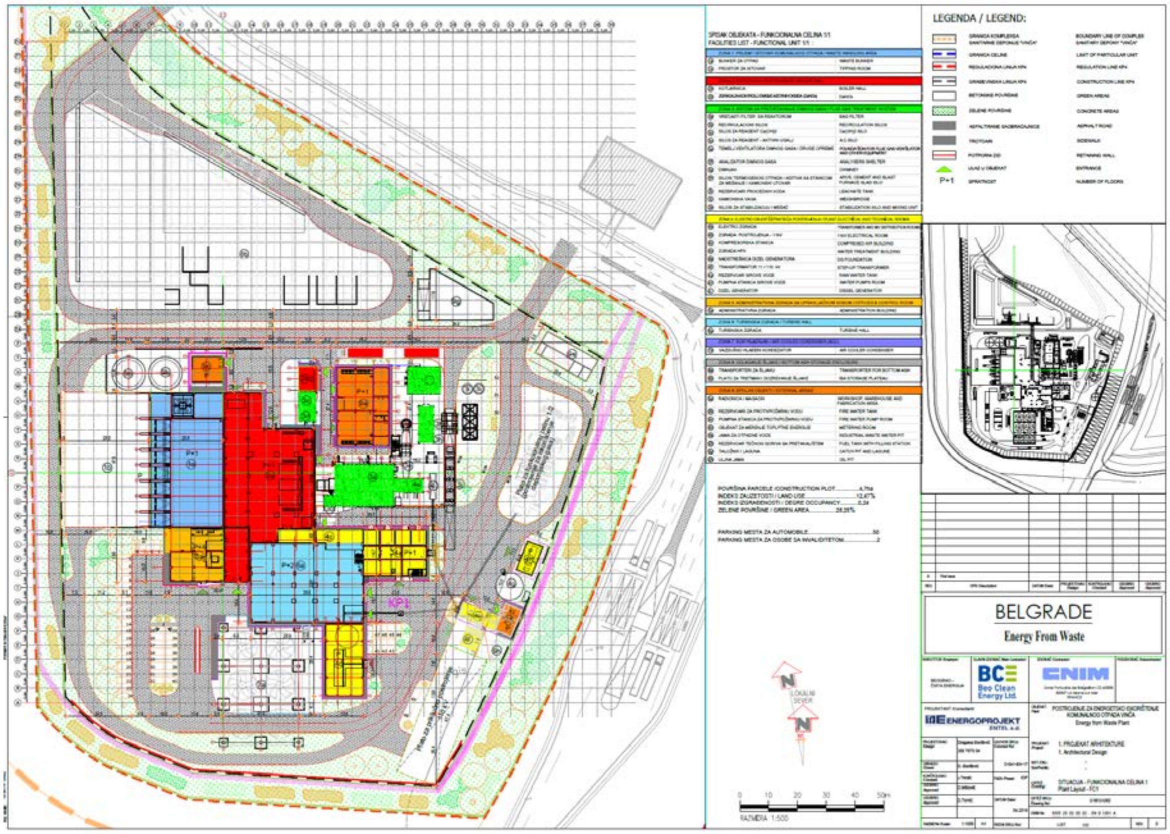


Figure 13 Layout plan - Functional unit 1
(Source: IDP, 1/1: Architecture Design - Main Facilities)

In accordance with the list of buildings/facilities of the EfW plant, the following text contains their architectural and construction description with the main purpose.

ZONE 1: Receipt and unloading of municipal waste

1a - Waste hopper

The purpose of the waste hopper is the storage space for unloading and receiving waste. The volume of the hopper is determined by technological requirements, dimensions 47.45 x 27.09 m and the height level -6.00 to level + 20.90. In addition to the hopper space, this facility contains a crane space above level +20.90. The crane path is at a level of +27.80 m. Large forks are mounted on the crane, which fill the boilers with municipal waste. The facade of the entire hopper is lined with facade panels. The gross area of this facility is 1397.41m^2.

1b - Unloading space

Municipal waste will be delivered with suitable vehicles via access roads and the plateau in front of the unloading space. The unloading space contains seven unloading ramps through which the waste is stored in the waste hopper. The space is supported by steel columns and lined with facade and roof sandwich panels on three sides, the fourth side is attached to the hopper.

ZONE 2 – Boiler plant

2a - Boiler room

In accordance with the purpose and layout of the equipment in the boiler room, the construction and shape of the building have been determined. The primary purpose of this space is to accommodate a vertical boiler. Due to the high height of the building, the structure is steel, lined with vertical facade panels. Vertical communication was solved by installing two stairs and one elevator. The gross area of this facility is 1859.18 m^2. The elevator tower structure is an independent freestanding steel structure stiffened by joints, and is a spatial grid of four-sided cross-section. The dimensions of the tower are 3.10 m x 3.10 m in base. The height of the tower is 55.03 m.

2b - Nitrogen oxide emissions (DeNOx) control building

The nitrogen oxide emission control (DeNOx) building is intended to accommodate nitrogen oxide control equipment and urea solution tanks. The facility is ground-level, steel, based on the RC panel. The walls and roof are lined with façade and roof sandwich panels mounted on a steel substructure. The dimensions of the building are 8.6 x 7.1 m. The height of the building is 11.55 m. The gross area of the building is 61.06 m^2. The building has a urea tank, 50 m^{3}in volume.

The DeNOx building only includes the urea storage and injection system used to neutralize NOx released during waste incineration. The actual removal of NOx occurs only in the furnace - boiler plant. Therefore, the DeNOx building only includes urea detection.

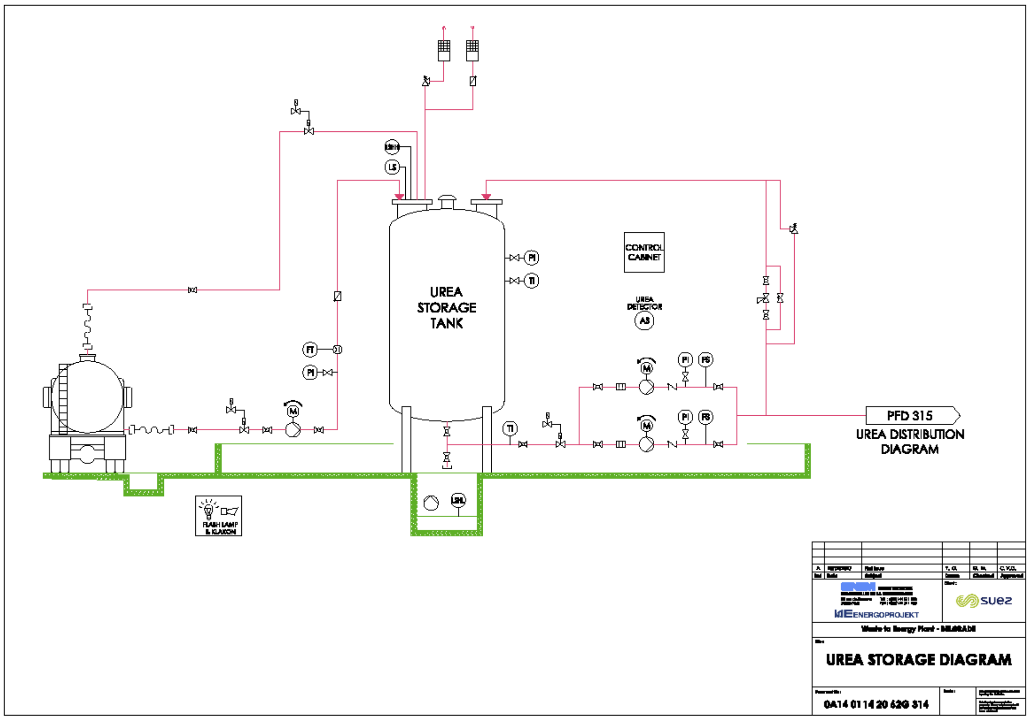


Figure 14 Process flow diagram of the urea dosing system

ZONE 3 – Flue gas purification systems

3a – Bag filter

The supporting structure of bag filters is a steel structure made up of columns and beams supported by platforms on which the equipment is located. The stability of this structure is ensured by vertical and horizontal couplings.

3b – Recirculation silo

The thermogenic waste recirculation silo is supported on a frame structure stiffened with couplings at the level of +6.5 m. The planned dimensions of the supporting structure are 4 x 4 m in base. On the west side of the silo, its supporting structure has been extended due to the staircase, which provides access to all levels of the structure and platform at the level of +6.5 m, on which the silo itself rests.

3c -– $Ca(OH)_2$silo and 3d – Activated carbon silo

The supporting structure of the two silos (lime and activated carbon) is a steel structure. It consists of steel columns and beams. The stability of this structure is ensured by vertical and horizontal couplings. The connections to the foundations are modeled as joint connections. The main level of the structure is: +4.35 m – access level and supporting structure of the silo. The structure consists of 4 main frame structures, which are 5.52 m wide and 4.15 m high. Frame spacing is 2.70 m, 2.893 m and 4.377 m.

3g - Stack

The stack is a steel freestanding cylindrical tube. The internal flue duct is insulated from the outer self-supporting sheath. The height of the stack is about 60.5 m. The outer supporting sheath measures are D = 2650 mm in diameter and inner diameter d = 2350 mm.

3h - Thermogenic waste and additives silos with the mixing station and truck loading

The supporting structure of the three stabilization silos is a steel structure. It consists of steel columns and beams. The stability of this structure is ensured by vertical and horizontal couplings. Bonds with foundations are modeled as rigid bonds. The main level of the structure is +8.23 m - level of inspection of the funnel. The structure consists of 3 main frame structures, which are 5m wide and 8.23 m high. The frame spacing is 3.95m, 4.2m and 3.95m.

ZONE 4 – Electrical facilities and supporting plants

4a - Electrical building

The electrical building is located adjacent to the turbine building (on the east side) and partly rests on the boiler room. The purpose of the building is to accommodate two 11/066kV transformers and two 11/04kV transformers, 11kV plants and LV plants. The floor of the building is P +1, with the part of the floor where the LV distribution is located above the compressor station. The structure is reinforced concrete, skeletal with concrete block filling. The dimensions of the building are 21.80m. x 16.65m. + 5.10m. x 19.7 m. The height of the building is 13.15m. The gross area of the building is 809.91 m^2.

4b - 11kV plant building

The facility is a ground floor facility with the purpose of transforming the voltage for delivery to the grid. It is located on the east side of the parcel, in the immediate vicinity of the equipment for connection to the electrical transmission system (EMS), and in direct connection with the facility for the measurement of thermal energy. The structure is reinforced concrete, skeletal with concrete block filling. The wall to the Step-up transformer is reinforced concrete for fire-fighting reasons. The dimensions of the facility are 5.30x13.80 m. The height of the building is about 5.0 m. The gross area of the building is about 73.40 m^2.

4c - Compressor station

The compressor station is intended for the production of compressed air. The structure of part of the building is reinforced concrete, skeletal with concrete block filling, and the part located inside the boiler room and turbine building is a steel structure with sandwich panel walls. Dimensions of the building are 29.77 x 7.20 m. Part of the building is within the boiler room (63.40 m^2), and part belongs to the turbine building (32.20 m^2). The height of the building is 6.15 m. The gross area of the building is 174.09 m^2.

4d - HPW Building

The chemical water preparation building is intended to accommodate the chemical water preparation (HPW) equipment. Air-cooled condensers are located in the immediate vicinity of the west side. The structure is reinforced concrete, skeletal with concrete block filling. The facility is a ground floor facility and the dimensions of the facility are 24.4x13.6 m. The height of the building is 11.9 m. The gross area of the building is 346.12 m^2.

4g - Raw water pumping station

The raw water pumping station is located east of the EfW plant complex, adjacent to the construction line of the parcel. It is intended for housing raw water pumps. The structure is reinforced concrete, skeletal with concrete block filling. The dimensions of the facility are 11.00m. x 6.00 m. The height of the facility is about 5.10 m. The gross area of the building is approximately 66.00 m^2.

ZONE 5 – Administrative building with control room

5a - Administrative building

The administrative building was designed next to the waste hopper and boiler room, floors P +4, total gross floor area of the building P = 2362.89 m^2. It is structurally related to the above facilities, so special attention was paid to the noise insulation of the plant. The administrative building at level +12.00 has a control room for the operator who controls the crane and fills the hopper. At level +16.00 there is an electric room with electrical cabinets for supplying the crane with electricity. The rest of the space is intended to accomodate people. The required conditions on the premises will be provided by accommodation of suitable installations (plumbing, sewage, heating, ventilation, cooling, fire alarm, telecommunication installations). The dimensions of the facility are 29.57x19.00 m. The height of the facility is +17.50 m.

ZONE 6 – Turbine building

6a – Turbine building

The turbine building accommodates the turbine, generator and other equipment. It is located below the boiler room and between the administrative and electrical buildings. The structure is reinforced concrete, skeletal with concrete block filling. The floor of the building is P +2. The ground floor accommodates the necessary equipment and an auxiliary boiler room. The turbine is at the level of +7.0 m. and is laid on a turbine table that is dilated from the structure of the facility. The gallery is at the level of +16.80m and is designed to accommodate pumps and other equipment. The dimensions of the building are ~39.60x28.00 m. The height of the building is about 22.4 m. The gross area of the building is 2529.34 m^2.

The auxiliary boiler room is designed for periods when the EfW plant does not operate, or in the event of a power outage, in the winter. This boiler room provides heating of the premises (where people spend time and the room where the equipment is stored) and duty, i.e. anti-freeze heating. In the boiler room it is planned to install one hot water boiler with a liquid - diesel fuel burner and a daily, above ground steel tank for diesel fuel, which provides the necessary autonomy of the boiler operation.

The characteristics of the liquid - diesel fuel boiler in the auxiliary boiler room are:

- heat capacity 270 kW
- temp. water inlet/outlet 90/70 ^oC
- max. operating pressure 4 bar
- water volume 400 l
- weight of the boiler with burner 710 kg
- required electrical power 0,518 kW
- power supply 230 V/50 Hz
- dimension with the burner 2100/900/1500 mm (lxwxh)

(Source: IDP, 6/10 Mechanical Installation Design, Thermal Engineering Installations)

ZONE 7 – Air-cooled condenser

Air-cooled condensers rely on a steel structure at the level of +12.0 m relative to the reference level of the plant (absolute level +215 m). Access platforms are located next to the condenser. Above the main platform there is a noise protection wall on the secondary sub-structure. The primary steel structure consists of four rows of frames in the transverse direction and three rows in the longitudinal direction. The dimensions of the structure are 42.00 x 28.6 m in base. The distance between the transverse frames is 13.30 m each. The distance between the longitudinal frames is 13 m. Block foundations are provided below the main columns. The depth of the foundation is at -1.5 m from the ground.

ZONE 8 – Transport, treatment and maturing of incinerator slag

8a – Slag conveyors and 8b - Plateau for the treatment and maturation of slag

The slag disposal area is an open storage facility and equipment for crushing and separating slag, covering an area of 5400 m^2. The total area (storage and road) is approximately 7500 m^2. The area is used for unloading slag from the EfW plant, which is transported by conveyors from the plant to the crushing and separation equipment and further to an open storage facility.

The storage area is located on a reinforced concrete slab. The drop of the slab is regulated so that the soiled rainwater (due to the filtration through the slag storage) is collected into the perimeter canals and sent to a nearby settlement basin and lagoon. A waterproofing membrane is provided below the entire surface of the slab to prevent rainwater from seeping into the soil.

The slag will be located inside the walls which will be mobile concrete blocks of trapezoidal profile, suitable for mounting. Block manipulation will be done with two lifting anchors that are mounted on top of the block.

Crack induced boards are located at every 6 m, while expansion joints are provided at every 24 m.

The following loads were taken into account: constant (self-weight and permanent equipment), useful loads (other equipment, standard vehicle and two-way wind on the walls). Materials provided for:

- concrete C30/37 (impermeable),
- reinforcement B-500.

Lagoon and settling basin

On the plateau, a lagoon and a settling basin are foreseen for the disposal, maturation and treatment of slag. These facilities are used to collect contaminated water from the slag landfill plateau and from the process when the amount of water exceeds the volume of the wastewater pit.

The settling basin is used to deposit larger particles as the water flows into the lagoon, whose design volume is 800 m^3.

The settling basin is a buried open tank with two chambers, receiving and settling, with an area of about 350 m^2 and the variable depth of 1.7-2.55 m. In the deepest part, a sediment pit is formed and above it is an overflow into the lagoon. The settling basin shares one wall with the lagoon. The lagoon is trapezoidal in shape, the dimensions of the base are 5.7 m and 17.8 m and 22.2 m high. The lagoon consists of retaining reinforced concrete walls 3.9 m high on the foundation slabs. The space between the walls is covered with a 20 cm thick layer of sand. A waterproof membrane is applied over the sand to coat the inner surface of the walls.

The narrower part of the lagoon is envisaged to have a holder 2.4 m wide for supporting pumps. Along the circumference of the settling basin and the lagoon, a 1.1 m high guardrail is foreseen. The following loads have been taken into account: constant (own weight and constant load - platform of rost, fences, ground and water pressures), useful loads (standard vehicle) and temperatures. Materials provided for:

- concrete C30/37 (impermeable),
- reinforcement B-500.

ZONE 9 – External facilities

9a - Workshop and warehouse

The workshop and warehouse building have two equipment repair rooms as well as a laboratory with associated spare parts storage facilities. The building is located to the right of the boiler room and the building for the control of nitrogen oxide emissions, and above the flue gas purification system. The structure is reinforced concrete, skeletal with concrete block filling. The floor of the building is P +1. On the ground floor there are storage rooms and workshops for repair of equipment parts. Also, on the ground floor there is a laboratory room with storage and sample preparation rooms, as well as rooms with electrical cabinets. At levels +6.0 m and +7.0 m there is a storage area for parts. The dimensions of the facility are 18.30 x 27.40 m. The height of the facility is about 12.50 m. The gross area of the facility is approximately 652.12 m^2.

9c – Pumping station for fire water

Within the fire water pumping station there are fire water pumps with a water tank adjacent to the facility. It is located above the waste hopper and to the right of the fire water tank. The structure is reinforced concrete, skeletal with concrete block filling. The facility is a ground floor facility. The dimensions of the facility are 11.10 x 9.20 m. The height of the facility is about 4.9 m. The gross area of the facility is approximately 102.12 m^2.

9d - Thermal energy measuring facility

The facility has equipment for the district heating system. It is located to the right of the 11 kV plant building and below the raw water storage tank. The structure is reinforced concrete, skeletal with concrete block filling. The facility is a ground floor facility. The dimensions of the facility are 10.30 x 6.30 m. The height of the facility is 15.00 m. The gross area of the facility is about 64.89 m^2.

9e - Wastewater pit

The pit for waste (oily) water is 20.8 x 9.1 m in base. The level of the top of the circumferential walls of the pit is ± 0.00 m and the level of the water is -3.50 m. It consists of four sections:

receiving chambers, settling basin, recirculation chamber and the clean water chamber. The receiving chamber has the dimensions of 13.3 x 4.0 m. The lower panel of the receiving chamber is in decline, with a variable elevation level of –5.60 to –6.00 m.
The receiving chamber, settling basin, and the recirculation chamber are physically separated by a wall (wall top level – 2.50 m) from the clear water chamber. The settling basin is 3.5x4.0 m in size with a bottom plate level of -7.80 m. The recirculation chamber has the dimensions of 3.0x4.0 m with a bottom plate level of -6.00 m. The clear water chamber is 20.0 x 4.0 m in size with a bottom plate level of 6.00 m. The bottom plate rests on the ground. Depths of foundation vary depending on the part of the facility and range from -5.90 to - 8.10 m.

9f - Liquid fuel tank with pump room

Diesel fuel foundations (two tanks of 60 m^3 each), which rely on plinths located in a reinforced concrete bundwall of 11.4 x 9.4 m. The bundwall is semi-buried, the upper level of the foundation slab at a level of 1.0 m (foundation angle – 1.3 m) and the height above ground is 1.1 m. The tub volume is determined to accommodate 80% of the fuel volume from both tanks, i.e. about 100 m^3.

Planned surface of the Functional Unit 1/2 for the installation of the BEP plant is a paved plateau of irregular shape of about 600 m^2 (approximate dimensions 42.6x14 m).

The cogeneration BEP plant is of a modular - container type accommodating, equipment including a gas generator set (CHP module, 2 pcs.). The containers with the gas generator set are 13,600 × 3,000 × 3,000 mm in size, with a guardrail on the roof, an access staircase and a grate for secure access on the roof.

On the plateau there is a plan to install a heat exchanger, boiler for superheated and hot water, waste gas treatment system and an exhaust gas analyzer.

The exhaust stack is mounted above the container with a CHP module, about 7.5 m high, measured from the top of the container.

3.2.2. Description of production process and activities

3.2.2.1. Description of the EfW plant technological process

The plant for energy utilization of municipal waste (EfW plant) is a cogeneration type and is used for the production of electricity and heat by combusting municipal waste.

The thermal energy will be supplied to PUC "Beogradske toplane" for the purposes of district heating, and the generated electricity will be supplied to the existing power distribution system AD "Elektromreža Srbije" Belgrade.

The EfW plant technological process consists of several basic technological units, operations and activities:

- delivery and reception of municipal waste
- municipal waste incineration
- utilization of the energy obtained
- distribution of energy obtained

For the smooth functioning of the basic technological units, the EfW plant is equipped with the following auxiliary systems:

- water supply system
- energy generating products supply system
- waste gas treatment system
- plant residual management system
- wastewater management system

In the description of the technological process, data from preliminary designs of "Energoprojekt Entel" a.d. from Belgrade were used.

Delivery and reception of municipal waste

Control zone

Vehicles delivering municipal waste to the complex/plant from the access road to the complex pass through the gate at the entrance to the complex and the Control Zone, which is outside the construction parcel KP6-1 (or planned functional unit K1) and is the subject of another design.

Based on the preliminary design data (IDR - Entrance to the Vinča landfill, Energoprojekt Hidroinžanjering ad, 2018), the control zone at the entrance to the landfill complex includes control space and truck scales. In this zone, it is planned to set up containers for the registry desk, weighing equipment, video control center, offices and staff rooms, etc.

Reception hall with the waste hopper

For the approach of vehicles with municipal waste to the reception hall, a reception plateau is foreseen from which waste is unloaded through seven unloading ramps into the waste hopper. Each place will be equipped with traffic lights placed in a visible place. Signaling is controlled from the control room, which enables active management of access vehicles for unloading. The vehicles approach the unloading ramp by moving backwards. After unloading, vehicles leave the complex through the Control Zone.

Seven unloading ramps are foreseen at the hall, with a red/green signal placed in a visible position to signal which ramp is in operation when moving the vehicle backwards towards the unloading ramp. This enables active control of vehicle movement from the central control.

The reception hall is closed and the hopper is equipped with louvers to allow natural air ventilation. A dust extraction system is provided to prevent particulate emissions from the hopper zone. Also, the space in the hall is in the conditions of subpressure, to reduce the spread of odors. Exhaust fan louvers and flaps are controlled from the control room.

The hopper is sized according to the technological needs of the plant. The volume of the hopper ensures the storage of waste for a five-day operation of the plant at maximum capacity.

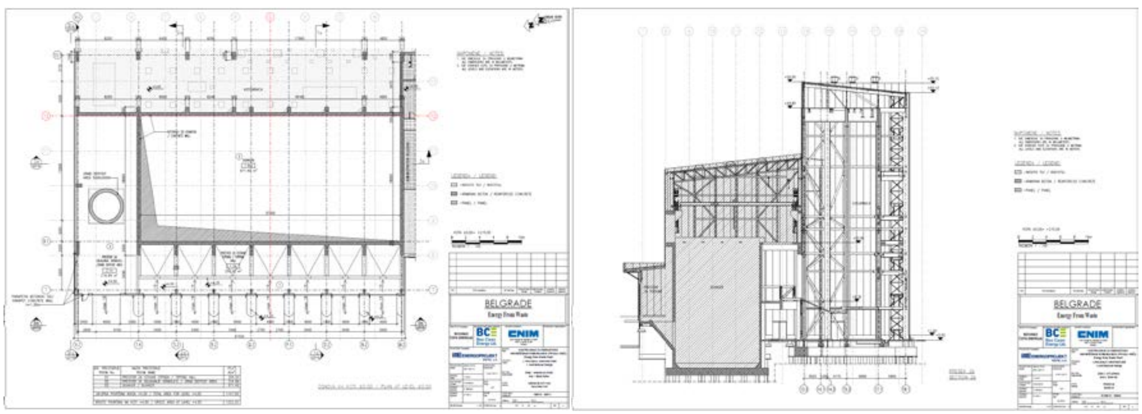


Figure 15 Base of the Reception Hall and Hopper with the vertical cross section (IDP, 1/1: Architecture Design - Main Facilities)

The hopper is equipped with two mobile cranes with mechanical grippers, which are capable of picking up/capturing waste from any point within the hopper. Two grippers are provided - one for each crane. The cranes are equipped with a remote control system with manual, semi-automatic or automatic mode.

Cranes are operated from the control panel (one panel per crane), located in the control room from which good visual control of the entire waste storage facility is enabled. It is planned that one crane will be operational and the other back-up. The operation and control of the work in the hopper hall will be done through an appropriate control system, which enables fully automatic operation of the installed equipment.

The crane and the gripper work in a synchronized manner in two directions: the crane in the horizontal plane, while the gripper rises and lowers in the vertical plane.

The function of the crane is to transfer and insert waste into the dozing funnel of the boiler plant. In addition, cranes transport, mix and plan waste for disposal in the storage hopper. A video camera is provided on each dosing hopper to monitor the level of waste, which is connected with the control room.

The grippers are equipped with weight sensors, showing the weight of the cargo before the discharge of waste into the dozing funnel of the boiler plant, with the capacity of 12 m^3. Load capacity of cranes is 16.5 tons.

Figure 16 Layout of the crane with a waste gripper (illustration)

Waste incineration plant

The waste incineration plant includes:

- Waste incineration system;
- Combustion air supply system;
- Flue gas extraction and purification system;
- Slag and ash evacuation system;
- Auxiliary fuel system (for boiler start-up and low load support);
- Other accessories and devices.

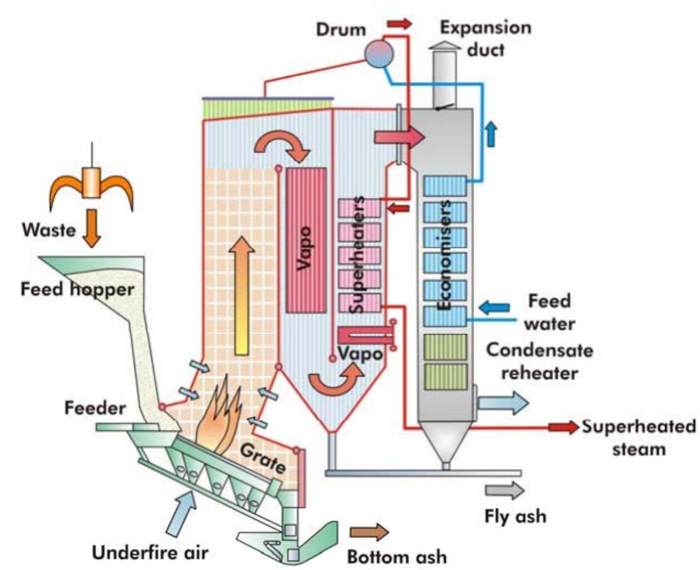


Figure 17 Typical vertical boiler scheme (illustration)

The waste incineration plant is designed for continuous operation with lower thermal power (LTP) fuel in the range of 6,000 kJ/kg to 12,000 kJ/kg and for the incineration of mixed municipal waste. The maximum combustion capacity is 49.4 t/h for waste with LTP between 6,000 kJ/kg and 7,500 kJ/kg, or 43.6 t/h when using waste with LTP of 8,500 kJ/kg.

The table provides information for the assumed composition of the fuel - waste.

Table 8 Assumed fuel - waste composition
(IDP 6/1 Mechanical Installation Design - Boiler Plant with Incinerator)

	Fuel flow (t/h)	49.44	43.6
	LTP (kJ/kg)	7,500	8,500
Estimated fuel composition	**Non-combustible substances**	25.50	23.50
	Water	35.90	33.60
	Combustible substances	38.60	42.90
	(Carbon)	*(20.66)*	*(22.96)*
	(Hydrogen)	*(2.77)*	*(3.08)*
	(Oxygen)	*(13.73)*	*(15.26)*
	(Nitrogen)	*(0.77)*	*(0.86)*

Waste incineration system - boiler plant with incinerator

Based on the stated combustion capacity and the lower thermal power of the waste, a boiler of a vertical construction with optimized energy recovery, a system for reducing nitrogen oxides in the combustion chamber and Martin's movable grate was selected.

The type and quality of the boiler and related equipment are adapted for incineration of municipal waste and meet the requirements regarding the steam flow for the turbine plant, as well as other requirements regarding the steam in the plant itself.

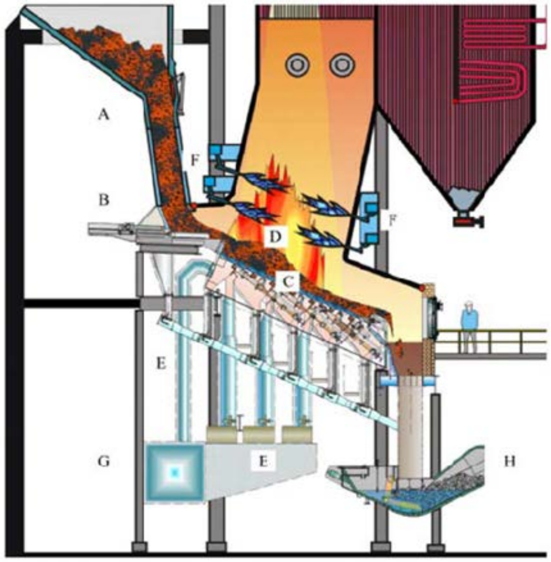
The basic parameters of the steam boiler for project fuel are given in the table.

Table 9 Basic parameters of the steam boiler
(IDP 6/1 Mechanical Installation Design - Boiler Plant with Incinerator)

Name	Unit of measure	Value
Boiler type	-	Vertical, suspended structures, with natural circulation (with drum)
Basic fuel	kJ/kg	Household waste, commercial and industrial waste, Hd = 8,500
Fuel for boiler start and fire support	kJ/kg	Diesel fuel, Hd = 42,705
Fresh steam flow	t/h	132
Temp. of steam at the boiler outlet	ºC	400
Steam pressure at the boiler outlet	bar	61
Temperature of saturated steam in the drum	ºC	281
Drum pressure	bar	67.2
Supply water temperature at the boiler inlet	ºC	130
Supply water pressure at the boiler inlet	bar	71.5
The gas temperature at the outlet of the furnace	ºC	891
The temperature of the gases behind the water heater	ºC	177
The gas temperature behind the final economizer	ºC	140
The utility grade of the boiler	%	86.86
Fuel consumption	t/h	43.6
NOx emission at 6% O_2	mg/Nm^3	<200

The boiler is designed and manufactured in accordance with EN12952 and with the appropriate CE conformity marking.

The basic elements of the waste incineration plant are shown in the figure.



A-inlet funnel, B-feeder, C-return grate, D-combustion chamber, E-primary combustion air, F-secondary combustion Air, G-air preheater, H-slag

Figure 18 Incineration line with the "Martin" return grate (illustration)

Waste dosing

The dosing of waste into the plant is done by a feed canal consisting of a feed funnel and an inclined canal. The feed funnel allows the waste to be accepted during one filling cycle without scattering from the side. The level of waste in the funnel is controlled by the crane operator at all times.

When the waste incineration line is in operation, the feed canal is filled with waste that falls gravitationally onto the grid. The canal below the boiler unit dosing funnel is designed in such a way as to provide a seal at the junction with the boiler plant combustion chamber. This solution prevents the penetration of air and the emission of hot gases from the boiler to the hopper and the possible occurrence of fire in the canal.

The waste canal also serves as a reservoir for waste to be filled up with the help of grippers. Also, a system for unblocking/decluttering the canal is envisaged using a special crane gripper.

The feed canal covers the entire width of the grate. The waste level in the canal is controlled by the level sensors. In case the minimum level is not reached, the alarm signal is forwarded to the control room and the crane operator cabin.

A shut-off valve is provided which covers the entire width of the feed canal. It is located below the feed funnel. This valve ensures that the incineration system starts and stops even when there is no waste in the canal.

The waste is dispensed with an automated piston feeder directly onto the grate ("Martin" type). The waste, which is gravitationally pushed into the fall shaft, is dispersed by a piston, thereby achieving a uniform distribution of fuel on the grate. The waste dosing cycle is connected to the combustion control system.

Inclined grate for waste incineration

The "Martin" return grate, type "Vario", is tilted at a 24° angle from the piston feeder to the outlet. The grate consists of stationary and moving grids, arranged in alternating series.

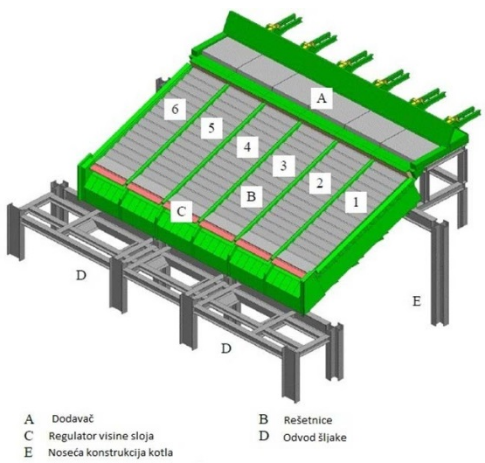


Figure 19 "Martin" return grate for waste incineration (illustration)

Due to the backward movement of the moving segments of the grate in the opposite direction to the natural movement of the incinerated (layer) waste on the grate, the fuel is first mixed in the forward direction and then backwards. Continuous moving of the grate back and forth ensures uniform heat release and high efficiency of waste incineration. In this way, continuous mixing of the layers of waste at the front end of the grate and in the immediate vicinity of the grate surface is also ensured with the formation of glowing particles in the main incineration zone.

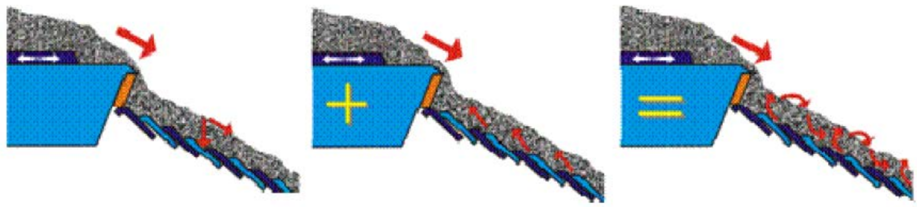


Figure 20 Waste movement on the return grate (illustration)

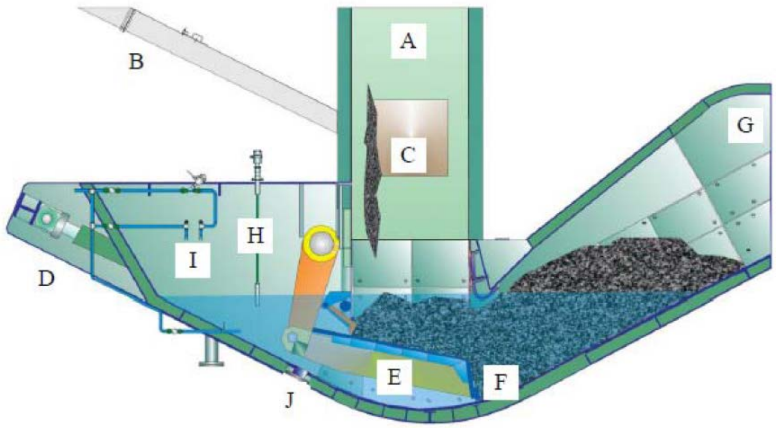
An active and stable incineration process, in which all phases of the primary incineration process (drying, gasification, igniting and incineration) participate simultaneously and consecutively, takes place at the front of the grate. The primary incineration air is fed into each section of the grate in a controlled manner.

Slag removal

After the waste is incinerated, slag is formed. The complete slag incineration takes place at the back end of the grate. At the end of the grate, there is an electrically adjustable slag regulator that provides slag layer height and ash retention time in the incineration zone, which will be regulated independently of the grate drive to provide sufficient coverage of the grate surface as protection against heat emission - radiation from the combustion chamber.

The hot slag falls through the slag hole into the deslugger. Complete quenching and cooling of slag to approximately 80 - 90°C allows safe slag removal without ash and odor. The water trough provides full sealing between the combustion chamber and the boiler, which prevents air from entering the combustion chamber through the slag outlet.

The picture shows the basic elements of the slag removal system.



Legend: A-connecting part, B-discharge from the combustion chamber, C-inlet, D-hydraulic cylinder, E-metal frame,
F-scraper, G-outlet, H-water level gauge, I-water inlet, J-drain for quick emptying

Figure 21 The principle of operation of the slag removal system (illustration)

The water level in the deslugger is maintained constant, by automatic supply through the float valve.

The table shows the quantities of ash generated by waste incineration.

Table 10 Amounts of ash for different waste incineration capacities (IDP 6/1 Mechanical Installation Design - Boiler Plant with Incinerator)

	Maximum load		**Maximum load**	
	LTP = 7,500 kJ/kg		**LTP = 8,500 kJ/kg**	
	Waste flow = 49.4 t/h		**Waste flow = 43.6 t/h**	
	kg of ash per ton of waste [kg/t of waste]	**Flow of ash [kg/h]**	**kg of ash per ton of waste [kg/t of waste]**	**Flow of ash [kg/h]**
Unburned matter	250	12,337	272	11,872
Slag below the grate	227	11,202	247	10,755
Fly ash after second and third draft	2.3	113	2.6	112
Fly ash after the fourth draft	4.6	227	5.1	223
Fly ash to treatment of flue gases	16.1	794	17.9	782

To collect fly ash below the gas tract, the boiler is equipped with funnels. The ash funnels are located at the bottom of the canal. The funnels in the high-temperature zones of the boiler are cooled by water, while the funnels in the low-temperature zones of the boiler are in the form of a housing and are thermally insulated only from the outside.

Incineration air system

The primary incineration air is supplied from the unloading zone - reception hall with the waste hopper, so that odors and dust carried by the air are removed from the reception hall and hopper by the primary air system to the boiler plant.

One fresh air fan is also provided to supply primary incineration air and secondary air to the combustion chamber.

The air is heated in the air heaters. One part of the air is used for the zone above the combustion chamber as the secondary air and is fed into the combustion chamber. The second part of the air, at the outlet of the heater, is used as the primary air, which is distributed over the zones below the incineration grate.

Most of the unburnt gas, which is released, is oxidized immediately at high temperatures as soon as it is mixed with the remaining primary air in the combustion chamber.

This effect is amplified by secondary air, which is fed along the entire section of the the combustion chamber. It provides the oxygen necessary for the complete oxidation of gases. Practically complete combustion of gases is achieved by the regulated supply of the secondary air. Secondary air inlet nozzles are arranged in rows opposite each other to provide complete coverage of the combustion chamber, thereby achieving intense flue gas mixing and efficient secondary combustion.

As a result, a uniform temperature, flow profile and optimum mixing of the gases in the combustion chamber are achieved. It also controls and extends the residence time of gases in the high temperature zone, thereby improving the combustion of unburned gases and reducing the formation of nitrogen oxides in the combustion chamber.

Generation of carbon monoxide and halogen hydrocarbons is basically prevented by intense agitation and mixing of gases emitted from the flames just above the main incineration zone by means of controlled supply of the secondary air.

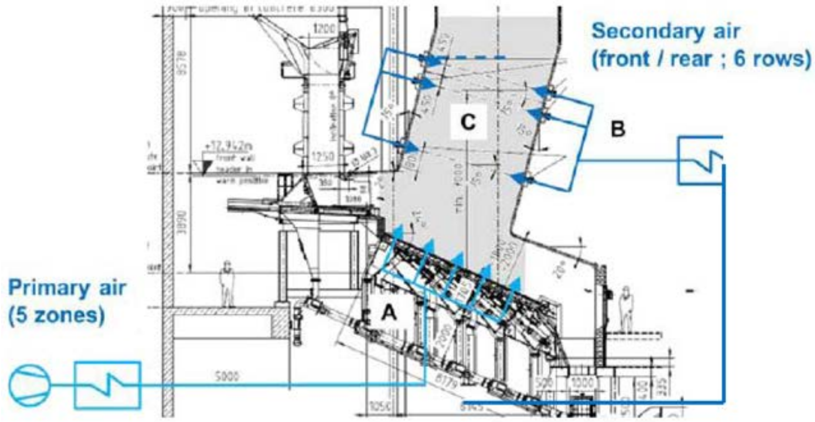
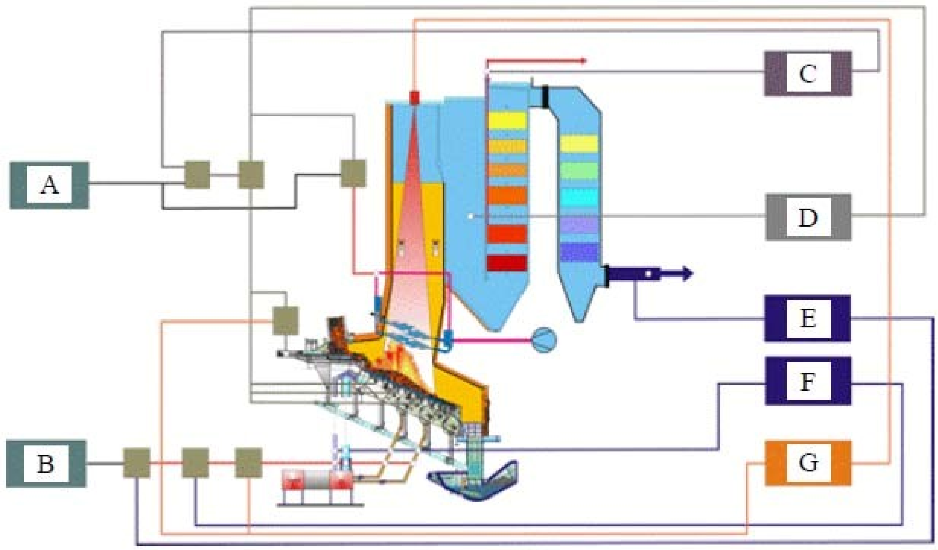


Figure 22 Incineration air supply - process in steps (IDP E3 Fire Protection Survey)

The aforementioned boiler system of the the combustion gases in the combustion chamber is a practical description of the selective non-catalytic reduction (SNCR) -) of waste gases. The application of SNCR leads to a drastic reduction of NOx, ammonia, carbon monoxide and halogen hydrocarbon emissions in the waste gases.

The infrared camera software system, which captures the heat radiation intensity distribution on the surface of the fuel layer from the top of the boiler, is used to obtain additional combustion information in order to achieve the best possible combustion.

Changes in flue gas temperature are recorded using an infrared pyrometer. Changes in the released heat from the combustion chamber are detected quickly and reliably. This results in a very short response time of the process parameter control.



A	set point for steam flow	B	O_2 set point
C	steam flow	D	gas temperature (IR pyrometer)
E	O_2 content (dry)	F	underfire air flow (per zone)
G	fuel bed temperature (IR camera)		

Figure 23 Waste combustion regulation principle
(IDP E3 Fire Protection Survey)

Fuel system for the boiler start and low load support

For the purposes of igniting and maintaining fire at low boiler loads, it is envisaged to use liquid fuel - diesel. Liquid fuel is delivered by tanker trucks. Unloading of fuel is performed at the fuel pump room (pos. 9f, *IDP, 1/1: Architecture Design - Main Facilities)*) into the main tanks with a total capacity V = 120 m^3 (2 x 60 m^3). The fuel tanks are constructed with a double wall and a fuel leak detection system and are housed in a watertight bundwall.

If flue gas temperature drops below 850^{o}C in the boiler two burners are automatically switched on to maintain the incineration temperature while the waste is on the boiler grate.

For the transportation of diesel fuel to the boiler in which the municipal waste is incinerated, 2 distribution pumps were installed, 1 service and 1 back-up. In addition to the municipal waste incineration boiler, the following consumers will be supplied with liquid fuel from the main tanks:

- fuel tank in the auxiliary boiler room
- daily fuel tank in the diesel generator building
- fuel tank for diesel pumps at the fire water pump station

Energy production

The energy production system consists of the following main components:

- Turbo-plant with auxiliary equipment
- Electric generator with auxiliary equipment

Turbo plant

The basic set of turbo-installations consists of a condensing steam turbine, an air-cooled condenser and a condensate tank, a deaerator feed tank, regenerative heaters, two main-operated condenser pumps with electric drive and two electric-powered supply pumps.

The steam turbine is designed to operate with a superheated steam of 58 bar and 397 °C without additional steam heating in the boiler.

An air-cooled condenser is provided for condensing steam at the outlet of the turbine. The condenser is designed to accept and condense all steam coming from the turbine.

The turbo-plant has a steam boiler with a nominal steam capacity of 132.5 t/h. The superheated fresh steam is introduced from the boiler into the turbine via stop and control valves. The total amount of steam generated by the boiler is used in the condensing steam turbine for combined production of electricity and heat for district heating purposes. After expansion in the turbine, the steam is discharged into the condenser.

The main condensate is collected in the condensate tank, from where the condensate is pumped from the condensate tank via a regenerative heating system to the feed tank with a deaerator. From the feed tank, the feed pumps send feed water to the boiler, thus closing the cycle.

For the purposes of district heating, the turbine will also be constructed constructively for the heating regime. The heated water will be sent to the district heating system of PUC “Beogradske toplane”, i.e. to the Konjarnik heating plant.

The parameters of hot water for district heating (DH) are:

- water temperature at the inlet/outlet of the exchanger for DH	102/60 °C
- water flow through the exchangers for DH	1160 t/h
- diameter of the connection pipe	DN500

The steam turbine is a condensation, single-housing turbine, with three subtractions of steam for heating the main condensate, boiler air heaters and heaters for the district heating system. One small portion of the steam taken from the turbine is also used to heat the administration building.

The steam turbine has the following basic technical characteristics:

Nominal power	29 MW
Nominal power in the heating regime	20.5 MW
fresh steam pressure	58 bar
fresh steam temperature	397 ºC
nominal fresh steam flow	132.2 t/h
nominal flow of fresh steam in the heating regime	131.9 t/h
feed water temperature	130 ºC
nominal pressure in the condenser	0.11 bar
nominal pressure in the condenser in the heating regime	0.06 bar
nominal ambient temperature	20 ºC
nominal ambient temperature in the heating regime	-12 ºC
specific heat consumption of the turbo plant gross	11,974 kJ/kWh

In the case of cogeneration, i.e. combined power production, the steam turbine delivers 20.5 MW of electrical power and 56.5 MW of heat at an ambient temperature of -12 ° C and a condensation pressure of 0.06 bar.

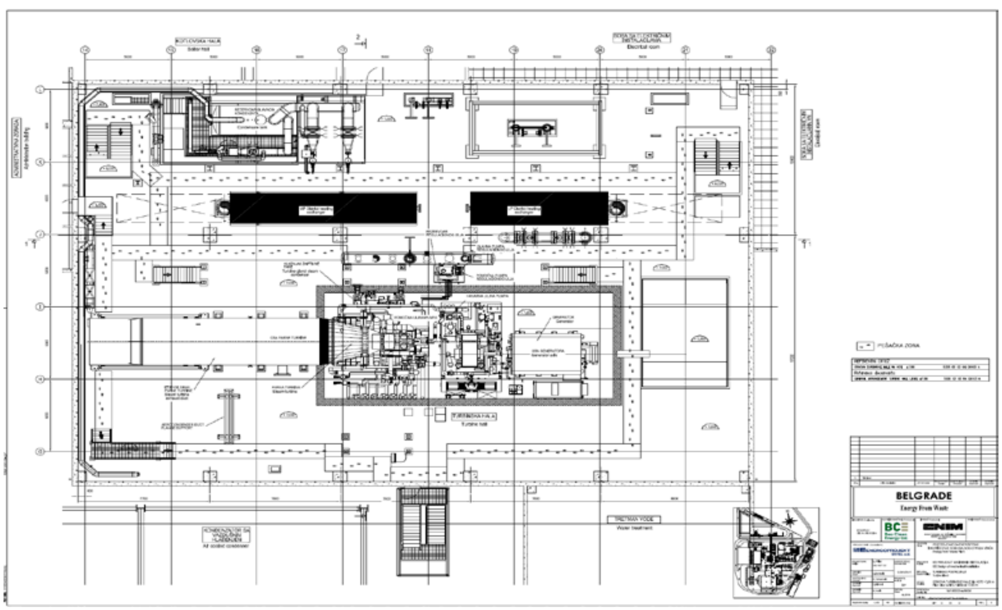


Figure 24 Base of the turbine plant (IDP, 6/2 Turbine Plant Design)

Electric generator

The electricity generation system consists of:

- Electric generator;
- 110/11 kV transformer for the connection of the power plant with the transmission system;
- 11 kV switchgear for the 110/11 kV generator and transformer connection;
- 10 kV switchgear for the power supply of own consumption and the connection to the distribution network;
- 10/0.66 kV and 10/0.4 kV transformers for own consumption;
- LV 660 V main power distribution for the supply of large consumers (engines);
- LV 400 V main power distribution for the power supply to other consumers;
- 400 V power distribution for the supply of consumers;
- Diesel electric generator;
- Uninterruptible power supply - UPS

It is envisaged that the electric generator will be connected to the11 kV plant, to which a 110/11 kV transformer is also connected, which is used to connect to the transmission system EMS to which the fully produced electricity is delivered.

The 10 kV plant is used to connect power supply equipment for its own consumption. Transformers 10/0.66 kV and 10/0.4 kV are connected to the 10 kV plant, through which the main distribution lines 660 V and 400 V are supplied, as well as the 2000 kVA diesel power unit, which is started in the event of a power failure at this plant.

The electric generator, powered by a steam turbine, has a maximum power of 32.8 MW. The steam turbine-generator set is powered by the energy generated by the incineration of municipal waste. The generator is air-cooled via a fan on the rotor, in a closed system.

The drive of the generator is contactless, that is, without the existence of conventional brushes through which the current is fed to the rotor coil. Instead, a permanent magnet system on the rotor is used to power the automatic voltage regulation system and an auxiliary coil on the stator to regulate the voltage induced in the auxiliary coil on the rotor, which is further transmitted via a diode rectifier (which turns with the rotor and permanent magnet), feeds the main coil on the rotor to create excitation.

The diesel power unit, with the nominal power of 2000 kVA, is designed to supply critical consumers in the event of a power failure at the 10 kV switchgear.

In the normal operation of the power plant, its own consumption is supplied from the distribution network via a 1 kV cable and the 10 kV plant. In the event of a power failure through this connection, or loss of voltage at the 10 kV plant, the diesel unit is automatically started, which is also connected to this switchgear via a 10/0.4 kV transformer, thus ensuring the continuity of the power supply for its own consumption.

The purpose of the Uninterruptible Power Supply System (UPS) is to ensure the smooth and safe operation of all electronic devices and the main selected devices at a voltage level of 400/230 V.

The uninterruptible power supply system is sized so that it can cover all the power consumption in the event of a failure of one of the power supplies, namely transformers, rectifiers/inverters and batteries.

The UPS system is powered by a main power switchgear with the own consumption of 400 V.

An independent DC power supply system from the batteries will be provided with the electric generator to safely shut down the turbine-generator system in the event of an accident. The UPS system should provide power to the pump for the bearing lubrication for one hour, protection and synchronization of the generator and other devices, in the event of a power failure in normal operation.

Technical data of the steam turbine generator are:

- Nominal power: 29.12 MW
- Maximum power: 32.8 MW
- Nominal power factor: 0.80
- Frequency: 50 Hz
- Revolving speed: 1500 rpm
- Number of stages: 3
- Nominal voltage: 11 kV
- Stator Y Coil Coupler (Star)

The technical data of the transformer of the diesel electric generator are:

- Type: Completely enclosed in the housing
- Engine: Turbo diesel
- Engine speed: 1500 rpm
- Generator rpm: 1500 rpm
- Nominal generator power: 2000 kVA
- Nominal generator voltage: 400 V
- Frequency: 50 Hz
- Stator Y Coil Coupler (Star)

It is envisaged to measure electricity at the 11 kV plant, where it is possible to measure the production of a steam turbine generator, which is fed further into the grid.

It is also envisaged to measure electricity at a 10 kV plant, where it is possible to measure the energy consumed for own consumption of the EfW plant.

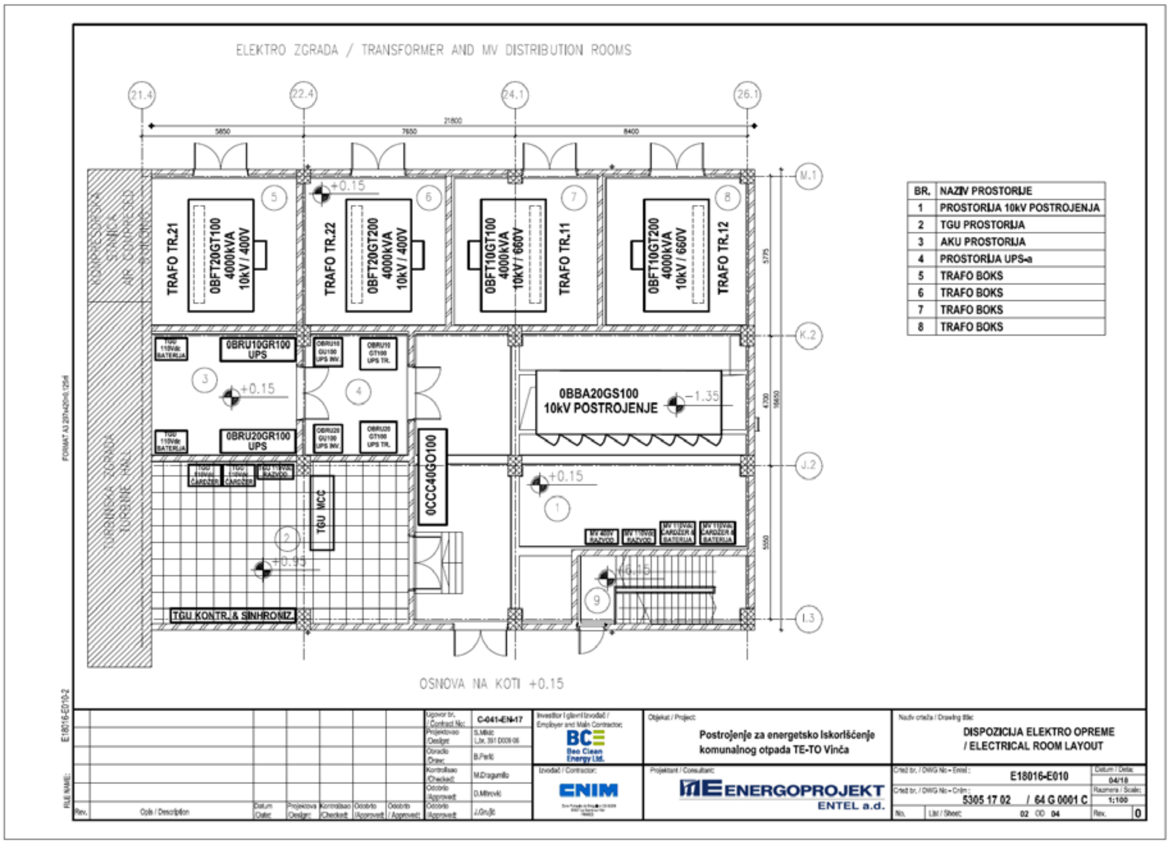


Figure 25 Disposition of electrical equipment (IDP, 4/1 Electrical Installation Design)

Process water supply system

On the water line, for the purposes of the technological process, the EfW plant is supplied with raw and demineralised (demi) water. Preliminary Design, IDP, 6/3 Machine Installation Design - Chemical Water Preparation (HPW), includes the production of demi water, conditioning of feed and boiler water, as well as the treatment of technological wastewater generated in the EfW plant.

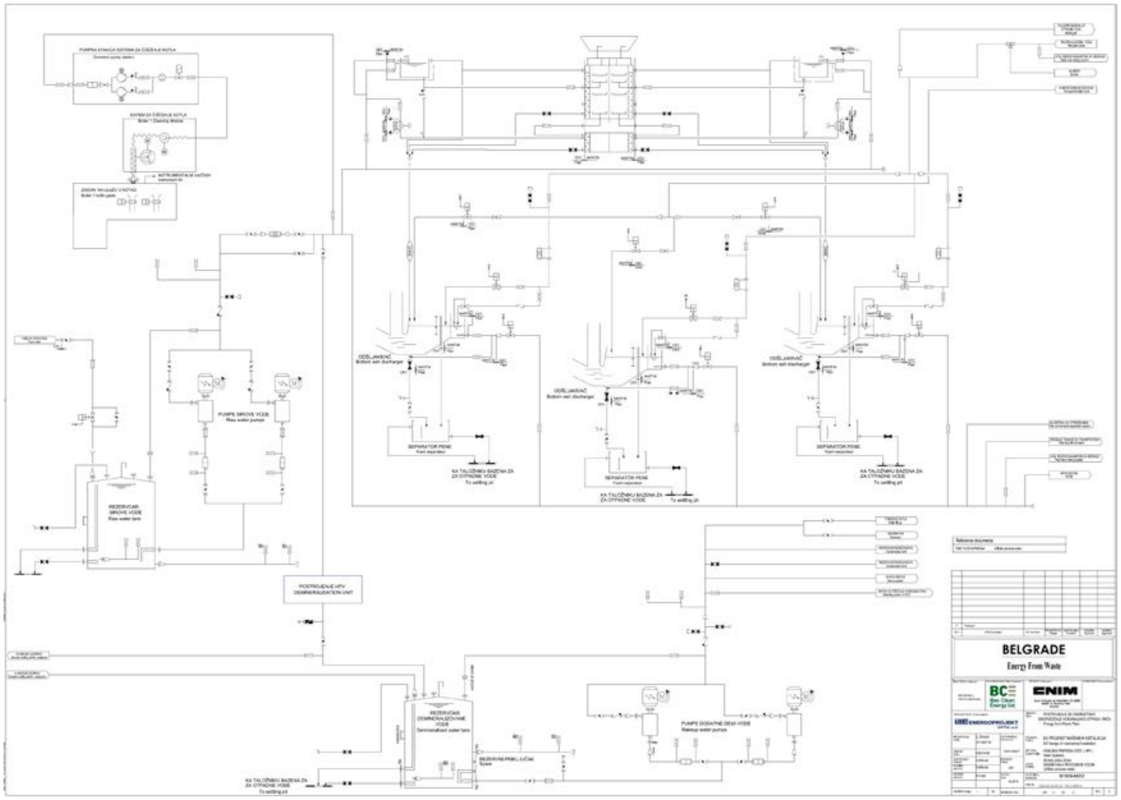


Figure 26 Scheme of supplying the EfW plant with process water (IDP, 6/3 Mechanical Installation Design)

The process water distribution for the EfW plant runs from the suction port of the raw water pumps on the raw water tank, to the consumers of the raw water and the HPW plant.

The water and boiler water conditioning system in the water-steam cycle comprises demi-water from HPVW, through the chemical dosing systems, to the connection to the suction pipeline of the feed pumps, i.e. to the connection to the boiler drum inlet.

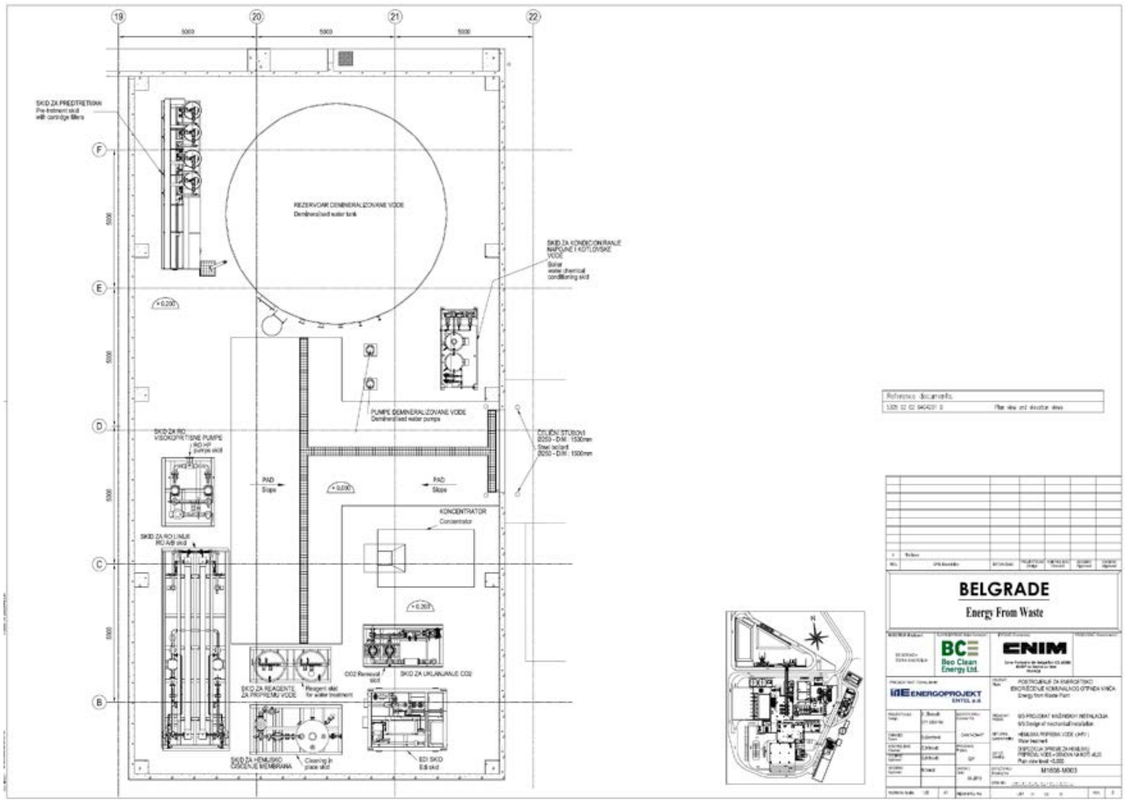


Figure 27 Equipment Disposition at HPW Plant (IDP, 6/3 Machine Installation Design)

On the line of technological wastewater from the EfW plant, it includes the discharge of wastewater from the place of origin, through the wastewater collection basin, to the technological consumers of this water (system of technological wastewater recirculation). In case of excess technological wastewater, it is envisaged to connect the wastewater pipeline to the lagoon for wastewater from the municipal landfill, outside the boundary of the construction parcel KP1, which is not the subject of this Study.

Technical water line

Drinking water from Belgrade's public water supply will be used as raw water for various purposes in Functional Unit 1/1.

The main consumer of raw water for technological purposes is the HPW Demineralized Water Production Plant. In addition, raw water will also be used to cool the slag from the boiler combustion chamber, wash the slag conveyor, supply the thermogenic waste stabilization system from the flue gas treatment plant (APCR), supply the boiler cleaning unit, etc.

The raw water for process purposes will be supplied from the raw water tank by raw water pumps. From the thrust collector of the raw water pumps, the water will be diverted to the consumers.

Raw process water consumption is 5.31 t/h nominally, up to 5.65 t/h maximum.

The Chemical Water Preparation Plant is intended for the production of demineralized water for the needs of consumers. Demineralized water will be consumed for the following major consumers:

- Compensation for losses in the water-vapor cycle resulting from the desalinization of the boiler;
- Compensation for losses in the water and steam sampling system;
- Preheating in the system of the blower, as well as to compensate for losses in it, due to evaporation;
- Preparation of urea solution in the flue gas denitrification system (DeNOx),
- Own needs of the HPW plant,

In addition to these major consumers, demi water will also be supplied with a closed cooling system for the plant, for filling the system and for compensating for losses, as well as the system for cleaning the condenser. Considering that consumption for these purposes is occasional, it is not considered in the water balance.

Based on the demi water balance, the required amount is 3.3 t/h nominally, up to 4.8 t/h maximum. The adopted capacity of the demineralization plant is 2x10 m^3/h. One line is service and the other back-up, but simultaneous operation of both lines is possible.

The process of water demineralization is based on reverse osmosis (RO) technology. Since reverse osmosis membranes are susceptible to the formation of deposits (inorganic, organic and biofilms), as well as degradation due to the presence of chlorine, the RO process requires pretreatment in order to protect the membranes. Considering that the raw water for the HPW plant is tap water, no water disinfection is provided.

The reverse osmosis process does not provide sufficient purity of the produced water (RO permeate) for use in high pressure boilers, and additional water demineralization - electrodeionization (EDI) needs to be carried out.
The process of preparing demi water involves the following procedures:

- Raw water pretreatment,
- Dosing of chemicals for the protection of RO membranes,
- Reverse osmosis,
- Removal of CO_2,
- Electrodeionization (EDI) and
- Thickening of RO concentrate.

The block diagram of the said process with the water balance is given in the following figure.

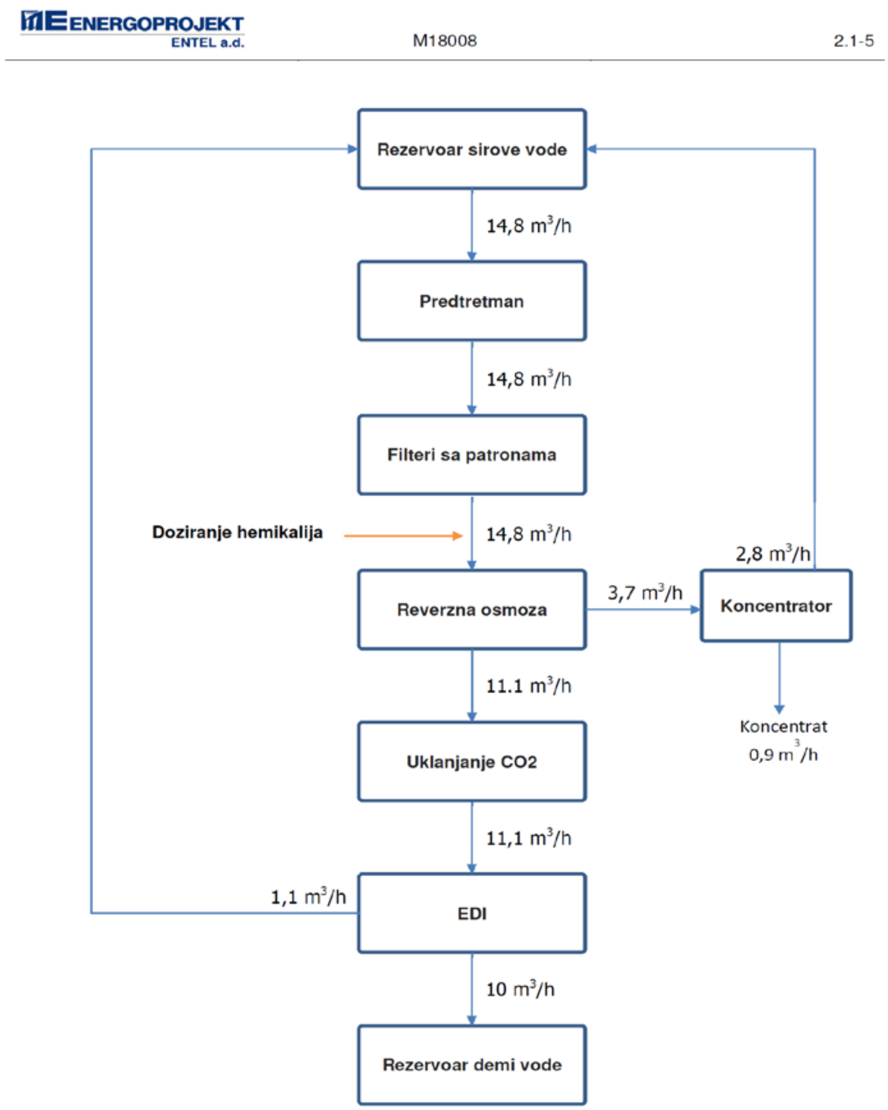


Figure 28 Balance block diagram of raw water demineralization (IDP, 6/3 Mechanical Installation Design)

Part of the raw water from the thrust of the raw water pumps is transported through the pre-treatment line via a special pipeline. Pretreatment involves mechanical filtration, the last step before entering RO membranes is filtration through cartridge filters, with aperture size of 5 µm and 1 µm. In order to reduce the hardness of raw water, softening in duplex softeners is envisaged.

In order to protect the RO membranes from deposits and damage, it is envisaged to dosage the chemicals into the feed water for RO, namely: acids and anti-scale agents, to prevent the formation of deposits and bisulphite to remove residual chlorine. Since CO_2 present in raw water cannot be removed by reverse osmosis, its removal is predicted in the membrane contactor by air or nitrogen.

RO permeate, emitted CO_2, is introduced into the electrodeionization units to achieve the required water quality to power supply the boiler. The produced demineralized water is stored in a 225 m^3 demi water tank. Demi water from the tank is pumped to the consumer.

In order to reduce the amount of waste concentrate from the RO lines, it is introduced into the evaporator (concentrator). The concentrate from the evaporator is discharged into the wastewater basin from the Plant, while the distillate returns to the beginning of the process, together with the concentrate from the EDI line.

All systems within the HPW plant are intended as skid units (skids). All equipment is designed as service and back-up, except the concentrator (1 service). In addition to the aforementioned main equipment, the plant also includes all supporting equipment, pipelines, fittings and instrumentation required for smooth operation.

The quality of water, steam and condensate in the water-vapour cycle will be maintained by the continuous desalination of the boiler and the dosing of chemicals into the feed and boiler water.

Feed water conditioning includes: dosing trisodium phosphate, as a corrosion inhibitor and buildup inhibitor, into the boiler drum and carbohydrazide to remove the oxygen remaining after the deaerator, to the suction of the feed pumps.

The skid unit includes, for each chemical, a solution preparation tank, two dosing pumps (service and back-up) and a protective tub. Demi-water is used to prepare diluted chemical solutions.

Wastewater line

The operation of the EfW plant will lead to the generation of wastewater, which, depending on the source, will have a different type and degree of pollution. Wastewater generation is related to the very process of production and washing of equipment (technological wastewater), floors and open surfaces, use of water for sanitary needs of employees, as well as rainfall at the complex of the EfW plant (sanitary and atmospheric wastewater).

This chapter deals with the management of technological wastewater (recirculation system), while the channeling of atmospheric and sanitary and oily wastewater is dealt with in chapter 3.2.4.

Some of the technological wastewater is continuously produced, while others are produced occasionally. The project does not envisage the discharge of technological wastewater from the plant into the natural recipient, but it will, through the technological sewage network, be collected at several locations in the Functional Unit 1 complex and reused in the technological process.

Any excess wastewater, in the event of heavy rainfall, will be transported to the lagoon for leachate from the municipal landfill. The figure shows a general block diagram of channeling wastewater.

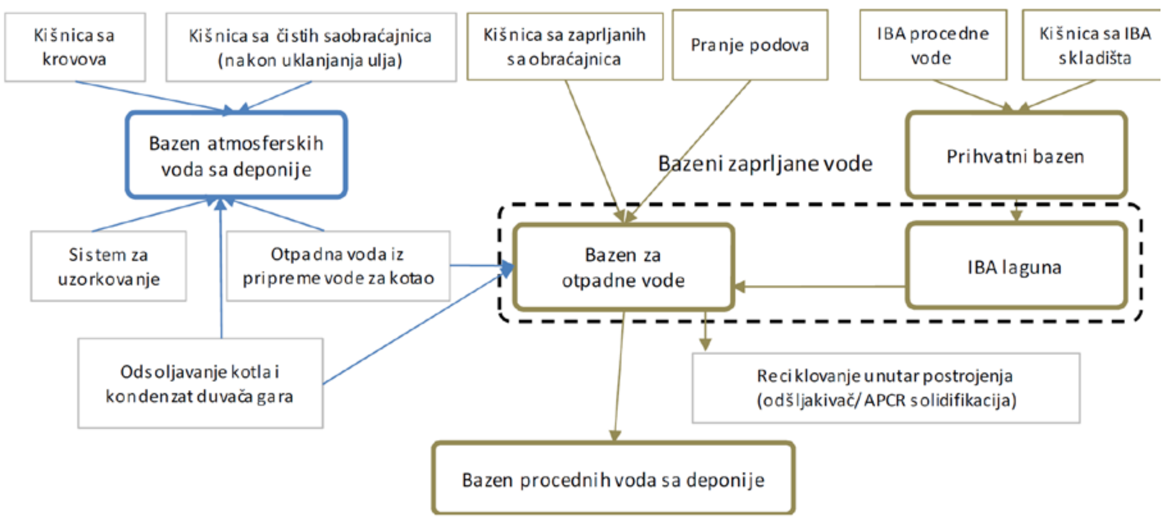


Figure 29 Block diagram of channeling wastewater from Functional unit 1 IDP, 6/3 Mechanical Installation Design)

There are several receiving basins/lagoons for wastewater collection from the EfW plant:

- 60 m^3 IBA settling basin
- IBA lagoon, 800 m^3 in volume
- Wastewater basin, total volume of 330 m^3

The IBA settling basin, IBA lagoon and wastewater basin are located in the northeast part of the plant complex (zones 9g and 9e on the complex layout plan). These basins are part of the slag treatment system, and are addressed in the chapter "Dispensing and treatment of the slag of the boiler plant".

Leachate and atmospheric waters from the slag treatment system will be routed to the IBA receiving basin, which also acts as a mechanical settling basin, and from this, partially clarified water will be transported to the IBA lagoon. The IBA lagoon acts as a buffer tank for wastewater for further use.

Water from the lagoon is transported to the wastewater basin for reuse for process purposes. The following wastewater is collected in the wastewater basin:

- Waste water from the HPW plant;
- Waste water from boiler desalination and boiler drainage, which is discharged through the starting and atmospheric tanks, is taken to the basin (some of the condensate from the tank is returned to the cycle);
- Waste water from floor washing in technology zones (including boiler room, machine room, HPW plant area, etc.).
- Atmospheric water from the storage area of reagents and fly ash and the flue gas purification zone where ash, thermogenic waste or reagents are possible.

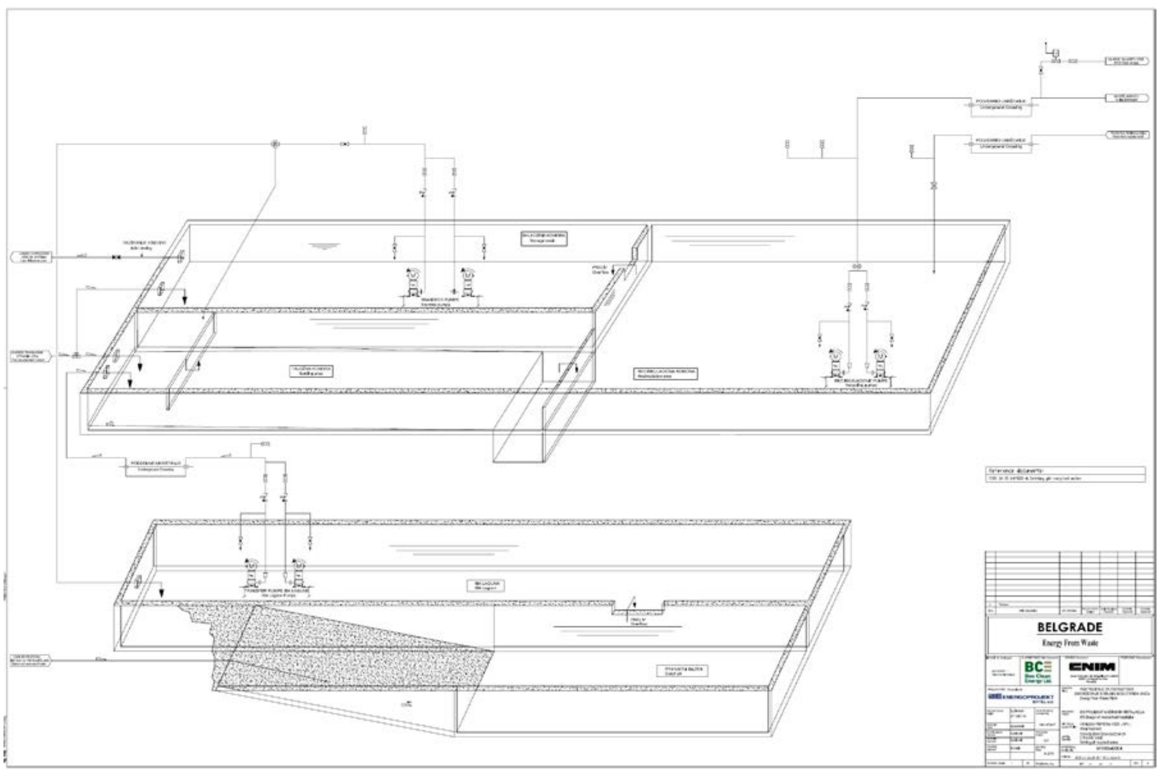


Figure 30 IBA settling basin and wastewater basin (IDP, 6/3 Machine Installation Design)

The wastewater basin consists of several zones: a settling chamber, with a receiving section to calm the flow, a recirculation chamber and a storage (buffer) chamber. Reusable water is transported from the recirculation chamber to technological consumers by pumps:

- Deslugger (for slag cooling purposes) and
- Thermogenic Waste Solidification System (APCR).

The excess water from the recirculating part of the basin is poured into a storage chamber from which pumping to the IBA lagoon is envisaged. The possibility of transporting water from the IBA lagoon to the receiving part of the wastewater basin is also envisaged.

The overflow of the storage part of the basin is connected by a pipeline to the lagoon for running water from the landfill, where waste water will be discharged in the event of heavy rainfall.

Water from the landfill lagoon will be treated in the leachate treatment plant (LTP plant) from the landfill, which will be located within the second part of the landfill complex (outside the construction parcel KP1) and is not the subject of this Study. The treated water will be discharged into the Danube River.

The table shows the water balance of the Plant (raw water, demineralised water and wastewater) for several cases of operating conditions, related to the amount of waste water from the boiler desalination and the amount of precipitation, as the main influencing factors for water consumption and waste water quantity.

Table 11 Balance of process and technological wastewater for 5 operating conditions (IDP, 6/3 Mechanical Installation Design)

Load	Unit	Case 1	Case 2	Case 3	Case 4	Case 5
		Nominally	Nominally/ Regular rain	Max desal. of the boiler/ Regular rain	Nominally/ heavy rain	Extreme conditions
Waste quantity	t/h	43.6	43.6	43.6	43.6	43.6
Lower thermal power of waste	kJ/kg	8500	8500	8500	8500	8500
Odsoljavanje kotla	%	0.5%	0,5%	2.0%	0.5%	2.0%
Precipitation	mm/day	0	2	2	40	40
Washing floors	kg/h	208	208	208	0	0
WATER CONSUMPTION						
Demineralized water	kg/h	3349	3349	4750	3349	4750
Raw water	kg/h	5309	4510	5858	4002	5649
Wastewater basin						
Input						
IBA lgoon (average)	kg/h	545	1203	1203	13712	13712
Atmospheric expander	kg/h	0	0	0	0	0
Waste water from HPV plant	kg/h	591	591	838	0	0
Washing floors	kg/h	208	208	208	0	0
Output						
Cooling slag	kg/h	1344	2143	1181	2443	1181
Stabilization of thermogenic Waste (APCR)	kg/h	0	0	1209	1594	1594
Excess water	kg/h	0	0	0	12474	13737
COOLING SLAG						
Water from wastewater basin	kg/h	1344	2143	1181	2443	1181
Water from atmospheric tank	kg/h	609	609	1871	609	1871
Additional war water	kg/h	1099	301	0	0	0
APCR - STABILIZATION OF THERMOGENIC WASTE						
Water from wastewater basin	kg/h	0	0	1209	1594	1594
Additional water from municipal waste landfill	kg/h	1594	1594	385	0	0
CLEAN SEWER						
Vapour and water sampling	kg/h	100	100	100	100	100
Waste concentrate from HPVplant	kg/h	0	0	0	591	838
Precipitation	kg/h	0	1842	1842	36833	36833
Total flow	kg/h	100	1942	1942	37524	37771

Case 1 corresponds to the maximum raw water consumption, assuming that there is available quantities of procedural water from the municipal waste landfill for thermogenic waste stabilization (APCR) purposes. In Cases 1 - 3, excess wastewater is not expected to occur due to water consumption in the IBA and APCR system. In cases 4 and 5, due to heavy rainfall, excess water is expected. For example, in Case 4, the excess water is estimated at 12.5 m^3/h with wastewater basin autonomy of ~ 16 h considering that the IBA lagoon is full and overflowing into the wastewater basin.

In case the IBA lagoon is empty, its autonomy is 58 h and wastewater basin autonomy is 74 h. If the capacity of the pool is exceeded, its overflow is carried to the lagoon for the leachate water from the municipal waste landfill.

Based on the considered operating conditions, the following figure shows the balance scheme of process and wastewater for the nominal operating conditions of the plant.

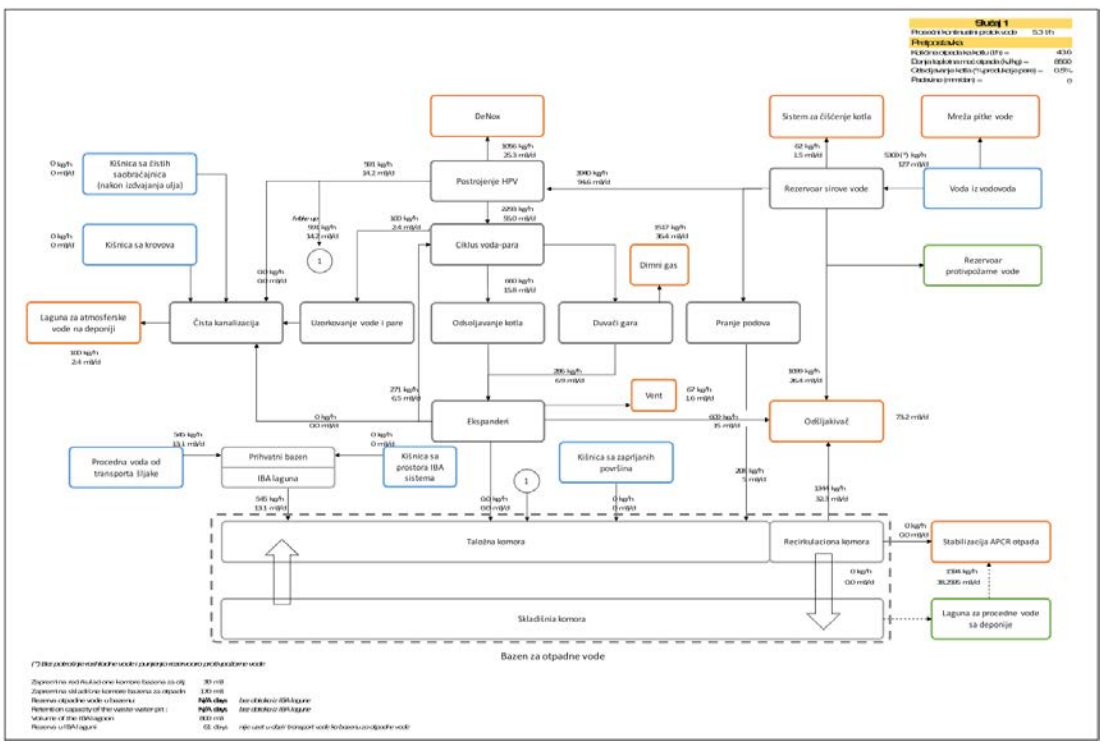


Figure 31 Process water balance scheme in the nominal operation of the EfW plant (IDP, 6/3 Mechanical Installation Design)

From the said balance it follows that under normal operational and atmospheric conditions of the Plant, the entire amount of wastewater generated will be consumed in the production process and there will be a need to add raw water and water from the municipal waste landfill to the technological process.

In case of heavy rainfall, and especially in the case of operating mode of the boiler plant with maximum boiler desalination, it is envisaged to remove unpolluted water from the process into the clean sewerage system, with quality control. If, however, excess water occurs in the wastewater basin, it will be discharged to the lagoon of leachate from the landfill with prior neutralization.

Therefore, under normal/nominal conditions of operation of the EfW plant, all technological wastewater will be consumed within the plant itself, so that during the regular operation of the plant and under "normal" atmospheric conditions, there will be no overflow of these waters to the lagoon of leachate, outside Functional unit 1 .

3.2.2.2. Description of the BEP plant technological process

The plant for energy utilization of landfill gas (BEP) is intended for electricity production by combustion of landfill gas.

The obtained electricity will be transferred to the existing power distribution system of AD "Elektromreža Srbije" Belgrade.

Landfill gas is delivered from the new and old landfill via the main manifold pipeline leading to the BEP plant.

The cogeneration plant will use landfill gas as the fuel, extracted by the anaerobic decomposition of landfill waste. The maximum energy potential of landfill gas from the Vinča landfill is estimated at about 4.5 MW. The planned power of the BEP plant is about 3.2 MW (IDR 4/2: Electrical Power Installation Design, 1. Text documentation, CEEFOR doo, November 2017).

Data on the expected quality of landfill gas are given in the table.

Table 12 Expected quality of landfill gas

	Unit of measure	Min. value	Max. value
CH_4	% of vol.	35	50
O_2	% of vol.	5.5% O_2 if CH_4= 30% 0.5% O_2 if CH_4= 30% linear between the two	<4
CL (chlorine)	mg/Nm^3		<50
F (fluorine)	mg/Nm^3		<25
CL + F (chlorine and fluorine)	mg/Nm^3		<50
Silicon	index in oil		<0.2
Siloxanes	index in oil		<0.2
H_2S	mg/Nm^3		<349
Relative humidity before drying	%		<80

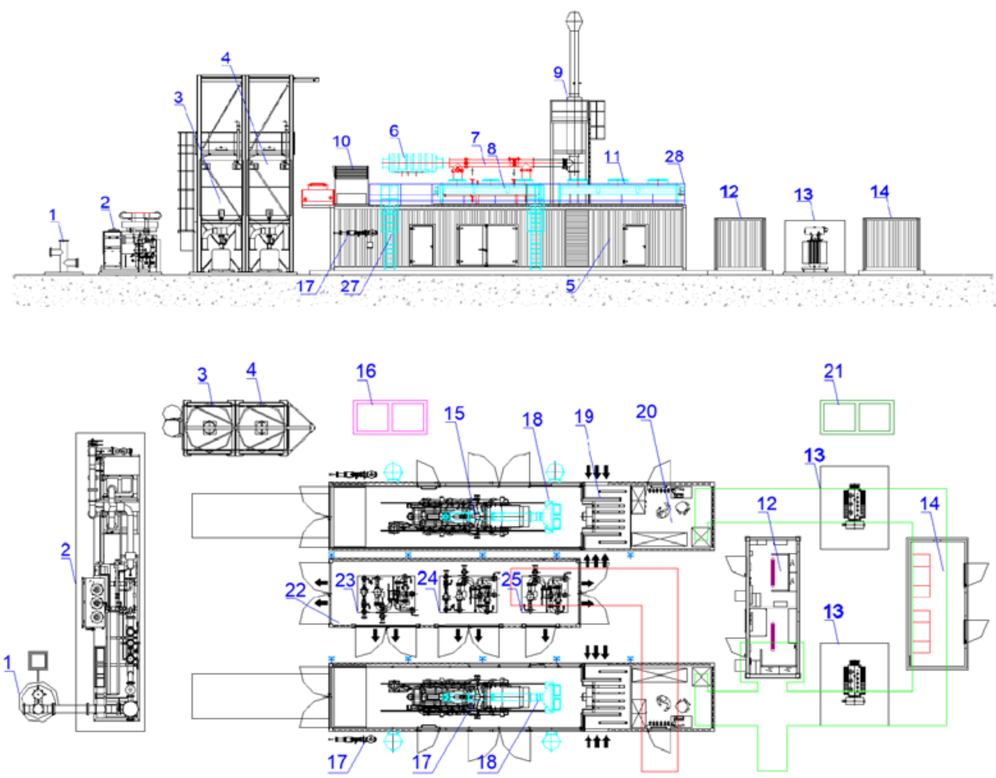
Relative humidity entering the electrical module	%		<50
Depression at the entrance to the platform	mbar	> -70	<0
Pressure at the entrance to the engine group		>= 160 mbar if CH_4= 30% >= 120mbar if CH_4= 40%	

(Source: CHP 05/04/18- LF GAS-SRB, Energy Production Sector, 2018)

The basic concept of the BEP plant is:

- to provide gross electricity of 2 × 1.5 eMW,
- to provide two temperature levels of thermal media as follows:
  - superheated water (160/120° C)
  - hot water (90/70° C)
- to provide the electricity generated as follows:
  - which must be 400 V and 50 Hz (produced on generator sets)
  - after the generator LV switch, a voltage increase must be made through the transformer for amplification up to 10/10.5 kV
  - to be ready for connection to the main substation (from 10/10.5 kV to 110 kV)

The block diagram of the basic elements of the BEP plant is given in the figure below:



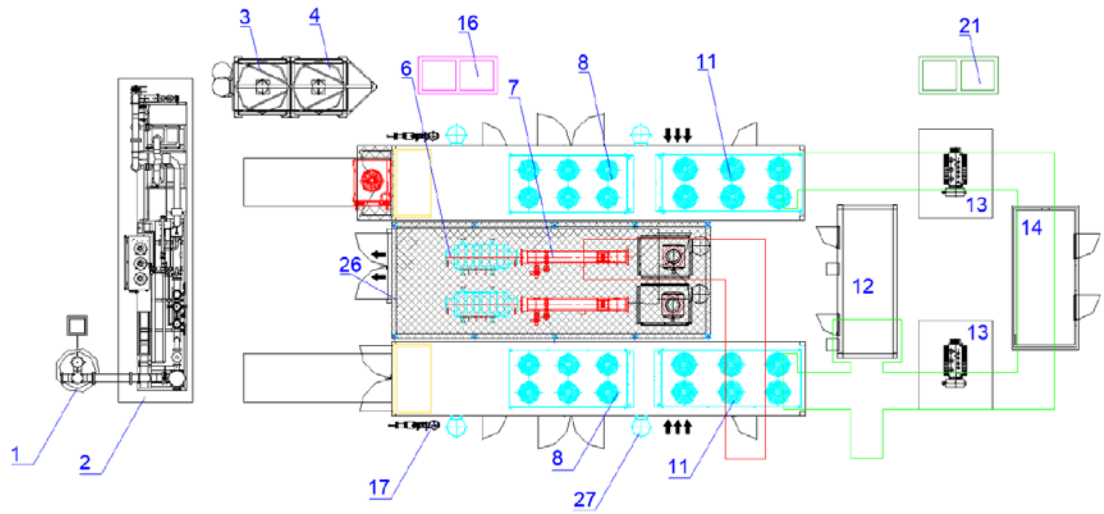


Figure 32 Schematic representation of the BEP plant (lateral and orthogonal sections) (Source: IDR, 6/2 Mechanical Installation Design, CEEFOR doo, 2017)

Table 13 Legend to the figure

Position	Description
1	landfill gas inlet - "U" tube
2	gas preparation unit - ("skid")
3	activated carbon filters to separating H_2S
4	activated carbon filters for separating silicon compounds
5	cogeneration plant containers
6	exhaust gas purification device
7	cup exchanger for the use of flue gas heat
8	air cooler in the engine cooling circuit
9	noise damper and stack
10	air outlet for ventilation
11	secondary cooler of a mixture of air and landfill gas
12	container of low voltage equipment
13	oil transformers
14	medium voltage container
15	gas engine and power generator
16	freestanding closed oil tanks
17	gas ramps
18	gas engine air preheater
19	air intake system
20	control room

21	closed tanks for fresh and used coolant
22	heat block container
23	block for the production of superheated water
24	hot water production unit
25	heat block container
26	exhaust system
27	stairs to access the roof of the container
28	fence on the roof

The simplified block diagram of energy utilization of the landfill gas on the BEP plant shows the following elements:

- gas preparation unit (PG)
- activated carbon filter block
- two cogeneration plants (CHP1 and CHP2) with gas/electric generators
- thermal energy production unit (BT)
- container with low voltage equipment and control room (LW)
- two oil transformers (UT1 and UT2)
- medium voltage container (SN1 and SN2)
- fresh engine oil container (RU) and
- refrigerant tank (RF)

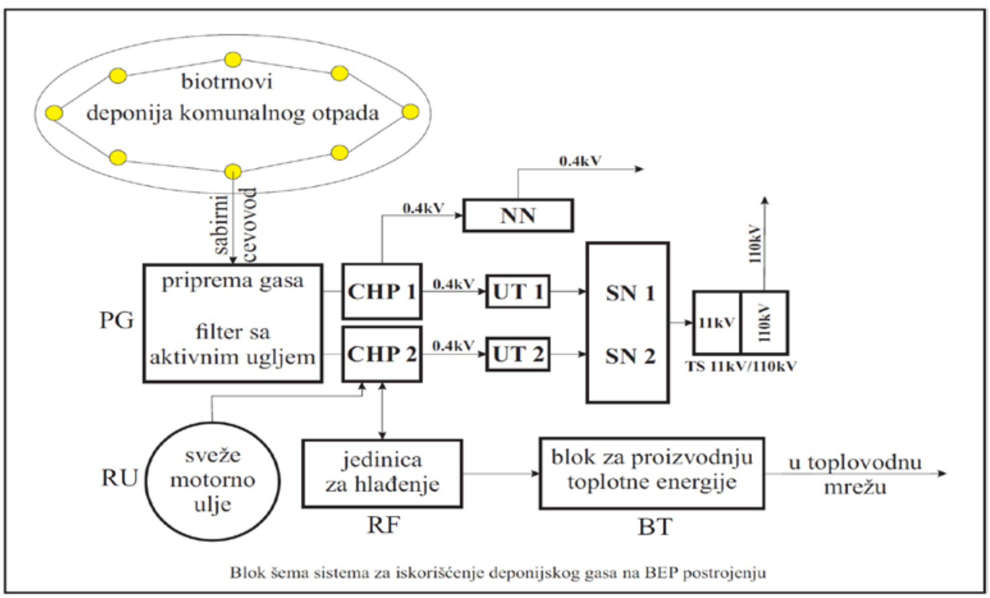


Figure 33 Block diagram of landfill gas utilization at the BEP plant (abbreviations are internal, apply only to the block diagram)

According to the block diagram, the landfill gas from the “old” landfill body (and later from the new one) is collected by biotrns and the central collection pipeline is fed to the BEP plant.

The landfill gas collection system is in the form of a network of vertical pipes (biotrns) placed at the depth of the landfill body and collectors for the collection and removal of landfill gas from biotrns. With the main manifold pipeline, the landfill gas is fed, to the activated carbon (PG) preparation/conditioning unit, to the BEP plant. The proposed number of biotrns per hectare of new landfill body is in the upper limit (safer system) of the value range prescribed by ADEME (the French Environmental and Energy Management Environmental Agency).

After preparation, the gas is compressed for incorporation into CHP modules, which are equipped with lubrication (RU) and cooling (RF) systems. The cooling system is connected to the heat utilization system (boilers of overheated and hot water). Two equal cogeneration units (CHP1 and CHP2) are planned in which the energy obtained from the combustion of landfill gas (in the gas generator with an alternator) is used to generate electricity.

A gas generator set is foreseen: a Caterpillar CG 170-16 gas engine and a Marelli alternator with the following characteristics.

Table 14 Technical characteristics of the gas engine
(Source: CHP 05/04/18-LF GAS-SRB)

Engine data	Unit	Value
engine type	Caterpillar	CG 170-16
type of alternator	Marelli	MJB 500 LA4
Nominal power	kW	1560
voltage	V	400
frequency	Hz	50
number of cylinders	-	16
cylinder volume	L	71
NOx emission (SCR and OXI catalyst)	mg/Nm^3	<100/5% O_2
CO emission (SCR and OXI catalyst)	mg/Nm^3	<80/5% O_2
gas consumption (for CH_4 30%)	Nm^3/h	1 240
gas consumption (for CH_4 50%)	Nm^3/h	734
rpm	min^{-1}	1 500
compression ratio	-	1:14

Electricity is produced by a three-phase, brushless, self-excited synchronous power generator/alternator that is mechanically coupled to the gas engine. The motor generator set is mounted on rubber dampers between the base and the foundation, minimizing vibrations.

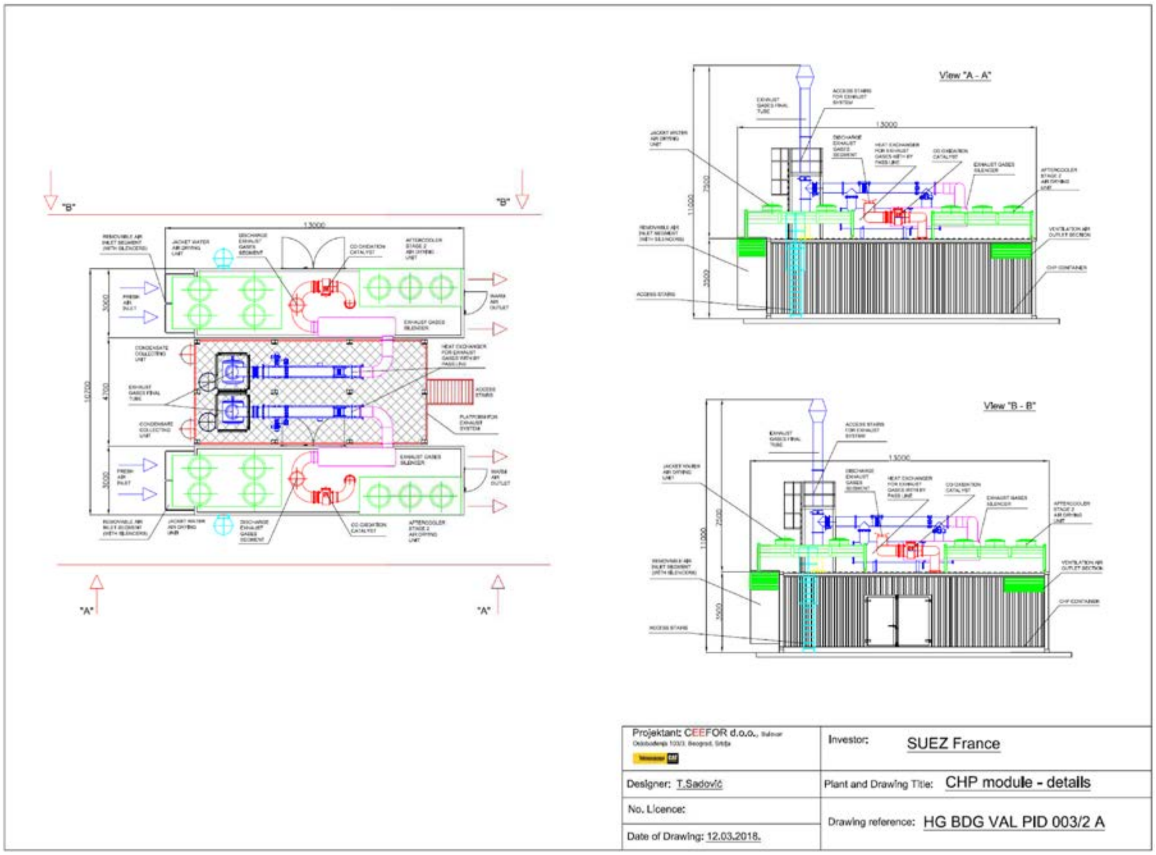


Figure 34 Layout of containers with the CHP module
(Source: CHP 05/04/18-LF GAS-SRB)

The electricity produced is delivered through transformers - containers with low voltage (LW) and medium voltage (MV) equipment. Within the BEP plant, two oil transformers are also provided to increase the voltage to the MV equipment.

The BEP plant is equipped with a fire alarm and gas detection control panel so that all alarm signals from these control panels are directed to the control room of the EfW plant.

The tanks of spare and used working fluids within the BEP plant are:

- Free-standing closed oil tanks (2 pieces, for fresh and used oil, 2 m^3 capacity, each equipped with an oil pump)
- Free-standing closed tanks for fresh and used coolant (water with 30% glycol), capacity 2m^3 each equipped with a pump)

Exhaust gases from the BEP plant are discharged into the atmosphere via a stack 7.5 m high (measured from the top of the container). The stack is common to both CHP modules.

The hot water production set uses energy from the circulation circuit from cooling the gas engine. In both cogeneration units, the engine cooling circuit contains a circulation pump and a plate heat exchanger. From the plate heat exchanger, heat is transferred to an external circulation circuit having a circulation pump and a plate heat exchanger of 1698 kW common to both cogeneration units and housed in the heat block container.

The hot-water production set uses the exhaust gas energy of the engine. In both cogeneration units, the exhaust gas cooling circuit contains a circulation pump and a plate heat exchanger. From the plate heat exchanger, heat is transferred to the external flue gas circulation circuit which has a circulation pump and a plate heat exchanger with a power of 1 314 kW, which are common to both cogeneration units and are housed in the heat block container. The exhaust gases are cooled from a temperature of 480° C to a temperature of 180° C.

Through these heat exchangers, overheated and hot water are delivered to the EfW plant for technological purposes.

To control the input, pre-prepared, landfill gas into the CHP module, a gas analyzer is provided to measure the concentrations of the following components:

- CH_4 → with a range of 0 - 100%
- CO_2 → with a range of 0 - 100%
- O_2 → with a range of 0 - 25% and
- H_2S → with a range of 0 - 5 000 ppm

Landfill gas sampling will be carried out at 4 points on the pipeline. The gas samples must be dried and prepared for precision testing (the analyzer has an integrated unit for drying the gas samples). The gas analysis system described is compact and built into the cabinet.

For the preparation of landfill gas, two filter units are provided for removal:

- H_2S - activated carbon filter (2 pcs.) and
- VOSiC - activated carbon filter (1 pc)

These filters have a capacity of 10 m^3. They are free-standing and have a common mounting structure. At the top of the structure there is a lift rail (to lift the filter fill when replacing).

3.2.3. Landscaping and greening areas in Functional unit 1

The landscaping and greening of all the areas within the complex are designed to meet the needs of the users as well as the standards of the planned facilities (IDP, 9 Exterior Design).

The concept of leveling solution of free surfaces in the complex is conditioned by the levels of the roads and the levels of the building. The leveling of the terrain foresees falls from the building and plateaus under the solid surface to the free green spaces and internal roads and further to the rain sewer.

The sidewalks around the buildings are made of compacted concrete, designed in a minimum fall towards green spaces and/or roads. Several types of plateau surfaces are foreseen at the complex.

Plateau for the accommodation of the air-cooled condenser facility is made of gravel pebble material 10 cm thick, while the other plateaus (unloading plateau, stack area and DeNOx facility, treatment and maturing slag plateau) are of compacted reinforced concrete.

The greening of the complex was done according to the conditions of PUC "Zelenilo Beograd", a preliminary architectural and transport design.

The goal of greening the complex is to stabilize the land and reduce the negative visual effect on the area, i.e. on the area in the immediate environment.

Within the complex, smaller green spaces are foreseen at the entrances to the building and at the parking area. Within the complex there are smaller areas for greening, while the larger green area, in the form of a protective belt, is provided around the complex.

On the parking area, there are tree-line seedlings and a lawn planned. Low decorative greenery and deciduous shrubs are foreseen at the entrance to the administration building to create a more pleasant effect.

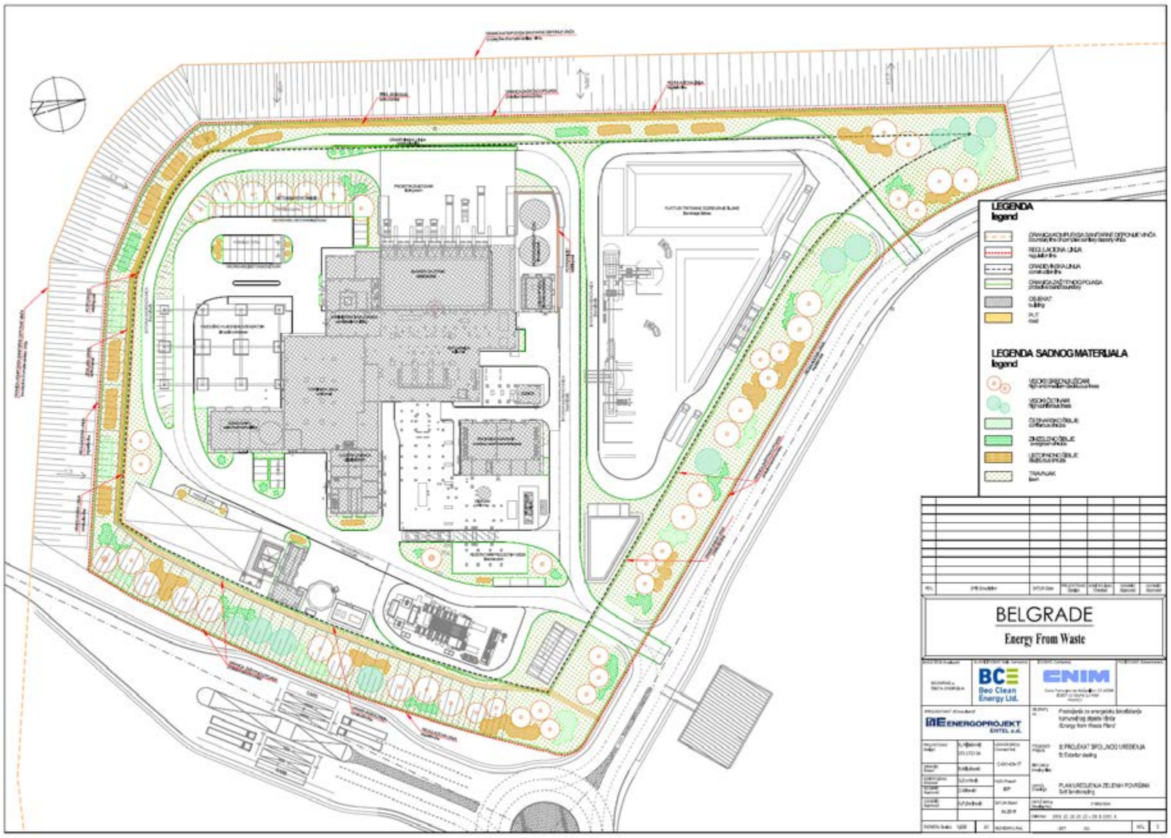


Figure 35 Landscaping Plan (Source: IDP, 9 Exterior Design)

3.2.4. Preview of the type and amount of required energy and energy generating products, water and raw materials

Electricity

In normal operation, for consumption, the EfW plant is powered from the distribution network (EMS) via 1 kV cable and the 10 kV plant. On disappearancein power supply across this connection, that is, loss voltage at 10 kV plant, automatici se is powered by a diesel electric unit, whichi je likewisee connected to this switchgear, as soon ase se provides continuitye t power supply own consumption.

The EfW plant will have one electric generator, which will be run by the steam turbine, with the maximum power of 32.8 MW. It is envisaged thatthe generator be connected to the 11 kV plant, to whichi the 110/11 kV transformer is also connected whichserves as a connection with thetransmission system (EMS) to which the fully produced electricity is handed over.

The 10 kV plant is used to connect power supply equipment for its own consumption. To the 10 kV plant the transformers 10/0.66 kV and 10/0.4 kV are connected over which the main distributors 660V and 400V as well as a 2000kVA diesel unit are powered, which is activated in the event of a power failure at this plant. The 10 kV plant is powered by a 10 kV cable from the distribution network (EMS).

To power own consumption, four transformers are foreseen: two 10/0.66 kV transformers and two 10/0.4 kV transformers. All transformers are dry, resin insulated and witha switch for voltage regulation.

Forpowering large engines, preko frekventnih regulatorathrough frequency regulators, the se switchgear of own consumption of 660 V will bee used.

To power the restof consumers, including i smaller engines, via several sub distribution systems and engine control centers, a switchgear of own consumption of 400 V will be used

Diesel electric generator, of power 2000 kVA, is provided forthe power supply of critical consumers in the event of a voltage failure at the 10 kV switchgear.

Energy generating products

The main energy generating products (as well as the raw material) at the EfW plant is municipal solid waste whose incineration in the boiler plant recovers the energy obtained to produce and distribute electricity and heat. The EfW plant is designed to utilize approximately 380,000 tonnes of municipal waste annually.

For the purposes of igniting and maintaining fire at low boiler loads, it is envisaged to use liquid fuel - diesel. The main diesel fuel tanks have a total capacity of V = 120 m^3 (2 x 60 m^3).

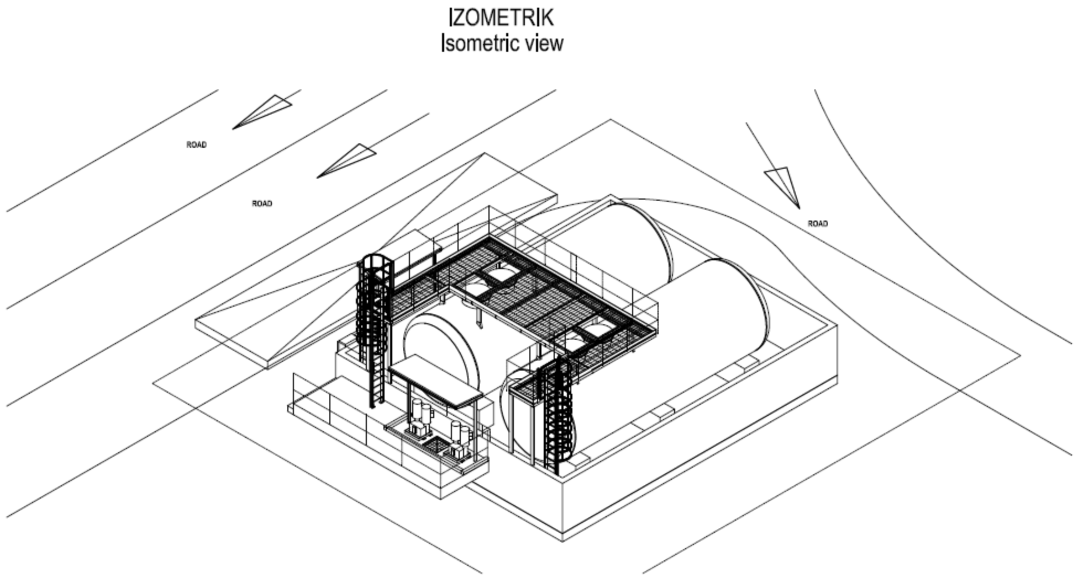


Figure 36 Main diesel fuel storage tanks
(Source: IDP, 6/8 Mechanical Installation Design, Liquid Fuel System)

The main diesel fuel tanks are double-sheathed, housed in a reinforced concrete watertight bundwall.

Next to the bundwall there is a transshipment station with the necessary equipment for connecting the tanker trucks to the transfer pumps, grounding and equalizing the electric potential with the tanks. The transshipment station is with a slope towards the grate to take the possibly leaked derivative during the transfer, with a drain to the oil pit (grease and oil separator).

From these tanks, the following (internal) tanks are supplied with fuel:

- Fuel tank in the auxiliary boiler room
- Daily fuel tank of the diesel electric power unit and
- Fuel tank for diesel fuel pumps in the fire water pump station

The connection of the above tanks to the main diesel fuel tanks is shown in the following figure.

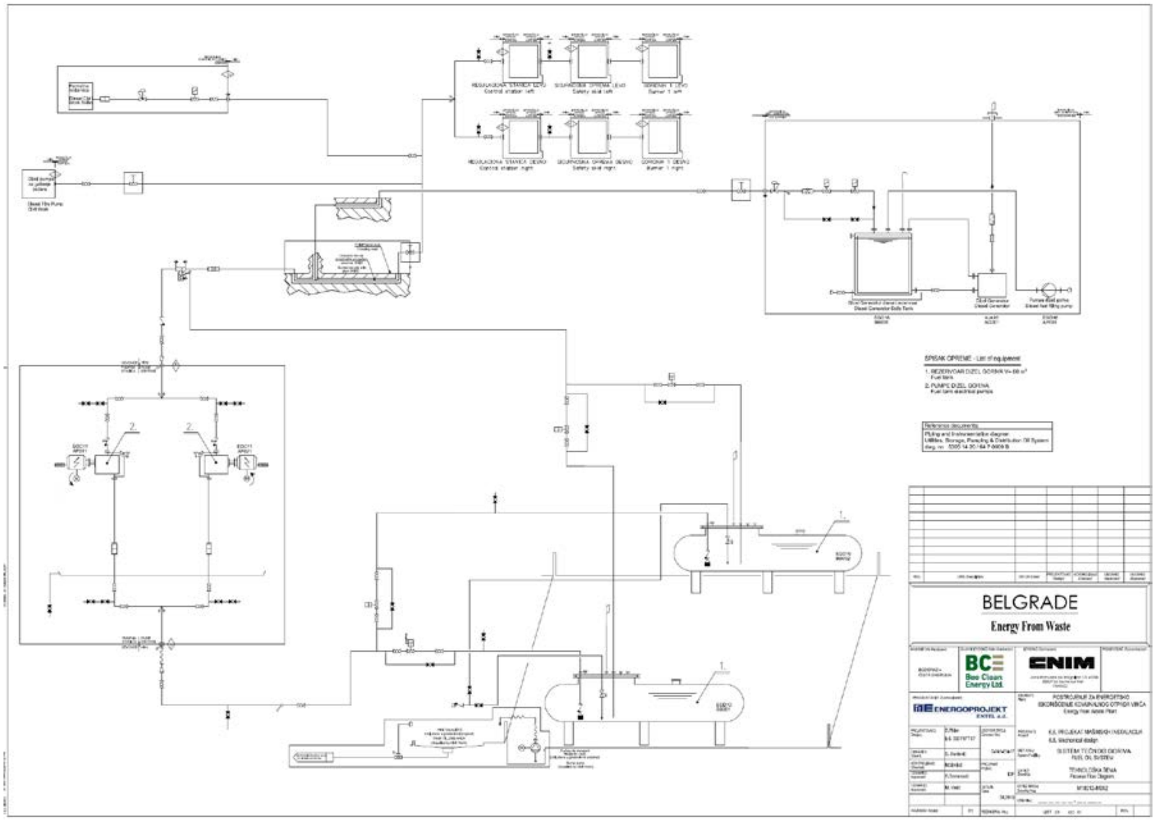


Figure 37 Schematic diagram of the Liquid Fuel System
(Source: IDP, 6/8 Mechanical Installation Design, Liquid Fuel System)

Water supply

For the water supply of Functional unit 1 thefollowing are hydrotechnical installations are envisaged for:

- Sanitary water
- Process water
- Fire protection water

Thei plantsa don'tin portsk na javnin linesodnu network.The facilities of the plant do not have a connection to the public water supply network. Functional unit 1 will be suppliedwith water through the internal connection to the water supply of the whole landfill complex in Vinča, which is connected to the Belgrade water supply system.

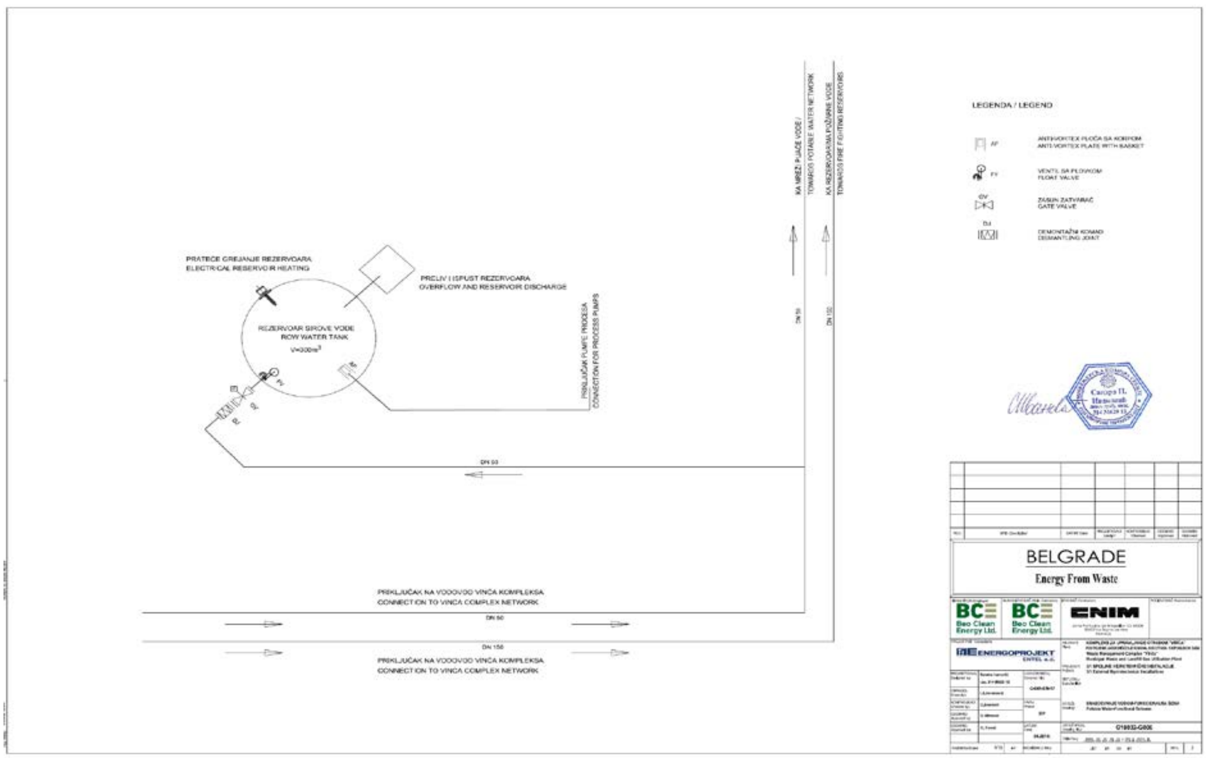


Figure 38. Functional scheme of water supply
(IDP, 3/1 Design of Hydrotechnical Installations)

After the connection, a manhole with a water meter is provided. The water supply network is then divided into two branches, one going to the raw water tank and the other to the raw water pumping station.

Expected available amount of water for the plant amounts to Qmax = 14.8 l/s, (expectedpressure up to 1.0 bar), which is enough for sanitary and plant needs, as well as filling fire tanks.

Within the plant, a raw water tank is provided (volume 300 m^3) and the pumping station. Pumps to fill fire tanks and pumps for pressure increase in the sanitary network are supplied directly from the water supply pipeline, while the process pumps are supplied with water from a raw water tank.

Required quantity of water for sanitary purposes of Qmax = 2.35 l/s is provided from the internal water supply network of the complex by pumps for pressure booster installed in the raw water pump station.

Requireda quantities of process water of 1.45 l/s is provided from the water tank, by pumps installed in the pump station of raw water. The tank with raw water of 300 m^3 provides a two-day quantity of water required for the process. The main consumer of raw water for technological purposes is the HPW Demineralized Water Production Plant. The raw water for process purposes will be supplied from the raw water tank by raw water pumps. From the thrust collector of the raw water pumps, the water will be diverted to the consumers. Raw process water consumption is 5.31 t/h nominally, up to 5.65 t/h maximum.

The tanksi for fire water is sized to provide sufficient water to extinguish the relevant fire in the durationof 2 h (volume 2 x 685 m^3). Plant facilities are protected externally from the fire by the external hydrant network, while for internal fire protection there is an internal hydrant network and sprinkler system.

The main energy source of the BEP plant is the generated landfill gas from the existing landfill (after its rehabilitation and remediation) and newly designed landfill of untreated waste (these landfills are the subject of another project and are not within the KP1 planning unit).

The BEP plant will use the aforementioned infrastructure facilities planned for Functional Unit 1.

3.2.5. Preview of the type and amount of discharged gases, water, and other liquid and gaseous effluents, considered by technological units including emissions into the air, discharges into surface and groundwater recipients, land disposal, noise, vibration, heat, radiation (ionizing and non-ionizing) etc.

EfW Plant (Functional Unit 1/1)

Flue gases

The technological scheme of the inlet air and the flue gases of the boiler plant is shown in the figure.

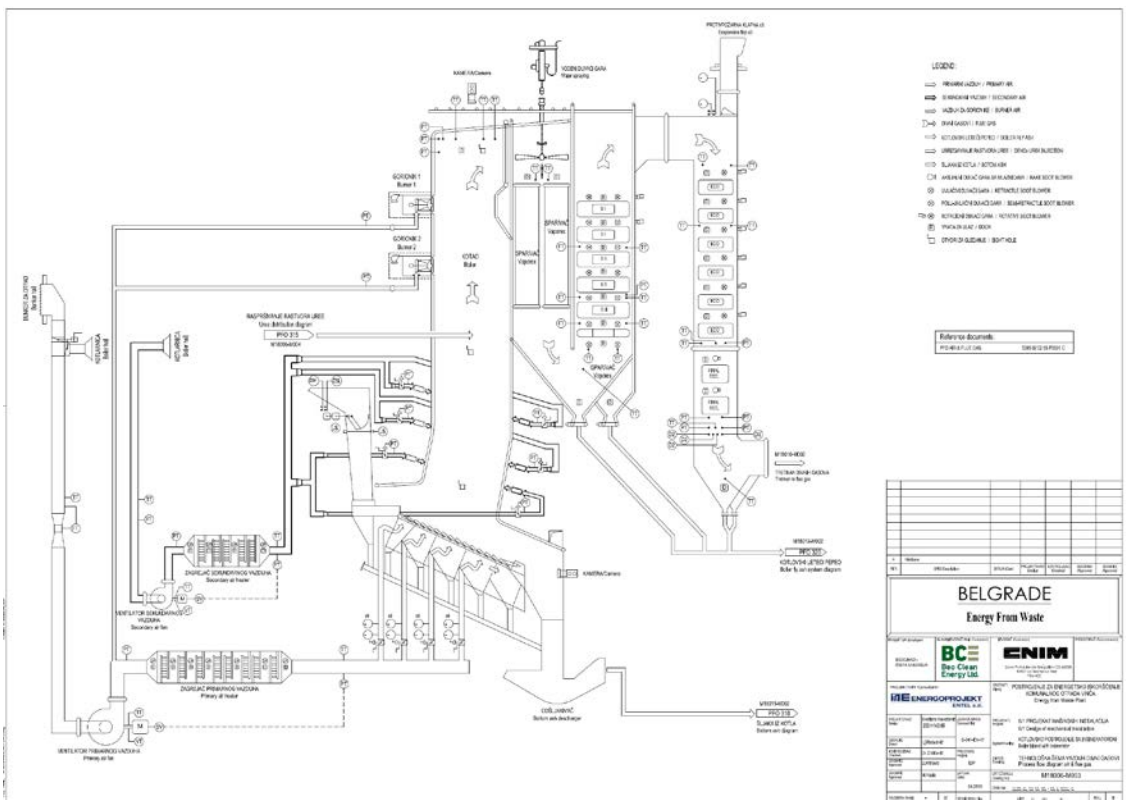


Figure 38 Technological scheme of air and flue gases
(IDP 6/1 Mechanical Installation Design, Boiler Plant with Incinerator)

To the defined EfW plant emitter, a boiler plant is connected to the associated facilities. Two fans are provided to supply fresh air to the boiler combustion chamber. The primary air fan takes air from the storage hopper and the unloading area - reception hall and from the boiler room, while the secondary air fan only takes air from the boiler room. The air is previously heated in the air heaters.

Table 15 Balance of the primary and secondary air and flue gases (IDP 6/1 Mechanical Installation Design, Boiler Plant with Incinerator)

Basic parameters	**Unit of measure**	**fuel, Hd = 8500 kJ/kg**
Air flow - inlet		
Primary incineration air (from the fuel tank)	Nm^3/h	102.330
Primary incineration air (from the boiler room)	Nm^3/h	
Secondary incineration air (from the boiler room)	Nm^3/h	50.930
Air for liquid fuel burners	Nm^3/h	38.160
Air and flue gas flow - outlet		
Air at the boiler outlet	Nm^3/h	159.160
Flue gas at the exit after the final economizer	Nm^3/h	196,419

The volume of waste air from the emitter/stack is about 200,000 m^3/h. The emitter at the EfW plant is a 60.5 m double-sheathed steel stack.

Wastewater

In general, Functional Unit 1 (and therefore EfW and BEP plants with associated facilities) does not have a direct connection to the public sewer network or direct discharge of waste and unpolluted atmospheric water into the natural recipient. All water, uncontaminated and contaminated, from this part of the landfill complex is discharged into internal sewer systems that connect at the boundary of Functional Unit 1 to the corresponding systems of the second part of the landfill complex, such as the Leachate Water Treatment Plant (LTP) from the landfill bodies and the Wastewater Treatment Plant (WWTP). These facilities are the subject of another project.

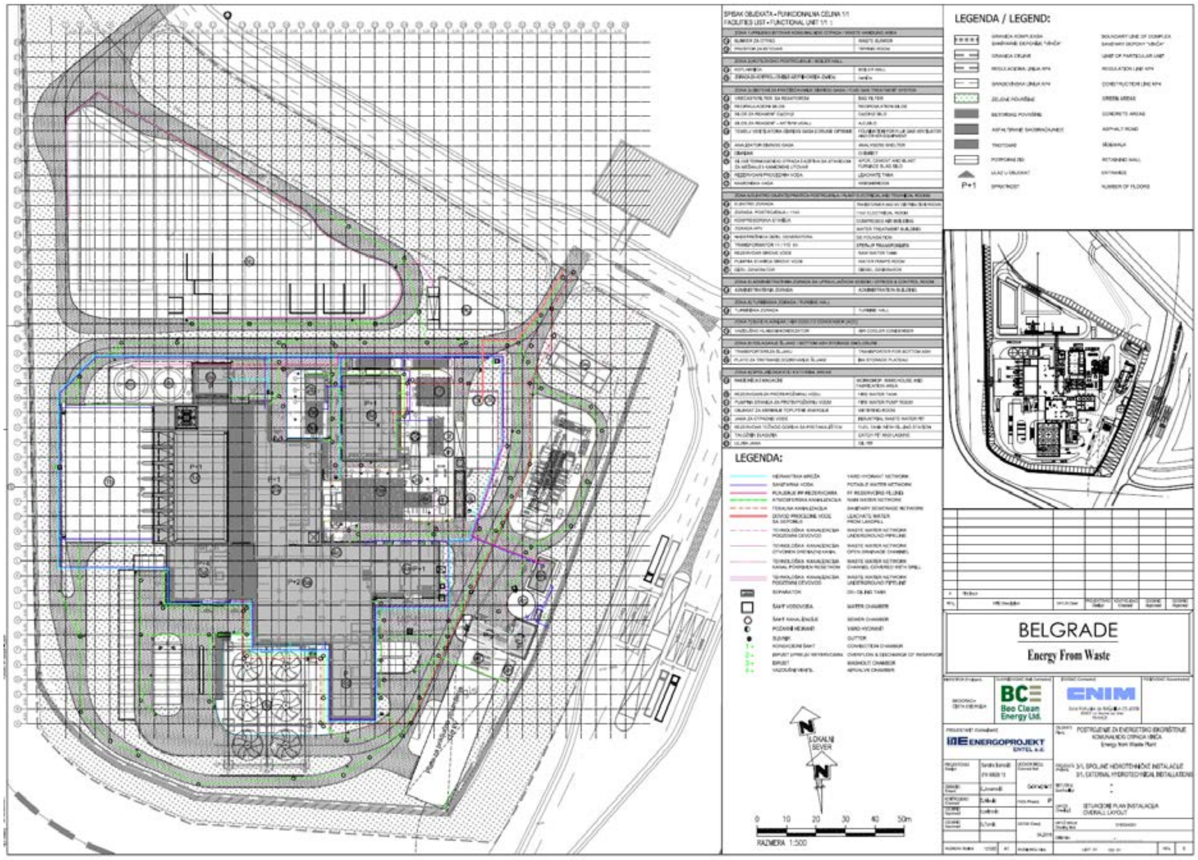


Figure 39 Layout plan of hydrotechnical installations
(IDP, 3/1 Exterior hydrotechnical installations)

Atmospheric sewer

The pollution of atmospheric waters depends on the pollution of the surfaces over which they flow.

Atmospheric water from new roads, roofs and plateaus will be collected by a special network of enclosed collectors located below the road divided into two basins, both of which gravitate towards the collector and continue to flow towards the peripheral canal of the landfill (clean water canal). Water from the parking lot is considered oily due to vehicle retention, and these waters are treated at the grease and oil separator before being discharged into the rain sewer.

Atmospheric waters in the boiler-slag zone (IBA zone) are collected by a special network of open canals placed next to (along) roads that gravitate towards the IBA settling basin and the IBA lagoon. Atmospheric waters in this zone are considered as polluted waters and belong to the technological sewage system.

Oily atmospheric waters that occur in the regular operation of a step-up transformer are discharged into the atmospheric sewage system after treatment in the grease and oil separator (oil pit).

Since there is no urban atmospheric sewer in the vicinity of the landfill, the collected clean atmospheric water is evacuated beyond the boundaries of the plant through an open canal system to the lagoon for receiving atmospheric water (beyond the boundaries of Functional Unit 1), and further to the Danube River (this lagoon is the subject of another project).

The relevant amounts of atmospheric precipitation for the calculation of atmospheric sewage were adopted on the basis of data issued by the Republic Hydrometeorological Institute in Belgrade and amounted to 182 lit/sec/ha for a return period of 5 years of 20 min, which was adopted as the relevant rain for the calculation of atmospheric collectors in Functional Unit 1.

Based on the calculation, (IDP, 3/1 of the Exterior Hydrotechnical installations), the total amount of atmospheric sewage discharged into the recipient is about 350 l/s.

Fecal sewer system

Pollution of sanitary wastewater (fecal water) is organic in nature.

As there is no urban fecal sewage system built around the landfill, sewage wastewater from the facilities will be collected by a special network of closed local collectors that gravitate towards the collector and continue to be evacuated beyond the boundaries of Functional Unit 1 to the Wastewater Treatment Plant (WWTP)) located on the second part of the landfill complex (WWTP is the subject of another project).

The total quantities of sewage water evacuated to WWTP are about 3.4 l/s (3.06 l/s from the administrative premises and 0.33 l/s from workshops and warehouses).

Technological sewer

Wastewater generated in the main and auxiliary systems of the EfW plant, as a result of the electricity/heat production process, as well as from various washes in the plant circuit, are potentially contaminated: municipal waste, combustion products, oils, water resulting from the event of fire, chemicals used in the process, etc. Some process wastewater also has an increased temperature.

The technological sewer network collects and drains waste water from process and technical facilities as well as from plateaus where technologically contaminated water occurs. The total amount of wastewater that is collected is about 130 m^3/h.

These waters will be collected by the system of closed collectors (sewage network of process waters) and after pre-treatment in the wastewater basin, they will be reused for various purposes in the technological process at the EfW plant.

Any excess of these waters will be overflowed and piped to the lagoon for leachate water from the sanitary landfill, from which it will be further directed to the leachate water treatment plant (LTP plant). The leachate lagoon and the LTP plant are the subject of another project as they are not within Functional Unit 1.

In addition to pipelines, the sewage system for technological waters contains the following facilities

- IBA settling basin of app. 60 m^3
- IBA lagoon, of app. 800 m^3
- Wastewater basin, of app. 340 m^3

The IBA settling basin and IBA lagoon will collect water from the IBA zone i.e. zones of the slag removal system from the bottom of the boiler plant, consisting of leachate and atmospheric water from that area. Preliminary sedimentation of suspended matter contained in this water is envisaged in the receiving basin - the IBA settling basin, after which partially clarified water will be discharged into the IBA lagoon, which is used as a buffer basin. Water from the IBA lagoon will be pumped by submersible pumps to the wastewater basin for re-use for process purposes (these waters are in the recirculation system).

The wastewater basin will collect:

- Atmospheric water from the reagent storage area
- Fly ash treatment system i.e. flue gas purification zone (APCR)
- Atmospheric water from the plateau of the DeNOx system/building
- Wastewater from the plant for the preparation of feed water for the boiler
- Condensate from the blower system
- Rainwater around the basin itself
- Wastewater from floor washing in process areas (including boiler room, machine room, zone of boiler feed water preparation plant, etc.)

The wastewater basin will consist of several chambers: a reception chamber for calming the flow, a settling basin, a recirculation chamber and a "clean water" chamber. The water from the "clean water" chamber is reused and taken by recirculation pumps to technological consumers. The wastewater basin will have a return connection to the IBA lagoon, where the wastewater will be pumped by the pumps from the "clean water" chamber in case of heavy water inflows. Also, the basin will be connected to the lagoon for leachate water at the sanitary landfill, in case of heavy rainfall or when the capacity of the IBA lagoon is filled. Under “normal” atmospheric conditions and regular operation of the plant, no overflow from the wastewater basin to the lagoon for the leachate water (i.e. outside Functional Unit 1) is foreseen.

Oil sewage and oily waters from transformers

In order to supply the plant with electricity, it is planned to build a transformer station, which will be located within the EfW plant. Below the transformer is a watertight concrete tub where oil and oily atmospheric water draining from the transformer may occur during regular operation.

The tub is of sufficient capacity to accept the entire amount of transformer oil in the event of an accident/emergency on the transformer. The poured amount of oil and/or oily atmospheric water is discharged to the oil pit (grease and oil separators) by oil sewage.

The oil pit also has the function of a separator/settling basin: separation of oil from water, deposition of dust and sludge and drainage of treated water. The oil pit consists of three chambers:

- Inflow chamber (A) - 2 m^3
- Oil Extraction Chamber (B) - 20 m^3
- Outflow chamber for treated water (C) - 2 m^3

As the amount of water draining from the tub into the pit/separator cannot be determined precisely, based on engineering practice and experience for similar oil pits, the useful volume in the stabilization chamber corresponds to the total oil volume of one transformer plus 20% of the reserve.

The aforementioned volumes of oil pit chambers have been adopted which fully guarantee the functioning of the pit as an oily wastewater separator/settling basin.

After the oily water separator, from the outflow chamber, the treated water flows gravitationally (through a 300 mm diameter pipeline in a drop of 2.5%) to the atmospheric sewer shaft.

Noise emissions into the environment

For the purposes of the project, modeling of the noise level in the environment was performed. The expected noise level of the project was performed by 3D acoustic modeling (CadnaA software version 2018)

Based on the calculation, the expected noise levels at the defined measuring points, in the wide area of the landfill complex, in the daytime/ evening operation ranged from 40-53.9 dB(A) and 40.2-47.5 db(A).

A more detailed description of the measurements performed and the results of modeling of environmental noise levels are given in sections 5.0. and 6.0.

Waste generation

In Functional Unit 1, different types of waste are generated both by origin and by type and quantity.

The generated waste consists of waste from the production process, offices, laboratories and warehouses, garden waste, etc., which can have non-hazardous and hazardous characteristics. The project documentation shows the process waste from the boiler plant consisting of the slag from the bottom of the combustion chamber and fly ash in a stream of hot gases from the waste incineration grate. The table shows the quantities of ash generated by the incineration of waste (calculated on dry weight).

Table 16 Amounts of ash for different waste incineration capacities
(IDP 6/1 Mechanical Installation Design - Boiler Plant with Incinerator)

	Maximum load		**Maximum load**	
	LTP = 7,500 kJ/kg		LTP = 8,500 kJ/kg	
	Waste flow = 49.4 t/h		Waste flow = 43.6 t/h	
	kg of ash per ton of waste [kg/t of waste]	Flow of ash [kg/h]	kg of ash per ton of waste [kg/t of waste]	Flow of ash [kg/h]
Unburned matter	250	12,337	272	11,872
Slag below the grate	227	11,202	247	10,755
Fly ash after second and third draft	2.3	113	2.6	112
Fly ash after the fourth draft	4.6	227	5.1	223
Fly ash to treatment of flue gases	16.1	794	17.9	782

Light, heat, radiation, etc.

Light emission is expected. Facilities in Functional Unit 1 will be illuminated by appropriate lighting.

The heat emission is expected from the ventilation system for natural and forced ventilation of the premises where the heat source equipment is housed (especially from the boiler room, electrical building, turbine building and compressor station).

Substations and high voltage cables are sources of non-ionizing radiation. There are no sources of ionizing radiation in this functional unit.

3.2.6. Demonstration of technology for treatment of all types of waste materials

3.2.6.1. Flue gas purification system for the EfW plant

In order to reduce pollutant emissions, flue gases are treated in two positions at the boiler plant: within the combustion chamber and at the boiler outlet.

For the purposes of reducing the emission of nitrogen oxides in the flue gas, a selective non-catalytic reduction (SNCR) system is provided within the combustion chamber, treatment with the so-called "wet" procedure. The SNCR system uses injection of urea solution directly into the boiler chamber. The urea solution is stored in a 50 m^3 tank from which the solution is directly injected into the combustion chamber of the boiler.

For the selection of the right equipment for the purification offlue gas, through the so-called "dry" procedure, at the exit of the boiler plant and its adequate sizing, the flue gas characteristics used for two boiler operating modes, at maximum continuous load (MCR,) were used for the calculation. The input design parameters are shown in the table.

Table 17 Input design parameters - flue gas characteristics
(Source: IDP, 6/5 Mechanical Installation Design – Flue Gas Purification Systems)

Parameter	**Unit**	**Flue gas**	
		Boiler outlet	
Operation mode	-	MCR	MCR+
Flow	Nm^3/h dry gas	154,346	180,499
	Nm^3/h wet gas	191,734	222,564
	kg/h wet gas	239,194	276,941
	m^3/s	82.3	95.8
Temperature	oC	140	140
Relative pressure	kPa	-0.75	-1.01
Content of O_2	% in wet gases	6.13	7.58
	% in dry gases	7.61	9.35
Content of CO_2	% in wet gases	9.50	8.33
	% in dry gases	11.80	10.27
Content of H_2O	kg/h	30,056	33,816
	% in wet gases	19.50	18.90
Harmful substances			
Powdered matter (and products of	kg/h	866	883
	mg/Nm^3 dry gas	4 192	4 196
HCl	kg/h	134.3	136.7
	mg/Nm^3 dry gas	650	650
HF	kg/h	2.1	2.1
	mg/Nm^3 dry gas	10	10
SO_2	kg/h	51.6	52.6

	mg/Nm^3 dry gas	250	250
NOx	kg/h	41.3	42.1
	mg/Nm^3 dry gas	200	200
Heavy metals			
Cd + Tl and their compounds	kg/h	0.41	0.42
	mg/Nm^3 dry gas	2	2
Hg and its compounds	kg/h	0.06	0.06
	mg/Nm^3 dry gas	0.3	0.3
Sb+As+Pb+Cr+Co+Cu+Mn+Ni+V	kg/h	33.1	33.7
	mg/Nm^3 dry gas	160	160
Dioxins and furans	kg/h	1.03	1.05
	ng/Nm^3 dry gas	5	5

The flue gases are introduced into the reaction canal (reactor) after the boiler plant and the bag filter and further through the flue gas fan (and gas analyzer) taken to the in stack.

The plant for purification of flue gases from sulfur oxides, volatile heavy metals (Hg) and organic components (dioxins and furans) after the boiler plant includes the following elements:

- Sorbent mixing reactor (activated carbon and hydrated lime) with flue gas before entering bag dust filters;
- Hydrated lime storage and injection system;
- Activated carbon storage and injection system;
- Bag filter;
- The system for the so-called “maturation” (chemical reactions to form the final waste product) and recirculation of waste matter (residues);
- Final waste matter collection/storage system;
- Flue gas fan, gas ducts and noise damper;
- Freestanding double wall stack for the removal and discharge of purified flue gases into the atmosphere with gas analyzers.

The figure shows a system model for purification of flue gas.

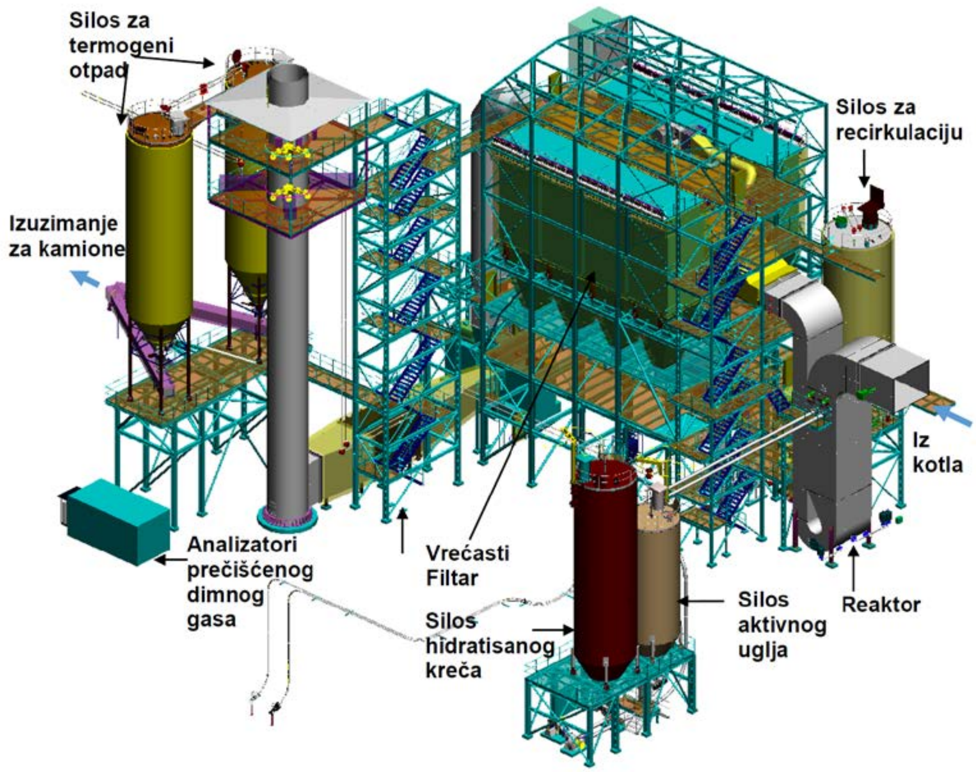


Figure 40 Model system for the purification of flue gas from the EfW plant

At the exit of the boiler, the flue gases go to the reactor which has the purpose of optimizing and intensifying mass transfer between flue gases and dry sorbents (activated charcoal and hydrated lime). Since sorbents are added in excess, as well as because of unreacted amounts and savings in reagents, the recirculation of contents from the bag filter is foreseen (recirculation silo is provided).

After dosing the sorbents into the flue gas stream, the following chemical reactions occur in the reactor between combustion products and hydrated lime:

$$2HCl + Ca(OH)_2 \rightarrow CaCl_2 + 2H_2O$$
$$2HF + Ca(OH)_2 \rightarrow CaF_2 + 2H_2O$$
$$SO_2 + Ca(OH)_2 + ½O_2 \rightarrow CaSO_4 + H_2O$$

Adsorption of heavy metals, dioxins and furans is made possible by the application of activated charcoal.

The flue gas from the reactor is introduced into the bag filter. The retained powders and the products of the reaction with the sorbents (the so-called "thermogenic waste") fall into the lower chamber of the filter and are withdrawn from the system into the recirculation silo. From the silo, part of the material is returned to the gas stream before the reactor, and part is discharged into the silos of thermogenic waste (flue gas treatment residues - APCR). From the silo of thermogenic waste, the material goes to the solidification and stabilization system (subsection 3.2.5.2).

Sorbents, hydrated lime and activated carbon are all dosed from the sorbent silo.

The system for storing and injecting hydrated lime includes a silo with the accompanying equipment necessary for loading the lime into the silo, its removal and dosage from the silo, and injection into the reactor.

Hydrated lime ($Ca(OH)_2$) is delivered to the plant as dry powdered sorbent by truck tanks and stored in a silo of 200 m^3 capacity.

For adsorption of volatile heavy metals (Hg) and organic components (i.e. PCDD/F- polychlorinated dibenzo-p-dioxins and dibenzo furan) to be separated, powdered activated carbon is added to the flue gas stream, together with hydrated lime.

The system for storing and injecting activated charcoal includes a silo with the accompanying equipment necessary for loading the activated charcoal into the silo, its removal and dosage from the silo, and injection into the reactor.

Activated charcoal is delivered to the silo by truck tanks in the form of dry powder and stored in a silo of 110 m^3 capacity.

In the EfW plant, the powdered injected activated charcoal is collected along with the residues in the APCR silo. The APCR is then stabilized and disposed of in a landfill for waste resulting from the treatment of waste at the EfW plant (which is the subject of another project, i.e. another impact assessment study). In the BEP plant, activated charcoal is deposited in large, big-bag, bags.

A bag filter is a high-efficiency compressed-air (impulse) bag shaking device consisting of a housing, with vertically mounted cylindrical bags, untreated gas inlet ducts, purified gas outlet ducts and ash collection funnels.

The recirculation silo also has the role of allowing the maturation of the material, the so-called "maturation" of thermogenic waste. From this silo, the settled material from the bag filter is discharged into thermogenic waste silos (2 x 200 m^3 in volume), i.e. to ***the system for the treatment of thermogenic waste (APCR) by the procedure of solidification***.

The waste material deposited in the flue gas purification plant is a mixture of fly ash, dry reaction salts from the chemical equations mentioned above ($CaCl_2 \times 2H_2O$, $CaSO_4 \times 2H_2O$, $CaSO_3 \times ½H_2O$, $CaF_2 \times 2H_2O$) and excess sorbents.

The flue gas fan is used to compensate for the pressure drop in the plant, transport the flue gas through all the elements located at the inlet to the plant and control the pressure in the combustion chamber.

The complete fan unit - fan and drive, is housed in a common housing protected from vibration. Given that the fan motor is the main source of noise in the plant, an adequate noise damper is provided.

The stack is a two-wall freestanding, made of stainless steel. The internal flue duct is carbon steel and is thermally insulated. The stack height is 60.5 m.

The internal flue duct has appropriate openings provided for manual sampling and connection of the ***system for continuous measurement of emissions (CEMS)***. The continuous emission measurement system consists of purified flue gas analyzers for measuring physical quantities (temperature, pressure and flow), concentration of pollutants at the exit from the plant (SO_2, HCl, NOx, NH_3, CO, TOC, HF, CO_2, powders, dioxins, furans) as well as oxygen (O_2) and moisture in the flue gas (H_2A) (Source: IDP, 6/5 Mechanical Installation Design - Flue Gas Purification Systems).

The main tasks of the control and management system at the flue gas purification plant are:
- Keep pollutant emissions within the permissible limits; -
To ensure continuous and reliable operation of the system;
- To achieve optimum reagent utilization with minimum energy consumption;
- To ensure the integration and harmonization of the system operation with the operation of the boiler plant and other technological equipment of the unit;

The following table gives the maximum emission values at the stack outlet into the atmosphere, which are expected after the designed Flue Gas Purification System.

Table 18 . Maximum expected values of emissions on the exit from the stack in the atmosphere, at nominal conditions of operation
(Source: IDP, 6/5 Mechanical Installation Design - Systems for purification of flue gas)

Harmful substances	**Unit**	**Value**
Powdered matter	mg/Nm^3, dry gas, 11% O_2	0-10 (*) / 30 (**)
HCl	mg/Nm^3, dry gas, 11% O_2	0-10 (*) / 60 (**)
HF	mg/Nm^3, dry gas, 11% O_2	0-1 (*) / 4 (**)
SO_2	mg/Nm^3, dry gas, 11% O_2	0-50 (*) / 200 (**)
Dioxins and furans	ng/Nm^3, dry gas, 11% O_2	0-0.1 (***)
Nitrogen oxides expressed as NO_2	mg/Nm^3, dry gas, 11% O_2	0-200 (*) / 400 (**)
NH_3	mg/Nm^3, dry gas, 11% O_2	0-15 (*) / 20 (**)
CO	mg/Nm^3, dry gas, 11% O_2	0-50 (*) / 100 (**)

Gaseous and vapor organic matter (expressed as total organic carbon – TOC)	mg/Nm^3, dry gas, 11% O_2	0-10 (*) / 20 (**)
Cd and Tl	mg/Nm^3, dry gas, 11% O_2	0-0.05 (****)
Hg	mg/Nm^3, dry gas, 11% O_2	0-0.05 (****)
Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V	mg/Nm^3, dry gas, 11% O_2	0-0.5 (****)

Note:
(*) - mean daily value
(**) - mean half-hour value
(***) - sampling from 6 to 8 h
(****) - sampling from 0.5 to 8 h

The following figures show the technological schemes of the Flue Gas Purification System.

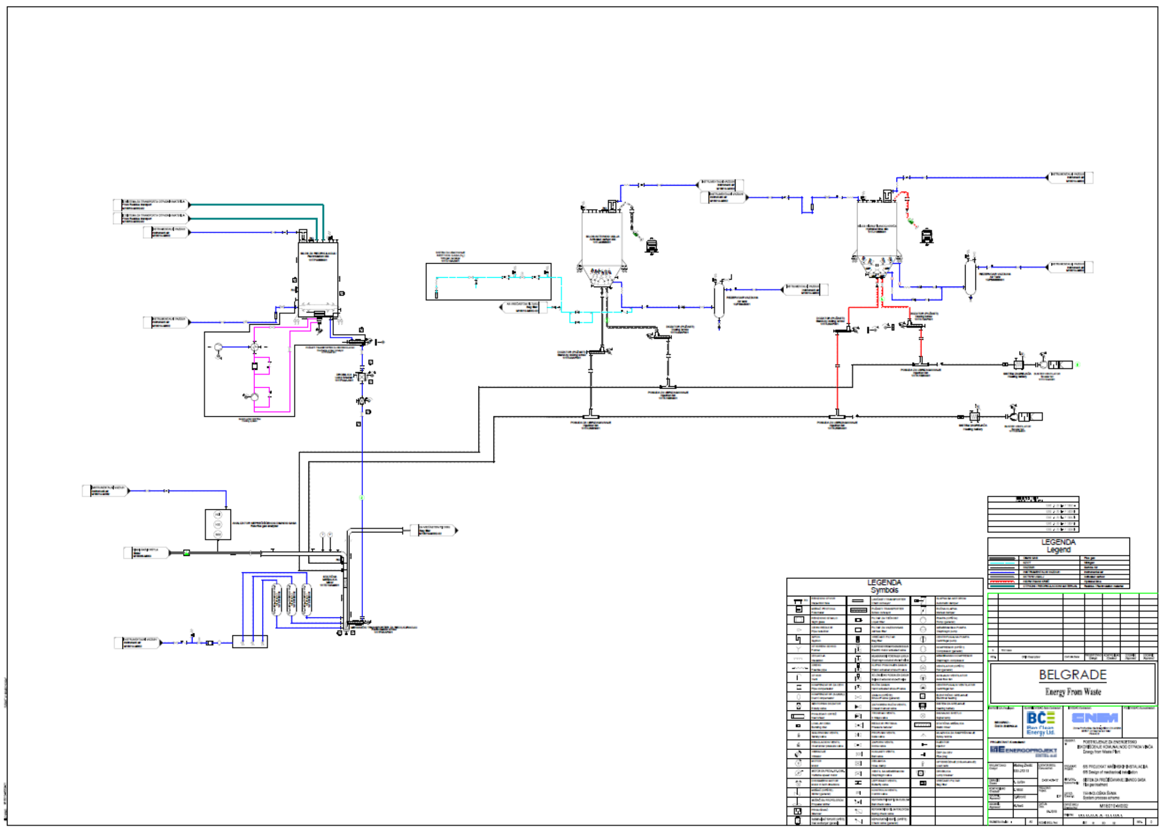


Figure 41 Technological scheme of the Flue Gas Purification System from the EfW plant (1) (Source: IDP, 6/5 Mechanical Installation Design - Systems for purification of flue gas

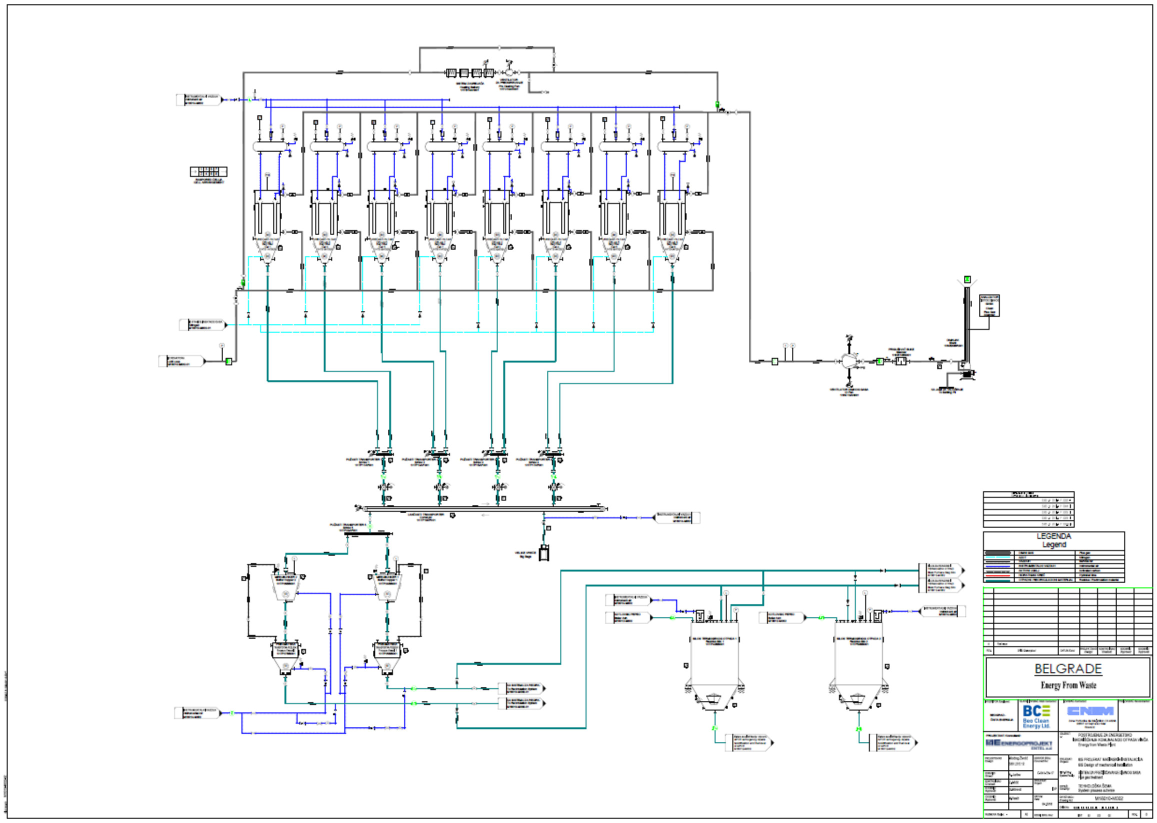


Figure 42 Technological scheme of the Flue Gas Purification System from the EfW plant (2) (Source: IDP, 6/5 Mechanical Installation Design - Systems for purification of flue gas)

The internal flue duct has appropriate openings provided for manual sampling and connection of the system for continuous measurement of emissions (CEMS). The continuous emission measurement system consists of purified flue gas analyzers for measuring physical quantities (temperature, pressure and flow), concentration of pollutants at the exit from the plant (SO_2, HCl, NOx, NH_3, CO, TOC, HF, CO_2, powders, dioxins, furans) as well as oxygen (O_2) and moisture in the flue gas (H_2O).

3.2.6.2. Treatment of thermogenic waste (APCR) from the EfW plant

From the flue gas purification system, thermogenic waste (APCR) retained in the bags of the bag filter is temporarily stored in the silo of thermogenic waste from which it is removed for treatment/stabilization by a solidification process.

The purpose of the application of solidification and stabilization of thermogenic waste (which has the characteristics of hazardous waste) is to use "reagents" to bind pollutants, to prevent their elution (leaching) from stabilized waste and its transformation into a product that has the characteristics of non-hazardous waste.

The process of solidification is relatively simple in technological terms and involves mixing/blending in a blender/mixer of streams of material: thermogenic waste, reactants and water. Final product -– solidification is environmentally friendly, i.e. has a useful value (and can be disposed of in a sanitary landfill as non-hazardous waste).

In accordance with the block diagram of material balance of thermogenic waste solidification plant (Source: IDP, 6/7 Mechanical Installation Design Solidification and Dispatch of APCR thermogenic waste) in the following figure, from thermogenic waste silos - APCR (2 x 200 m^3in volume), the silo for reactants (lime, cement, slag, etc.) with a volume of 2 x 100 m^3 and water tanks (2 x 15 m^3 in volume), through auger conveyors, the input materials are via measuring tanks (3 m^3 for APCR and 0.6 m^3 for reactants) and water from a measuring tank (1.2 m^3) inserted into a mixer with a volume of 2 m^3.

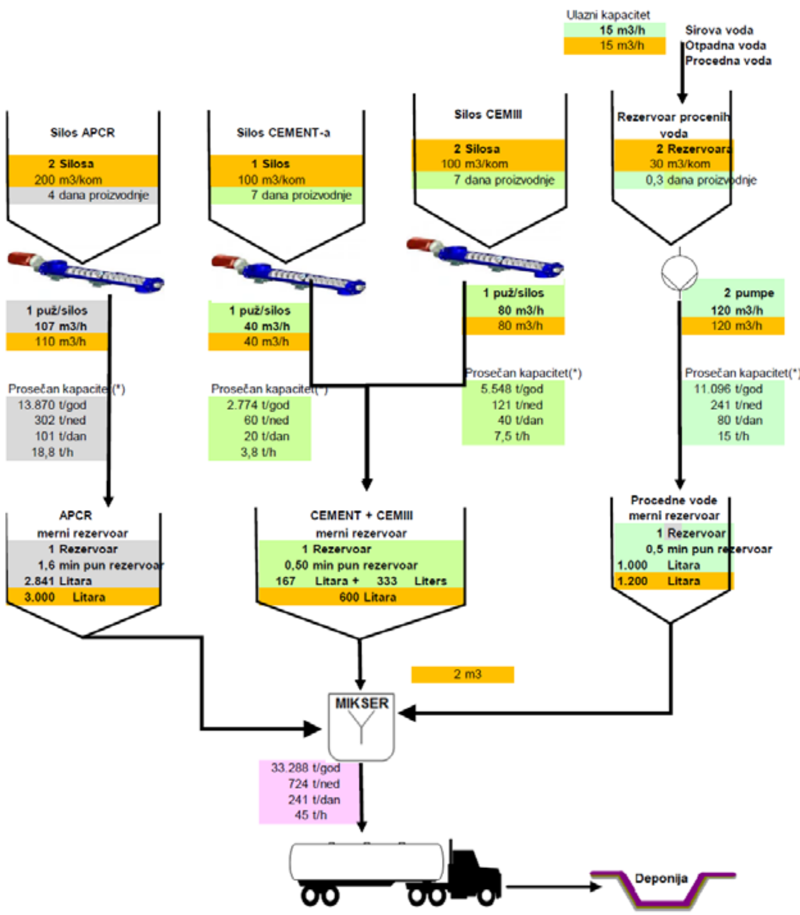


Figure 43 Material balance of the plant for the solidifikacation of thermogenic waste (Source: IDP, 6/7 Mechanical Installation Design, Solidification and Dispatch of APCR thermogenic waste)

After mixing and completion of the reaction, the truck tank will be transport the stabilized APCR to a new inert waste landfill, outside the KP1 planning unit, inside the Vinča landfill complex, which is not the subject of this study. The newly designed inert waste landfill is the subject of another project - a new landfill with associated facilities in Vinča.

3.2.6.3. Treatment of slag from the combustion chamber of the boiler of the EfW plant

The hot slag from the bottom of the boiler combustion chamber (IBA), below the "Martin" grate, drops through the slag opening into the deslugger. Complete quenching and cooling of slag to approximately 80 - 90^{o}C allows safe slag removal without ash and odor. After cooling, the slag is taken to a discharge device (3 pcs.), through which it is then transported to a system of vibrating screens that separates larger slag from smaller fractions. The larger slag that separates from the system is accepted in metal containers, 2 m^3.

The finer fraction is discharged by belt conveyors into a receiving hopper from which the belt conveyor is inserted through a magnetic separator into a drum sieve. On this conveyor, a larger metal fraction is separated. The metal fraction is separated from the system and accepted in a metal container.

From the drum sieve, a larger fraction is separated. The finer fraction from the drum is conveyed to the depots for temporary reception of the slag via a belt conveyor, over a magnetic separator. From the depot, the slag is transported to the slag maturation plateau within Functional Unit 1 (IBA zone, pos. 8b on the layout plan of Functional Unit 1). The finer metal fraction is separated from the system and accepted in a metal container.

In general, the treatment of slag from the bottom of the boiler plant includes a line for sorting and separating the following fractions:

- larger pieces of slag
- slag granulation 1 40-300mm
- slag granulation 2 0-40mm
- metal fraction 1 0-300mm
- metal fraction 2 0-40mm

Larger pieces of slag are transported to a new inert waste landfill, outside the KP1 construction site, within the Vinča landfill complex after maturation at the temporary storage area - IBA zone. The newly designed inert waste landfill is the subject of another project - a new landfill with associated facilities in Vinča. The separated metal fraction is accepted in metal containers, and after characterization is completed, will be submitted to the Operators with the appropriate waste management permit.

The following figure shows the technological scheme of the Slag Dispatch and Treatment System from the incinerator of municipal waste.

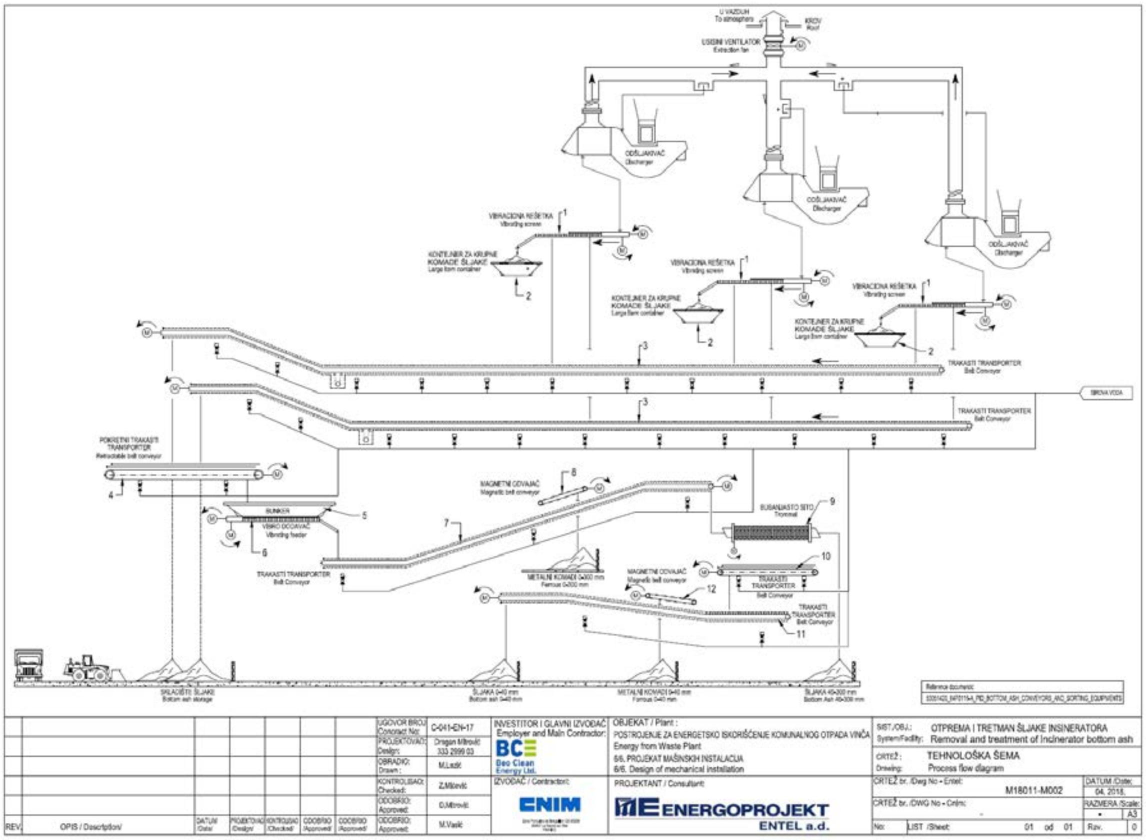


Figure 44 Technological scheme of the System for dispatch and treatment of slag (Source: IDP, 6/6 Mechanical Installation Design, Dispatch and Treatment of incinerator slag)

3.2.6.4. Flue gas treatment of the BEP plant

Based on the gas flow diagram of the BEP plant, the landfill gas is treated on the filter for the removal of H_2S before being introduced into the CHP module. After this filter, gas is introduced into the demister to remove the droplets from the gas stream. From the demister, gas is introduced into the activated carbon filter through a booster compressor to remove volatile and silicate materials. After the activated carbon filter, the gas is introduced into the CHP module.

Removal filter H_2S consists of two filter units with a capacity of 2 x 10 m^3. Filter with activated carbon has a capacity of 10 m^3.

Landfill gas in the amount of 800-1,400 Nm is delivered to the BEP plant^3/h (with 50% CH_4). After san diego, they described him as driving
utilization in the CHP module, the amount of gas output is 400-700 Nm^3/h.

The amount of gas at the landfill was obtained by modeling. The diagrams show the production of gas from the "old" and new landfill.

The following diagrams indicate for each landfill (old and new) the collection and production of biogas estimated by the SIMCET software.

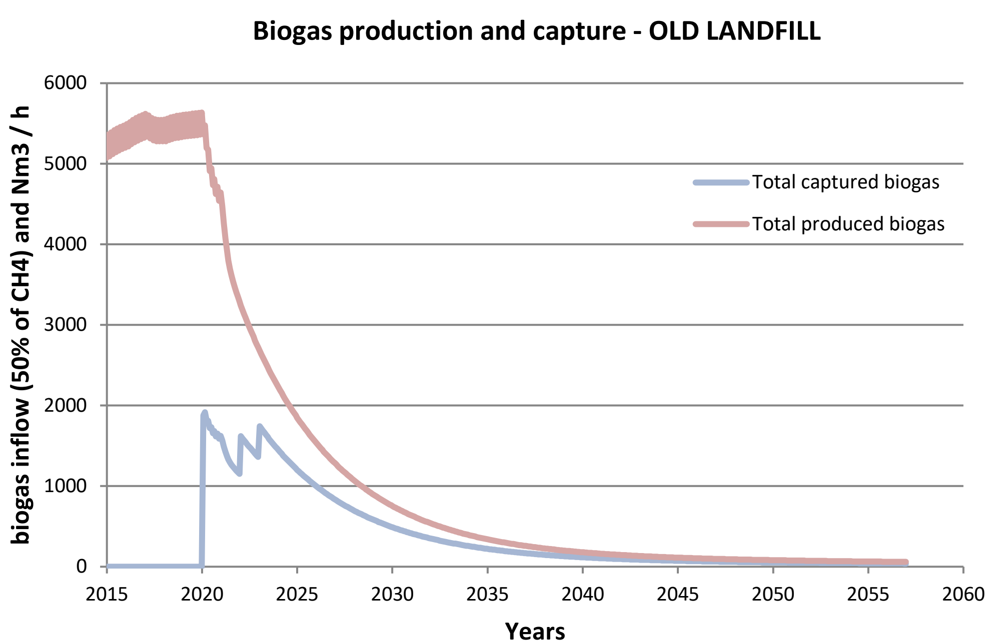


Figure 45 Production and collection of biogas from the "old" landfill

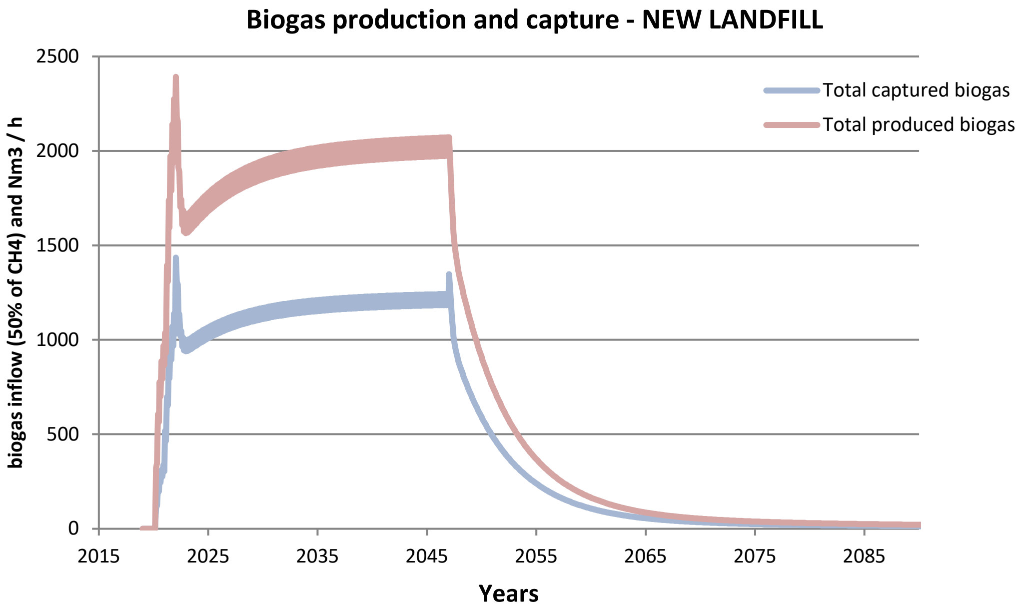


Figure 46 Production and collection of biogas from the new landfill

Old landfill:

- Biogas production reaches a maximum flow value of 5500 Nm^3 h (with 50% CH_4) in 2020, then logarithmically decreasing, to reach near zero in 2060;
- From 2020 to 2035, biogas flow ranges between 1900 Nm^3/h and 300 Nm^3/h with an average flow of about 830 Nm^3/h.

New landfill:

- Except the production at start (2390 Nm^3/h in 2022), biogas production reaches a maximum flow rate of 2070 Nm^3/h (with 50% CH_4) in 2050 and then logarithmically decreases to reach 300 Nm^3/h in 2056 and near zero in 2090;
- From 2020 to 2053, biogas flow ranges between 300 Nm^3/h and 1400 Nm^3/h with an average flow of about 1000 Nm^3/h.

After utilization of the landfill gas energy on the gas generator, an emitter / stack is anticipated to release gases into the atmosphere, 7.5 m high (measured from the top of the container with the CHP module).

The following figures show diagrams of gas treatment systems, filter systems and material balance of gas flows at a BEP plant (Source: CHP-05/04/18-LF GAS-SRB, CEEFOR, 2018).

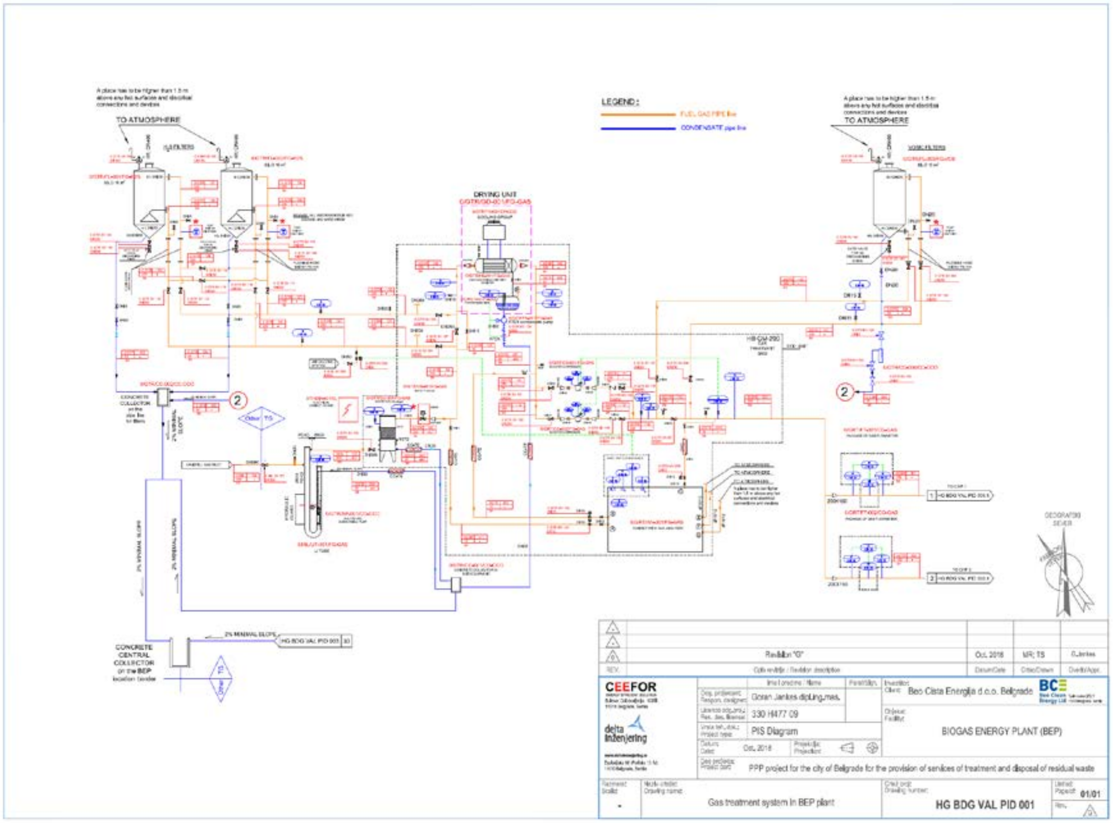


Figure 47 Landfill gas treatment system diagram

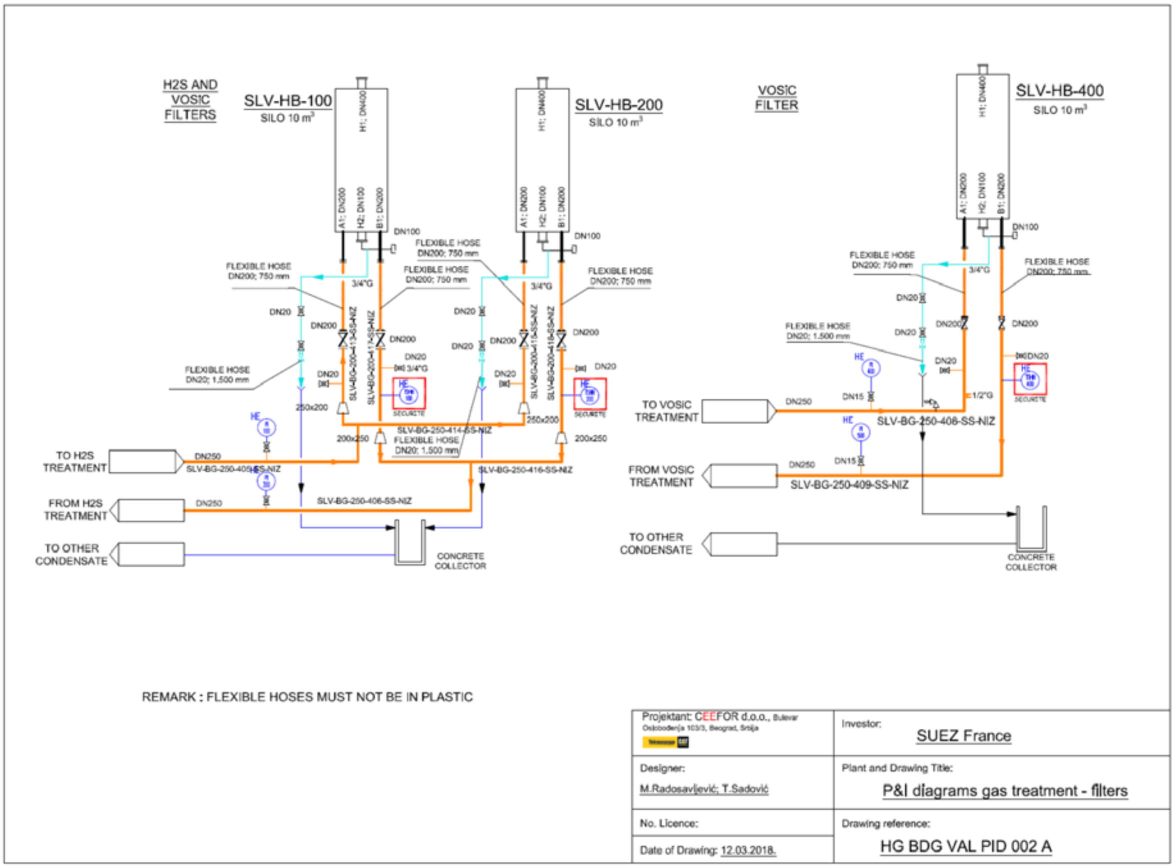


Figure 48 Diagram of gas flow through filters

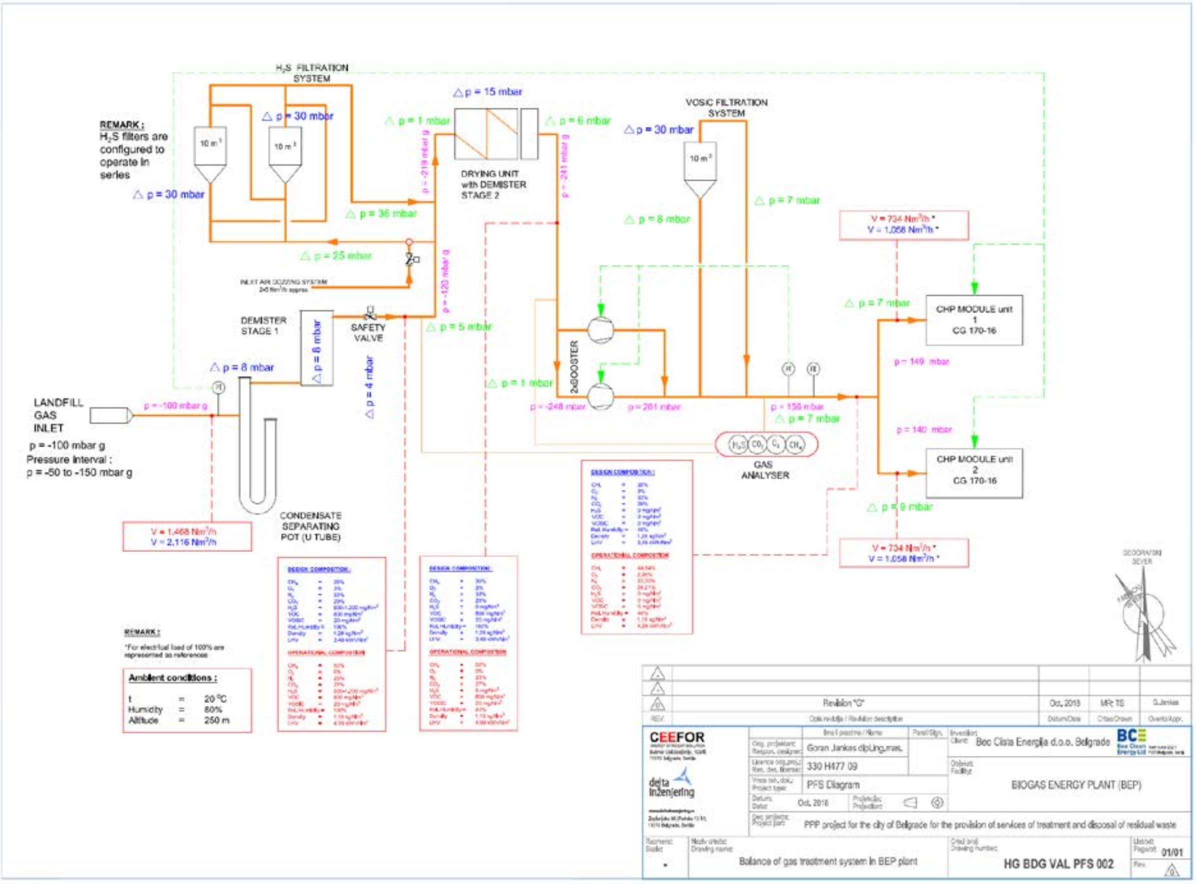


Figure 49 Material balance of landfill gas treatment systems

The analysis and quality control of landfill gas is performed by a Gas analyzer connected to the gas flow to the CHP module. The gas analyzer is intended to measure the concentrations of pollutants in the exhaust gas, having the following characteristics:

- CH_4 → with a range of 0 – 100%
- CO_2 → with a range of 0 - 100%
- O_2 → with a range of 0 - 25% and
- H_2S → with a range of 0 - 5 000 ppm

Flue gas treatment plants are planned on the BEP platform. Existing legislation does not define emission limit values for stationary sources for combined heat and power production, especially if landfill gas is used.

The Regulation on Limit Values of Emissions of Pollutants into the Air from Combustion Plants ("Official Gazette of RS", No. 6/2016) defines the emission limit values for NOx and CO (including gas engines).

The source of emissions at the BEP cogeneration plant is gas engines, that is, flue gases from cogeneration units.

According to the regulation, the BEP plant is in the category of "new medium combustion plants" that use gaseous fuels other than natural gas. For this group of combustion plants (which do not exclude gas engines), the maximum permitted values for pollutants are:

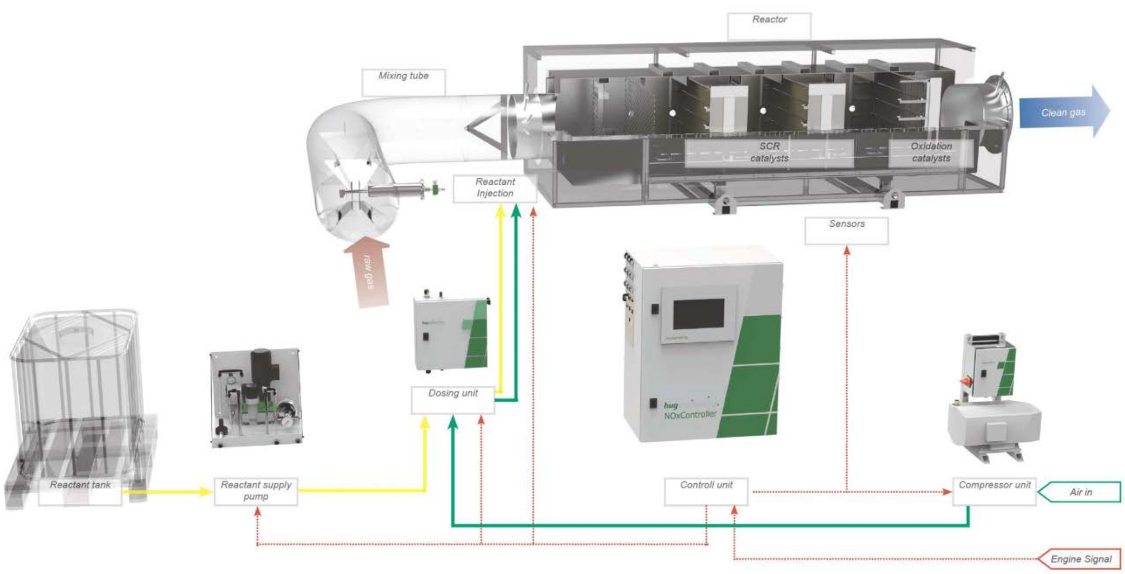
- for CO = 80 mg/Nm^3 and
- for NOx = 200 mg/Nm^3 (calculated for dry gas with 3% O_2)

The gas engine manufacturer guarantees the following maximum values of pollutant concentrations in the exhaust:

- NOx emission values (according to TA-Luft regulations) - <500 mg/Nm^3 (5% O_2)
- CO emission values (according to TA-Luft regulations) - <600 mg/Nm^3 (5% O_2)
- dust emission values - <100 mg/Nm^3 (5% O_2)

A system for continuous measurement of NOx concentration is provided at the BEP plant. This system will be linked to the control of the urea dosing system to reduce NOx emissions.

Based on the requirements of the PDR, it is necessary to anticipate the SCR OXY module to reduce engine exhaust emissions. An example of this system is shown in the following drawing:



The planned, automatic system for reducing concentrations of pollutants from exhaust gases, contains:

a) NOx control, which is necessarily linked to
b) the dosage unit.

To reduce CO and NMHECH emissions, the oxidation catalyst must be slightly higher than standard and must be replaced (every 16,000 hours of plant operation).

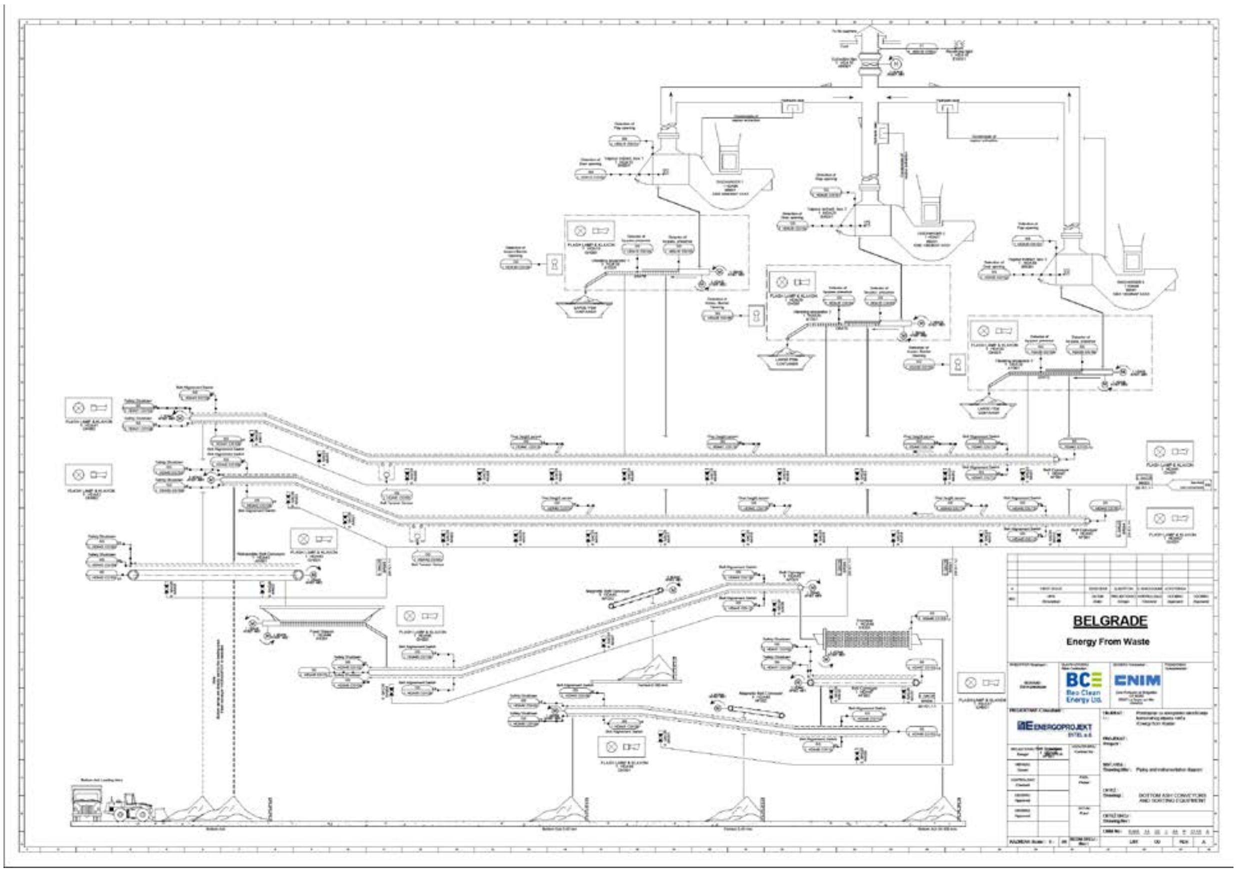
It should be noted that using the above system, the NOx level in the engine may be less than 500 mg/Nm^3, which will increase electrical efficiency (but reduce thermal efficiency). The overall efficiency of the plant remains almost unchanged.

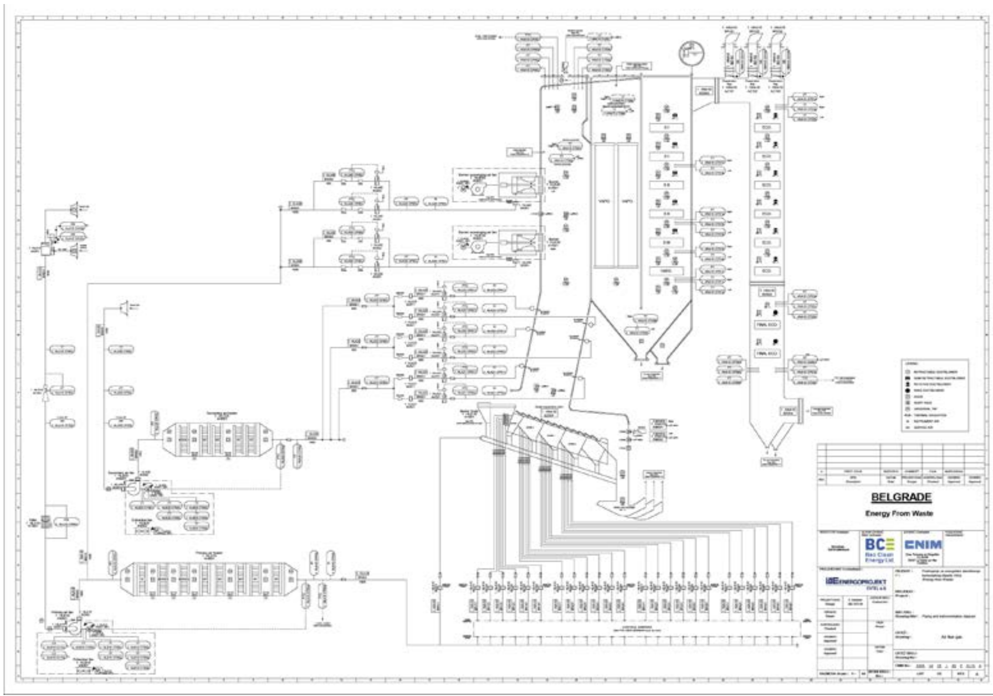
Dust extraction systems - industrial ventilation and filtration systems

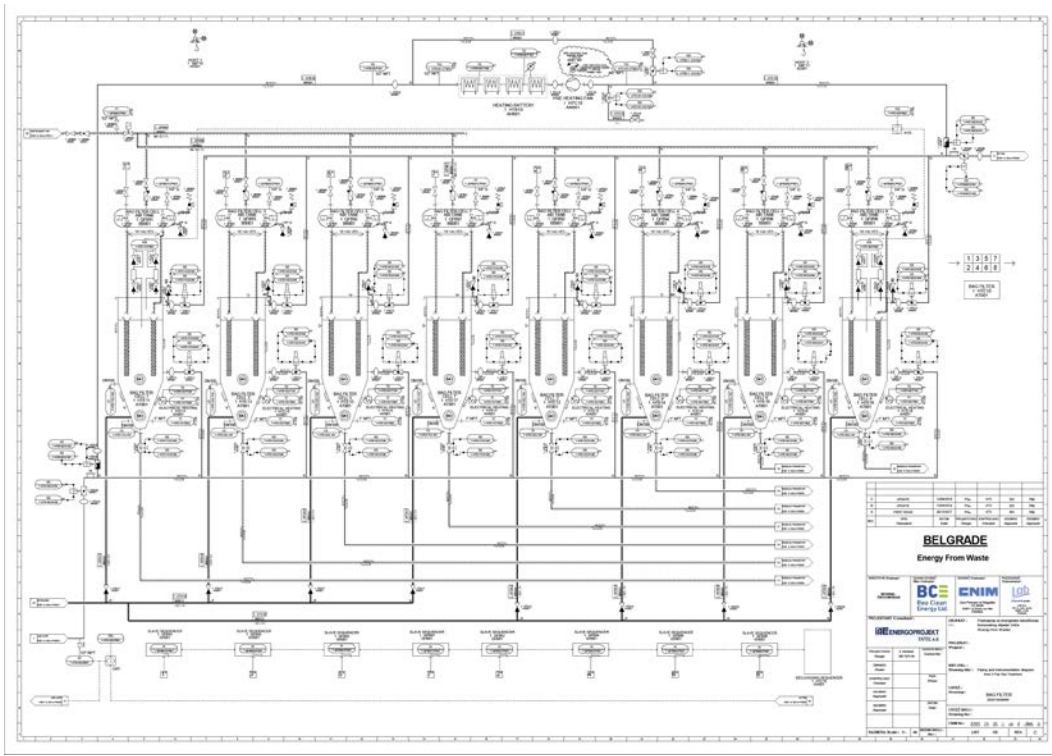
In the waste acceptance phase, the reduction of dust emissions into the environment is ensured by the primary suction of air from the waste hopper, which is discharged into the boiler plant, for the purpose of waste incineration.

The dust generated during the waste incineration process at the EfW plant is extracted from the system by the use of bag filters. The dust is then collected from the tank under the bag filter into silos, with a closed transport system. The reduction of dust emissions from the slag under the boiler grate (IBA) is done by a water sprinkler system.

In the following text, P&I diagrams of the combustion air system, IBA system and bag filter system are given, as well as in the Study annexes.

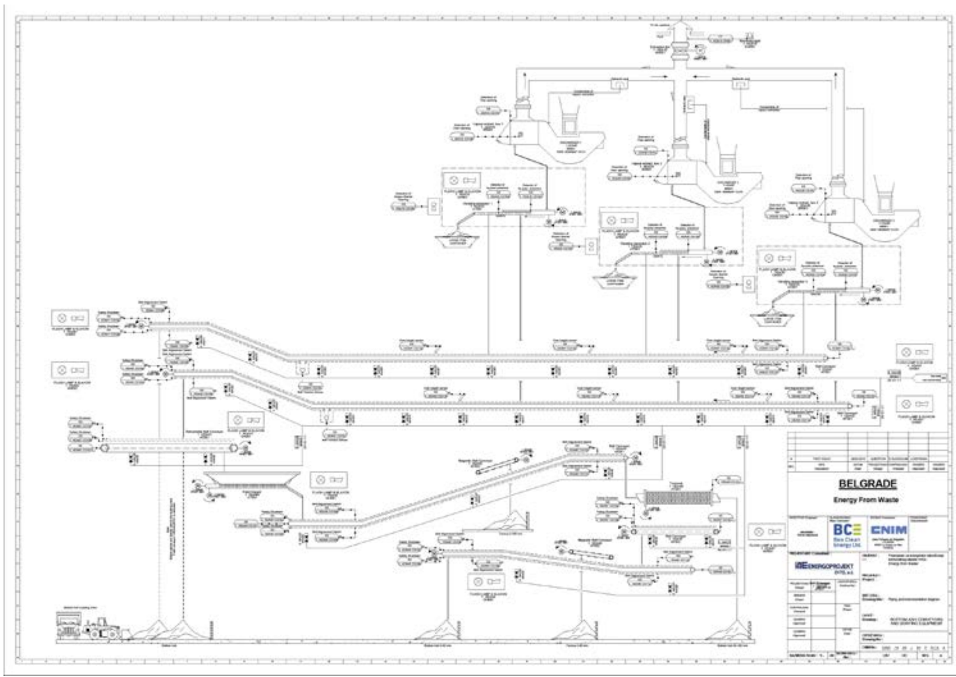


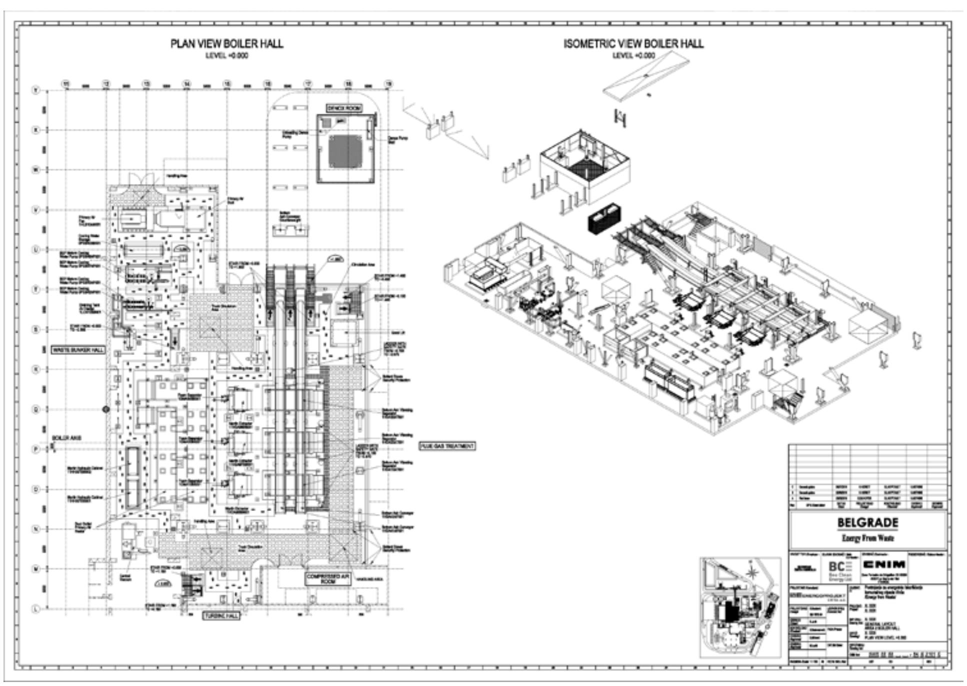

BELGRADE
Energy From Waste
BCE
Beo Clean Energy Ltd
CNIM
ENERGOPROJEKT



The cooled ash and slag (IBA) exits the damp part of the slag and ash extractor below the grate of the boiler plant so that there is no dust emission. The extractor also has a water vapor extraction system that ensures the extraction of any particles in the ash and slag emptying zone on the lower conveyors. When ash and slag are deposited in the IBA zone before final disposal, dust emission is controlled by water spray.

The figures show the IBA system and the central vacuum system of the plant. Figures are also included in the Study annexes.





There are two sources of emission of powders from the EfW plant: from the waste hopper and during waste reception and from the stack after flue gas treatment. Dust emissions from the waste reception area are mitigated by the primary intake of air that is discharged into the boiler plant for the waste incineration process. Stack dust emissions are mitigated by a comprehensive flue gas purification system (more specifically, with bag filters). The emission of dust from the stack is constantly monitored by a continuous emission monitoring system. The detailed technical characteristics of a comprehensive filtration and ventilation system are an integral part of the extensive design and technical documentation and cannot be presented in the Study in such an extent. As an illustration, a table of System for the extraction of dust with the bag filter is provided, as well as excerpts from the part of the technical documentation in the annexes to the Study.

	Flue Gas Treatment: Bag Filters + ID Fan	Primary Air Suction (Waste Hopper)
total air flow capacity (m3/h)	246207 Nm3/h	124060 Nm3/h
sources of pollution, from which the exhausting from the processing equipment with the envisaged quantities of exhausting (m3/h) takes place	Flue Gas from Incineration: 224118 Nm3/h	Ambiant Air from Waste Hopper: 101720 Nm3/h
the envisaged deduster (filter) with its filter surface area (m2)	5600 m2	Not known at this stage
type of filter elements (bags, cartridges, packets)	Bag Filters, material: P84/PTFE 0,130m diameter x 6m length	2 mm mesh at suction in Waste Hopper + Cartridge Filter (See PID 53051420_65P0110)
how the collected dust in filters is discharged, and which is the manner of further handling thereof	Pulsed Compressed Air at the top of the bag filters makes the dust drop into hoppers under each compartments then it is transported automatically via screw and chain conveyors followed by sealed Pneumatic transport to Residues Silos.	Cartridge Filter (See PID 53051420_65P0110)
exhausting fan: capacity (m3/h), pressure (Pa) and electric engine power (kW)	ID Fan Capacity: 270504 Nm3/h Total Head: 6100 Pa Electrical Power: 910kW	ID Fan Capacity: 134394 Nm3/h Total Head: 8800 Pa Electrical Power: 560kW
Bag Filters data extracted from EPC Contract Schedule ERS B07		
ID Fan data extracted from ID Fan Datasheet (LAB) 53051321_LAJ0001		
Primary Air Fan Data extracted from Datasheet 53051311_65I0003		

The emission of powdered substances is monitored in accordance with the monitoring plan and the legislation and it is guaranteed that emissions will be below 10 mg/Nm^3 under the EPC Contract. This is in line with the EU directive on waste incineration. A dust emission of 100 mg/Nm^3 is guaranteed for the BEP plant under the PPP Contract.

It is guaranteed that the envisaged dedusters (filters) in each of these systems will purify pollutants below the limit values prescribed by the legislation are regular monitoring of pollutant emissions from the plant, reports on monitoring carried out in accordance with the regulations and control by the competent authorities for control and surveillance (inspection).

The planned dust extraction systems are in themselves a concrete technical and technological measure designed to reduce the emission of pollutants from the plant.

The replacement of bag filters in the EfW plant is carried out during the planned overhaul - filter bag replacements. Three landfill gas filters at the BEP plant utilize activated carbon: the filter is filled with fresh activated carbon from above, while used activated carbon is discharged at the bottom. The adsorption rate is monitored, even when the adsorption rate drops below 80% fresh activated carbon must be introduced. The process is to empty 50% of the height of the filter fill and reset to 100% to move the fill top to the bottom of the silo.

3.2.6.5. Wastewater collection, treatment and evacuation

Wastewater collection, treatment and evacuation from Functional Unit 1 is part of the newly designed integral wastewater management system at the Vinča landfill complex.

Generally, generated wastewater and atmospheric water from the planned functional unit of KP1 do not have direct discharge into the final recipient of all water from the landfill complex in Vinča - the Danube River.

The boundary of the description of the internal system for collection, treatment and evacuation of waste water from Functional Unit 1 ends at its boundary with the planned unit K3 - surface for the construction of a new sanitary landfill of municipal waste (new landfill body), or to the appropriately designed connections for: atmospheric unpolluted/treated water, excess process wastewater and sanitary fecal wastewater.

The following figure shows a block diagram of a newly designed integrated wastewater management system at the Vinča landfill complex.

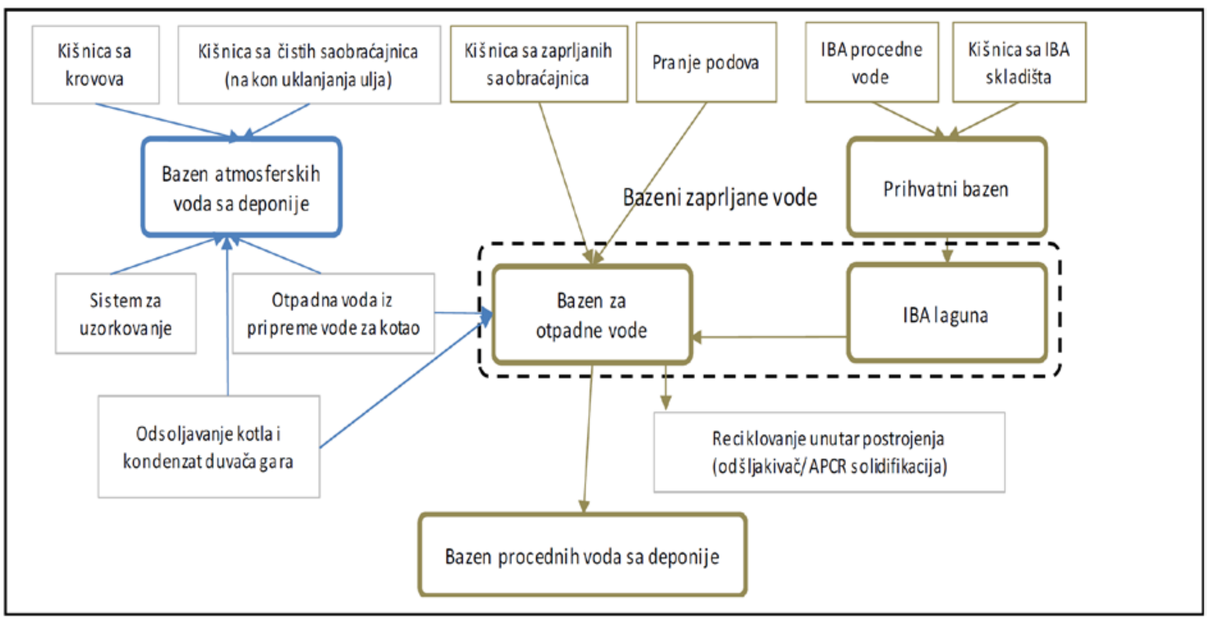


Figure 50 Block diagram of wastewater management
(Source: IDP, 3/1 Hydrotechnical Installation Design, Exterior Hydrotechnical Installations)

Atmospheric sewer

Atmospheric water from new roads, roofs and plateaus will be collected by a special network of enclosed collectors located below the road divided into two basins, both of which gravitate towards the collector and continue to flow towards the peripheral canal of the landfill (clean water canal). Water from the parking lot is considered oily due to vehicle retention, and these waters are treated at the grease and oil separator before being discharged into the rain sewer.

Atmospheric waters in the boiler-slag zone (IBA zone) are collected by a special network of open canals placed next to (along) roads that gravitate towards the IBA settling basin and the IBA lagoon. Atmospheric waters in this zone are considered as polluted waters and belong to the technological sewage system.

Oily atmospheric waters that occur in the regular operation of a step-up transformer are discharged into the atmospheric sewage system after treatment in the grease and oil separator (oil pit).

The collected clean atmospheric water is evacuated beyond the boundaries of the plant through an open canal system to the lagoon for receiving atmospheric water (beyond the boundaries of Functional Unit 1), and further to the Danube River (this lagoon is the subject of another project).

Technological sewer

Wastewater generated in the main and auxiliary systems of the EfW plant, as a result of the electricity/heat production process, as well as from various washes in the plant circuit, are potentially contaminated: municipal waste, combustion products, oils, water resulting from the event of fire, chemicals used in the process, etc. Some process wastewater also has an increased temperature.

The technological sewer network collects and drains waste water from process and technical facilities as well as from plateaus where technologically contaminated water occurs. These waters will be collected by the system of closed collectors (sewage network of process waters) and after pre-treatment in the wastewater basin, they will be reused for various purposes in the technological process at the EfW plant.

Any excess of these waters will be overflowed and piped to the lagoon for leachate water from the sanitary landfill, from which it will be further directed to the leachate water treatment plant (LTP plant). The leachate lagoon and the LTP plant are the subject of another project as they are not within Functional Unit 1.

The system for treatment of technological wastewater contains the following facilities:

- IBA settling basin of app. 60 m^3
- IBA lagoon, of app. 800 m^3

- Wastewater basin, of app. 260 m^3

The IBA settling basin and IBA lagoon will collect water from the IBA zone i.e. zones of the slag removal system from the bottom of the boiler plant, consisting of leachate and atmospheric water from that area. Preliminary sedimentation of suspended matter contained in this water is envisaged in the receiving basin - the IBA settling basin, after which partially clarified water will be discharged into the IBA lagoon, which is used as a buffer basin. Water from the IBA lagoon will be pumped by submersible pumps to the wastewater basin for re-use for process purposes (these waters are in the recirculation system).

The wastewater basin will collect:

- Atmospheric water from the reagent storage area
- Fly ash treatment system i.e. flue gas purification zone (APCR)
- Atmospheric water from the plateau of the DeNOx system/building
- Wastewater from the plant for the preparation of feed water for the boiler
- Condensate from the blower system
- Rainwater over the basin itself
- Wastewater from floor washing in process areas (including boiler room, machine room, zone of boiler feed water preparation plant, etc.)

The wastewater basin will consist of several chambers: a reception chamber for calming the flow, a settling basin, a recirculation chamber and a "clean water" chamber. The water from the "clean water" chamber is reused and taken by recirculation pumps to technological consumers.

The wastewater basin will have a return connection to the IBA lagoon, where the wastewater will be pumped by the pumps from the "clean water" chamber in case of heavy water inflows. Also, the basin will be connected to the lagoon for leachate water at the sanitary landfill, in case of heavy rainfall or when the capacity of the IBA lagoon is filled. Under “normal” atmospheric conditions and regular operation of the plant, no overflow from the wastewater basin to the lagoon for the leachate water (i.e. outside Functional Unit 1) is foreseen.

The largest technological consumers of water from the wastewater basin are:

- Desluggers (for slag cooling purposes) and
- Thermogenic Waste Solidification System (APCR).

Oil sewage and oily waters from transformers

In order to supply the plant with electricity, it is planned to build a transformer station, which will be located within the EfW plant. Below the transformer is a watertight concrete tub where oil and oily atmospheric water draining from the transformer may occur during regular operation.

The tub is of sufficient capacity to accept the entire amount of transformer oil in the event of an accident/emergency on the transformer. The poured amount of oil and/or oily atmospheric water is discharged to the oil pit (grease and oil separators) by oil sewage.

The oil pit also has the function of a separator/settling basin: separation of oil from water, deposition of dust and sludge and drainage of treated water. The oil pit consists of three chambers:

- Inflow chamber (A) - 2 m^3
- Oil Extraction Chamber (B) - 20 m^3
- Outflow chamber for treated water (C) - 2 m^3

After the oily water separator, from the outlet chamber, the treated water flows gravitationally (through a 300 mm pipeline in a drop of 2.5%) to the atmospheric sewer shaft and further to the corresponding connection at the boundary with the K3 planning unit.

Faecal sewer system

Sanitary-fecal wastewater from the facilities will be collected by a special network of closed local collectors that gravitate towards the collector and continue to be evacuated beyond the boundaries of Functional Unit 1 to the Wastewater Treatment Plant (WWTP)) located on the second part of the landfill complex (WWTP is the subject of another project).

3.3. OVERVIEW OF CONFORMITY OF PLANNED AND DESIGNED SOLUTIONS WITH THE REFERENCE BAT DOCUMENT

As a candidate country for EU membership, the Republic of Serbia has partially transposed the EU legal framework related to integrated prevention and control of environmental pollution. Waste incineration is an activity for which a number of standards are provided through a reference document: the Best Available Techniques (BAT) Reference Document on Waste Incineration, August 2006 and the draft Best Available Techniques (BAT) Reference Document on Waste Incineration, draft 1 , May 2017).

The EfW plant should comply with a given set of BATs, more specifically the technical requirements defined in the reference documents should be implemented through the technical solution for the plant. The analysis of compliance with BATs include:

- identification of key environmental issues for the waste incineration sector;
- examining the techniques most relevant to solving the key issues identified;
- identification of the best environmental measures;
- examining the conditions under which the best environmental effects are achieved;
- selection of the best available techniques, their emission levels (and other environmental effects), monitoring and more.

A comparison of the planned technological solutions for the EfW plant with the BATs is shown in the following table.

Table 19 Compliance of planned EfW plant technological solutions with BAT

Activity (BREF Chapter 5)	BAT REQUEST (BREF Chapter 4 references)	METHODS AND TECHNIQUES APPLIED	CRITERIA FULFILLMENT
(1)	(2)	(3)	(4)
GENERAL PRACTICE BEFORE THERMAL TREATMENT			
1. Construction of installations	Sections 4.1.1/4.2.1/4.2.3 Selection of installations that meet the characteristics of the waste received	The installation design (and its functioning) is fit for purpose, suitable for municipal waste. Hopper: The dimensions of the hopper and waste hoist allow the operator to mix in the waste stream. Grate technology: The facility will include a single incineration line with a maximum combustion capacity of 49.4 t/h of waste with LTP between 6,000 kJ/kg and 7,500 kJ/kg, or 43.6 t/h when using waste with LTP of 8,500 kJ/kg. The grate is designed for continuous operation with LTP in the range of 6,000 kJ/kg to 12,000 kJ/kg and the incineration of various types of waste. The proposed technology includes air cooling of the grate with the Martin Vario reversible effect Boiler: The facility includes a boiler designed according to the latest experiences of our CNIM Technology Provider with a vertical heat exchanger, behind the flow furnace.	YES, according to BAT
2. Arranged location, cleanliness	Section 4.1.2 Maintaining the site in generally orderly and clean condition	The facility will be surrounded by a fence and neatly organized with a peripheral green belt and maintained in a clean and tidy condition. Also, production areas within process buildings will be maintained and clean. The waste unloading reception hall will be closed and will occupy a limited area at the level of dumpsite and hopper, and will be equipped with openings for natural air circulation. A dust removal system will prevent or retain airborne dust from the hopper. Includes an automated spray control and radio control system operated from the control room. In addition, combustion air is sucked in from the unloading hall so that odors and air dust are sucked from the hopper to the incineration line. All powder storage silos are equipped with a filter to limit dust emissions to the environment (during loading or unloading). Separate collection and discharge of clean and contaminated wastewater is provided (see also Article 47). Pure atmospheric water is discharged into the internal system of open canals for receiving atmospheric waters of the entire Vinča complex, which are directed to the lagoon (clean water) located in the landfill. Waste process and atmospheric waters are treated and recirculated within the plant. The excess water is distributed to the lagoon for the process water (outside the EfW construction parcel) and further to the leachate treatment plant.	YES, according to BAT - periodic evaluation of technical conditions

		The fecal sewage network is connected to the internal sewage system of the Vinča complex and distributed to the waste water treatment plant of the Vinča complex.	
3. Technical conditions	Section 4.1.2 Keep all equipment in a generally tidy and clean condition	The facility is equipped with a Computerized Maintenance Management System (CMMS). CMMS assists the maintenance team in scheduling maintenance schedules and recording all work, including prior maintenance issues such as preventive maintenance findings, failure of routine tests, equipment history, and maintenance costs. Routine maintenance will be performed through a system of "work orders" based on the priorities identified by the maintenance team. CMMS will enable the execution of key maintenance actions such as preventative maintenance schedule, spare parts inventory, work order, repair record, work/purchase order details, and provide data reports. CMMS will reduce the likelihood of unplanned unavailability of the facility. For simple cleaning and for capturing fugitive emissions in the main boiler building, a centralized cleaning system is provided to clean all levels of the building.	
4. Quality control of incoming waste	Section 4.1.3.1 Input constraints and key risks	The facility is designed to operate continuously with LTPs in the range of 6,000 kJ/kg to 12,000 kJ/kg and incineration of various types of waste that corresponds to targeted municipal waste. It should be noted that these assumptions about the content of pollutants in gases are common for municipal solid waste. The waste is mixed in the hopper before dosing, so the content of the pollutants is fairly constant over time.	YES, according to BAT
4. Quality control of incoming waste	Section 4.1.3.2 Communication with waste suppliers to improve quality control of incoming waste: Waste transportation/collection Maintenance of proper condition of collected waste. Safe and supervised transportation.	Municipal waste will be brought to the plant by waste collection trucks, vehicles will be controlled (weighing and radioactivity measurement) and monitored at the entrance and exit.	YES, according to BAT
4. Quality control of incoming waste	Section 4.1.3.3 On-site waste quality control	A hopper equipped with an operator-operated hoist used for: - mixing to homogenize waste and calorific values; - removal of non-combustible or prohibited waste (if any) and disposal to the side of the hopper; - discharge of waste to the incineration line, i.e. into the feed funnel. Although the crane is capable of automatic control, it will mostly be used by the crane operator for manual or semi-automatic operation for better control.	YES, according to BAT
4. Quality control of incoming waste	Section 4.1.3.4 Inspection, sampling and testing of incoming waste	Wheel scales are located at the entrance to the site. The weighing measurements will be recorded on the weighing software. Visual inspection in the hopper by the crane operator. There is radioactivity detection at the entrance to the site	YES, according to BAT

4. Quality control of incoming waste	Section 4.1.3.5 Detection of radioactive materials	A radioactive detection system will be installed at the entrance after the scales.	YES, according to BAT
5. / 57. Waste storage	Section 4.1.4.1 Sealed surfaces, controlled drainage and weather protection	The waste is stored before treatment in a fully covered hopper The hopper is constructed of reinforced waterproof concrete.	YES, according to BAT
6. Waste storage	Section 4.1.4.2 Waste storage time management	The hopper capacity is about 5 days of nominal operation (including storage)	YES, according to BAT
58. Waste storage	Section 4.1.4.3 Solid waste baling	No baling is required to accommodate maximum deliveries or excess volume storage per day/during closure. If necessary, shipments of waste are diverted to the site landfill.	N/A
7. Waste storage	Section 4.1.4.4 Minimizing odors, dust, fugitive emissions	Dust removal system will prevent or stop dust from the hopper. Includes an automated sprinkler and radiation control system operated from the control room. Incineration air will be drawn through the corridor, creating a subpressure to prevent dust and odors from escaping.	YES, according to BAT
8. Waste storage	Section 4.1.4.5 Separation of waste types for safe treatment	Bulky items not suitable for the process are not shipped and are listed as prohibited waste. A visual inspection in the hopper by the crane operator is carried out to detect potential prohibited waste. If prohibited material is discovered, it is brought into the truck and sent to the landfill. When radioactive waste is detected, the truck is routed to a purposefully secured quarantine area where appropriate treatment is carried out.	YES, according to BAT
9. Waste storage	Section 4.1.4.6 Labeling of waste contents	The waste is delivered with trucks with a proper identity declaration and checked at the entrance windshield gate. There is no waste in the container.	YES, according to BAT
10. Waste storage	Section 4.1.4.7 Fire detection and control system	The facility has a fire detection and notification system that is required by law and the requirements of insurance companies. A fire system consisting of a hydrant net, sprinklers and reels. The fire network has been designed, constructed and installed in accordance with the applicable standards and guidelines of the competent authority. The fire system consists of: - Fire hose system - Hydrant systems (supplied from the fire extinguisher tank, if necessary). - Portable fire extinguishers which may be multi-purpose dry chemical type, foam type and CO2 type. - Flame detectors will be provided above all equipment that can cause a fire (i.e. burner, oil tank, ...). These detectors will have direct action on safety measures such as stopping fuel/gas flow for burners. - Automatic and manual alarm system for appropriate facilities - Liaison with the fire brigade from the main alarm station through the Decentralized Alarm Monitoring System (DECAMS) including a telephone line and all necessary equipment - Emergency communication system (two-way) for direct communication between the central control room and the plant area - Stationary foam-water production system - Trailer mounted foam/water monitor, (rainwater only) - The entire fire system will be connected to the power supply. The fire system must be equipped with its own battery. - The sprinkler system and the hydrant system must be supplied with a system of pumps connected to the power supply, - One fire-fighting water storage	YES, according to BAT

		- One water pump, - One back-up pump (diesel engine), - One jockey pump. - Liaison with local state authorities for testing and commissioning of fire protection systems.	
11. Pre-treatment of incoming waste	Section 4.1.5.1 Waste pre-treatment and mixing: Initial operations - mixing in the waste hopper using a gripper or other device, breaking, crushing, cutting and segregation (if necessary)	The plant is equipped with two mobile cranes with mechanical grippers, which can capture waste from any point within the hopper. During operation, only one crane is used for loading waste into the feed funnel and mixing the waste to ensure that the waste in the feed funnel is of constant calorific value. The crane and the gripper are designed to load waste into the feed funnel over a period of 12 hours. During the other 12 hours, the crane and the gripper can be used to lift, move, stir, switch, stack waste in the hopper.	YES, according to BAT
11. Pre-treatment of incoming waste	Section 4.1.5.2 Grinding of mixed municipal waste	Since bulky waste is not allowed, shredding operation is not required.	Not applicable
12. Extraction of metals	Section 4.1.5.5 / 4.6.4 Separation of ferrous and non-ferrous metals before heat treatment of waste, e.g. using an electromagnet before incineration and/or during the IBA valorisation process.	There is no removal of recyclable metals before incineration as there is no shredded waste at the inlet. The slag is taken from the Martin grate to the discharge device (3 pcs), which is then transported to the pretreatment device, i.e. the vibrating grate and belt conveyors. The slag falls on the vibrating grate (1 per outlet) with a 300 mm opening to separate larger pieces. These pieces are loaded into a 2 m3 metal container that can be manipulated with a forklift truck. The average slag fractions are further transported to the slag treatment plant using two closed lines of conveyor belts (1 service +1 back-up). The recovery of ferrous metals will take place at the IBA valorisation stage (see section 52 and 53). Slag treatment includes the following steps: The slag from the deslugger falls on the vibrating grate on which large pieces (> 300mm) are separated to start treatment or bypass treatment. Hanging magnetic separators remove metal fractions before sorting the slag into two 0-40 mm and 40-300 mm fractions using a rotary drum sieve. Separated metals are stored outdoors. Metals are once again removed from the 0-40 mm fraction. The fraction> 40 mm is stored outdoors in a separate area and the separated metals are stored in containers.	YES, according to BAT
13. Operator at waste reception	Section 4.1.6.1 Operators for the visual monitoring of waste storage facilities	The crane operator controls the activity in the hopper and feeds the furnace 24 hours/7 days. The crane operator's workplace will be located in the central control room. The cabin must be fitted with a glazed cockpit to give operators a clear view of the hopper side of the outlet. The cabin window must be fully accessible for maintenance and cleaning and protected from impact. In addition, the cameras are installed and well positioned for complete protection of the plant and traffic areas, including the area where the waste feeds the furnace and hopper. The screens were set up in the control room for video surveillance.	YES, according to BAT
14. Waste transfer and loading	Section 4.1.6.4 Minimize uncontrolled air intake into the combustion chamber via waste or other pathways	The waste will be discharged into the feed funnel using a crane with a gripper. The waste canal ensures good sealing between the combustion chamber and the waste hopper, thus preventing any air leakage. The waste canal also serves as a reservoir for waste to be filled up with the help of grippers. The capacity of the dosing funnel allows the funnel to be sufficiently filled during one filling cycle. The level of waste in the funnel is controlled by the crane operator at all times.	YES, according to BAT

		The canal, which covers the entire width of the grid, consists of steel sheets reinforced with steel profiles. Microwave detectors monitor the level of waste in the canal. When the level is below the minimum, an alarm signal is sent to the control room and the cabin from which the crane is operated. The shut-off valve, which covers the entire width of the feed canal, is installed below the funnel. This valve ensures that the incineration system starts and stops even when there is no waste in the canal.	
	THERMAL PROCESS		
60. Incineration technology	Section 4.2.14 Grate	Martin's inclined grate, Vario It is not necessary to cool Martin's inclined grate even when temperatures are very high. The back-and-forth motion of the moving grids allows coverage of the entire surface of the grate with a layer of waste and/or slag. As a result of all this, the grids are maximally protected against thermal radiation from the combustion chamber.	YES, according to BAT
15. Flow modeling	Section 4.2.2 Using flow modeling to provide incineration information or FGT performance	The design of the following is supported by CFD studies: - Air condenser; - Flue gas distribution in the bag filter - Flue gas distribution in the first pass (for T2s measurement)	
16. Operating mode	Section 4.2.5 Continuous operation of the installation without frequent on and off operations is achieved by storing waste	The grate is designed to operate in continuous mode. The maximum combustion capacity is 49.4 t/h for waste with LTP between 6,000 kJ/kg and 7,500 kJ/kg, or 43.6 t/h when using waste with LTP of 8,500 kJ/kg. The hopper volume provides a reserve of up to 4.5 days of waste disposal at maximum capacity. The delivery of waste to the complex is much more important than the maximum capacity of EFW. Delivery management between landfill and EfW will lead to optimization of storage in the hopper to maintain the treated waste flow by EFW.	YES, according to BAT
17. Incineration control system	Section 4.2.6 Maintaining efficient combustion	All devices will be equipped with measuring devices and sensors for measuring parameters. The combustion chamber and boiler will be equipped with measuring devices that enable control and maintenance of the required thermal treatment parameters. The incineration control system includes a fuel regulator, which controls the discharge of waste onto the grate. It also includes an O2 controller that determines/corrects the combustion flow. In addition, air flow, air distribution, and the grate speed are controlled. Changes in flue gas temperature were recorded using an infrared pyrometer in the second round of the boiler. Changes in heat release from the furnace are identified quickly and reliably. This results in the control of steam flow in a very short time. Fluctuations in temperature in the furnace and boiler as well as fluctuations in steam flow have been reduced by the following measures: There are three modes of control: "steam flow", "furnace temperature" or "steam temperature/IR pyrometer temperature". The drive variables that are calculated using the incineration control system are transferred to the parent control system, where they are further processed. The additional controllers for which signals are received from the IR camera system generally influence the distribution of air under fire, as a function of the position of the main incineration zone, the feed rate and the grate movement. IR cameras significantly improve the quality of "steam"/"IR pyrometer temperature" control. The plant is equipped with fuzzy control which is an interesting alternative to the classical control system. The main advantage of fuzzy control is the ability to find the "best compromise".	

		When residues are specifically combusted, the process provides partially contradictory or inaccurate information for the control system. Fuzzy control processes such information and finds the best solution. Manual intervention is significantly reduced and control is more stable overall. The "If ... then" formulation of controlling behavior allows everyone to formulate every possible control case, which is not possible to the same extent as with the classical control. Control logic programming is less complex than classical control, but more complex logic ports can be implemented.	
17. Incineration control system	Section 4.2.7 Techniques to consider for combustion control, such as using infrared cameras and other methods, e.g. ultrasonic measurements or other methods for temperature control	An infrared camera system that records the intensity of heat radiation distribution on the surface of a combustible material is used to obtain additional information from the combustion process to achieve even better combustion results. The information provided by the infrared camera is processed in an image analysis program developed to meet the specifications of Martin's inclined grate. The values are then calculated almost in real time for the combustion control system. The employee can also see the temporal and spatial distribution of the surface temperature of the fuel plant on a separate monitor in the control room. In addition to the additional controllers, staff can also see the state of the waste power supply, what type of waste (quality, heat value, large objects, landfill waste, ...) is currently being incinerated, etc. And can intervene if necessary (crane operator, manual intervention control). Blurring of boiler walls and transient air jets can also be observed. The extent of fluctuation of combustion parameters can be further reduced by this expansion of the combustion control system and the visual information available to operating personnel. Additional controllers influence the feeding behavior, scheduling of movement and distribution of combustion air.	YES, according to BAT
18. Optimization and control of combustion parameters in the incineration chamber.	Section 4.2.8 (optimization and control of delivered air) Section 4.2.9 (primary air intake system Section 4.2.11 (secondary air injection system)	The incineration control system includes a fuel regulator, which controls the discharge of waste onto the grate. It also includes an O2 controller that determines/corrects the combustion flow. In addition, air flow, air distribution, and the grate speed are controlled. Air for combustion is divided in two parts: The primary air is distributed by a specific fan into a separate space for the air zone located on the underside of the grate Secondary air is also distributed by a special fan in the combustion chamber above the grate and across the surface (nozzles located in front and at the back of the furnace, in several stages) This secondary air allows complete combustion and mixing of the gas. Air fans are designed for the proper combustion of waste fuels in the harshest operating conditions. The primary air setting allows a constant pressure of approximately 40 hPa in the primary air ducts. Therefore, thanks to the primary air valve, it is possible to establish the required primary air flow in each box without affecting the remaining boxes. The pressure drop between the primary air duct and the subwoofer serves as a measurement for the primary air flow circulating in each box. The aerodynamic strength of the grate of approximately 10 hPa is significantly higher than the resistance of the fuel layer covering it (usually about 1 to 3 hPa). So, even with improper distribution of waste, the air passes through the fuel layer on the grate evenly.	YES, according to BAT
18. Optimization and control of combustion parameters in the incineration chamber.	Section 4.2.19 Optimization of time, temperature, gas turbulence in the combustion zone and oxygen concentration	The combustion chamber will be approved in size and shape to provide: • Full combustion (with CO emissions) before the flue gas leaves the furnace. • In addition, some of the total combustion air should be introduced as secondary air above the grate. • The performance of the combustion chamber should be such that the flue gas temperature can be maintained at over 850°C for at least 2 seconds in the combustion diagram. Combustion control is based on the following principles: • set point = steam flow (maximum allowable variation +/- 5% for 95% of the time and at least 10% for 100% of the time), • control of grate power and movement,	

		• combustion air control. Total air flow is calculated as a function of the set steam flow and combustion temperature. The division of the primary airflow (total and by zone) and the secondary airflow can be manually adjusted as a function of the waste LHV according to the previous settings specified by the supplier; a small correction of secondary airflow will be made to ensure at any time under normal operating conditions a minimum O2 content of 7.5% in wet flue gases after the boiler (6% in the case of flue gas recirculation)	
18. Optimization and control of combustion parameters in the incineration chamber.	Section 4.2.4 Turbulence in the secondary combustion chamber	Secondary air nozzle positions were considered to ensure good distribution of secondary air in the combustion chamber: 3 nozzle levels are provided behind and in front of the combustion chamber.	
19. Incineration conditions	The need to meet operating conditions as set out in Article 6 of Directive 2000/76	• The performance of the combustion chamber has been designed so that the flue gas temperature can be maintained at over 850°C for at least 2 seconds in the combustion diagram. The facility shall comply fully with the requirements of the European Directive 2010, and in particular Article 6 thereof.	
20. Preheating of primary incineration	Section 4.2.10 Pre-heating using heat from installations	Primary air heater: Includes several stages: MP steam, LP steam, exhaust gas engine cooling, landfill gas engine cooling. The MP and LP stages should be steam powered by the first two turbines. Secondary air heater: Includes several stages: MP steam, LP steam, landfill gas engine cooling. The MP and LP stages should be steam powered by the first two turbines. Energy (loss of energy) from the biogas plant enables the reduction of steam consumption for heating air. Energy (lost energy) from biogas engine plant allows to reduce the consumption of steam (from turbine bleed) for air heating.	YES, according to BAT
21. Use of automatic burners/auxiliary burners	Section 4.2.20 The auxiliary burner constantly maintains the required process temperature and supports starting and stopping operation.	The boiler has two (2) auxiliary burners, designed for: Raising the temperature in the combustion chamber before starting from a cold state and when the plant is shut down, Burning of waste fuel at start-up after shutdown, Burners comply with EU Directive (2000/76/EC) on waste gas emissions (IED) This means that when the temperature drops below 850°C, the auxiliary burner automatically starts operation to allow the temperature to be maintained while the fuel is on the grate. Each burner is equipped with a separate fan.	YES, according to BAT
22. Protection and insulation of combustion chamber walls	Section 4.2.22 & 4.3.12 Refractory material/alternative material	The boiler is vertical with natural circulation, a single drum and a suspended steel structure, with 4 vertical passages and evaporator tubes, in the first three drafts, which form membrane walls: Combustion chamber: irradiated combustion chamber, vertical passage Second pass: vertical passage with evaporation packs Third pass: vertical passage with evaporator pack and superheaters Fourth passage: vertical passage with water heater packs The passages are closed with lining (except the 4th passage). Membrane walls consist of pipes welded in length. The first vertical passage is protected by an anti-corrosive welded lining - Inconel (in the zone of feeding waste onto the grate, at the exit from the first passage and the ceiling of the boiler) and a wall to the central screen collector of the combustion chamber.	

<table>
<tr>
<td></td>
<td></td>
<td>Welded linings - Inconels applied on the first vertical passage starting at least 0.3 m below the refractory lining, up to and including the ceiling and entrance of the second passage. In addition, at a height of 1m, a common wall between the first and second passages (on the other side of the passage) is covered by Inconel.
In order to optimize the efficiency that is particularly suitable for waste incineration and to prevent damage, erosion and corrosion, the project is governed by the following main criteria:
Combustion chamber of appropriate width and proper height
Low flue gas velocity in the combustion chamber to reduce ash transmission
Long retention time
Refractory protection of welded combustion linings in the flame zone is designed to achieve good heat transfer without high temperatures of hot faces
Low gas velocities and long staying times before entering the first convective surfaces
Large pipe spacing in convective banks
Convective superheaters for high flue gas temperature and stable vapor temperature
Easy access to inspect and maintain all pressurized parts
On-line cleaning systems based on water injection in the second pass, and cleaning devices-blowers on the other pass.
Two types of insulation were used:
Refractory wall: use of refractory bricks, silicone carbide (SiC) bricks, nitrite bound bricks, insulating or refractory concrete
Refractory tubes: Using patented SiC high refractory bricks</td>
<td></td>
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<tr>
<td>23. Design of the combustion chamber</td>
<td>Section 4.2.23
The combustion chamber is designed to be large enough to provide low gas speeds and long gas retention times</td>
<td>In order to avoid damage and corrosion, the plant will be designed typically according to the minimum requirement below:

Typical minimum conditions for arranging the surface for heat exchange
<table>
<tr><th>Boiler type</th><th></th><th></th><th>Vertical</th></tr>
<tr><td>Membrane walls</td><td>maximum width</td><td>mm</td><td>30</td></tr>
<tr><td>First pass</td><td>maximum speed at MCR (maximum continuous load)</td><td>m/s</td><td>4.5</td></tr>
<tr><td>Second and third pass</td><td>maximum speed at MCR</td><td>m/s</td><td>6.0</td></tr>
<tr><td>First evaporator section</td><td>maximum inlet gas temperature at MCR (according to corrosion protection diagram)</td><td>°C</td><td>700</td></tr>
<tr><td></td><td>maximum speed</td><td>m/s</td><td>4.5</td></tr>
<tr><td></td><td>minimum free space (longitudinal)</td><td>mm</td><td>80</td></tr>
<tr><td></td><td>minimum free space (transverse)</td><td>mm</td><td>150</td></tr>
<tr><td>Superheater</td><td>maximum inlet gas temperature at MCR</td><td>°C</td><td>630</td></tr>
<tr><td></td><td>maximum inlet gas temperatures</td><td>°C</td><td>650</td></tr>
<tr><td></td><td>maximum speed at MCR</td><td>m/s</td><td>4.5</td></tr>
<tr><td></td><td>minimum free space (longitudinal)</td><td>mm</td><td>80</td></tr>
<tr><td></td><td>minimum free space (transverse)</td><td>mm</td><td>150</td></tr>
<tr><td></td><td>minimum free space (transverse)</td><td>mm</td><td>120</td></tr>
<tr><td>Evaporator</td><td>maximum speed at MCR</td><td>m/s</td><td>4.5</td></tr>
<tr><td></td><td>minimum Free space</td><td>mm</td><td>60</td></tr>
<tr><td>Economizer</td><td>maximum outlet gas temperature at MCR</td><td>°C</td><td>200</td></tr>
<tr><td></td><td>maximum speed</td><td>m/s</td><td>5.5</td></tr>
</table>
</td>
<td>YES, according to BAT</td>
</tr>
</table>

		minimum free space (longitudinal) mm 50 minimum free space (transverse) mm 60	
24. Gasification/Pyrolysis	The section applies to the gasification or pyrolysis technique	Not applicable.	N/A
	ENERGY RECOVERY		
25. Boiler design	Section 4.3.11 / 4.2.23 / 4.3.14 The boiler design allows for a significant reduction in the gas temperature before the convective beam for heat exchange	Heat obtained from flue gases using an integral water tube boiler. The type and quality of the boiler and associated equipment are suitable for the municipal waste incineration plant and satisfy the steam requirements of the steam turbine as well as all other requirements of the plant. The boiler is specially designed for municipal waste incineration and has well proven technology. The design is the outcome of many years of boiler supplier experience. The boiler is vertical with natural circulation, a single drum and a suspended steel structure, with 4 vertical passages and evaporator tubes, in the first three drafts, which form membrane walls: Combustion chamber: irradiated combustion chamber, vertical passage Second pass: vertical passage with evaporation packs Third pass: vertical passage with evaporator pack and superheaters Fourth passage: vertical passage with water heater packs External economizer: It is placed under the boiler The passages are closed with lining (except the 4th passage). Membrane walls consist of pipes welded in length. A final economizer (external economizer) is provided at the outlet of the steam boiler for the purpose of flue gas cooling to 140°C before entering the dry reactor - dry reaction canal (LABloop). Injection of feed water is provided in order to regulate the condensate temperature, which is introduced into this economizer, as well as a bay-pass system for regulating the flue gas outlet temperature. See answer in Part 23.	YES, according to BAT
26. Optimization of efficient use and energy recovery	Section 4.1.3.1 The incineration plant can release energy from waste and can supply electricity, steam and hot water	The total amount of steam generated by the heat recovery boiler is used in a common condenser turbine to generate electricity and steam output for CHP. The steam turbine will be used in full condensation mode when no CHP is used. Heat exchange with DH network will be done with 2 heat exchangers powered by 2 different turbines: - Exchanger 1 is powered by controlled steam app. 1.5 bar - Exchanger 2 is powered by an uncontrolled steam of app. 5 bar This configuration allows for greater energy recovery than with a single delivery exchanger at 102°C, and brings flexibility to deliver at lower temperatures, if required by the City.	YES, according to BAT

26. Optimization of efficient use and energy recovery	Section 4.3.2 / 4.3.5 Energy Loss Reduction Measures: Reduction of flue gas losses and other measures	Energy loss reduction measures: Retention in the boiler The drive unit is located in the building Effective boiler cleaning system Also, at the steam boiler outlet, a final economizer (external economizer) is provided to cool the combustion gas to 140°C before entering the dry reactor. Flue gas heat is used to increase the condensate temperature. This reduces the steam flow from the condensate heating turbine.	
26. Optimization of efficient use and energy recovery	Table 3.46 Boiler thermal conversion efficiency of at least 80% for mixed municipal waste	Boiler efficiency is higher than 80% during MCR Load in accordance with EN 12952-15.	YES, according to BAT
27. Heat/steam requirements	Section 4.1.3.1 Long term heat/steam supply contract for large heat/steam users	The plant will be connected to the district heating system - Konjarnik heating plant. The total amount of heat exported is projected to reach 630,000 GJ/year.	YES, according to BAT
28. / 61. / 62. Location of installations	Location of the plant maximized to supply electricity heat/steam, process steam to industries or cooling system	Heat and electricity will supply the Konjarnik thermal power plant and the electricity power grid. The plant is located near the landfill. Landfill biogas is used in biogas plant for electricity generation. Flue gas heat and engine cooling are used to pre-heat the air from the EFW combustion.	
29. Optimization of steam parameters	Section 4.3.8 Steam parameters to increase electricity production Boiler material protection	The steam cycle is optimized at 60 bar/400°C to achieve maximum power output. Combustion protection of high-temperature corrosion boilers is achieved by a combination of refractory lining and Inconel lining (see section 22).	YES, according to BAT
30. Choice of turbine	Section 4.3.7 The turbine is suitable for: - Supply of electricity and heat - High electrical efficiency	The total amount of steam generated by the heat recovery boiler is used in a common condenser turbine to generate electricity and steam for CHP. The steam turbine will be used in full condensation mode when there is no use in CHP. The third subtraction for district heating is with a fixed pressure. The turbine is designed to accept the total steam flow produced in the boiler plant in all the intended ambient conditions.	
31. Condenser pressure	Section 4.3.9 Condenser pressure reduction	Exhaust steam from the turbine will condense on an air-cooled condenser. The vacuum will be 100 mbar for the ambient temperature of 20°C.	
32. / 63. Comprehensive minimum energy demand	Section 4.3.6 Techniques and measures to reduce energy requirements in the process	Near the BEP, there will be a thermal energy loop that will allow the recovery of additional energy from the BEP engine, which will be used to heat the primary air in the EfW facility, thereby increasing overall energy efficiency. Variable speed drive is provided for: - ID fan - Water pumps for supplying - ACC engines,	

		A condenser/flue gas heat exchanger is installed at the boiler outlet to reduce the flue gas temperature at the inlet of the FGT. This system allows to reduce the consumption of condensate heating steam.	
33. Cooling system	Section 4.3.10 Choice of steam condensation technology	An air-cooled condenser is provided. The air-cooled condenser is designed to condense the total amount of exhaust vapor	
34. Cleaning the boiler	Section 4.3.19 Cleaning of boiler pipe and other surfaces for heat exchange	The systems for cleaning the heating surfaces are based on the water blowers of soot in the second passage and the steam blowers of soot in the other vertical passages. Satisfactory cleanliness of the convective heat transfer surfaces is insured by a combination soot blowing devices and online water sprays as follows: Second vertical passage: Continuous cleaning with water nozzles of the second vertical canal allows cleaning of the boiler walls, the ceiling of the irradiated chamber and the evaporator panels. To this end, water will be sprayed with special nozzles directed at the heating surfaces. Third vertical passage: Cleaning of the third gas tract will be carried out by retractable blowers (at the inlet of the evaporator panel and preheater P3, by the batch-retractable blowers (for P3 and P2) and rotary blowers (for P1). Fourth vertical passage: Cleaning of the fourth gas tract is done by rotary blowers of soot (for the economizer).	
	FLUE GAS PURIFICATION		
35. FGT System	Table 5.2 Air emissions	Flue gas emissions must meet all the limit values requirements laid down in EU Directive 2010/75/EC on Industrial Emissions (IED). In order to reach the limit values set by the EU directive, SNCR with liquid urea injection and CNIM/LAB "SECOLAB" dry process was selected. The emission of nitric oxides is controlled by the Selective Non-Catalytic Reduction (SNCR) - DeNOx system. The system uses liquid urea solution injection into the combustion chamber The flue gas treatment plant includes the following elements: The reactor for mixing the sorbent with the flue gas before entering the bag filters for dusting, Bag filter with P84/PTFE bags, Flue gas fan, gas ducts and noise damper; Freestanding double wall stack for the removal and discharge of purified flue gases into the atmosphere. In the CNIM SECOLABTM dry process, the injection of hydrated lime as a reagent into the flue gas is used. The reagent is injected with a pneumatic conveying system and then intensely mixed with the recirculated residues from the bag filter. Activated carbon is also added to the flue gas to reduce volatile heavy metals and dioxins/furans. The gases flow through the reaction canal and the bag filter and are then discharged through the flue gas fan into the stack	

36. FGT system	Section 4.4.1.1 / 4.4.1.3 Factors for FGT choice	Requirements giving rise to the FGT type: - Regardless of the incineration technology used, the main plants will be equipped with an FGT system to reduce the concentration of pollutants from flue gases emitted into the atmosphere in accordance with the requirements of applicable law, Directive 2010/75/EU and the contractor's guaranteed level of purification. - Semi-dry, conditionally dry and/or dry systems are accepted based on proven supplier experience. If wet systems are applied, a system without wastewater generation must be designed. No wastewater should be generated during the FGT. - A bag filter unit with at least four sections is required.	
36. FGT system	Section 4.4.1.2 Impact on energy consumption	For example, FGT does not require heat for the DeNOx system. The optimized temperature in the dry process with hydrated lime is about 140°C. Energy from the flue gas to reduce the temperature at the boiler outlet to 140°C is used to heat the condensate.	
36. FGT system	Section 4.4.1.4 Additional overall system compatibility when retrofitting existing installations	This section does not apply in this project: construction of a new plant. The FGT plant may accept SCR DENOx in the future, subject to several modifications.	Not applicable
37. FGT system	Table 5.3 Selection of criteria for FGT	As stated in section 36, the scrubber is not accepted unless the wastewater is discharged. Hydrated lime dry process was selected because of: - Low water consumption - Easy reagent delivery - Simple unit. The recirculation of residues from the bag filter further reduces the consumption of reagents as it contains more unreacted lime. To best use this, a portion of the bag filter residue is recycled back to the reaction canal.	
38. Controlling the increase in electricity consumption during the FGT process	Section 4.4.2.2 / 4.4.2.3 Additional gas purification system and application of double bag filters	The dry process enables compliance with EU Directive 2010/75/EC on industrial emissions (IED). There is no need for a system for additional gas purification due to the constant content of pollutants at the FGT inlet, due to the good mixing of the waste prior to incineration. There is no need for double filtration as there is no separate treatment for ash and air pollution residues (APCR).	
39. Use of reagents in FGT	Section 4.4.3.7 / 4.4.3.9 Adjusting and controlling the amount of reagents injected/optimizing the reagent dosing rate and recirculating FGT residues.	The control of lime flow is influenced by the concentrations of acidic pollutants (HCl and SO_2) and flue gas flow. The amount of activated carbon is affected by the flow of flue gases; the injection rate is constant, but the operator can adjust it. The recirculation of residues from the bag filter further reduces the consumption of reagents as it contains more unreacted lime. To best use this, a portion of the bag filter residue is recycled back to the reaction canal.	YES, according to BAT

40. NOx reduction system	Section 4.4.4.1 / 4.4.4.2 Selective Catalytic Reduction (SCR)/Selective Non-Catalytic Reduction (SNCR)	The injection of combustion air into several stages allows for the reduction of NOx formation and excess air in waste incineration systems. When combined with the SNCR system, this results in drastically reduced NOx and ammonia emissions. The technology is based on an incineration process in which secondary air is injected through several (sampled) air levels. Secondary air inlet nozzles and nozzles are stacked in rows opposite each other to ensure that the furnace is fully interspersed, thereby achieving thorough flue gas mixing and efficient secondary combustion. Position combustion, among other things, encourages the chemical reactions required to convert NOx emitted during the incineration of waste on the grate to nitrogen. This process produces favorable combustion results such as reduced excess O2 levels, reduced NOx emission levels, reduced NH3 consumption, increased boiler efficiency, reduced boiler size and downstream flue gas cleaning components. Nitrogen oxide emissions are controlled by the selective non-catalytic reduction (SNCR) system DeNOx. The system uses injection of urea solution into the combustion chamber.	
41. PCDD/F emissions	Section 4.4.5.1 / 4.4.5.2 / 4.4.5.3 / 4.4.5.4 / 4.4.5.6 / 4.4.5.7	Primary Technique for Preventing PCDD / F: - Waste mixing owing to the capacity of hoppers and cranes. - Combustion control with the phase combustion system (see paragraph 40 above) - Design of the boiler to avoid application and heating in the specific temperature range of 450 to 200 °C - Efficient boiler cleaning system (soot blowing system) There is no re-formation of PDCC / F in FGT due to an operating temperature of app. 150 °C Adsorption of PCDD / F is done by injecting activated carbon at the inlet of the bag filter.	
42. PCDD / F emission	PCDD / F assessment using a scrubber	No scrubbers are used. The FGT process is based on a dry system.	Not applicable
43. Residues from a waste gas treatment system	Re-incineration of treatment residues	Re-incineration of treatment residues is not applicable at the plant. The residues are stored in appropriate silos until the stabilization process.	Not applicable
44. Mercury emission	Section 4.4.6.1 / 4.4.6.2 / 4.4.6.5 / 4.4.6.6 / 4.4.6.7 Mercury emission control by using wet scrubbers	No scrubbers are used. The flue gases are cleaned with a dry system.	Not applicable
45. Mercury emission	Section 4.4.6.2 Control of mercury emissions using semi-wet or dry systems: use of activated carbon for mercury adsorption	For adsorption of volatile heavy metals (i.e. mercury Hg) and organic components (i.e. PCDD / F), powdered activated carbon (PAC) is injected into the flue gas along with lime. Activated carbon is injected into the bag filter. The injection is controlled by the flue gas flow. The injection rate is constant and the operator can adjust it.	
	WASTE WATER TREATMENT AND CONTROL		

46. Wastewater reuse	Section 4.5.6 / 4.5.8 Site recirculation and re-use of wastewater: boiler water use/wastewater recirculation into the process.	Flue gas treatment is a dry system without wastewater discharge Process water from the incineration plant is reused in the process (incineration and APCR solidification), and the projected mass balance of process water shows that water needs are greater than the water production in the process Boiler emptying water and blower condensate are reused for the quenching process on the bottom ash. The leachate from the slag treatment plant is also reused for the slag extinguishing process.	YES, according to BAT
47. Atmospheric water management	Section 4.5.9 Separate system for drainage, purification and discharge of rainwater, prevents mixing with contaminated wastewater streams	The pure atmospheric water from the roofs is collected in a dedicated pit before being sent to the pit for atmospheric water from the landfill. Clean water from the traffic surfaces is collected and sent to the atmospheric water pit from the landfill. Contaminated atmospheric water (for example from the surface of the APCR solidification plant) is collected and sent to a wastewater treatment plant. From the wastewater pit, water is again used to quench the ash, to stabilize FGT residues, and the excess (during periods of heavy rainfall) is treated at the water treatment plant prior to discharge from the site.	YES, according to BAT
48. Atmospheric water management	Section 4.5.4 / 4.5.10 / 4.5.11 / 4.5.12 / 4.5.13 Wastewater management resulting from wet waste gas treatment	No wet flue gas treatment is used.	Not applicable
	WASTE MANAGEMENT - SOLID RESIDUES FROM THE PROCESS		
49. Ash and TOC value	Section 4.6.1 Using thermal process techniques and rules to obtain total organic carbon content of ash below 3% (typically 1-2%)	The thermal process design, described in section 18, guarantees ash with a maximum TOC of 3%. Elements that allow the content of TOC <3% in ash to be: Air-cooled moving grate process Well distributed primary and secondary air (see section 18) Speed control of the plant at rated thermal capacity The thermal radiation intensity distribution on the surface of the fuel plant (grate) is controlled by the infrared camera system (MICC) to achieve even better combustion results. Mixing waste before incineration (high waste storage capacity, about 50% of crane operation time is used to mix waste)	YES, according to BAT
50. Ash segregation from flue gas treatment residues	Section 4.6.2 Separate fly ash management from fly ash and other FGT residues to avoid ash contamination and improve treatment	Fly ash collected from the boiler and economizer, as well as residues of flue gas treatment, are directed to the treatment of flue gases and ash silos from the boiler. The slag is transported to the emptying device - a deslugger that transports the slag to the pretreatment device, that is, vibrating grates and belt conveyors.	

51. Separation of dust removal phase from flue gas treatment	Section 4.6.3 / 4.4.2.1 Assessment of the composition of fly ash when the dusting phase is completed	The plant project does not foresee a dusting phase. There is no dusting process because fly ash and residues are treated in the same system: APCR solidification.	
52. Extraction of metals from IBA	Section 4.6.4 Use of separation to recover (if economically and practically feasible) ferrous and non-ferrous metals (Section 4.6.4)	Ferrous metal will be extracted from IBA using magnetic separators at the slag treatment plant. Following the assessment, it has been shown that the separation of non-ferrous metals is not economically viable given their amount within the residual municipal waste.	YES, according to BAT
53. Slag treatment	Section 4.6.6 / 4.6.7 dry methods with or without additional components including storage outdoors or in a suitable facility for several weeks;	The transport mechanism coming from the EfW plant is constantly passing through the IBA treatment plant. Slag treatment includes the following steps: • The slag from the deslugger falls on the vibrating grate on which large pieces (> 300mm) are separated to start treatment or bypass treatment. • Hanging magnetic separators remove metal fractions before sorting the slag into two 0-40 mm and 40-300 mm fractions using a rotary drum sieve. Separated metals are stored outdoors. • Metals are once again removed from the 0-40 mm fraction. The fraction> 40 mm is stored outdoors in a separate area and the separated metals are stored in containers. • Slag and metals are loaded using an excavator. The residues from the IBA treatment plant are collected and reused (slag quenching, APCR solidification plant)	YES, according to BAT
54. Methods for handling residues from FGT residues from flue gas treatment	Section 4.6.11 FGT treatment to meet the relevant criteria of the waste management option selected	Residues from the air pollution control system are automatically transported to dedicated storage silos prior to stabilization treatment. The process involves mixing residues with slag and/or cement with leachate (and/or recycled water) in regular industrial equipment to solidify and form dense and solid blocks with reduced total volume The process of stabilization binds salts and heavy metals through a physical-chemical reaction. The stabilized product will comply with applicable waste disposal regulations before being sent to a dedicated landfill cell for site residues, separate from municipal waste.	YES, according to BAT
NOISE EMISSION REDUCTION			
55. Noise Reduction Measures	Section 4.7 / 3.6 Noise protection and measures	The noise generated by the system will not exceed the allowed values during the day and at night. Wherever necessary to meet the guaranteed noise levels, the plant will be equipped with sound attenuators. The main sources of noise, i.e. waste unloading, waste hopper with loading and unloading equipment, boiler, turbine will be installed indoors. Cooling fans will be located outside buildings; however, it will not cause excessive noise emission to the environment.	YES, according to BAT
	ENVIRONMENTAL MANAGEMENT INSTRUMENTS		

56. Environmental Management System	Section 4.3.8 The environmental management system includes the organizational structure, responsibilities, practices, processes and resources to develop, implement, maintain, review and monitor environmental policies.	The QHSE (Quality, Health, Safety, Environment) team, led by the QHSE Manager, will implement, monitor, and control quality and environmental management systems based on: Quality management system, usually in accordance with the latest version of ISO 9001; Environmental management system generally in accordance with the latest version of ISO 14001; Occupational safety and health management systems (OHS) usually in compliance with the latest version of OHSAS 18001. The team will be responsible for: Monitoring objectives and key performance indicators, in line with quality management and environmental management systems; Raising employee awareness of environmental and safety risks; Informing employees of the achieved goals; Monitoring compliance with environmental and safety guidelines through periodic QHSE rounds; Coordination of environmental monitoring in the field and relevant sample analysis regimes; Implementation and monitoring of corrective measures Coordination of QHSE plans and revisions	YES, according to BAT

4.0. OVERVIEW OF MAIN ALTERNATIVES CONSIDERED BY THE PROJECT LEADER

The project was initiated to provide a variety of waste management alternatives in Belgrade. All considered alternative solutions are presented in detail in the E&S Scoping Study report and in the Process of Competitive Dialogue with Bidders. This chapter presents a summary of the alternatives discussed earlier and explains the reasons for excluding them in the updated concept.

Tender documentation for the first round of Competitive Dialogue offered two potential locations for the EfW plant:

- Vinča location, which would offer space for new landfills, EfW and BEP plant and
- Location of Cerak, where an EfW plant could be built alternatively.

Three possible Concepts of the Design were considered, each with the aim of treating 100% of municipal waste from the territory of Belgrade, taking into account the above two locations:

- Option 1:
  - Construction of a plant for mechanical-biological treatment at the Vinča site, where fuel from waste would be produced;
  - Transport of waste prepared for incineration to the Cerak site, near the residential area;
  - Construction of a new combined heat and power plant (CHP) at the Cerak site, near the existing heating plant that would use waste for its operation;
  - Transport of combustion residues at the Vinča site where new landfills would be built.
- Option 2:
  - Transport of untreated residues from the Vinča site mixed with municipal waste impurities to the Cerak site;
  - Transport of combustion residues to the Vinča site where new landfills would be built.
- Option 3:
  - Incineration of unprepared municipal waste at the site in Vinča, at the EfW plant that would be built there;
  - Disposal of combustion residues at the new landfill that would be built at the Vinča site.

In addition to each of these options, the contractor was allowed to integrate equipment for the disposal of recyclable or organic materials (sorting, composting, digestion) to further reduce the amount of municipal waste that would be finally treated at treatment facilities within the said options.

In addition, treatment, recycling, storage and disposal of construction waste is a component of each of these options.

The following project parts were considered:

- Part 1: Management of the existing landfill by PUC "Gradska čistoća" Belgrade:
  - Operation of the existing Vinča landfill in the transitional period of the project of 3 years (2016 - end of 2018).
- Part 2: Measures from the project implemented by the contractor:
  - Remediation and closure of the existing Vinča landfill, including landfill gas treatment plant, energy generation and leachate treatment plant
- Part 3: Construction of a new landfill at the Vinča site, comprising:
  - Temporary landfill
  - Landfill for combustion treatment residues, including a facility for the maturation or solidification of these residues
  - Construction waste recycling plant and inert waste landfill
- Part 4: Construction Phase and Routine Phase for the above three options of the considered Concept of the Design and, Option 3, as preliminary the most favorable concept.

The key impacts and risks of the three alternative solutions of the Design and the "no project" situations on the physical, biological and environmental impacts during the construction and operational phases of the project were assessed. The basis for comparison lies in the ability of the option under study to avoid and minimize the impact on the environmental and social characteristics of the projected facilities at project sites. Comparison of options showed that:

- Options 1 and 2 have similar disadvantages,
- Option 3 has the most advantages,
- The "no project" option has the most disadvantages.

The Cerak location is disadvantageous due to the many disadvantages considered by Options 1 and 2. The location is close to (about 120 m) residential areas which:

- makes potential noise, odors and imissions significant,
- causes a more visible visual impact of the plant,
- entails a greater risk of public complaint.

Additionally, Option 1 requires significantly more transportation effort between the Cerak site and the Vinča site than other options.

Option 3 shows the most advantages over the other two options. This is mainly due to the fact that:

- the facilities are located relatively far from the volatile/residential facilities, in an area where visual effects are minimal,
- the facilities will be located in the immediate vicinity of the existing waste disposal site.

The Leachate Treatment Plant (LTP) as a biological treatment of water was considered as a possible alternative during the development of the project. This solution was not accepted for several reasons:

• the required layout (bases) of the necessary infrastructure was not compatible with the available space on the site (especially given the limited space below the supporting structure)
• the commissioning period required to put the biological treatment into operation is much longer
• this anticipated type of process would require more experienced professionals for the process monitoring and more intensive operation monitoring
• fluctuation of certain parameters in the quality of the leachate would require modifications and adjustments to the design during the working period
• the equipment could not be so easily put out of operation once the production of treated water has declined significantly (as expected after the supply of leachate from the existing landfill is treated)

The "no project" option is unsustainable in the current state. The Vinča site currently has a typical unsanitary landfill that has been forming over more than 20 years in the area. The consequence of the operation of this landfill is the pollution of the water of the Ošljanski stream and Ošljanska pond, the pollution of the surrounding agricultural land, groundwater and air. The landfill is not equipped with technical control systems. No lower impermeable layer (natural or artificial) was used which resulted in uncontrolled migration of leachate to the underground. There is no collection and treatment of leachate, so leachate is discharged to the nearest surface recipient. No sewer system was built at the site.

Currently, septic tank is also disposed of at the landfill. Landfill gas accumulation is not technically controlled and utilized, leading to its complete migration and release into the air. The presence of many birds, rodents, waste-feeding insects is evident, as is their role in the potential transmission of infectious diseases beyond the boundaries of the complex. The landfill is partially fenced, but does not have an adequate and complete vegetation barrier. Waste dispersion and dispersion of particles into the air are also not controlled. Adequate supply of fire protection water is not available.

As part of the Competitive Dialogue process, bidders evaluated different project options. The results of the dialogue are as follows:

Dialogue result	Effect
None of the bidders selected the Cerak site as part of the project	Options 1 and 2 are no longer the subject of interest due to the proximity of the residential area and the potential impacts of the planned project on the closest environment.
Pre-treatment and production of recyclable products were not of interest to most bidders	Prior primary separation of all recyclable components from waste is done prior to disposal of municipal waste into containers. In the further development of the project, the option based on direct incineration of waste, Option 3, should be considered.
An estimate of finances and costs resulted in the City's decision to reduce the project	Option 3 will be modified. This means reducing the planned capacity of the EfW plant to around 65% to build a new landfill for untreated waste.

Source: „Environmental and Social Scoping Study for the Belgrade EfW Project in Serbia, Amendment to the E&S Scoping Report” Fichtner, April 2017)

In short, the project opted for the location of the existing landfill in Vinča with the concept of direct incineration of municipal waste and landfill gas with the utilization of heat and electricity, as well as the construction of a new landfill for untreated waste, landfill for inert waste, landfill for EfW residues and rehabilitation, remediation of the body of the existing landfill and its final closure, with the application of modern technological solutions and equipment, the legislation of the Republic of Serbia, EU directives and guidelines of BAT reference documents.

5.0. OVERVIEW OF THE ENVIRONMENTAL STATUS OF THE LOCATION AND THE SURROUNDING AREA

5.1. POPULATION

Around the site of the Vinča landfill there are Belgrade settlements Veliko selo in the north, Slanci and Mirijevo in the northwest, Kaluđerica in the west and Vinča in the south. The closest settled households in individual settlements are at a distance of about 1700 m. The landfill complex is not directly visible from the aforementioned settlements and the nearest inhabited households. To the east is the Danube River.

In addition to the existing landfill (in the north) there is an informal Roma settlement consisting of barracks with no basic infrastructure (water supply, sewerage). The settlement is populated by families who collect, classify and sell secondary raw materials from the landfill to companies that have contracts with PUC "Gradska čistoća".

Due to the implementation of the project, residents of this informal settlement will be physically resettled to free up space for the construction of newly designed facilities at the Vinča landfill complex.

The City of Belgrade is aware of the importance of physical and economic relocation, as well as the consequences that are likely to result from the implementation of the project.

By Decision of the Mayor of the City of Belgrade No. 020-3678/16-G-01, of 26 June 2016; as amended by the Decision of the Mayor of the City of Belgrade, No. 020-6553/17-G of 18 October 2017; a Working Group was formed to design and monitor the implementation of the Action Plan for the Resettlement of Roma Families living in informal settlements at the Vinča landfill sand on the land planned for the construction of public utility infrastructure. The Working Group drafted the said Action Plan in November 2017.

Based on the Action Plan, it is the obligation of the City of Belgrade (in accordance with the Public Private Partnership Agreement) to resettle Roma families in order to free up space for the construction of planned facilities. It is the obligation of the City of Belgrade to hand over to the public-private partner a site freed from all persons and things for the purpose of bringing the site (land) to the intended purpose determined by the planning acts. The aim of the Action Plan is to reduce the adverse effects of the project and to restore and improve the standard of living of the people to be resettled.

The Action Plan stated:

- That members of the working group from the Secretariat for Social Welfare, the Secretariat for Environmental Protection and the Center for Social Work repeatedly went to the field and visited the site of the Vinča landfill. On 03.12.2014 15 (fifteen) families were listed, while on 16.01.2015 14 (fourteen) families were listed at the site of the Vinča landfill;
- On 08.06.2016, the third listing was conducted on the site of the informal settlement at the site and a survey was conducted on the socio-economic status of households living in the informal settlement at the said location by an expert team comprising representatives of the Secretariat for Social Welfare and the Center for Social Work.
- The City Center for Social Work (Department of Planning and Development) conducted an analysis of the social status of families at the site and verified that they were on the records of the city Center for Social Work and prepared the Report filed under No. 551-879/7 of 1 August 2016;

As part of the latest survey (8 June 2016), there were 17 families (85 people) whose members were present in their homes between 2014 and 8 June 2016. Of the total number of respondents, a total of 41 were registered: 41 men, 44 women, 38 minors (under 18), 47 adults and 6 (six) persons without documentation on the basis of which their age would be determined.

Families generally have two, three, and four members, accounting for 70% of the total number of families. Three families have more than four members.

All households claim to have permanent residence in the settlement. Out of the total number of respondents, 9 (nine) persons were listed as "head of household-family" have their last registered place of residence in the City of Belgrade, while 9 (nine) have no registered place of residence in the City of Belgrade.

Of the 17 (eighteen) families enumerated in the last listing: 13 (thirteen) families were found in the settlement during all three censuses, 3 (three) families were found in two censuses, 2 (two) families were found only in the last census.

In the meantime, two persons left their households and formed 2 (two) separate households in separate barracks.

The length of residence of families in the settlement is shown in the table.

LENGTH OF RESIDENCE IN THE SETTLEMENT				
Number of years of residence	Up to 3 years	10-20 years	20-30 years	Over 30 years
No. of families	4	5	6	3

Families were asked to estimate the monthly income of each family member. In addition, they were asked to indicate the primary and secondary sources of income and the amounts generated from these sources. Individual amounts were summed and taken as an estimate of the entire family's income on a monthly basis.

Information on the amount of income is given in the table.

	INCOME AMOUNT, in dinars			
Income	up to 10,000	10,000 - 15,000	Over 15,000	It has not been stated
Number of families	5	4	3	6

The main sources of family income are: contract with landfill - 25 (twenty-five) tenants, the right to financial social assistance in Belgrade is exercised by 5 (five) tenants, while the right to social assistance in the municipality of Šabac is exercised by 4 (four) tenants.

All families live in illegally built barracks without electricity and water. After checking the property status and income on a different basis, it was determined that 2 (two) tenants are indebted with the property tax of the taxpayer. Thirty-one (31) persons have incomplete elementary education, 6 (six) persons have completed primary education, 2 (two) persons have completed secondary education, 1 (one) has completed post-secondary education, and 3 (three) are illiterate. Five (5) tenants are still going to school. The Working Group noted that a total of 9 families (with a total of 37 persons - household members) having the last reported claim on the territory of the City of Belgrade are entitled to resettlement with appropriate housing support in accordance with the Action Plan and the provisions of the Law on Housing and the Maintenance of Residential Buildings.

In addition to the right to resettlement with the appropriate housing support defined in the Action Plan, all families covered by the project will be entitled to the following forms of assistance whose implementation will be the responsibility of the City of Belgrade, or the competent City Administration bodies of the City of Belgrade:

- Assistance in obtaining personal documents
- Help when enrolling children in school
- Assistance in exercising the right to health care
- Assistance in employment and re-establishing sources of income
- Assistance in exercising the right to social assistance

The Action Plan states that there are currently seven companies present at the landfill, under contracts with PUC "Gradska čistoća". These companies employ collectors from informal settlements, (on average 10-15 per company), who extract recyclable waste from the imported municipal waste in order to reduce the amount of waste to be deposited and to increase recycling rates.

PUC "Gradska čistoća" undertakes not to increase the number of companies operating in the landfill, as well as the number of employees in the existing ones, and to terminate contracts with the said existing companies 6 months before taking over the landfill operations by the said private partner, and in cooperation with the City, to adopt a plan for monitoring and restoring the living conditions of the employees of these companies.

The Secretariat for the Environment commits itself to informing PUC "Gradska čistoća" of the adoption of the Action Plan as well as of the obligations set out in the Action Plan.

Following the adoption of the Action Plan, the City of Belgrade, through the competent secretariats, will continue to regularly inform and consult the families involved in the project about the following activities:

- Plan for the placement of families in apartments;
- Individual discussions with property owners and agreement on activities that will be undertaken to assist them;
- Presentation and signing of contracts;
- Consultative meetings with local communities in which families move;
- Date of commencement of the resettlement and planned transportation of families and their belongings (families will be notified of the exact date of resettlement at least one week before that date).

In the period from 15 June 2018 to 25 June 2018, representatives of the Secretariat for Social Work and PUC "Gradska čistoća" held meetings with companies for the collection of secondary raw materials and informed them of a possible interruption of the collection of raw materials by 2019. These companies informed their employees of the date of the meeting. PUC "Gradska čistoća" introduced employees with whom it has contracts for the collection of secondary raw materials. Subsequent discussions with the public private partner and review of the implementation plan for the various components of the project identified that these activities could continue for two more years. This was presented to recycling companies at a meeting held on 13 July 2018.

Neither company owns the facility at the Vinča landfill, so they use hangars belonging to PUC "Gradska čistoća". Two companies have mobile equipment for baling collected waste at the landfill, and one company has a special waste collection vehicle. The Secretariat confirmed that the companies have the right to transport the equipment to another location, but the companies refuse this option. The companies said they had no plans for further work after the landfill closed and that their revenue would be jeopardized. One of the larger companies at the meeting, estimated that its workload would be reduced by app. 20%. The Action Plan states that PUC "Gradska čistoća" undertakes not to increase the number of companies operating in the landfill, as well as the number of employees in the existing ones, and to terminate contracts with the said existing companies 6 months before taking over the landfill operations by the said private partner, and in cooperation with the City, to adopt a plan for monitoring and restoring the living conditions of the employees of these companies.

As stated in the study above, the City of Belgrade is responsible for the resettlement of Roma families in order to free up space for the construction of planned facilities, as well as for providing information and assistance to affected households. The City Assembly formally adopted the Resettlement Action Plan (RAP), which commits the City to meet all legal requirements, as well as the International Financial Institutions (IFIs) that will participate in the financing of the Project.

According to the latest information obtained by the City, the resettlement status is as follows:

All families that meet the requirements of the Law on Housing and Building Maintenance and adequate housing support was provided and are housed in already constructed apartments of the City of Belgrade in accordance with the Plan of Resettlement of households living in the informal settlement at the landfill site as well as re-establishing the sources of income of the collectors of secondary raw materials at the Vinča landfill.

The City of Belgrade provided assistance to individuals who do not have IDs to obtain them. Persons over the age of 16 have been assisted in obtaining ID cards. Parents were helped to obtain birth certificates for children under 16 years of age.

Prior to the resettlement itself, all children under the age of 14 were enrolled in a preparatory pre-school program and primary school, in accordance with compulsory pre-school and primary education defined by positive RS regulations. Class attendance is monitored on a regular basis in collaboration with school principals, teachers and the Secretariat for Education.

After the resettlement, all the medical records of the persons covered by the project were transferred to the health centers in the new locations. Those who do not have medical records are helped to apply for and obtain medical records at health centers.

Families are employed by the Vinča landfill as collectors, paying housing costs out of their own income. Prior to the resettlement, families were informed of the costs of using the apartments, i.e. households were told that they would have an obligation to pay the rent (if they did not go to their apartment, i.e. house) and utility costs, but also that the City would use subsidies to help them cover these costs, and that the City would also help them with drafting personal documents, enrolling children in school, health care, social protection and finding a job.

The City of Belgrade, the City of Šabac and the Municipality of Vladimirci will assist the persons involved in the project to re-establish and improve their sources of income through the following measures:

- offering seasonal jobs;
- job offers in urban utility companies;
- offering jobs through public works programs;
- offering jobs in collaboration with the NES (development and implementation of individual employment plans, job search training as well as adult training and retraining courses, job

opportunities available, employment mediation, entrepreneurship incentive and development services, special programs for individuals who are at risk; harder-to-employ groups);

- offering employment and self-employment assistance within available programs and projects of NGOs and other organizations (e.g. EU IPA 2016 EU Support Program for Roma Inclusion - Empowering Local Communities for Roma Inclusion, funded by the European Union and implemented by the Permanent Conference of Cities and Municipalities, in cooperation with local governments across Serbia);
- offering adult education and craft training courses;
- offering jobs during the construction phase of the project, at the Vinča landfill and later during the operational phase of the new landfill;

by offering collection and sorting jobs for secondary raw materials at other locations where PUC Gradska čistoća operates (e.g. at locations of future recycling centers).

Since the families were resettled from the informal settlement to the Vinča landfill in September 2018, the Working Group has been monitoring the implementation of the Resettlement Plan for at least two years after resettlement in collaboration with all other organizational units involved in the implementation of the Resettlement Plan.

5.2. AIR

Monitoring of air quality in the local network in the territory of Belgrade is determined by the Program of air quality control in the territory of Belgrade, number 501-164/16-S ("Official Gazette of the City of Belgrade", no. 14/16).

The program is in compliance with the Regulation on monitoring conditions and air quality requirements ("Official Gazette of RS", no. 11/10, 75/10, 63/13) and thus prescribes the following: selection of measuring stations and measuring sites, pollutants to be monitored, sampling methods and methods for determining pollutants, as well as air quality assessment criteria.

The program covers continuous fixed measurements (level of pollutants originating from stationary sources of air pollution in populated areas and level of pollutants originating from stationary sources of air pollution in industrial areas) and indicative measurements (level of pollutants originating from mobile sources of air pollution).

Sampling and measurement of pollutants is carried out 24 hours throughout the year. Data from automatic measuring stations ("real time" measurements) are averaged to 1 hour, and from semi-automatic to 24 hours.

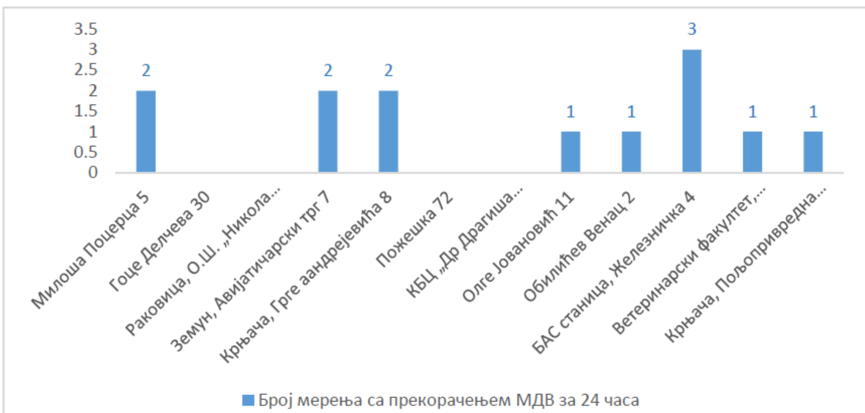
Concentrations of pollutants are expressed as mean hourly and/or mean daily values, except for carbon monoxide and ground-level ozone, which are expressed as mean eight-hour and maximum eight-hour values. The values obtained are expressed in micrograms per cubic meter, except for carbon monoxide, which is expressed in milligrams per cubic meter.

The air quality assessment was performed according to the criteria prescribed in the Regulation on monitoring conditions and air quality requirements.

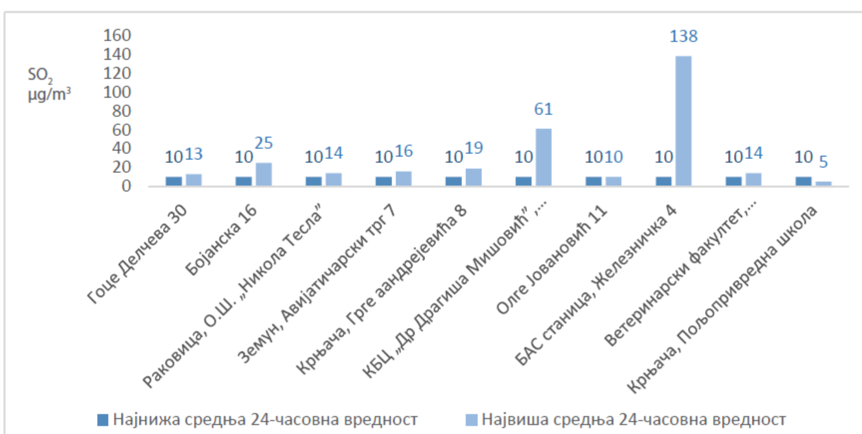
Below are the data from measurement points in the local air quality control network during 2017 (Source: Belgrade Environmental Quality for 2017, City Administration, Secretariat for Environmental Protection, 2018).

The following graphs show the mean values of daily 24-hour measurements of pollutants in the period 01.01.2017 - 31.12.2017, the lowest and highest mean 24-hour values, the number of measurements with exceeding the limit, tolerance value and maximum allowable value (for soot) for 24 hours, as well as the number of measurements with exceeding the limit and tolerance per hour (with automatic measuring stations) at 18 measuring points/stations for continuous fixed measurements of pollutant levels originating from stationary sources of air pollution in populated areas.

Graph 1 The lowest and highest mean 24-hour value for soot for 2017

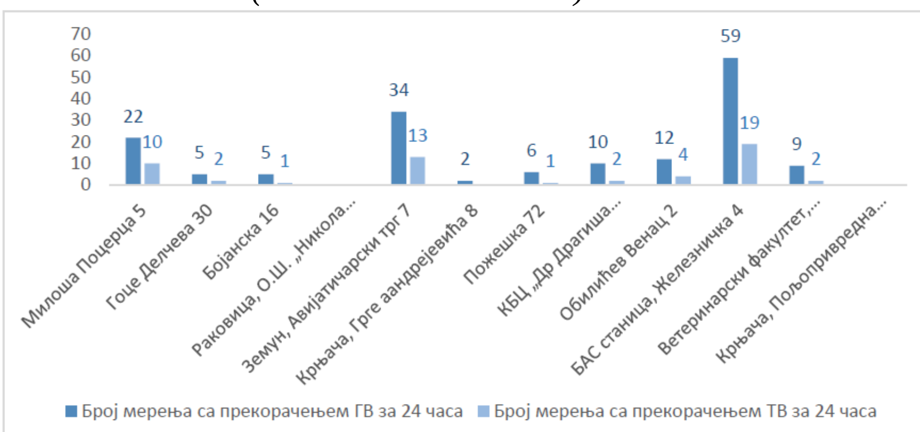


Graph 2 Number of measurements with MDV exceedance for 24 hours for soot in 2017

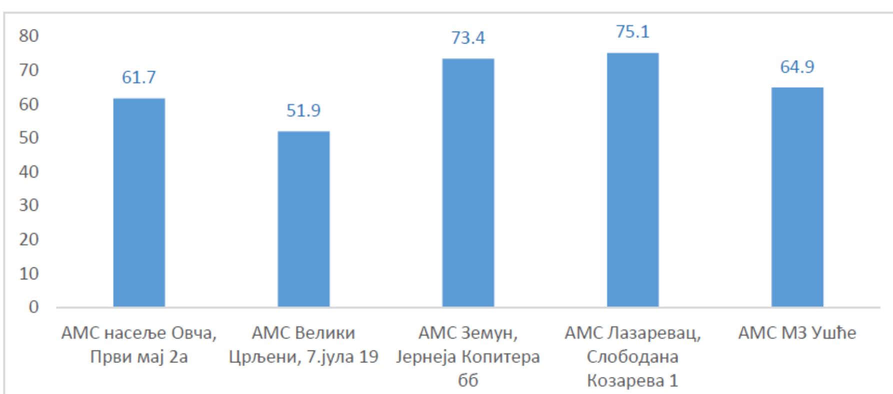


Graph 3 The lowest and highest mean 24-hour values for sulfur dioxide (semi-automatic methods) in 2017.

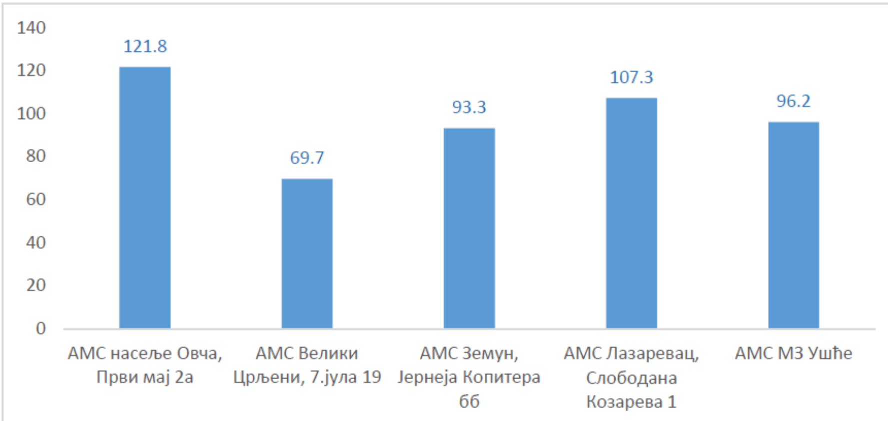
Graph 4 The lowest and highest mean 24-hour values for nitrogen dioxide (semi-automatic methods) in 2017



Graph 5 Number of measurements with MDV exceedance for 24 hours for nitrogen dioxide (semi-automatic methods) in 2017

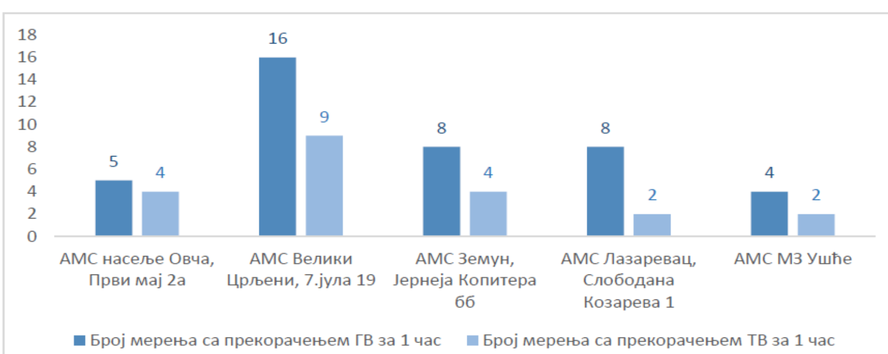


Graph 6 The highest mean 24-hour value for sulfur dioxide (automatic methods) in 2017

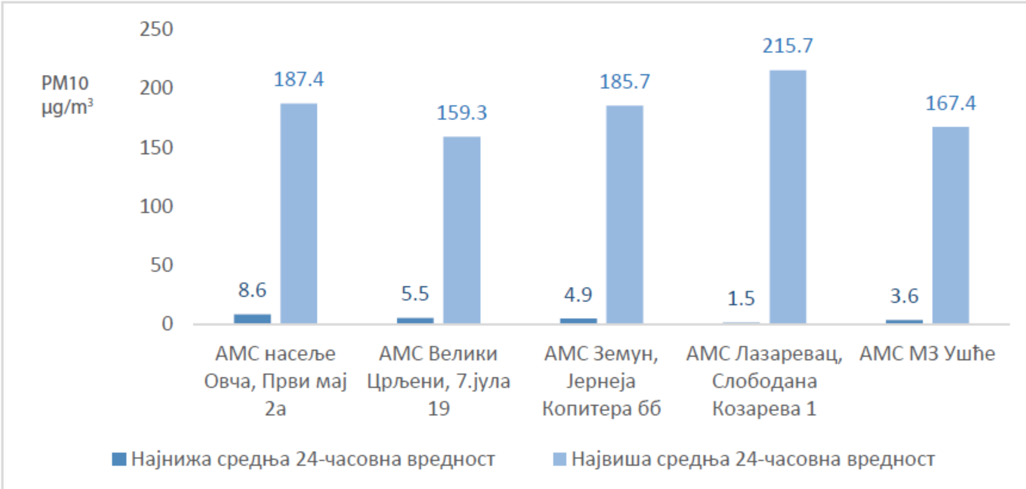


Graph 7 The highest mean 24-hour value for nitrogen dioxide (automatic methods) in 2017

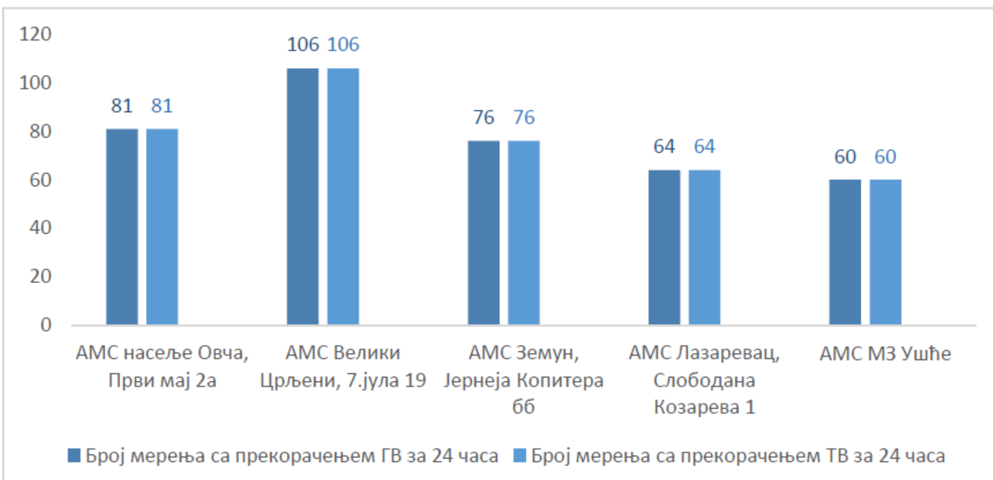
Graph 8 Number of measurements with MDV exceedance for 24 hours for nitrogen dioxide (automatic methods) in 2017



Graph 9 Number of measurements with limit and tolerance values exceeded for 1 hour for nitrogen dioxide (automatic methods) in 2017



Graph 10 The lowest and highest mean 24-hour values for suspended particles (daily measurements) in 2017



Graph 11 Number of measurements with limit and tolerance values exceeded for 24 hours for suspended particles (daily measurements) in 2017

The analysis of the results of continuous fixed measurements of pollutant levels originating from stationary sources of air pollution in inhabited areas within the State and Local Networks in 2017 concluded that PM10 suspended particles and nitrogen dioxide are predominantly present as dominant air pollutants in Belgrade.

During 2017, no increase in radioactivity in the atmosphere was detected in the city of Belgrade. In monthly samples of air and precipitation, low concentrations of radionuclides produced (^{137}Cs i ^{90}Sr), whose presence is a consequence of the Chernobyl accident.

In addition, a natural radionuclide was detected ^{7}Be, whose concentrations in the air ranged from 0.5 mBq/m^3 up to 9.1 mBq/m^3, while in precipitation this interval was 2 Bq/ m^2 up to 79 Bq/m^2. All measured values are characteristic of Serbia. During the summer, slightly higher values were detected, which was expected due to the highly seasonal character of this radionuclide.

In the precipitation samples, an isotope ^{40}K was also present, also of natural origin and the values in which its specific activity was moving did not exceed 40 Bq/m^2, which corresponds to its normal values.

<u>Additional monitoring of air quality during the great fire period in June 2017. (SEPA)</u>

During June 2017, the Vinča landfill was caught by fire. Emerging smoke spread to surrounding parts of the city. During the fire, as well as several days after the extinguishing, the City Institute of Public Health in Belgrade, which regularly monitors 24 measuring stations within the local monitoring network, continuously monitored the concentration of pollutants in the air in Belgrade, with particular emphasis on the situation regarding fire at the Vinča landfill. Particular attention was paid to Lešće, Višnjička Banja, Višnjica, Rospa Ćuprija, Karaburma, Krnjača, Kotež, Borča, Mirijevo, parts of Zvezdara in Belgrade, as well as other parts of the city that may have been affected, even if they are located at a considerable distance from the landfill , because, due to meteorological conditions during the night and during the early morning hours, pollutants do not spread very far. Together with the Secretariat for Environmental Protection of the City of Belgrade, 4 additional measuring stations were set up to monitor the situation in more detail. Additional measuring stations measured between 8 June 2017 and 29 June 2017.

These measuring stations were selected to best demonstrate the impact of the Vinča landfill on air quality:

1. 35 Darinke Jevrić, Višnjička spa with the following parameters: suspended particles (PM_{10}) with analysis of heavy metals, polycyclic aromatic hydrocarbons and ions, benzene and its derivatives, phenolic substances, formaldehyde, acrolein, ammonia;
2. 15 Nova 109. ulica, with the following parameters: total suspended particles with analysis of heavy metals, polycyclic aromatic hydrocarbons and ions, benzene and its derivatives, phenolic substances, formaldehyde, acrolein, ammonia;
3. Environmental Agency, 27a Ruže Jovanović Street with the following parameters: total suspended particles with analysis of heavy metals, polycyclic aromatic hydrocarbons and ions, benzene and its derivatives, phenolic substances, formaldehyde, acrolein, ammonia;
4. Vinča Pumping Station, PUC Belgrade Water Supply and Sewerage with the following parameters: suspended PM particles$_{10}$ with analysis of heavy metals, polycyclic aromatic hydrocarbons and ions, benzene and its derivatives, phenolic substances, formaldehyde, acrolein, ammonia. In addition, a mobile ecotoxicological unit of the City Institute of Public Health in Belgrade visited the site and performed measurements of pollutants.

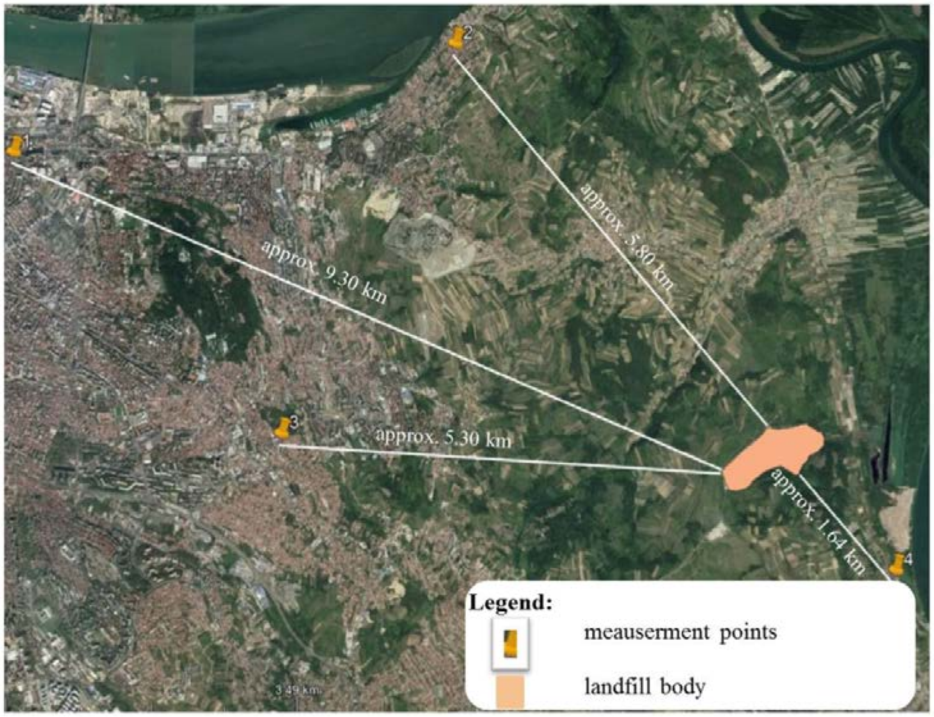


Figure 51 New measuring points for monitoring air quality during the fire (Source: SEPA)

According to the results of the City Institute of Public Health, the results obtained from the network of measuring stations of regular continuous monitoring of air quality in the period from 8 June 2017 to 29 June 2017, did not show exceedance of the limit values of the basic pollutants (carbon monoxide, oxides of nitrogen, sulfur, dioxide, suspended particles (PM_{10}), ground-level ozone), which are covered by program measurement of air pollution in Belgrade.

Results with four additional measuring stations, which measured parameters not covered by regular monitoring (PM_{10}, phenolic substances, ammonia), show that the measured values did not exceed the limit values and maximum allowable concentrations established by the Regulation on monitoring conditions and air quality requirements ("Official Gazette of RS" no. 11/2010, 75/2010 and 63/2013).

The measured concentrations of polycyclic aromatic hydrocarbons did not deviate from the values characteristic of the urban environment, except on days 11 June 2017, 12 June 2017 and 13 June 2017, when a concentration variation was observed depending on the compound. Some compounds tended to decline while some tended to grow. According to the findings of the City Institute for Public Health, oscillations in the concentrations of certain compounds from the group of polycyclic aromatic hydrocarbons are due to the presence of smoke from the fire at the Vinča landfill.

Although the concentrations found were not at levels that could have serious health effects, recommendations were made to vulnerable groups of people (chronic cardiovascular and respiratory diseases, the elderly, children, pregnant women) in terms of reducing outdoor exposure (exposure to smoke) and exposure to odor.

Concentrations of heavy metals (arsenic As, cadmium Cd, nickel Ni, lead Pb) in suspended PM particles$_{10}$ were at a level characteristic of the urban environment. As ammonia and phenolic substances were not detected in the previous monitoring period, these parameters were not included in the monitoring program that began on 12 June 2017.

Results of the zero condition test

For the purpose of determining the zero condition of the quality of the environmental parameters, air quality monitoring was carried out in the wider area of the Vinča landfill complex before the start of works on the planned facilities.

The monitoring program combines continuous monitoring and passive monitoring carried out over the same period. The first monitoring period (January) was representative of winter conditions and, generally speaking, represented a statistically unfavorable period of high concentrations for most pollutants. Sampling and measurement was performed by the City Institute for Public Health in Belgrade, in accordance with standard methods and accreditation, in the period January-February 2018.

Continuous monitoring was performed over 28 days and included the following parameters:

- determination of mass concentration of sulfur dioxide (automatic method);
- determination of the mass concentration of nitrogen dioxide and nitrogen monoxide (automatic method);
- determination of carbon monoxide mass concentration (automatic method);
- PM_{10} particle concentration determination;
- determination of the concentration of heavy metals in PM_{10} particles;
- determination of polycyclic aromatic hydrocarbons in PM_{10} particles;
- determination of the mass concentration of ammonia, hydrogen sulfide, hydrochloride, hydrogen fluoride and volatile aromatic hydrocarbons (BTEX).

Figure 52 Spatial layout of measurement points for "zero" air quality monitoring

The analysis of the results of the measurements revealed that the concentrations of sulfur dioxide, nitrogen dioxide, nitrogen monoxide and carbon monoxide, with an average time period of 1 and 24 h, during the period of air quality testing at a measuring point set near the administrative building within the existing landfill complex in Vinča (A1), did not exceed the tolerance limits defined in the Regulation on monitoring conditions and air quality requirements ("Official Gazette of RS", Nos. 11/2010, 75/2010 and 63/2013).

Analysis of the measurement results revealed that the concentration of PM_{10} articles and heavy metals in it, with a 24-hour aggregate period, exceeded the limit value 9 times during the period of air quality testing at the given location.

No exceedance of the limit value prescribed for lead has been observed. The concentration of heavy metals As, Cd and Ni is prescribed by the annual target value, so it is not possible to comment on the results obtained from 28 days of air quality testing, it is only necessary to note that this mean value during the monitoring period was not higher than the annual standard for air quality.

Benzo (a) pyrene is defined under the Regulation as representing a group of polycyclic aromatic hydrocarbons of compounds in PM_{10} particles through the target value on an annual basis and it is not possible to comment on the results obtained on the basis of 28 days of air quality testing.

Analysis of the results of the measurements showed that the concentrations of ammonia, hydrogen sulfide, hydrogen chloride and hydrogen fluoride, with an aggregation period of 24 hours, were below the quantification limit of the methods used, i.e. there was no exceeding of the maximum allowable concentration of these parameters during the air quality test period.

Regarding the concentration of volatile aromatic hydrocarbons (BTEX), with a 24-hour aggregation period, benzene is recognized by the Regulation as representative of the analyzed compounds through the annual limit value, therefore it is not possible to comment on the results obtained based on a 28-day air quality test period . On the other hand, the results show that the mass concentrations of toluene did not exceed the maximum permissible value for a period of 7 days.

Sampling by passive samplers was done for a period of 15 days between 31 January and 15 February 2018. Passive samplers were placed within 3 km around the location of the landfill (measuring points A2 – A6). Air pollutants measured were: PM_{10}, HF, NO_2, SO_2, HCl, Hg, BTEX and heavy metals. Average concentrations were calculated over a period of 15 days.

Content of PM_{10}, NO_2, SO_2, Pb and benzene are given in the Regulation as a daily and annual target value, therefore it is not possible to properly comment on the results obtained on the basis of the above air quality monitoring, but it should be noted that:

- Levels of NO_2, SO_2 and Pb are much lower than daily AQS
- Benzene concentrations are below the annual AQS, except for the Air 6 measuring point where this value is exceeded
- PM_{10} concentrations are below the daily and annual AQS except for the Air 3 measuring spot.

Continuous measurement over 7 days in the month of April 2018 was performed at three locations (A2, A4 and A6) to determine:

- Mass concentration of nitrogen dioxide and nitrogen monoxide
- Mass concentration of suspended PM_{10} particles.

The three locations where PM_{10} concentrations and nitrogen oxides were monitored are:

- Slanci Monastery (A7);
- 79 Vinčanska Str (A8);
- 27a Ruže Jovanovic Str (A9).

The analysis of the measurement results showed that the concentrations of nitrogen oxides with a one-hour aggregation period during the period of air quality testing at the locations concerned did not exceed the limit or tolerance values defined in the Regulation on monitoring conditions and air quality requirements ("Official Gazette of RS", No. 11/2010, 75/2010 and 63/2013). It was also found that the concentrations of PM_{10} particles at defined measuring points do not exceed the values defined by the Regulation.

5.3. WATER

Quality of surface water on the territory of Belgrade, for more than 40 years, has been systematically controlled by the Belgrade City Institute for Public Health in cooperation with the Secretariat for Environmental Protection. In 2017, monitoring included 24 watercourses from 28 control sites *(Source: Environmental Quality in Belgrade for 2017, City Administration, Secretariat for Environmental Protection, 2018)*.

The purpose of the monitoring is: assessment of the water quality of the watercourses in relation to the relevant regulations, monitoring of the trend of water pollution, assessment of suitability for water supply of Belgrade, Obrenovac, Barič and Vinča, assessment of sanitary status of watercourses and possibilities of health safe recreation of citizens, suitability for fishing, irrigation of agricultural land, monitoring sedimentation of inorganic and organic micro-pollutants in the sediment and bioaccumulation in the hydrobionts, assessment of self-purification capacity, saprobic status and progress of the eutrophication process, provision of data for the design of wastewater treatment facilities, as well as verification of the effectiveness of measures taken to preserve water quality and possible additional remediation measures, protection and promotion.

Monotoring controls the following freshwater ecosystem media: water, sediment and hydrobionts.

The following is determined in the water: general and basic physicochemical, microbiological and biological parameters and elements for classification of ecological potential and assessment of suitability for bathing, as well as priority, priority hazardous and other pollutants.

The following is determined in the sediment: general parameters, heavy and toxic metals, and organic micropollutants, while in hydrobionts (shells and fish) biocumulation of organic and inorganic micropollutants is monitored.

Water quality of the Danube

The Danube is a large lowland river with a predominance of fine sediment and according to the Rulebook on parameters of ecological and chemical status of surface waters and parameters of chemical and quantitative status of groundwater (Official Gazette of RS, 74/2011) it belongs to type 1 water courses.

Of the 33 samples analyzed in 2017, not a single sample of Danube water corresponded to Class II surface water quality.

The exceedances of the norms for the prescribed class are due to the increased values of certain microbiological and physicochemical parameters in 11 (33.3%) samples, while in 22 (66.7%) samples the deviation was recorded only due to certain microbiological parameters.

Of the chemical and physicochemical parameters that support ecological status, constantly within the limits of Class II were: pH value, electrical conductivity, five days biological oxygen consumption (BOD_5), COD permanganate method, COD bichromate method, total mineralization and concentrations: TOC, orthophosphate, sulfate, chloride, nitrate, nitrite and total dissolved phosphorus.

The oxygen regime is more balanced than last year, with fewer deviations from Class II. The exceedances of the limit values are not large, they are all in the Class III of river waters, so they do not endanger the aquatic fauna present.

Tests of the so-called "nitrogen triad" (NH_4, NO_2 and NO_3) show that the loading of the Danube with protein substances is relatively small. Both stages of the mineralization of nitrogenous substances are successfully carried out, which is understandable given the high flow and abundance of oxygen.

The nutrient content (P and N) is relatively low but sufficient to ensure the growth of algae and macrophytes especially in slow-moving parts. The presence of mineral oils was not detected in any of the samples tested. The content of detergents (ABS) and phenol was constantly below the detection threshold for the analytical method used. The situation is practically similar to several previous years.

Of the standard inorganic and organic micropollutants, the methods below were constantly below the detection limits: Cd, Hg, Cr, and PAH, while the presence of different pesticides, As, Zn, Pb, Ni, was sporadically detected in the samples tested.

For many years, the microbiological pollution of the Danube in the area of Belgrade, including Serbia, is larger and more significant than the chemical one, because the sanitary wastewater of Novi Sad, Belgrade and other Danubian cities is discharged into the recipient without any treatment. This is best seen through the abundance of fecal pollution indicator bacteria. Sanitary-microbiological tests show that no sample was within the boundaries of Class II river waters. The number of total coliforms deviated from class II in 22 (66.7%) samples, the number of fecal coliforms deviated from the prescribed class in 28 (80%) samples, while the intestinal enterococcus numbers were increased in 11 (33.3%) samples .

Studies of the macroinvertebrate, phytoplankton and phytobenthos communities, as well as the calculated indices, show that the ecological status of the Danube River in both tested sites is poor. According to the Regulation on Limit Values of Pollutants ("Official Gazette of RS, No. 50/2012) in sediment samples from both sites, none of the tested parameters exceeded the remediation value, which is very favorable. At the site near Batajnica it was found that the concentrations of Cd, Zn, Cu, phenanthrene, fluoranthene, benzo (a) anthracene, benzo (k) fluoranthene and benzo (a) pyrene were above the target values, while the Ni concentration was above the maximum permissible value .

At the Vinča site, it was found that the concentrations of Zn, Cu, Hg, phenanthrene, fluoranthene, benzo (a) anthracene, benzo (k) fluoranthene, benzo (a) pyrene and total hydrocarbons were above the target values and that the nickel concentration was above the maximum allowed.

The insecticide, herbicide, and polychlorinated biphenyl compounds were not registered in the Danube sediment.

The concentrations of Hg and As found in the muscle tissue of the tested fish samples were lower than the reference values. The presence of organic pollutants was not detected in the samples tested.

Examination of the muscle tissue sample of the shell revealed the presence of Pb, Cd, Hg and As, and the concentrations obtained were lower than the reference values. The presence of organic pollutants was not detected in the samples tested.

Comparative results of the Danube water quality, by groups of parameters, on the territory of Belgrade in the last thirteen years, are presented in the following table, but we emphasize that the control parameters and norms have also been changed, so the comparison is not valid:

Table 20 Danube water quality in the period 2004 - 2017 (Source: Belgrade Environmental Quality for 2017, City Administration, Secretariat for Environmental Protection, 2018)

Year	**Nr. of the samples taken**	**In Class II of river waters**		**Outside Class II due to changed parameters**					
				microbe and phys-hem		**only phys-hem.**		**microbiol. only**	
		Nr. of samples	**%**	**Nr. of samples**	**%**	**Nr. of sample s**	**%**	**Nr. of sample s**	**%**
2004	68	27	39.7	10	14.7	5	7.4	26	38.2
2005	68	13	19.2	26	38.2	9	13.2	20	29.4
2006	68	11	16.2	23	33.8	9	13.2	25	36.8
2007	68	20	29.4	17	25.0	8	11.8	23	33.8
2008	68	27	39.7	8	11.8	15	22.1	18	26.4
2009	68	12	17.6	14	20.6	10	14.7	32	47.1
2010	40	10	25.0	13	32.5	6	15.0	11	27.5
2011	40	18	45.0	5	12.5	4	10.0	13	32.5
2012	30	2	6.7	13	43.3	0	0	15	50.0
2013	30	3	10.0	10	33.3	3	10.0	14	46.7
2015	4	0	0	1	25.0	0	0	3	75.0
2016	16	1 6,	6.25	15	93.75	0	0	0	0
2017	33	0	0	11	33.33	0	0	22	66.7

Groundwater quality in Belgrade in 2017

Systematic control of spring water characteristics from public faucets monitors groundwater quality in Belgrade. The program is implemented with the aim of monitoring the environmental status indicators, groundwater quality from sources that can be used as alternative sources of water supply, bearing in mind the preventive role in the protection of public health.

In 2017, the Spring Water Hygiene Control Program covered 30 public fountains/faucets on the territory of the city, with testing of 15 public fountains conducted twice a month throughout the year, and with 15 facilities in suburban settlements, once a month in the period from April until September *(Source: Environmental Quality in Belgrade for 2017, City Administration, Secretariat for Environmental Protection, 2018)*.

Facility name	**Nr. of samples**	**Physically and chemically unsafe**		**Bacteriologically unsafe**	
		Number	**%**	**Number**	**%**
1. Hajdučka česma fountain	24	2	8.3	8	33.3
2. Miljakovac spring	24	0	0.0	13	54.2
3. St. Petka Kalemegdan-after filter.	24	4	16.7	6	25.0
4. St. Petka Mon. Rakovica - after filter.	22	19	86.4	0	0.0
5. Sakinac Avala spring	24	23	95.8	5	20.8
6. Topčider česma fountain - right	24	22	91.7	4	16.7
7. Topčider česma fountain - left	24	23	95.8	5	20.8
8. Kakanjska česma fountain	24	0	0.0	21	87.5
9. Pašina česma fountain II - Zvezdara	24	24	100.0	23	95.8
10. Milošev konak public fountain	22	0	0.0	10	45.5
11. Bele vode pblic fountain	24	0	0.0	22	91.7
12. Zmajevac spring	24	0	0	24	100.0
13. Višnjica public fountain	24	1	4.2	23	95.8
14. Točkić Barajevo spring	24	0	0.0	16	66.7
15. Public fountain Grabovac Institute of Hygiene	24	10	41.7	12	50.0
16. Višnjička Spa	6	5	83.3	5	83.3
17. Boleč public fountain	5	0	0.0	4	80.0
18. Mokroluška public fountain	6	6	100.0	3	50.0
19. Memorial fountain - Letićeva	6	6	100.0	6	100.0
20. Big fountain Beli potok	2	2	100.0	1	50.0
21. Rajnovac Monastery	6	0	0.0	4	66.7
22. Točak Zuce spring	6	6	100.0	6	100.0

23. Jajinci public fountain	6	0	0.0	3	50.0
24. Radmilovac public fountain	3	0	0.0	2	66.7
25. Čelamino Brdo public fountain	6	0	0.0	0.0	0.0
26. Hunter fountain Beli Potok	6	0	0.0	5	83.3
27. Public fountain at Ica Umčari	6	4	66.7	5	83.3
28. Spring Kamenac - Beli Potok	6	3	50.0	5	83.3
29. Zorina česma fountain - Grocka	6	6	100.0	40	66.7
30. Public fountain Pandurice	6	2	33.3	6	100.0
T O T A L	438	168	38.4%	252	57.5%

Based on the results of a laboratory test of the quality of water from public fountains in Belgrade in 2017, it was concluded that the largest number of tested spring water samples did not meet the criteria stipulated in the Rulebook on the hygienic safety of drinking water, which is dominated by microbiological unsafety.

The most common reason for the hygienic unsafety of groundwater from public fountains is bacteriological contamination, which, in addition to the increased total number of coliform bacteria, is also caused by fecal bacteria (E.coli, fecal coliforms and Streptococcus group "D").

The presence of fecal bacteria in groundwater from public fountains indicates poor sanitary and hygienic condition of the facilities and environment and presents a significant hygienic-epidemiological risk for users.

The physico-chemical quality of water is relatively satisfactory in most public fountains, with the exception of the Sakinac spring, Topčider fountains, Mokroluška fountain, Big fountain in Beli Potok, Točak spring in Zuce, public fountain Višnjička Spa, Pašina česma fountain II, public fountain Jajinci, public fountain "at Ica" Kamenac spring, memorial fountain.

Letićeva and Zora's fountains where the most common cause of unsafety is an increase in the nitrate, chloride content and an increase in electrical conductivity.

The purification filter, installed at St. Petka spring in Kalemegdan, gives satisfactory results regarding the conditioning of water that was unsafe for drinking in previous years (before filtering) due to the presence of increased concentration of certain chemical parameters (chlorides, nitrates, arsenic).

The purification filter installed at the St. Petka spring in the Rakovica Monastery gives acceptable results in terms of groundwater conditioning, which is predominantly unsafe for drinking prior to filtration due to the presence of increased concentrations of certain chemical parameters (chromium). However, due to the unregulated level of free residual chlorine in water, a large percentage of chemical unsafety has been registered after chlorination.

The biological quality of groundwater is unsatisfactory in some public fountains, where the finding indicates the possible penetration of surface water into the catchments, as well as the existence of organic sludge, which is an excellent basis for the growth and development of micro and macro organisms, which can significantly affect quality, i.e. hygienic safety of drinking water.

The reasons for the often present hygienic unsafety of groundwater from public fountains should be sought in the negative anthropogenic impact on environmental substrates in the urban area, especially in the fact that no regular infrastructural maintenance of facilities (damage repair, cleaning and disinfection of captures) is carried out, as well as an adequate arrangement of the environment.

Results of the zero condition test

Physico-chemical analyses of surface waters

For the purpose of environmental impact assessment studies for the construction of a new landfill and EfW plant, and in order to determine the current (zero) status of surface water quality at a wide location prior to the commencement of construction works on the rehabilitation of the existing landfill, the construction of a new landfill and EfW plant, sampling and analysis of water samples were performed from a total of 7 locations during March and June 2018: 1st and 2nd Ošljanski stream, 3th Ošljanska pond (small), 4th Ošljanska pond (large), 5th Leachate from the landfill, 6th Danube River (downstream) and 7th Danube River (upstream).

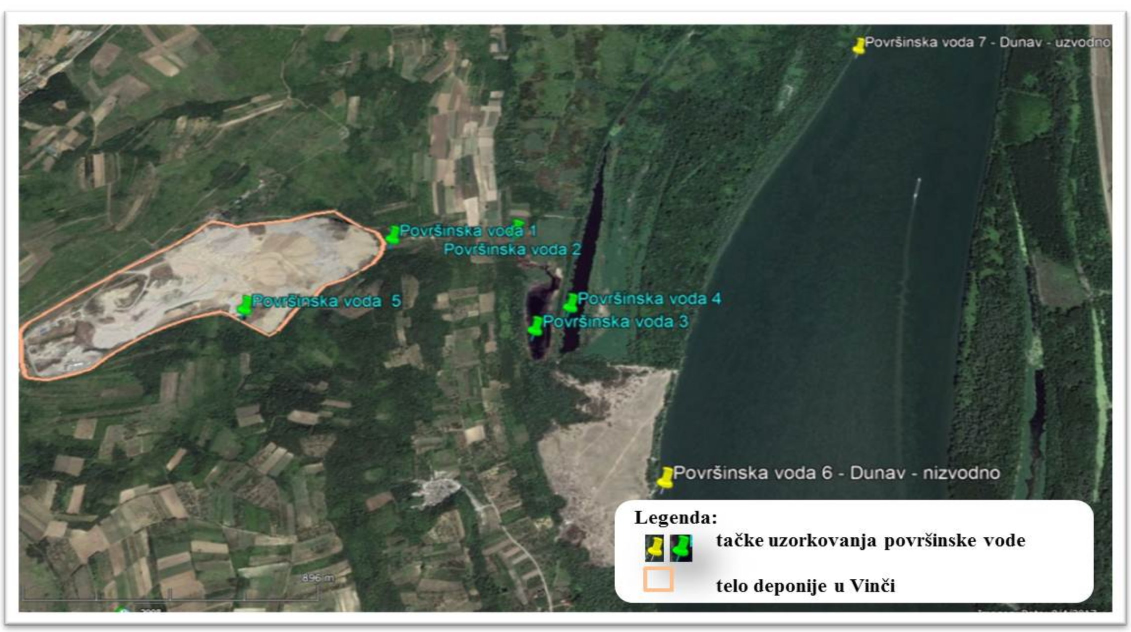


Figure 53 Surface water sampling site in March and June 2018

Sampling and analysis of samples was carried out by the accredited Anahem Laboratory in Belgrade in accordance with standard methods presented in the official report of the laboratory.

The analysis of the samples and interpretation of the results were carried out in accordance with the Regulation on limit values of pollutants in surface and groundwater and sediment and deadlines for their attainment ("Official Gazette of RS", no. 50/2012), Rulebook on Determination of Water Bodies of Surface and Groundwater (“Official Gazette of RS”, No. 96/10) and Regulation on limit values of priority and priority hazardous substances that pollute surface waters and the deadlines for achieving them ("Official Gazette of RS", no. 24/2014).

Since, except for the Danube, these are watercourses not covered by the Rulebook on the identification of surface water bodies and groundwater bodies, ecological status class boundaries for Type VI surface watercourses (watercourses not covered by the Rulebook on the identification of surface water bodies and groundwater bodies ("Official Gazette of RS", No. 96/10)) were used for the interpretation of results.

The table shows the results obtained and the following colors were used to interpret the water classes according to each parameter:

GV CLASS I	GV CLASS II	GV CLASS III	GV CLASS IV	GV CLASS V

Table 21 Results of surface water testing in the landfill area, March and June 2018

Parameter	Unit of Measure	Sample tags (code) and sampling period								
		SW1 (1803281601)	**SW2** (1803281602)	**SW3** (1803281603)	**SW3** (1806191303)	**SW4** (1803281604)	**SW 4** (1806191304)	**SW5** (1803281605)	**SW 6** (1806191301)	**SW 7** (1806191302)
		March	March	March	March	March	June	March	June	June
Color	descriptive	black	black	black	pale yellow	brown/black	pale yellow	black	pale yellow	pale yellow
Odor	descriptive	unpleasant	unpleasant	unpleasant	present	unpleasant	present	unpleasant	present	none
Water temperature	°C	15.4	15.4	15.5	29.0	15.3	29.0	13.7	29.0	29.0
Air temperature	°C	16.2	16.2	16.0	27.4	15.8	28.1	14.1	25.3	24.6
Visible floating matter	descriptive	present	present	present	present	present	none	present	none	none
Turbidity	NTU	29	29	25	0.56	3.5	1.1	30	20	27
Electrical conductivity at 20 °C	µS/cm	21150	16940	18610	389	443	406	6054	442	439
Dissolved oxygen O2	mg/l	5.3	5.2	7.1	6.4	10.1	6.5	3.9	6.8	6.7
pH	/	8.4	8.4	8.3	7.5	7.8	7.5	7.8	7.8	7.7
Evaporation residue (at 105 °C)	mg/l	388	376	8948	264	286	221	3516	237	250
Chemical Oxygen Demand (COD)	mg/l	4855	4951	5794	10	23	20	1110	24	20
Consumption of KMnO4	mgO2/l	1063	724	1105	5.3	4.36	5.6	177	5.8	5.1
Biochemical Oxygen Consumption (BOD5)	mg/l	400	450	600	4.0	10.0	5.0	190	6.0	5.0
AOX	mg/l	2.3	1.6	2.1	< 10	< 0.01	< 10	0.13	< 10	< 10
Total nitrogen	mgN/l	1041	1027	1033	1.1	4.3	0.9	214	1.4	1.6
Total Organic Nitrogen by Kjeldahl	mgN/l	580	605	654	0.69	1.6	0.44	123	0.33	0.35
Ammonia (mg/l NH4-N)	mg/l	449	416	373	< 0.05	1.2	< 0.05	89	< 0.05	< 0.05
Nitrates NO_3^-	mgN/l	12	5.7	6.3	0.43	1.5	0.52	2.3	1.1	1.3

	Nitrites NO_2^-	mgN/l	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
	Total INORGANIC nitrogen	mgN/l	461	422	379	0.43	2.7	0.52	91	1.1	1.3
	Chlorides Cl-	mg/l	2854	2080	2316	19	22	28	936	25	24
	Sulphates SO_4^{-2}	mg/l	443	193	187	28	21	27	194	24	25
	Fluorides	mg/l	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.035	< 0.05	< 0.05
	Sulphides	mg/l	19	16	18	<0.5	<0.5	<0.5	14	<0.5	<0.5
	Sodium Na	mg/l	907	742	693	7.2	12	7.9	308	7.3	65
	Potassium K	mg/l	616	(542)	523.	4.6	2.6	4.7	196	2.9	2.8
	Magnesium Mg	mg/l	84	84	58	8.8	7.9	9-6	56	9	(man) 9-1-1.
	Calcium Ca	mg/l	105	62	74	35	39	40	84	35	34
	Iron Fe	mg/l	19	16	17	<0.3	0.67	<0.3	8.3	<0.3	<0.3
	Manganese Mn	mg/l	0.73	0.58	0.70	< 0.05	< 0.01	< 0.05	0,97	< 0.05	< 0.05
	Bor B	mg/l	5.5	4.5	5.3	< 0.1	0.11	< 0.1	1.9*	< 0.1	< 0.1
	Total organic carbon (TOC)	mg/l	2702	2936	2961	9.7	17.7	10.1	915	6.2	7.8
	Copper Cu	mg/l	350	0.080	300	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
	Total chromium Cr	mg/l	0.82	0.70	0.80	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
	Chromium Cr VI	mg/l	< 0.05	< 0.05	< 0.05	< 0.01	< 0.05	< 0.01	< 0.01	< 0.01	< 0.01
	Lead Pb	mg/l	<0.02	<0.02	<0.02	< 0.01	<0.02	< 0.01	< 0.01	< 0.01	< 0.01
	Zinc Zn	mg/l	0.30	0.38	0.28	< 0.05	< 0.05	< 0.05	< 0.01	< 0.05	< 0.05
	Cadmium Cd	mg/l	<0.005	<0.005	<0.005	<0.0005	<0.005	<0.0005	< 0.01	<0.0005	<0.0005
	Arsenic As	mg/l	0.10	0.068	0,077	<0.001	<0.001	<0.001	< 0.01	<0.001	<0.001
	Mercury Hg	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	< 0.01	<0.001	<0.001
	Orthophosphates	mg/l	26	21	24	< 0.01	0.46	< 0.01	< 0.01	< 0.01	< 0.01
	Cyanides	mg/l	< 0.01	< 0.01	< 0.01	0.004	< 0.01	010	< 0.01	<0.001	<0.001
	Phenolic index	mg/l	104	0.088	1:12	< 0.01	022	< 0.01	< 0.01	< 0.01	< 0.01
	Mineral oils C10-C40	mg/l	12	17	15	< 0.1	1.1	< 0.1	< 0.01	< 0.1	< 0.1
BTEX											
	Benzene, µg/l	µg/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Toluene, µg/l	µg/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Ethylbenzene, µg/l	µg/l	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Xylene, µg/l	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Styrene, µg/l	µg/l	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Organochlorine pesticides											
	Alachlor, µg/l	µg/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Aldrin, µg/l	µg/l	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03

	Atrazine, µg/l	µg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	a-BHC, µg/l	µg/l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
	b-BHC, µg/l	µg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
	d-BHC, µg/l	µg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
	g-BHC, µg/l	µg/l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
	Chlorobenzylate, µg/l	µg/l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
	Chlorothalonil, µg/l	µg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
	Chloroneb, µg/l	µg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
	Dacthal, µg/l	µg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
	p,p'-DDD, µg/l	µg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
	p,p'-DDE, µg/l	µg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
	p, p'-DDT, µg / l	µg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
	Dieldrin, µg / l	µg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
	Endosulfan l, µg / l	µg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
	Endosulfan II, µg / l	µg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
	Endosulfan sulfate, µg / l	µg/l	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
	Endrin, µg / l	µg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
	Endrin aldehyde, µg / l	µg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
	Etridiazole, µg / l	µg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
	a-Chlordane, µg / l	µg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
	g-Chlordane, µg / l	µg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
	Heptachlor, µg / l	µg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
	Heptachlor epoxide, µg / l	µg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
	Methoxychlor, µg / l	µg/l	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
	Permethrin, µg/l	µg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
	Simazine, µg / l	µg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
	Nonachlor, µg / l	µg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Organophosphorus nitrogen pesticides:											
	Ametryn, µg/l	µg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Atrazine, µg/l	µg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Bromacil, µg / l	µg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Butylate, µg / l	µg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Chlorpropham, µg / l	µg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Dursban, µg / l	µg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Cycloat, µg / l	µg/l	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
	Cyanazine, µg / l	µg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

	Dichlorvos, µg / l	µg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Diphenamide, µg / l	µg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	EPTC, µg / l	µg/l	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
	Ethoprop, µg / l	µg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Fenarimol, µg / l	µg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Fluridone, µg / l	µg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Hexazinone, µg / l	µg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Methyl paraoxon, µg / l	µg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Metribuzin, µg / l	µg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Mevinphos, µg / l	µg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	MGK-264, µg / l	µg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Molinate, µg / l	µg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	NaproPAMId, µg / l	µg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Norflurazone, µg / l	µg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Prometon, µg / l	µg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Prometryn, µg / l	µg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Pronamide, µg / l	µg/l	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
	Propazine, µg / l	µg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Simetryne, µg / l	µg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Tetrachlorvinphos, µg / l	µg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Tebuthiuron, µg / l	µg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Perban, µg / l	µg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Triadimephone, µg / l	µg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Trifluralin, µg / l	µg/l	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Polycyclic aromatic hydrocarbons:											
	Acenaphthene, µg/l	µg/l	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
	Benzo (a) pyrene, µg / l	µg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
	Benzo (b) fluoranthene, µg / l	µg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Benzo (g, h, i) perylene, µg / l	µg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Benzo (k) fluoranthene, µg / l	µg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Indeno (1,2,3-cd) pyrene, µg / l	µg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Naphthalene, µg / l	µg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Bacteriological analysis:											

	Total coliforms	cfu/100ml	>24000	2400	2400	>24000	< 10	>24000	>24000	430	4600
	Faecal coliforms	cfu/100ml	40	< 10	230	150	< 10	430	>24000	< 10	40
	Intestinal enterococci	cfu/100ml	>24000	4600	>24000	150	< 10	>24000	2400	< 10	40
	Number of aerobic heterotrophs at 37 °C	cfu/100ml	4.2 x 107	3.1 x 107	5.6 x 107	9.3 x 105	20000	1.68 x 106	9.7 x 106	8.5 x 105	1.15 x 106

Legend: SW1. and SW2. Ošljanski stream, SW3. Ošljanska pond (small), SW4. Ošljanska pond (large), SW5. Leachate from the landfill, SW6. Danube River (downstream) and SW7. Danube River (upstream).

Based on all of the above, it can be concluded that the results of the physicochemical analyzes of the Ošljanski stream and Ošljanska pond at locations SW1, SW2, SW3 and SW5 show that some of the most important parameters that determine water quality (COD, BOD_5, total nitrogen, ammonia, KMnO consumption$_4$, chlorides, phosphates, phenols, electrical conductivity, number of aerobic heterotrophs), have significantly higher values than parameters corresponding to water of Class V. From this it can be concluded that these are uncategorized watercourses, i.e. water out of class. Such waters cannot be used for any purpose and their environmental impact is extremely unfavorable due to the possibility of its contamination. It can be concluded that the surface waters at these sites have poor ecological status from a chemical and microbiological point of view.

For sample SW4, results of physico-chemical analyzes for BOD_5 parameters, phosphates and phenols, correspond to Class IV water, and for parameters total nitrogen, consumption $KMnO_4$ and aerobic heterotrophs, Class III. For parameters HPC, nitrates, chlorides, sulfates, metal content, faecal coliforms, total coliform bacteria and intestinal enterococci, the values obtained correspond to Class I. The better water quality at this site compared to the other four sites is probably due to the dilution due to the increased Danube water level, at the time of sampling. It can be concluded that the site has mixed, excellent to poor ecological status from a chemical and microbiological point of view. Regarding the results of the analysis of samples from sites SW3 and SW4 (Ošljanska pond, June 2018), the water quality is much better.

The results of the physico-chemical analysis of the small Ošljanska pond (sample SW3) show that at the sampling point, most of the analyzed parameters correspond to the quality of water of the first class, except for the consumption of $KMnO_4$ parameter, BOD_5 and total nitrogen corresponding to Class II water quality. Bacteriological analysis shows that for faecal coliforms, total coliform bacteria and intestinal enterococci, the values obtained correspond to Class I, while the values obtained for aerobic heterotrophs correspond to Class V water quality. It can be concluded that at this location, water has a mixed ecological status from a chemical and microbiological point of view.

The results of physicochemical analyzes of the large Ošljanska pond (sample SW4) show that at the sampling location, most of the analyzed parameters correspond to the water quality of Class I, except for the $KMnO_4$ consumption parameter and total coliforms corresponding to Class II water quality and dissolved oxygen, COD and BOD_5 parameters corresponding to Class III water quality. Bacteriological analysis shows that for total coliform bacteria and intestinal enterococci, the values obtained correspond to Class I, while the values obtained for aerobic heterotrophs correspond to Class V water quality. It can be concluded that at this location, water has a mixed ecological status from a chemical and microbiological point of view. The reason for the different values of the quality parameters of these waters analyzed in March and June may be the increase in the amount of wastewater during the sampling period in May, but also in the large amounts of precipitation that were present throughout the month of June, which resulted in the dilution of the water in the pond.

Regarding the results of the Danube River analysis carried out in June 2018 at sites downstream and upstream of the existing Vinča landfill, they show that at the sampling site, most of the analyzed parameters correspond to the quality of water of the first class, except for parameters $KMnO_4$ consumption, total nitrogen, nitrates, and fecal coliforms, corresponding to Class II water quality. Some of the most important parameters that determine water quality (COD, BOD_5, dissolved oxygen, total coliforms) correspond to Class III water quality. It can be concluded that at this location, water has a mixed ecological status from a chemical and microbiological point of view.

Biological analysis of surface water in the project area

The analysis of the status of aquatic ecosystems was done by the expert team of the Institute for Biological Research "Siniša Stanković" from Belgrade in early April and mid-June 2018. Analysis of macroinvertebrate (invertebrate) communities in surface waters at a landfill site was performed on samples taken at the same sites where samples were taken for physical, chemical and microbiological analysis in March 2018.

Due to the increased water level of the Danube at the time of sampling, it was not possible to access the same locations, so the locations where the samples were taken were somewhat different. In a second, additional campaign, conducted in June, selected samples were taken at the same locations as the samples for physico-chemical and microbiological analyses.

Figure 54 Display of sampling sites of aquatic invertebrates at low and high water levels of the Danube, April and June 2018

Table 22 Preview of basic data on sampling sites - surface water

Number	Sample label	Description of sampling location
	April 2018	
1	SW1	The place is located near the body of the landfill and is directly influenced by the waters draining from it. The water body is very polluted, has an intense odor reminiscent of the decomposition of organic matter. Clear indicators of pollution are present in the water - greasy layers on the surface, sediment of intense and unnatural color, residues of various waste and more.
2	SW2	The site is also located near the landfill body and the same conditions were observed as in the case of SW1 sampling site.
3	SW3	The sampling sites are located in the Danube River floodplain, downstream of Veliko Selo and the side branch called Male vode. The water level in this body of water depends directly on the level of the Danube River and is a typical wetland.
4	SW4	
5	SW5	
6	SW6	
	June 2018	
1	SW3	The sampling sites are located in the Danube River floodplain, downstream of Veliko Selo and the side branch called Male vode. The water level in this body of water depends directly on the level of the Danube River and is a typical wetland.
2	SW4	

The biological material was collected using a mesh with a diameter of 500 µm, in accordance with standard method EN 27828: 1998 (Methods for surveying aquatic macro invertebrates in running and standing waters are specified by the international standard). Sampling covered all habitats estimated to cover more than 5% of the target water body.

Research has shown that the presence of macro invertebrates in all of these locations is very weak during both campaigns (April/June).

As for the April 2018 campaign, aquatic invertebrates were not recorded at SW1 and SW 5 locations adjacent to the body of the landfill alone. At sites SW2, SW3, SW4 and SW6, a total of 15 species from 10 different aquatic macroinvertebrate groups were recorded. During the analysis, only species inhabiting aquatic habitats were considered, while for other taxa (terrestrial species) only the presence was recorded.

It is important to note that the hydrological situation for the collection of aquatic macroinvertebrates during the sampling period in April at sites SW2, SW3, SW4 and SW6 was not favorable as it was high water level and a significant part of the area around the wetland was flooded. The communities of aquatic macroinvertebrates in the water-covered area during this period are not representative of the entire water body. This situation does not apply to SW1 and SW5 locations.

Table 23 Results of the analysis of the presence of macro invertebrates in surface waters at the landfill site, April 2018.

Number	Species/taxa	Number of species recorded by sampling site			
		SW2	SW3	SW4	SW2
1	Nematodes				1
2	Limnoodrilus udekemianus Claparède, 1862	4	2	7	5
3	Limnoodrilus sp	3		1	4
	Cyclops sp.	150	110	35	50
	Daphnia sp.	50	41	33	35
4	Niphargus valachicus Dobreanu & Manolache, 1933	2			1
5	Asellus aquaticus (Linnaeus, 1758)	1	22	36	40
	Ostracoda	12	11	6	120
6	Planorbarius corneus (Linnaeus, 1758)				1
7	Viviparus viviparus (Linnaeus, 1758)	1			
8	Hydrobiidae	15	2	11	
	Hygromiidae	20	16	4	1
	Oxyloma elegans (Risso, 1826)	1		1	
9	Dytiscidae	2	4	1	2
10	Tipula sp.	9			2
11	Chironomus sp.	2		4	1
12	Ceratopogonidae				1
	Trichoptera				1
13	Hemiptera	1			
14	Notonecta glauca (Linnaeus, 1758)	1			
	Collembola	2			
	Milipaeda	8			1
15	Argyroneta aquatica (Clerck, 1758)	1			
16	Hydrachnidia	1			1

Based on the results of testing of macro-invertebrate aquatic communities in the wider Vinča landfill, the indicative ecological status of water bodies at SW1 and SW5 can be characterized as poor (Class V), in accordance with all the parameters prescribed in the Regulation on the parameters of ecological and chemical status of surface waters and the parameters of the chemical and quantitative status of groundwater ("Official Gazette of RS", no. 74/2011). It should be noted that it was deliberately stated as indicative, since the status assessment procedure requires a larger number of samples and, by law, is not subject to individual studies for such projects. Water bodies representing samples from sites SW1 and SW5 can be defined as artificial, and therefore their indicative ecological potential can be characterized as poor.

The indicative ecological status of the standing water body, according to the results obtained for samples from sites SW2, SW3, SW4 and SW6, may also be assessed as poor, in accordance with the applicable Rulebook.

In the June 2018 campaign, the apparent similarity of communities is present in both ponds/wetlands, i.e. at both selected sampling points (SW3, SW4, June 2018).

The dominant species in the community are insect larvae, mainly Diptera larvae that make up about 90%. The most common were mosquito larvae (Culex sp.) and hoverflies (Eristalis sp.). Other insect groups include Hemiptera and Coleopteran from the Ditiscidea and Hydrophilide families, with representatives typical of stagnant water that is under high organic pollution. Cleon dipterum (Ephemeroptera) was also recorded at both sites, while a single monocular larva of Ishnura elegans (Odonata/Zigoptera) was recorded at the SW4 site at the larger pond

The indicative ecological status of these permanent waters may be assessed as poor, in accordance with the Rulebook on parameters of ecological and chemical status of surface water and parameters of chemical and quantitative groundwater status ("Official Gazette of RS", no. 74/2011).

Table 24 Results of the analysis of the presence of macro invertebrates in surface waters at the landfill site, June 2018

Number	Species/taxa	Number of species recorded by sampling site	
		SW3	SW4
1	Crustacea		
	Cyclops sp.	5	3
	Ostracoda	1	1
2	Odonata		
	Ischnura elegans	1	0
3	Ephemeroptera		
	Cleon dipterum	5	3
4	Hemiptera		
	Corixa sp.	4	5
	Mesovelia sp.	1	1
	Velia sp.	1	1
	Plea lechi	2	1
5	Coleoptera		
	Agabus sp.	2	3
	Hydrophilidae ad	2	2
	Hydrophilidae Lv	4	4
	Coelostoma sp.	1	1

Number	Species/taxa	Number of species recorded by sampling site	
		SW3	SW4
	Cercion laminatus	1	1
	Laccophilus sp.	1	1
	Helochares sp.	1	1
6	Diptera		
	Eristalis pupae	2	3
	Eristalis sp.	23	20
	Ephidridae pupae	4	2
	Dichaeta caudata	2	3
	Culex sp.	190	220
	Ceratopogonidae	1	1
	Chironomus sp.	4	5
7	Hydracarina	1	1

From all of the above, it can be concluded that it is necessary to continue monitoring the status of these water bodies in order to reach the target class of ecological potential, i.e. the maximum ecological potential that can be achieved in a given water body.

Sediment analysis in the project area

As part of the determination of the zero state of the quality of the environmental parameters, prior to the commencement of works on the construction of the planned facilities, the determination of the quality of sediments was carried out in the wider area of the Vinča landfill complex.

Sampling was conducted on 29.03.2018 by the Anahem laboratory in Belgrade, at 10 measuring points - 7 for soil and 3 for sediment. The analysis of the samples, in order to determine the physicochemical and microbiological parameters, was carried out by the same laboratory, while the determination of the presence of asbestos at 5 out of 10 locations was carried out by the laboratory Institute "Mol" from Stara Pazova.

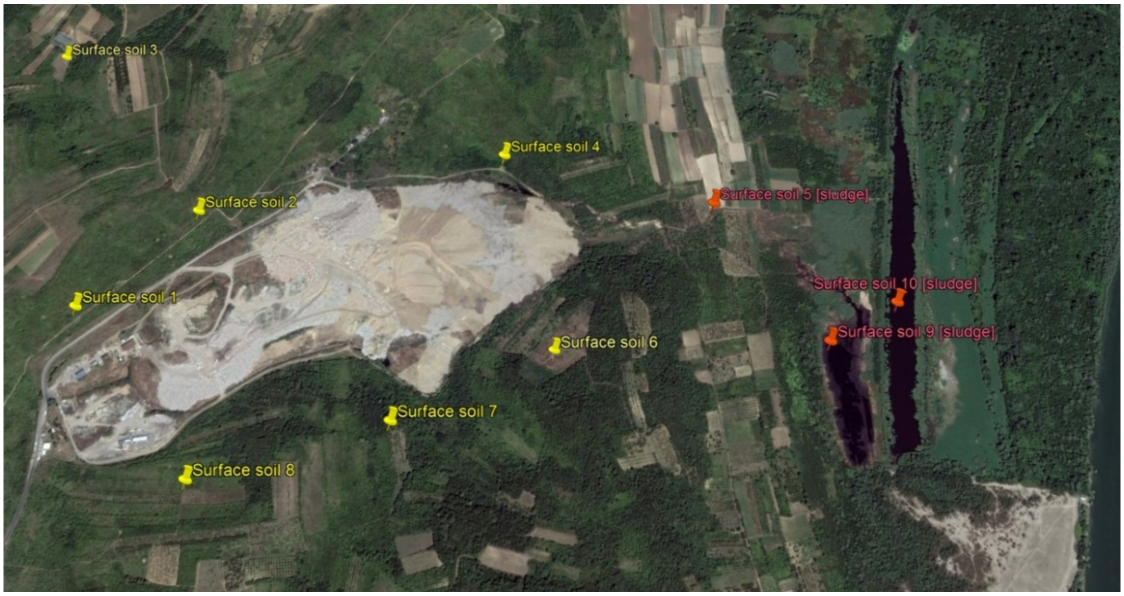


Figure 55 Spatial representation of soil and sediment sampling locations

Table 25 Presentation of basic data on sampling sites - soil and sediments

Number	Measuring point label	Type of sample	Tested for the presence of asbestos
1	Surface soil 1	Soil	NO
2	Surface soil 2	Soil	YES
3	Surface soil 3	Soil	NE
4	Surface soil 4	Soil	YES
5	Surface soil 5 - sludge	Sediment	YES
6	Surface soil 6	Soil	NE
7	Surface soil 7	Soil	YES
8	Surface soil 8	Soil	NE
9	Surface soil 9 - sludge	Sediment	YES
10	Surface soil 10 - sludge	Sediment	NE

The table below shows the results for compounds whose concentration is above the quantification value (> GV), while the concentrations above the detection threshold are indicated in gray.

Table 26 Results of sediment analysis

Parameter	Sample label and corresponding MDK													
	1	* MDK	2	* MDK	3	* MDK	4	* MDK	6	* MDK	7	* MDK	8	* MDK
Dry	82		77		76		82		82		80		80	
Organic substances,	3.4	-	5.5	-	4.8	-	4.6	-	3.5	-	4.2	-	5.1	-
Mineral oils, mg/kg	< 10	50[1]; 5000[2]	< 10	50[1]; 5000[2]	< 10	50[1]; 5000[2]	< 10	50[1]; 5000[2]	< 10	50[1]; 5000[2]	< 10	50[1]; 5000[2]	< 10	50[1]; 5000[2]
pH	6.9	-	7.1	-	7.3	-	7.4	-	7.2	-	7.3	-	7.2	-
Metals, mg/kg														
Cadmium	0.56	0.72[1];	0.60	0.76[1];	0.56	0.73[1];	0.44	0.73[1]; 11[2]	0.45	0.71[1];	0.53	0.72[1]; 11[2]	0.57	0.76[1];
Arsenic	4.5	30[1]; 56[2]	5.1	30[1]; 58[2]	4.8	29[1];55[2]	3.4	29[1];55[2]	2.9	29[1];55[2]	3.9	29[1];55[2]	4.2	31 [1] :
Chromium	49	116[1];	68	116[1];	58	112[1];	31	112[1];	37	114[1];	30	112[1];	39	118[1];
Mercury	0.04	0.32[1];	0.08	0.32[1];	0.13	0.31[1];	0.19	0.31[1]; 10[2]	0.07	0.31[1];	0.05	0.31[1]; 10[2]	0.04	0.32[1];
Copper	41	37[1];	29	38[1];	24	36[1];192[2]	15	36[1];192[2]	15	36[1];192[2]	14	36[1]; 191[2]	16	38[1];
Nickel (Ni)	35	43[1]; 258[2]	78	43[1]; 258[2]	71	41[1];246[2]	35	41[1];246[2]	45	42[1]; 252[2]	31	41[1];246[2]	42	44[1]; 264[2]
Lead (Pb)	17	85[1];	20	89[1];	19	86[1]; 534[2]	12	86[1]; 534[2]	13	86[1]; 533[2]	15	85[1]; 531[2]	16	89[1];
Zinc (Zn)	56	154[1];	55	157[1];	52	150[1];	38	150[1];771[2]	45	151[1];	43	149[1];768[2]	45	160[1];
Other compounds														
HC C_{5-10}, mg/kg	<0.15	-	<0.15	-	<0.15	-	<0.15	-	<0.15	-	<0.15	-	<0.15	-
CVOC (sum),	<0.22	-	<0.22	-	<0.22	-	<0.22	-	<0.22	-	<0.22	-	<0.22	-
Bromides,	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Chlorides,	340	-	6.3	-	316	-	24	-	33	-	19	-	28	-
Fluorides,	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Nitrates,	16	-	47	-	33	-	20	-	67	-	39	-	26	-
Sulphates,	39	-	5.6	-	171	-	12	-	19	-	7.6	-	13	-

** Based on the Regulation on limit values for pollutants, harmful and hazardous substances in soil, Annex 1, "Official Gazette of RS" 30/2018: (1-MDK, 2-remediation value of hazardous and harmful substance).*

Analysis of the surrounding soil samples showed that, in accordance with the Regulation on the systematic monitoring of soil quality, indicators for assessing the risk of land degradation and the methodology for developing remediation programs, Annex 3 ("Official Gazette of RS" no. 88/10):

- The measured copper concentration exceeds the limit value in the soil sample taken at site 1 (surface soil 1), located to the northwest of the boundary of the landfill complex;
- The measured nickel concentration exceeds the limit values in soil samples taken at sites 2 and 3 (surface soil 2, surface soil 3), located northwest of the complex and sites 6 (surface soil 6), located southeast of the complex;
- The measured concentrations of all the analyzed parameters do not exceed the remediation values of the hazardous and harmful substances in the soil.
- Asbestos was not detected in any of the analyzed soil and sediment samples.

Physico-chemical analyses of groundwater

At the site of the Vinča landfill, numerous studies have been carried out in recent years on the state and quality of groundwater from existing and new piezometers and wells, so the results obtained from these surveys can also be considered a zero condition, which is especially true of the research carried out by "Energoprojekt" (continued in the text that follows) - Designing of geological-geotechnical research for the purpose of the construction of the facility for energy utilization of municipal waste (EfW), Summary, Energoprojekt Hidroinženjering, 2017.

All the aforementioned surveys were carried out in the process of preparation for realization of the project of rehabilitation of the existing landfill and construction of new facilities (piezometers), by different actors, depending on the phase of project preparation.

Geological-geotechnical testing for the design and construction of the new and remediation of the old landfill in Vinča, Energoprojekt Niskogradnja, November 2017.

Survey involves examining the content, characteristics and condition of the geological conditions of the area by performing geological, hydrogeological, geophysical, geomechanical, seismological and other explorations. For the purposes of wider testing, more wells and exploration pits have also been excavated.

Table 27 Piezometer Overview, Energoprojekt Niskogradnja, 2017

Label of exploratory activity	Type of exploratory activity	Y	X	Depth [m]	Groundwater level, 2017
Pz-1	piezometer	7468958.44	4960564.25	20	7.35
Pz-2	piezometer	7469090.51	4960244.82	20	12.50
Pz-3	piezometer	7468353.07	4960560.54	25	12.50
Pz-4	piezometer	7468366.38	4959997.38	25	4.00
Pz-5	piezometer	7467691.28	4959733.85	25	17.90
Pz-6	piezometer	7467987.38	4959418.89	25	22.30

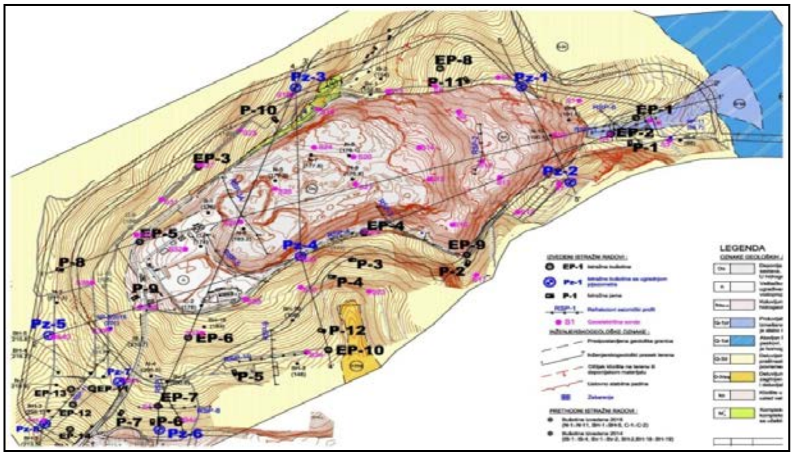


Figure 56 Overview of piezometers (Pz-1 ÷ Pz-8) and other excavated wells and pits, 2017

Groundwater levels in all piezometers specified and data on this are presented in the table for the period 25.10.2017 to 12.13.2017

Table 28 Groundwater level measured in period from 25.10.2017 to 13.12.2017.

Piezometer	Groundwater levels measured (m.a.s.l)						
	25/11/2017	01/12/2017	13/12/2017	01/02/2018	07/03/2018	30/3/2018	Average water level
Pz-1	114.0	113.2	112.9	113.7	/	120.4	7.30
Pz-2	108.0	108.1	108.1	108.5	108.8	108.3	12.50
Pz-3	161.6	162.4	162.7	162.9	162.9	162.8	12.50
Pz-4	161.9	162.3	162.4	162.4	162.5	161.1	4.00
Pz-5	196.1	196.2	196.1	196.1	196.0	194.1	17.90
Pz-6	197.3	196.9	197.0	197.1	197.1	196.3	22.30
Pz-7	194.0	194.0	194.0	193.8	193.8	193.9	16.30
Pz-8	200.4	200.4	200.4	200.3	200.5	199.5	28.00
NP-2	189.3	189.3	189.2	189.0	189.0	188.0	11.80
NP-11	81.3	81.4	81.9	81.7	83.7	81.8	6.70
BH-2	125.3	125.3	125.3	126.0	126.2	125.5	3.40
BH-5	180.0	180.0	180.0	179.9	180.1	179.4	8.00
Asphalt base well	/	/	/	/	/	148.2	/
BVp-2	/	/	/	/	/	93.6	/
BV-5	/	/	/	/	/	100.6	/
BV-7	/	/	/	/	/	93.5	/

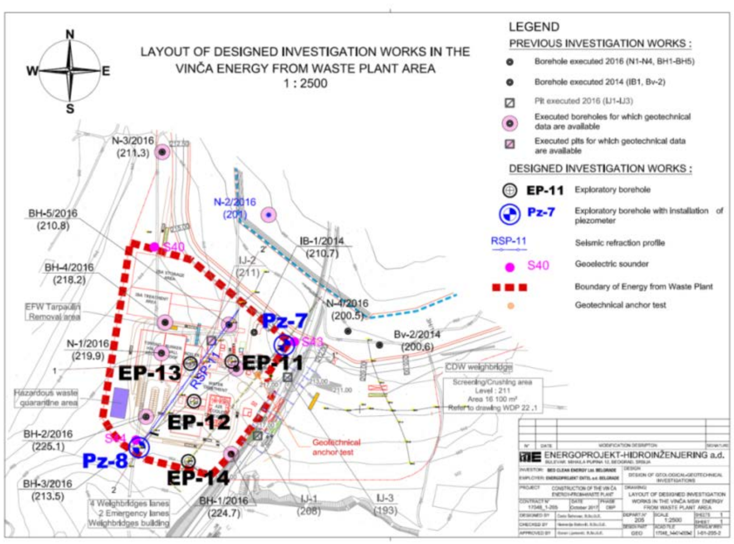
In order to determine the aggressiveness of groundwater on concrete and reinforced concrete, a chemical analysis of groundwater from piezometers (Pz-1 to Pz-6) was carried out, in accordance with the Rulebook on Technical Standards for Concrete and Reinforced Concrete in Subjects Affected by an Aggressive Environment (Official Gazette FRY, No. 18/92).

- Pz-1: Groundwater sample does not show aggressive effects of excretion, general acidity or magnesium aggressiveness but shows carbonate, sulfate and ammonia aggressiveness.
- Pz-2: Groundwater sample shows aggressive excretion effect but does not show general acidity, carbonate, sulfate, ammonia or magnesium aggressiveness.
- Pz-4: Groundwater sample shows aggressive excretion effect and carbonate aggressiveness but does not show general acidity, sulfate, ammonia or magnesium aggressiveness.
- Pz-6: Groundwater sample shows aggressive excretion effect but does not show general acidity, carbonate, sulfate, ammonia or magnesium aggressiveness.

As part of a similar exploration, two additional piezometers, the Pz-7 and the Pz-8, were constructed and equipped for the area where the EfW plant will be built.

Table 29 Designed exploratory wells, piezometers and pits

Label of exploratory activity	Type of exploratory work	Y	X	Depth [m]
EP-11	exploratory well	7467806.77	4959556.47	25
EP-12	exploratory well	7467755.32	4959502.32	25
EP-13	exploratory well	7467750.34	4959553.80	25
EP-14	exploratory well	7467747.62	4959420.09	25
Pz-7	piezometer	7467878.28	4959578.82	30
Pz-8	piezometer	7467680.47	4959438.94	30



Slika 57 Presentation of designed exploratory wells, piezometers and pits - EfW Plant, 2017

Table 30 Groundwater level in piezometers (from 25.10.2017 to 13.12.2017)

Piezometer	Altitude (m.a.s.l)	Groundwater level data (m.a.s.l)						Average relative water level
		25/11/2017	01/12/2017	13/12/2017	01/02/2018	07/03/2018	30/3/2018	
Pz-7	210.2	194.0	194.0	194.0	193.8	193.8	193.9	16.30
Pz-8	228.4	200.4	200.4	200.4	200.3	200.5	199.5	28.00

In order to determine the aggressiveness of groundwater on concrete and reinforced concrete, chemical analyses of groundwater from piezometers (Pz-7 and Pz-8) were carried out, in accordance with the Rulebook on Technical Standards for Concrete and Reinforced Concrete in Facilities Exposed to Aggressive Environmental Action (Official Gazette FRY, no. 18/92). The analysis of groundwater was carried out by the Institute of Public Health of the Province of Vojvodina during November 2017.

Based on the concentration of hydrocarbon, sulfate, magnesium and ammonia, according to the valid Rulebooks, it was concluded that the water from Pz-7 was not aggressive. The analysis performed for Pz-8 is irrelevant since the water sample taken represents the water from the top of the piezometer.

Chemical analyses of groundwater from piezometers (Pz-1 to Pz-6) and existing wells (NP-11 and wells in the asphalt base) were also carried out in order to determine the quality of groundwater, in accordance with the Regulation on the systematic monitoring of soil quality, indicators for assessment of land degradation risk and methodology for drawing up remediation programs (Official Gazette of RS, No. 88/10) Annex 2. - Remediation values for concentrations of hazardous and harmful substances and values that may indicate significant groundwater contamination.

The results of these analyses are presented in the framework of the document entitled "Groundwater Quality Report", which was produced in April 2018 by "Energoprojekt Hidroinženjering" in Belgrade.

For the assessment of groundwater quality, two series of water sampling and analysis were carried out by a certified laboratory Occupational Health and Environmental Protection "Beograd" doo, which are:

- Series I: Sampling was performed in November 2017 at the following locations: NP-11, Pz-1, Pz-2, Pz-4, Pz-5, Pz-6;
- Series II: Sampling was performed in March 2018 at the following locations: NP-11, Pz-2, Pz-4, Pz-5 and water from asphalt base wells.

As mentioned in the Report, these piezometer locations were selected for testing to analyze the impacts of the existing landfill on groundwater quality (NP-11, Pz-1, Pz-2, and possibly Pz-4, located downstream of the existing landfill) and groundwater quality in the part that should not be exposed to the impact of the existing landfill (Pz-5, Pz-6 and the asphalt-based well located upstream of the existing landfill). The results indicate the following conclusions:

The pH of the water in the piezometers varies in the slightly alkaline range, which is 7.2-8 except for NP-11 and Pz-1, where the values in Series I were 6.7 and 6.9 (slightly acidic medium). The turbidity values are generally high, ranging from 2.06 to 136 NTU. Total suspended particulates range from 13 mg/l to 390 mg/l.

High values were registered in the impact zone of the existing landfill (NP-11), which is logical, but also in the asphalt base (185 mg/l). It is interesting to note that the highest turbidity and suspended particulate matter values were registered in Pz-5, which is not exposed to the existing landfill (136 NTU and 390 mg/l).

Electrical conductivity is highest in the impact zone of the existing landfill, i.e. In Pz-1 (12620 µS/cm), Np-11 (4380 µS/cm), Pz-4 (1349 µS/cm) and Pz-2 (1234 µS/cm). The dry residue at 180 °C corresponds to the electrical conductivity value. Of the mineral substances, macro components, chlorides are most common in the area of influence of the existing landfill: Pz-1 (3,711.31 mg/l) and NP-11 (10,515.32 mg/l), while other values were in the range of 6 mg/l to 134 mg/l. The lowest value was registered in the asphalt base.

The high sodium value was registered in the landfill impact zone, at Pz-1, at 2156.9 mg/l. Other values range from 8.1 to 232.8 mg/l. The concentration of bicarbonate is highest in NP-11 (1017mg/l), while the values of this parameter in other piezometers range between 24.5 and 699.2 mg/l. The calcium concentration is highest in Pz-1 (434.4mg/l) and NP-11 (30.3 mg/l).

The highest nitrate concentration was observed in Pz-1 (370.91 mg/l). The values of this parameter for other piezometers range from <0.04 mg/l to 12.92 mg/l. Ammonia concentration was also highest in Pz-1 (21.4 mg/l), followed by Np-11 (2.72 mg/l). In other samples it was below 1 mg/l.

Nitrite concentrations in most samples were <0.04 mg/l and were only 0.08 mg/l in Pz-2 only and 0.3 mg/l Pz-5 only. The concentrations of phosphate and total phosphorus in all samples were <0.08 mg/l 0.01 mg/l, respectively.

Value of biological oxygen demand (BOD_5) was highest in Pz-1 (398mg/l) and NP-11 (63mg/l). On the other hand, very low BOD values$_5$ (1 and 2mg/l) are registered in Pz-2, although this piezometer is influenced by the existing landfill. BOD_5 values in other piezometers range from <1 to 5 mg/l. chemical oxygen demand (COD) values were consistent with BOD_5 values.

Oxygen concentration is directly dependent on the presence of oxidizable substances. Dissolved oxygen concentrations were lowest in NP-11 (3.5mg/l) and Pz-1 (5mg/l), where the lowest values of BOD_5 and COD were also recorded. A low value of oxygen concentration was also recorded in the well of the concrete base (4.1 mg/l).

The well is very deep (300 m), and the water remains for a long period, while the penetration of fresh (atmospheric) oxygen-rich water through a layer of soil about 80 m thick is very slow.

Concentrations of heavy metals are below remediation values, in accordance with the Regulation on the systematic monitoring of soil quality, indicators for assessing the risk of soil degradation and the methodology for designing remediation programs (Official Gazette of RS, No. 88/10), Annex 2. - Remediation values for concentrations of hazardous and harmful substances and values that may indicate significant groundwater contamination.

The only exceptions are:

- the concentration of chromium in Pz-1 (0.1 mg/l), while the remediation value is 0.03 mg/l;
- the concentration of copper in Pz-1 (0.13 mg/l), while the remediation value is 0.075 mg/l;
- the concentration of zinc in Pz-2 (1.62 mg/l) and Pz-5 (1.27 mg/l) while the remediation value is 0.8 mg/l;
- the nickel concentration in Pz-1 (0.73 mg/l) and NP-11 (0.13 mg/l) while the remediation value is 0.075 mg/l.

Analyses include control of mineral oils and cyanides. Mineral oil and cyanide concentrations were below the appropriate remediation values, in accordance with the Regulation.

Based on the water quality analyses conducted in November 2017 and March 2018, it was concluded that samples taken from piezometers exposed to the existing landfill (NP-11, Pz-1, Pz-2 and possibly Pz-4) and those that are not influenced by the landfill differ in their physicochemical composition. Increased concentrations of some parameters (turbidity, suspended particles, nitrites, zinc) were observed to be registered in Pz-5, which is not affected by the existing landfill.

This situation is explained as a consequence of leaching from the surrounding terrain (from the existing landfill zone) and the penetration of pollutants into the groundwater.

As for the deep well on the asphalt base, it was concluded on the basis of an analysis conducted in March 2018 that the existing landfill has no effect on the water quality of the well.

The profile view of the derived piezometers is given in the figure. It is evident that all installed and equipped piezometers are placed in areas not covered by waste. The Pz-4 piezometer is closest to the landfill.

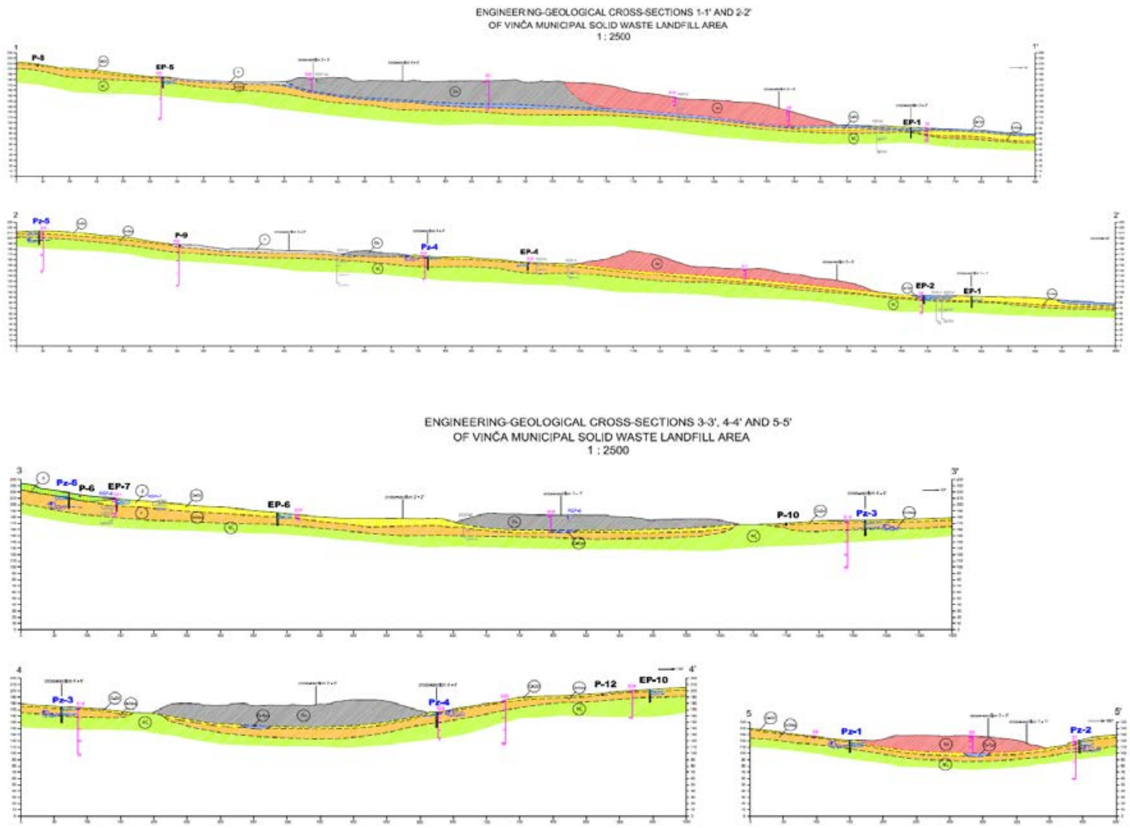


Figure 58 Position of groundwater control piezometers

Groundwater quality testing was also carried out on 02.04.2019. The Anahem accredited laboratory from Belgrade performed sampling and analysis using the methods specified in SPRS EN ISO 5567-1, SRPS ISO 5567-3, SRPS ISO 5567-11 and SRPS EN ISO 19458.

As part of this campaign, water from 13 piezometers was sampled, and 76 different parameters were tested and analysed.

The results of these analyses are presented within the document "19040102 Vinca Sampling 02042019".

Overview of basic parameters of tested samples:

General parameters

None of the measured values exceeds the remediation levels.

Salinity

None of the measured values exceeds the remediation levels.

Oxygen regime

None of the measured values exceeds the remediation levels.

Metals

None of the measured values exceeds the remediation levels except nickel (Ni) in water sampled in the Np-11 piezometer, whose concentration is slightly higher than the remediation level (measured: 96 µg/l; remediation level: 75 µg/l).

Organic compounds

None of the measured values exceeds the remediation levels.

5.4. SOIL

The program of soil contamination testing on the territory of Belgrade in 2017 was conducted by the Belgrade City Institute for Public Health on the basis of the Agreement concluded with the Secretariat for Environmental Protection of the City of Belgrade.

During the implementation of the Soil Pollution Testing Program in Belgrade in 2017, a total of 48 soil samples were sampled and laboratory tested.

In accordance with the purpose of the test, and considering the purpose and the manner of land use, the Program of soil pollution testing in the territory of Belgrade focused on the following areas of testing:

I Soil in the zone of sanitary protection of sources of central water supply systems in the territory of Belgrade - 12 locations

II Soil from the agricultural land - 3 locations

III Soil near major roads - 2 locations

IV Soil from public areas and within non-hygienic settlements - 7 locations

Sampling was performed at depths of 0.10 and 0.50 m at all locations.

During sampling at each location and depth, a composite sample was formed, obtained by capturing land from 3 different places on an area of about 20-30 m^2.

Laboratory testing was performed in accordance with the provisions of ISO 17025: 2006, and the calculation and interpretation of results in accordance with the Regulation on the systematic monitoring of soil quality, indicators for assessing the risk of soil degradation and methodology for the preparation of remediation programs ("Official Gazette of RS", no. 88/2010).

According to the results of laboratory testing of soil composition at 24 locations within the territory of Belgrade (Source: Belgrade Environmental Quality for 2017, City Administration, Secretariat for Environmental Protection, 2018), in certain surface layers of soil (up to 50 cm), in certain locations there is an increase in the concentration of certain test parameters.

Taking into account all the results of soil pollution testing on the territory of Belgrade, the most frequent deviation was related to the increased nickel content in the soil (in 40 out of 48 samples analyzed) in relation to the limit values according to the Regulation ("Official Gazette of RS", No. 88/2010). The finding of increased nickel content in soil is related to the specific geo-chemical composition of the soil surface layers in this area and in most cases is not predominantly caused by contamination of anthropogenic origin. This can be inferred from the analysis of a large number of samples and long-term monitoring of soil contamination in the observed area, since similar concentrations of nickel are observed in most of the studied samples within the GUP (Master Urban Plan) area. A similar situation regarding the content of nickel in the soil is in other areas outside the territory of the City of Belgrade (Smederevo, Požarevac, etc.).

Considering the fact that soil contamination with nickel is possible due to the influence of industry, thermal power complexes, transport, utilities, etc., we cannot completely exclude anthropogenic influence.

For the increase of concentrations of other metals: copper (32 samples), zinc (13 samples), arsenic (3 samples), chromium (2 samples) and lead and cadmium (1 sample each), causes should be sought in adverse environmental influences, mainly as a consequence of the purpose and activities in close proximity to sampling sites (spot contamination) and/or aerosol pollution (diffuse spread of pollutants).

Increased content of organic parameters: total hydrocarbons (C_{10}-C_{40}) (9 samples) and PAU (2 samples) is not so significant in terms of concentrations and locations identified, but indicates that their presence in the soil requires further monitoring, given the long half-life and other significant eco-toxicological characteristics (possible inclusion in the food chain, adverse health effects, etc.).

The presence of registered deviations in the content of heavy metals (primarily nickel) and other pollutants in soil on the territory of Belgrade may, in addition to anthropogenic adverse effects, be related to the implementation of the Regulation ("Official Gazette of RS", No. 88/2010). This Regulation introduced a procedure for determining - calculation of limit and remediation values for each parameter tested, based on the content of organic substances and clay. Given that the above regulation is entirely transcribed from the Dutch legislation, the natural characteristics of the soil composition in our area have not been taken into account. This resulted in non-logical reduced limit and remediation values for some of the tested parameters, which resulted in the finding that almost all the soil samples tested have an increased nickel content. This situation makes it difficult to assess the actual contribution of soil pollution in the particular territory/location.

In the zone of sanitary protection, sources of central water supply systems at 3 locations have registered deviations regarding the concentrations of the tested parameters. These are: Mladenovac Water Supply - B11 well, Serava spring; Obrenovac Water Supply - well no. 2 "Vić bare" and Lazarevac Water Supply - B10 well.

No significant deviations were registered in the samples of soil taken from agricultural areas as well as in the area of influence of major roads in 2017,compared to the standards of the current Regulation.

Surveys conducted on public areas have shown that there is no significant deviation of the content of the tested parameters in the land at the site of the Avala Protected Natural Area - near the Avala Tower and near the "Čarapića brest" Mountaineering Hut.

In contrast, at locations of 3 unhygienic settlements: Jabučki rit, Vuka Vrčevića Street and Čukarička padina there are exceedances of many tested pollutants, mostly heavy metals, some of which exceeded the remediation value in addition to the limit value.

The largest deviations were registered in the soil at the location at Vuka Vrčevića Street, where concentrations over the limit value were: Pb, Zn, Cu, Ni, total hydrocarbons C_{10}-C_{40} and polycyclic aromatic hydrocarbons (PAHs). In this case, the concentrations of zinc (Zn) and copper (Cu) in the sample 10-17-0040 (h = 10 cm), in addition to the limit significantly exceeded the remediation value.

A significant exceedance of the remediation value for arsenic (As) was registered in both samples 17-10-0042 and 17-10-0043 (h = 10 and 50 cm) at the site of the unsanitary settlement "Čukarička padina". In addition to arsenic at this site, the limit values were exceeded by the concentrations of Cd, Zn, Cu, Ni and total hydrocarbons C_{10}-C_{40}.

The content of Zn, Cu, Ni and total hydrocarbons C10-C40 was increased at the site of the unhygienic settlement of Jabučki rit, with the concentration of copper (Cu) in the sample 10-17-0032 (h = 50 cm), in addition to the limit significantly exceeding the remediation value.

The above deviations of pollutants that exceeded the limit value, and some of them significantly exceed the remediation value, indicate at the locations of unhygienic settlements that the soil in the respective locations is under significant load of anthropogenic influence, that is, exposed to the presence of dangerous and harmful substances related to the manner of land use and land regulation.

In the particular case, the finding can be largely linked to land use for the purpose of disposal of the collected secondary raw materials and waste which is improperly collected and disposed of on the land (without protection measures), by applying partial treatment or waste treatment by inadequate procedures..

Results of the zero condition test

As part of the determination of the zero state of the quality of the environmental parameters, prior to the commencement of works on the construction of the planned facilities, the determination of the quality of soil was carried out in the wider area of the Vinča complex.

Sampling was conducted on 29.03.2018 by the Anahem laboratory in Belgrade, at 10 measuring points - 7 for soil and 3 for the sediment. The analysis of the samples, in order to determine the physicochemical and microbiological parameters, was carried out by the same laboratory, while the determination of the presence of asbestos at 5 out of 10 locations was carried out by the "Mol" laboratory from Belgrade.

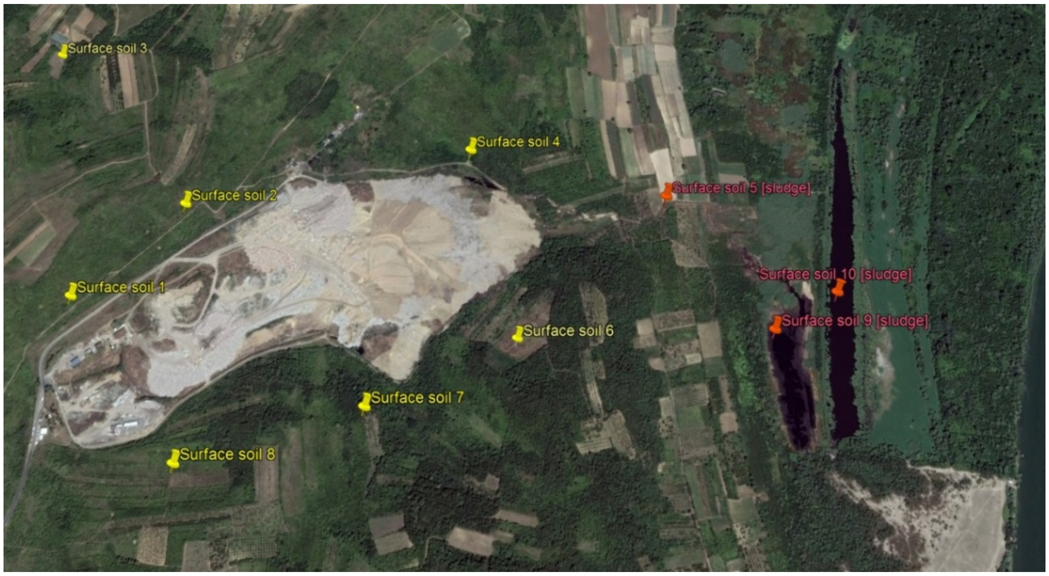


Figure 59 Spatial representation of soil and sediment sampling locations

All soil and sediment samples were subjected to the same analysis. Two soil samples were subjected to analysis of polychlorinated dibenzodoxins and dibenzofuran on 15 March. The table below shows all compounds analyzed in soil and sediment samples.

Table 31 Overview of the compounds analyzed

Sample label	Compound analyzed
Measuring points SS1 - SS4, SS7 - SS9	Metals, chlorinated volatile organic matter (CVOC), polychlorinated aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), C5-C10 volatile hydrocarbons, benzene, ethylbenzene, toluene, xylene (BTEX), bromides, nitrates, fluorides, chlorides, sulfates.
Measuring points SS3* and SS6*	Polychlorinated dibenzodioxin PCDDS and polychlorinated dibenzofuran PCDF

The results of the analysis of soil samples showed that:

In accordance with the regulation in force at the time of measurement (Regulation on the systematic monitoring of soil quality, indicators for assessing the risk of land degradation and methodology for the preparation of remediation programs, Annex 3 (Official Gazette of RS, No. 88/10), the measured concentration of copper exceeds the limit value in the soil sample taken at location SS1 (Surface Soil 1). The exceeded limit value for copper concentration at location SS1 is below the prescribed limit for land remediation, according to the above program;

The measured nickel concentration exceeds the limit values in soil samples taken at locations SS2 and 3 and SS6 (surface soils 2, surface soils 3 and surface soils 6). The exceeded limit value for nickel concentration at locations 2, 3 and 6 is below the prescribed limit for soil remediation, according to the above program.

The measured concentrations of the other parameters analyzed do not exceed the remediation values of the hazardous and harmful substances in the soil in accordance with the above program.

Asbestos was not detected in any of the analyzed soil and sediment samples.

Analysis of the SS3* and SS6* samples showed relatively low concentrations of dibenzodioxin (<56 ng/kg) and dibenzofuran (35.1 ng/kg). The regulation on the systematic monitoring of soil quality, indicators for assessing the risk of soil degradation and the methodology for developing remediation programs defines the remediation values for the concentration of dioxin (1 µg/kg) in soil. If the sum of dioxins (<0.056 µg/kg) is considered, this value is not exceeded in any soil sample.

5.5. FAUNA AND FLORA

Flora and flora habitats

Based on a field study on biodiversity conducted in April 2018, (Environmental Zero Condition Survey for the Vinča Landfill Site, Belgrade, Republic of Serbia, DVOKUT - ECRO doo, June 2018.), the following habitats were found in the planned project area:

Anthropogenic habitats:
- landfill body;
- leachate canals and ponds;

Other anthropogenic habitat types.
- Semi-natural (extremely modified) habitat:
- intermittent flows (streams);

Natural habitats:
- Subcontinental shrubs;
- Subcontinental shrubs and mosaically distributed grasslands.

The habitats of the area surrounding the landfill (planned project protection area) are:

- Anthropogenic habitats:
- Agricultural habitats
- Another anthropogenic habitat types
- Natural habitats:
  - freshwater lakes (oxbow lakes) with associated coastal vegetation;
  - alluvial forests;
  - oak forests.

The distribution of all habitats detected is shown in the figure below.

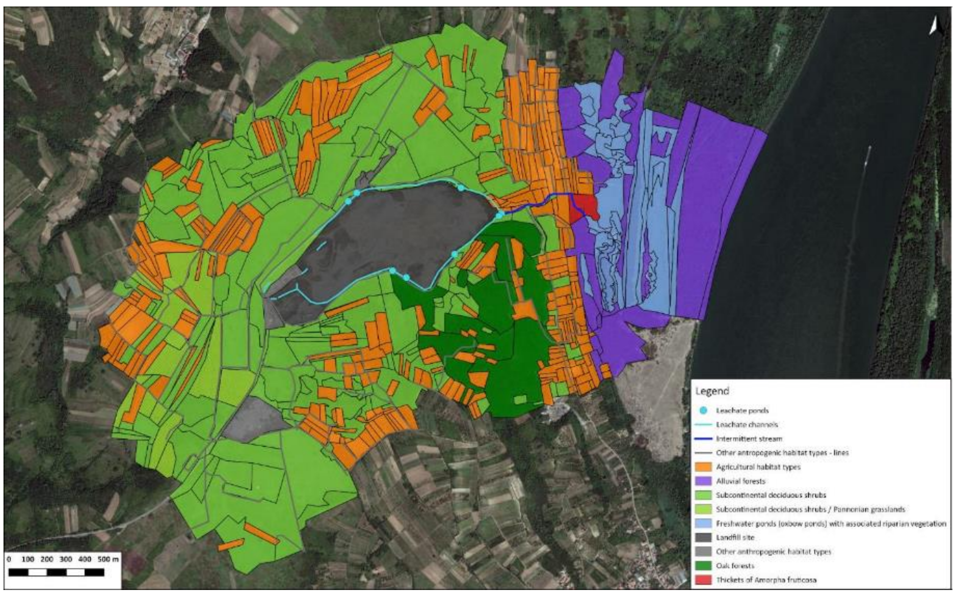


Figure 60 Map of flora habitats, based on data obtained during field research

<u>Habitats on the landfill body</u>

The landfill body was created over decades of waste disposal. Part of the landfill is still active, other parts are partially covered by inert waste/soil. Vegetation, consisting mainly of different species of grasses (Poaceae spp.), narrow-leaved plantago (Plantago lanceolata L.), broadleaf plantago (Plantago major L.), Shepherd's purse (Capsella bursa-pastoris (L.) Medic.) and beet (Brassica rapa L.) began to cover the older parts of the landfill.

Leachate canals and ponds

Leachate canals and ponds are located around the landfill body and occupy a relatively small space. In several locations, small sections of reed beds developed, namely the Scirpo-Phragmitetum Koch 1926 association.

The vegetation at the edges contains dock (Rumex crispus L.), galium (Galium aparine L.), hemmlock (Conium maculatum L.), turnip (Brassica rapa L.), common whitetop (Lepidium draba L.) and grasses (Poaceae spp.)

Agricultural habitats

In the part surrounding the landfill, large parcels of land are used to produce vegetables and fruits. Some of the parcels have been abandoned since then, so there are four types of habitats:

- orchards - in which different types of fruit trees were found: apples (Malus pumila Miller), apricots (Prunus armeniaca L.), cherries (Prunus avium L.), cherries (Prunus cerasus L.), plums (Prunus domestica) and pears (Pirus communis L.);
- abandoned orchards, in which trees are cut or removed and slowly heal;
- arable land and
- abandoned arable land that is in various stages of succession.

Within the project area, most of the agricultural land has been abandoned, however several orchards (south of the landfill body) are still being used.

These habitats, especially those that are still maintained, are under increasing human influence due to the activities that take place. In addition to selective planting, some areas are maintained by burning or applying herbicides, as research has shown. This is emphasized because these practices can have negative impacts on adjacent habitats.

Other anthropogenic habitats

This type of habitat includes various anthropogenic habitats that cover negligible areas and are not important for the conservation of biodiversity in the region. This includes other landfill infrastructures, roads and terrain paths, landfill buildings and handling areas. These are poorly permeable or vegetation-free areas.

This type of habitat also includes a nearby asphalt base nearby and a peacock farm (yard). Landscaping around the landfill has introduced into the environment different plants of some horticultural values, e.g. conifers. Along the paths and roads, nitrophilic ruderal vegetation was formed, characterized by tall herbaceous plants: nettle (Urtica dioica L.) and common dock (Rumex crispus L.).

Occasional watercourses

The Ošljanski stream is classified in this study as an intermittent watercourse based on data obtained from a topographic map (1:25 000) of the Republic of Serbia. The Ošljanski stream flows below the landfill and connects with the leachate. Therefore, its vegetation on the bank is very similar to that in the drainage canals. The vegetation on the bank consists of tall herbaceous plants, characteristic for the soil with nutrients enriched or disturbed: common dock (Rumex crispus L.), galium (Galium aparine L.), hemlock (Conium maculatum L.), thistle (Arctium lappa L.). nettle (Urtica dioica L.). The Ošljanski stream is free of water vegetation. Particles of the invasive false indigo bush (Amorpha fruticosa L.) species developed near the mouth of the Ošljanka pond.

Subcontinental deciduous shrubs

Subcontinental deciduous shrubs are the most widely distributed natural habitat in the planned project area. It developed because the earlier used land was abandoned, which can be deduced from the terraced, now overgrown slopes. Here, succession led to the development of grassland, followed by the development and spread of low shrubs, and in the later stages the formation of well-developed shrubs.

Depending on the location, dense, impenetrable groupings or shrubs developed, or as less dense groups alternating with grass.

The composition of the species is mostly homogeneous, mainly consisting of common dogwood (Cornus sanguinea L.), red hawthorn (Crataegus laevigata (Poir.) DC.) and blackthorn (Prunus spinosa L.). West of the landfill the shrubby vegetation is very dense and completely covered the soil, preventing the establishment of other plant species and impeding the migration of larger animals. Other higher shrub species, such as white hawthorn (Crataegus monogyna Jacq.), field rose (Rosa arvensis Huds.) and barberry (Berberis vulgaris L.), are represented in different percentages. Blackberry groups Rubus spp. are also regularly present. Occasionally smaller specimens of tree species such as elder (Sambucus nigra L.), common hazel (Corylus avellana L.) and Austrian oak (Quercus cerris L.) occur. Invasive species of false indigo bush (Amorpha fruticosa L.) and black locust (Robinia pseudacacia L.) have a significant presence in all locations. In some smaller parts, locust dominates the shrubby vegetation (e.g. north of the landfill).

Subcontinental deciduous shrubs/Pannonian grasslands

In the area southwest of the landfill, shrubs are less dominant and grass species, such as cat grass (Dactylis glomerata L.), false oat grass (Arrhenatherum elatius (L.) P.Beauv. ex J.Presl & C.Presl) and meadow grass (Poa pratensis L.), take up more space. Some of the other species present are common dock (Rumex crispus L.) and white clover (Trifolium repens L.).

Freshwater ponds (oxbow lakes) with associated coastal vegetation

This habitat refers to Ošljanska pond (oxbow lake), located about 600 m from the landfill site.

These freshwater ponds are still partly associated with the Danube, i.e. their water is refreshed during high water levels. This is significant because periodically, at least to some extent, the impacts of leachate inflows can be mitigated.

During the field survey, due to the high level of the Danube watercourses, the oxbow lakes were poorly accessible, which hindered detailed vegetation analysis. Ošljanska ponds have large areas under the Scirpo-Phragmitetum Koch 1926 vegetation, i.e. they were observed during the study of the Phragmites australis reed of considerable size.

These reed habitats are extremely important for maintaining biodiversity, as they are suitable for wetland birds.The beds of the reeds are better developed on areas further away from the mouth of the Ošljanski stream. So, in the area of the oxbow lake near the mouth, thick thickets of the invasive species of false indigo bush (Amorpha fruticosa L.) developed.

Alluvial forests

The alluvial forest in the study area is located in the area around Ošljanska ponds. The vegetation class of Salicetea purpureae Moor 1958 contains willow forests on banks and willow-poplar forests distributed along rivers - on river islands, banks, next to other freshwater bodies (e.g. wetlands, lakes). They are not biogeographically determined, but uniform throughout Europe, determined by the period of the year when their root systems are completely submerged underwater. The dominant species are white willow (Salix alba L.), white poplar (Populus alba L.), black poplar (Populus nigra L.) and gray poplar (Populus x canescens (Aiton) Sm.). Shrubs and parts of the forest are alternately distributed around the Ošljanska ponds.

Invasive species of flora

The planned area of the project is characterized by the presence of invasive plant species: locust (Robinia pseudacacia), false indigo bush (Amorpha fruticosa) and tree of heaven (Ailanthus altissima). Both older (at least ten years) and younger (germinated) samples were found. The locust group occasionally completely suppressed local vegetation (for example, near the asphalt base and instead of some shrubs). The false indigo bush was homogeneously present in areas with subcontinental deciduous shrubs and was also significantly present in grasslands. Tree of heaven specimens have expanded mainly near paths, but have also been found in other habitats.

Young ambrosia plants (Ambrosia artemisiifolia) were found in only one location near the northern edge of the landfill. As this species is known for its rapid dispersal in a disturbed environment, its population is probably in the early stages of local invasion.

Several specimens of gleditsia (Gleditsia triacanthos) have also been found near the Ošljanski stream. This species has already been observed in Serbia and is occasionally locally invasive.

Its invasions have been particularly successful in alluvial forests. Due to the significant degradation of the habitat in the wider area, it can be assumed that this species may have intense invasive potential.

In the area of the oxbow lake in the vicinity of the mouth of the Ošljanski stream (in the protection area of the project), thick thickets of the invasive false indigo bush species developed.

The invasive species discussed above: locust (Robinia pseudacacia), false indigo bush (Amorpha fruticosa), tree of heaven (Ailanthus altissima) and ambrosia (Ambrosia artemisiifolia) have been declared very invasive in Serbia. Disturbed natural environments (such as abandoned farmland, abandoned grassland, polluted land) are vulnerable to invasion, which means that even faster dispersion and population growth of these organisms can be expected in the future, posing a threat to local biodiversity.

<u>Oak forests</u>

In the vicinity of the landfill area, oak forests have not been extensively developed today, i.e. they cover limited fragments with significant areas of forest edges that fall into the shrub habitat category described earlier. They are located southeast of the landfill. The main determinant species of tree species is Austrian oak (Quercus cerris L.), however the following elements are predominant (mixed forest): field maple (Acer campestre L.), common hazel (Corylus avellana L.), common dogwood (Cornus sanguinea L.), honeysuckle (Lonicera caprifolium L.), blackberry (Rubus spp.), field elm (Ulmus minor L.). As in other habitat types, invasive species are also present in this habitat, such as locust (Robinia pseudoacacia L.).

Fauna and fauna habitats

During the field survey (Ecological Zero Condition Survey for the Vinča Landfill Site, Belgrade, Republic of Serbia, DVOKUT - ECRO doo, June 2018), traces of wild boar (mud digging) were found in the southern part of the planned project area of the Belgrade landfill in Vinča. Desirable habitats for this species are well-developed forests, so this finding indicates that fauna individuals occasionally use this area as food.

The landfill provides very good shelter and food source for large populations of different small rodents such as mice (Mus spp., Apodemus spp.) and rats (Rattus spp.). The brown rat population dominates the landfill relative to the black rat, which is the original species. A large number of small mammals (mice and field voles) are present throughout the study area (within the planned project and protection area).

Significant populations of small rodents are the main source of food for the (Martes foina), which has been observed to hunt on the southern border of the present landfill.

The most commonly distributed species of reptiles were the common wall lizard (Podarcis muralis). These lizards are very easily visible in places under direct sunlight, such as natural and artificial vegetation-free areas. They were usually present in groups of up to five specimens. The dense population of the wall lizard species was in the planned project area as well as in the protection area.

This pattern is conditioned by the large diversity of insects associated with the landfill (for example, Diptera species), which are an important source of food for lizards. Another species of reptile recorded in the planned project area was the Lacerta viridis, which is a species that prefers natural habitats such as shrubs and thickets.

The landfill offers adequately protected and wet habitats for species (Julidae sp.) and terrestrial isopods such as (Porcellio scaber). Populations of Helicidae family snails are often found in places shaded by vegetation. Various spider webs have been found in shrub-covered areas, with typical representative ones (Pisaura mirabilis).

The most common and largest group of insects present in the landfill are Diptera of the family Muscidae, Calliphoridae and Sarcophagidae. The Diptera larval stages, known as worms, were the only invertebrates present in the landfill waters of the landfill and in the Ošljanski stream, which implies significant resistance of these organisms to the polluted waters.

The entire study area, and especially around the surrounding the Ošljanski stream, is inhabited by a large and diverse mosquito population, Diptera (Culicidae).

The second largest group of insects in the landfill, after the order of Diptera, were cockroaches (Blattodea) represented by two species of German cockroaches (Blatella germanica) and cockroaches (Blatella orientalis) that were very easily spotted in and around the landfill within the planned project area.

A variety of flowering herbaceous plants and flowering shrubs provide feeding for nectar-feeding insects. Nine butterfly species from the following families are present at the site: Hesperiidae, Nimphalidae, Papilionidae, Pieridae, Licaenidae, Erebidae and Hesperiidae.

The common beetle found on flowering plants was (Cetonia aurata). The order of Hymenoptera was represented by Apidae and Vespidae with significant dominance of the western honey bee (Apis mellifica). Some specimens of this order are also found on the body of the landfill. The order Hemiptere was represented by three species from the families of Pirrhocoridae and Pentatomidae. The most dominant species of this order was the firebug (Pirrhocoris apterus), which was very easily detected due to its bright color and specific behavior (grouping of specimens).

Small fragments of grassland were inhabited by ants (Formicidae) and nymphs of crickets (Tettigoniidae). Beetles of the Coccinellidae family have been found in plants infected with the members of parasitic aphids.

Only two insects associated with wet and aquatic habitats were observed: one specimen of damselfly (Lestidae) and one specimen of water beetle (Ditiscidae), but not associated with the leachate from the landfill.

During the bird survey at the Vinča landfill, 57 bird species were recorded (Bird Survey at the Vinča City Landfill - Preliminary Report Prepared by Marko Šćiban and Nikola Stanojević of the Serbian Society for the Protection and Study of Birds (DZPPS) in April 2018). Some species of birds use the body of the landfill for food and rest, while some species only fly in the study area.

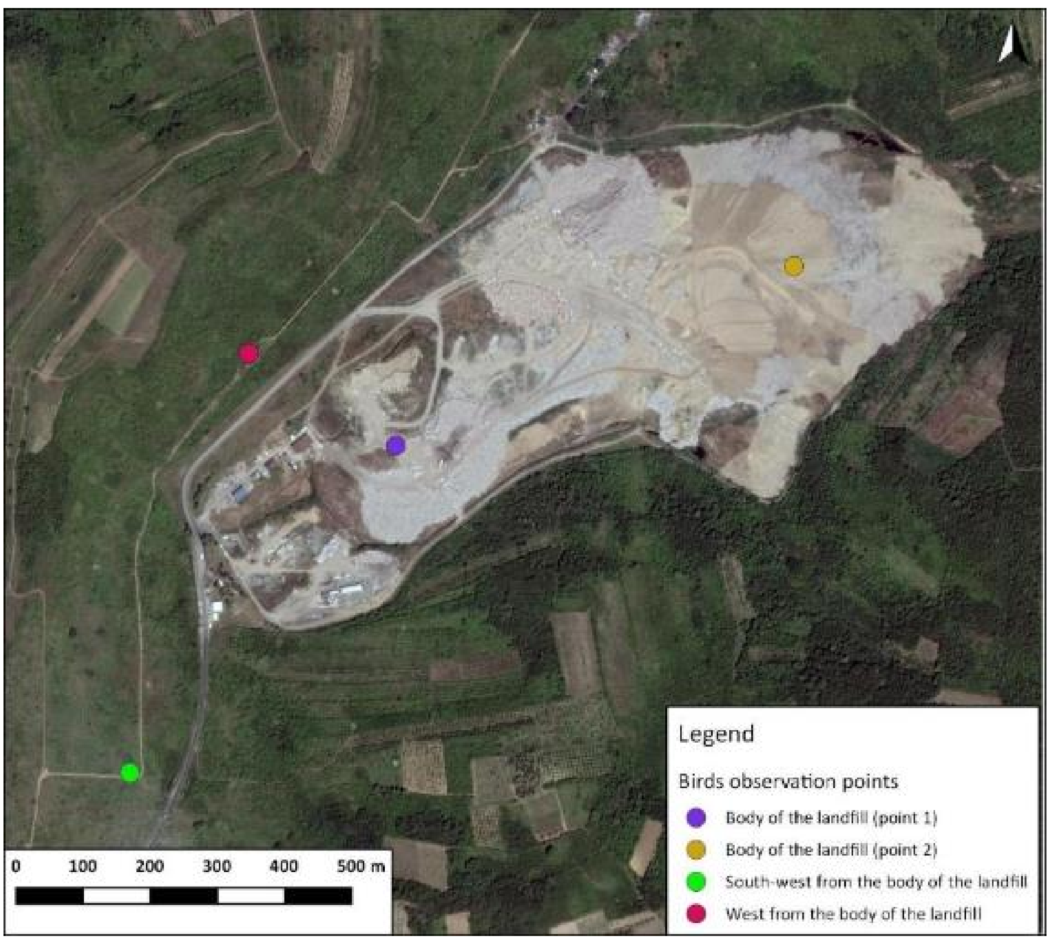


Figure 61 Birdwatching points within the planned project area

The most common species was the common gull (Larus ridibundus) with an estimated population of about 3,000 specimens in the landfill. Other common species such as blue gull (Larus cachinnans/michahellis), brown gull (Larus fuscus) and large crows (Phalacrocorax carbo) have also been reported, but with significantly smaller populations.

Seagulls (Larus spp.), wstorks (Ciconia ciconia), common starling (Sturnus vulgaris) and species from the crow family (Corvidae) are present in the vicinity of the landfill staff and waste disposal vehicles. Kinds of predators kept some distance and spent most of their time in parts of the landfill where waste disposal did not take place.

Birds of the Danube River and the oxbow lake of Ošljan Dead are characterized by the presence of wetland species (such as Aithya nyroca, Spatula clypeata, Spatula querquedula, Mareca strepera, Podiceps nigricollis, Microcarbo pigmaeus).

Species of flora and fauna of particular interest - endangered and protected species

For the purpose of conducting an environmental impact assessment study, a bird survey was conducted in the aforementioned wider area of the Vinča landfill throughout the calendar year, within 4 campaigns. Relevant ecological data on locally distributed species and specificities associated with the subject area were collected.

The preliminary survey was conducted in April 2018 (Bird Survey at the Vinča Landfill, Preliminary Report, Society for the Protection and Study of Birds, Novi Sad, April 2018, authors: M. Šćiban, N. Stanojević). More surveys followed after: in September/October 2018 (Bird Survey on the Landfill and Surroundings in Vinča in Belgrade during the Bird Migration from September to October 2018, Preliminary Report, October 2018, Serbian Ornithological Action League, author: D. Simić) and December 2018 (Bird Survey at the Vinča Landfill and Surroundings in Belgrade during December 2018, Preliminary Report, January 2019, League for Ornithological Action of Serbia, author: D. Simić). In October 2018, available literature and field data were summarized in the Review of Preliminary Bird Observations at the Vinča Landfill and Surrounding Areas (published by Dragan Simić, League for Ornithological Action of Serbia).

Monitoring of bird populations continued during May and June 2019 (Bird Breeding Survey at the Vinča Landfill in Belgrade in May-June 2019, Preliminary Report, July 2019, D. Simić, M. Raković).

Preliminary Survey April 2018

During the April survey, 56 bird species were recorded at the Vinča landfill. Many species actually used the landfill for feeding and resting, while some species were only recorded in passage, i.e. flying above the study area. The most abundant species was the common gull (L. ridibundus) with over 6,000 individuals observed in the landfill which flew and rested on the Danube (OP6). Three species attracted more attention than the others: the smaller brown gull (L. fuscus), of which less than 13 individuals represented one of the largest numbers of this species ever observed at the site (Šćiban et al. 2015); black-headed gull (L. melanocephalus), species believed not to be attracted to the landfill and recorded only once in the locality, and black kite (M. migrans), species in the national high-risk category and small population of which 1- 2 individuals spent considerable time in the locality, indicating possible multiplication in the vicinity. One newly recorded active nest of the white-tailed eagle (H. albicilla) is in the protection zone. Seagulls, white storks, common starlings and species from the crow family were feeding close to the landfill staff and operational vehicles, while predator species kept some distance and spent most of their time in parts of the landfill where no waste was deposited.

Flooded retentions found between the landfill and the Danube (Vinča pond) have not been surveyed before, and its significance for the migration of waterfowl has not been established so far. Several rare species and species of conservation importance (A. niroca, S. clipeata, S. kuerkuedula, M. strepera, P. nigricollis, M. pigmaeus) were noted during this survey, indicating the importance of this wetland for conservation.

September-October 2018 Survey

At the end of September and the first half of October 2018, 47 (+1) species were recorded in the landfill and buffer zone, defined as an area 1.5 km away from the landfill. The most numerous were the two dominant species of seagulls (marine and common) in small thousands, followed by the common starling and the common wood pigeon in small hundreds, followed by 13 additional species, recorded in the range of 10 to 99 individuals. Another 31 species were registered within the range of 1 to 9 individuals. The number of white-tailed eagles in the early morning at Vinča pond was particularly high, with up to 6 individuals. Most were too far away to determine their age, but unlike the others which would fly, try to hunt or just fly away, the two birds sat side by side, motionless all the time, suggesting they were a territorial couple. Although heavily polluted by the wastewater of the landfill, Vinča pond is generally the site of the most developed biodiversity in the study area, where, among others, mute swan, norther shoveler, gadwall, mallard, Eurasian teal, little grebe, Eurasian coot, dunlin, common snipe, marsh sandpiper, common gull, pygmy cormorant, great cormorant, gray heron, great white heron, little white heron, sparrowhawk, white-tailed eagle, common buzzard, common kestrel, along with various singing birds, including recorded white wag tail (at the climax of migration, 20 individuals), as well as mountain pipits (in the Balkans, it is a species of high mountains, common above the tree line).

Southeastern slopes have a wide variety of habitats and therefore the greatest diversity of species. As seagulls use the area as a flight corridor (and to a lesser extent Vinča pond as a resting place), the total number of birds recorded in this area is close to that recorded in the landfill.

The number of species recorded in the landfill and northwestern slopes is half, or less than half, of those recorded in the southeastern slopes. In terms of species and individual numbers, the northwestern slopes were the poorest area of the studied area.

Survey December 2018

In the mid to late December 2018, 31 species were recorded at the landfill and in the buffer zone. The most abundant species was the common gull (up to 21,000), followed by the larus, gull-billed tern and blue gulls in their lower hundreds, followed by the rook and Eurasian teal with about 100 individuals. Several species deserve more attention in winter: (sea)gulls (all species) as a group that directly uses the landfill, mainly as a feeding and habitat area, recently increased numbers of gray herons (5x) staying in the landfill, territorial white-tailed eagle in Vinča pond and numerous mountain pipits that use the pond as a winter roost.

May-June 2019 Survey

A total of 51 bird species were recorded during the survey, 12 of which were protected and 37 strictly protected by national legislation (Strictly protected wild species of plants, animals and fungi, 2010/2011). Four (4)of the recorded species have been included in the "Red Data Book of the Fauna of Serbia III Birds" (Radišić et al., 2018), and one of them is at risk of extinction - the European turtle dove.

Of the total 51 species detected, of which 36 were recorded to multiply, 6 as possible multiplication species, further 22 species as probable for multiplication and finally 8 species as confirmed for multiplication. Another 15 species were observed in non-multiplication activities. A total of 224 breeding pairs were recorded. Of these, the seven most numerous species taken together had 156 pairs, or 69.4%. Taken separately, the two most numerous species, the common sylvia warbler and the common nightingale, with 78 breeding pairs occupy more than one third, 34.8% of the total number of active nests.

Table 32 Observed protected and strictly protected bird species and their layout generally within the planned project area

Species	National protection status*	Apr-18			September-October 2018			December 2018			May 2019	June 2019
		On the body of the landfill	Southwest of the landfill body	West of the landfill body	Southwest of the landfill body	On the body of the landfill	Northwest of the landfill body	On the body of the landfill	Landfill complex	Buffer zone (green belt)	Landfill complex	Landfill complex
Gray partridge (Perdix perdix)	PROTECTED		✓									
Pheasant (Phasianus colchicus)	PROTECTED	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
Common Woodpigeon (Columba palumbus)	PROTECTED	✓				✓	✓		✓		✓	✓
Collared Dove (Streptopelia decaocto)	PROTECTED	✓			✓						✓	✓
White Stork (Ciconia ciconia)	STRICTLY PROTECTED	✓									✓	✓

Gray Heron (Ardea cinerea)	PROTECTED	✓			✓				✓			
Great Cormorant (Phalacrocorax carbo)	PROTECTED		✓		✓				✓			
Black-headed Gull (Chroicocephalus ridibundus)	PROTECTED	✓			✓	✓	✓	✓	✓	✓	✓	✓
Black-headed gull (Larus melanocephalus)	STRICTLY PROTECTED	✓										
Common Gull (Larus canus)	PROTECTED	✓						✓				
Lesser Black-backed Gull (Larus fuscus)	STRICTLY PROTECTED	✓				✓						
Black kite (Milvus migrans)	STRICTLY PROTECTED	✓										
Common Buzzard (Buteo buteo)	STRICTLY PROTECTED	✓			✓	✓	✓	✓	✓	✓	✓	✓
Common Kestrel (Falco tinnunculus)	STRICTLY PROTECTED	✓			✓	✓	✓	✓			✓	✓
Eurasian Jay (Garrulus glandarius)	PROTECTED	✓			✓	✓	✓		✓		✓	
Common Magpie (Pica pica)	PROTECTED	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
Eurasian Jackdaw (Corvus monedula)	PROTECTED	✓				✓		✓			✓	✓
Rook (Corvus frugilegus)	PROTECTED	✓			✓	✓		✓	✓		✓	

Common Raven (Corvus corax)	PROTECTED	✓			✓	✓	✓	✓	✓	✓	✓	✓
Gray crow (Corvus cornix)	PROTECTED	✓										
Great Tit (Parus major)	STRICTLY PROTECTED			✓	✓		✓		✓		✓	✓
Blue tit (Parus caeruleus)	STRICTLY PROTECTED			✓								✓
Farm swallow (Hirundo rustica)	STRICTLY PROTECTED	✓										
Long-tailed Tit (Aegithalos caudatus)	STRICTLY PROTECTED		✓		✓		✓					
Common Chiffchaff (Phylloscopus collybita)	STRICTLY PROTECTED	✓		✓	✓	✓						
Eurasian Blackcap (Sylvia atricapilla)	STRICTLY PROTECTED	✓	✓		✓						✓	✓
Eurasian nuthatch (Sitta europea)	STRICTLY PROTECTED	✓										
Common Starling (Sturnus vulgaris)	PROTECTED	✓		✓	✓	✓	✓		✓		✓	✓
Song thrush (Turdus philomelos)	STRICTLY PROTECTED	✓		✓								
Black redstart (Phoenicurus ochruros)	STRICTLY PROTECTED			✓								
European stonechat (Saxicola torquata)	STRICTLY PROTECTED		✓									

Eurasian Tree Sparrow (Passer montanus)	PROTECTED		✓		✓	✓	✓	✓	✓	✓	✓	✓
White Wagtail (Motacilla alba)	STRICTLY PROTECTED	✓			✓	✓			✓		✓	✓
Yellow wagtail (Motacilla flava)	STRICTLY PROTECTED	✓										
Meadow Blinkers (Anthus pratensis)	STRICTLY PROTECTED			✓								
Mountain Blinker (Anthus spinoletta)	STRICTLY PROTECTED	✓										
Common Chaffinch (Fringilla coelebs)	STRICTLY PROTECTED	✓			✓			✓				
European greenfinch (Carduelis chloris)	STRICTLY PROTECTED		✓									
Eurasian siskin (Carduelis spinus)	STRICTLY PROTECTED			✓								
Common linnet (Carduelis cannabina)	STRICTLY PROTECTED	✓										
Hawfinch (Coccothraustes coccothraustes)	STRICTLY PROTECTED		✓								✓	✓
Mute Swan (Cygnus olor)	PROTECTED						✓		✓			
Northern Shoveler (Spatula clypeata)	STRICTLY PROTECTED				✓							

Gadwall (maraca strepera)	STRICTLY PROTECTED				✓							
Common Quail (Coturnix coturnix)	PROTECTED											✓
Mallard (Anas platyrhynchos)	PROTECTED				✓						✓	✓
Eurasian Teal (Anas crecca)	PROTECTED				✓				✓			
Little Grebe (Tachybaptus ruficollis)	STRICTLY PROTECTED				✓				✓			
Feral Rock Dove (Columba livia f. Domestica)					✓	✓	✓	✓	✓	✓	✓	✓
Common Woodpigeon (Columba palumbus)	PROTECTED					✓	✓		✓		✓	✓
Turtle Dove (Streptopelia turtur)	PROTECTED										✓	✓
Common Whitethroat - Sylvia communis	STRICTLY PROTECTED											
Lesser Whitethroat - Sylvia curruca	STRICTLY PROTECTED										✓	✓
Barred Warbler - Sylvia nisoria	STRICTLY PROTECTED										✓	✓
Common Cuckoo (Cuculus canorus)	STRICTLY PROTECTED										✓	✓
Common Swift (Apus apus)	STRICTLY PROTECTED											✓

Eurasian Nightjar - Caprimulgus europaeus	STRICTLY PROTECTED											✓
Eurasian Coot (Fulica atra)	PROTECTED				✓							
Dunlin (Calidris alpina)	STRICTLY PROTECTED				✓							
Common snipe (Gallinago gallinago)	STRICTLY PROTECTED				✓							
Marsh sandpiper (Tringa stagnatilis)	STRICTLY PROTECTED				✓							
Black stork (Ciconia nigra)	STRICTLY PROTECTED											✓
Whiskered tern - Chlidonias hybrida	STRICTLY PROTECTED											✓
Yellow-legged Gull (Larus michahellis)					✓	✓	✓	✓	✓		✓	✓
Caspian Gull (Larus cachinnans)	PROTECTED							✓				
Yellow-legged / Caspian Gull (Larus michahellis / cachinnans)	PROTECTED								✓			
Great black-backed gull (Larus marinus)	STRICTLY PROTECTED					✓						
Pygmy cormorant (Microcarbo pygmaeus)	STRICTLY PROTECTED				✓							

Great white egret (Ardea alba)	STRICTLY PROTECTED				✓						✓	
Little Egret (Egretta garzetta)	STRICTLY PROTECTED				✓							
Eurasian Sparrowhawk (Accipiter nisus)	STRICTLY PROTECTED				✓							
White-tailed eagle – (Haliaeetus albicilla)	STRICTLY PROTECTED				✓	✓	✓	✓	✓		✓	
Little owl – (Athene noctua)	STRICTLY PROTECTED											✓
Long-eared owl – (Asio Otus)	STRICTLY PROTECTED											✓
European bee-eater (Merops apiaster)	STRICTLY PROTECTED										✓	✓
Eurasian golden oriole (Oriolus oriolus)	STRICTLY PROTECTED										✓	✓
Eurasian wryneck (Jynx torquilla)	STRICTLY PROTECTED										✓	
Great spotted woodpecker – (Dendrocopos major)	STRICTLY PROTECTED								✓		✓	✓
Syrian Woodpecker (Dendrocopos syriacus)	STRICTLY PROTECTED								✓			
Great spotted / Syrian Woodpecker	STRICTLY PROTECTED				✓				✓			

(Dendrocopos major / syriacus)												
Red-backed shrike (Lanius collurio)	STRICTLY PROTECTED											
Eurasian Hobby (Falco Subbuteo)	STRICTLY PROTECTED										✓	
Hooded Crow (Corvus cornix)	PROTECTED				✓	✓			✓	✓	✓	✓
Barn swallow (Hirundo rustica)	STRICTLY PROTECTED											
Spotted flycatcher – (Muscicapa striata)	STRICTLY PROTECTED					✓						
European rrobin (Erithacus rubecula)	STRICTLY PROTECTED				✓							
Black redstart (Phoenicurus ochruros)	STRICTLY PROTECTED				✓	✓						
Eurasian Blackbird (Turdus merula)	STRICTLY PROTECTED				✓	✓					✓	✓
Water pipit (Anthus spinoletta)	STRICTLY PROTECTED				✓				✓			
House sparrow (Passer domesticus)	PROTECTED					✓		✓			✓	✓
Green sandpiper (Tringa ochropus)	STRICTLY PROTECTED											
Common nightingale	STRICTLY PROTECTED											

(Luscinia megarhynchos)												
European goldfinch – (Carduelis carduelis)	STRICTLY PROTECTED											✓
European Serin (Serinus serinus)	STRICTLY PROTECTED											✓

It is very likely that at least some species observed southwest of the landfill body or west of the landfill body nests in this area, such as partridge (Perdix perdix), pheasant (Phasianus colchicus), Eurasian magpie (Pica pica), great tit (Parus major), blue tit (Cyanistes caeruleus), long-tailed tit (Aegithalos caudatus), common chiffchaff (Phylloscopus collybita), Eurasian blackcap (Silvia atricapilla), common starling (Sturnus vulgaris), song thrush (Turdus philomelaxos), Europeanstonechat (Saxicola torquata), field sparrow (Passer montanus), meadow pipit (Anthus pratensis), European greenfinch (Carduelis chloris), Eurasian siskin (Carduelis spinus) and the hawfinch (Coccothraustes coccothraustes). For other species, such as the large crow (Phalacrocorax carbo), the habitats found in this area are not adequate for breeding.

Two protected plant species were discovered at the border of the planned project area - gavez (Symphytum officinale L.) and small-leaved linden (Tilia cordata Mill.), and as individuals. However, two species that represent the supporting elements of the shrub habitat within the planned project area are protected - the hawthorn (Crataegus laevigata (Poir.) DC) and white hawthorn (Crataegus monogyna Jack).

5.6. NOISE LEVEL IN THE ENVIRONMENT

The communal noise in Belgrade is mostly driven by traffic, while industry, small businesses, construction and other activities are of minor importance.

During 2017, the measurement of communal noise in Belgrade was carried out in 2 cycles, at 35 measuring points in the city, selected in consultation with the Secretariat for Environmental Protection. Measuring points were selected as representatives of individual urban areas of different purposes, as well as along the most important roads. Based on the measurement results, it can be generally concluded that the measured communal noise levels were high (relative to the normalized values) over the observed period.

According to the measurement results (Source: Belgrade Environmental Quality for 2017, City Administration, Secretariat for Environmental Protection, 2018), noise levels from 35 monitored locations exceeded the prescribed values at 28 measurement points (for day, evening and night).

The measurement points according to the numbering given in the list of noise measurement locations belong to the following zones:

- points no. 1, 4, 5, 17, 18, 19, 24, 27, 27, 28 and 31 residential area (permitted levels for day 55 dB (A) and for night 45 dB (A));
- points no. 6, 9, 11, 12, 13, 14, 15, 20, 21, 22, 23, 32, 33, 34 and 35 next to the traffic roads (day 65 dB (A), night 55 dB (A));
- points 2, 3, 8, 10 and 16 in the city center area (day and evening 65 dB (A), night 55 dB (A));
- points 7 and 30 in the industry zone (noise level should correspond to the level determined for the zone with which the industry borders);
- point no. 27 in the school zone (day and evening 55 dB (A), night 45 dB (A));
- point no. 13 in the hospital area (day and evening 50 dB (A), night 45 dB (A));
- point no. 11 in the recreation area (50 dB (A) per day, evening and 40 dB (A) per night).

The first measurement cycle

Residential area				
No.	**Measuring point**	**Day**	**Evening**	**Night**
1	Juri Gagarin 259	63	63	55
4	Nemanjina 2	62	61	57
5	Zahumska 23	57	56	55
17	Gandijeva 55a	66	65	59
18	Radojke Lakić 15 entrance II	50	48	40
19	Pohorska - Post of Serbia	61	62	58
24	Stevana Filipovića 32	61	68	56
27	Ugrinovačka 147	63	61	58
28	Perside Milenković 1	24	24	24
31	Hopovska 26	46	53	46

Road traffic zone			
6	Blagoja Parovića 82	65	64
9	Krivolačka - Dž Voždovac	59	57
11	Vojvode Mišića 43	65	65
12	Vojvode Stepe 66	64	64
1	Ustanicka - Dz Vozdovac	57	57
14	122 Despot Stefan Boulevard	72	72
15	Zemun - Main, Madlenianum Theater	68	67
20	Karađorđeva 23	73	71
21	Borča - Bele Bartok 26	56	52
22.	Arsenija Čarnojevića	61	58
23	Goce Delčeva 1	66	66
32	Mirijevski bulevar 10	65	64
33	Nedeljka Gvozdenovića 54	64	64
34	Jovana Brankovića	64	68
35	Vojvođanska	67	65

City center area				
2	70 Kralja Aleksandra Boulevard	67	67	62
	Kraljice Natalije 66	72	68	65
8	Uzun Mirkova - Ethnographic Museum	60	59	58
10	Dalmatinska 1	65	66	59
16	Jug Bogdanova 3	66	65	59

Industry zone				
7	Kraljice Jelene 22	64	64	58
30	"Grmeč" Republic Geodetic Authority	58	55	53

School zone			
Zemun - High School	49	54	24

Hospital area				
13	Clinical Center	58	56	53

Recreation area				
11	Kalemegdan - Art Pavilion of Cvijeta Zuzorić	46	45	38

- **Values that exceed the permitted levels for a particular zone**
- Values below the permitted level for a particular zone

During the first measurement cycle in the residential area, noise exceeded the allowable level for the day, evening and night at most measurement points. In this zone the measured levels are higher than allowed by an average of 7 dB (A) per day, 8 dB (A) in the evening regime and in the night regime by an average of 12 dB (A).

In the area of traffic roads where noise measurement is carried out at 15 locations, the noise level at 8 measuring points exceeded the limit value for the day, by an average of 2.87 dB (A). In the evening regime, the noise level averaged over 3.57 dB (A) at 7 measurement points. The limit values for the night were exceeded by 12 measurement points, on average by 5.50 dB (A).

In other measurement points according to zones of purposes, which exceeded the permitted levels, exceedances ranged from 0.7 dB (A) to 12.6 dB (A) for day and night.

The second measurement cycle

Residential area				
1	Juri Gagarin 259	69	57	52
4	Nemanjina 2	64	64	61
5	Zahumska 23	59	56	53
17	Gandijeva 55a	65	69	57
18	Radojke Lakić 15 entrance II	46	44	39
19	Pohorska - Post of Serbia	66	66	61
24	Stevana Filipovića 32	61	61	55
27	Ugrinovačka 147	63	61	58
28	Perside Milenković 1	50	47	42
31	Hopovska 26		5	48
Road traffic zone				

6	Blagoja Parovića 82	68	67	61
9	Krivolačka - Dž Voždovac	58	58	52
11	Vojvode Mišića 43	65	65	62
12	Vojvode Stepe 66	61	60	56
1	Ustanicka - Dz Vozdovac	68	66	61
14	122 Despot Stefan Boulevard	70	70	65
15	Zemun - Main, Madlenianum Theater	66	65	62
20	Karađorđeva 23	73	72	68
21	Borča - Bele Bartok 26	51	50	46
22.	Arsenija Čarnojevića	66	65	62
23	Goce Delčeva 1	65	65	59
32	Mirijevski bulevar 10	65	64	60
33	Nedeljka Gvozdenovića 54	65	63	59
34	Jovana Brankovića	64	63	59
35	Vojvođanska Surčin	65	63	59

City center area				
2	70 Kralja Aleksandra Boulevard	66	65	61
	Kraljice Natalije 66	66	65	63
8	Uzun Mirkova - Ethnographic Museum	60	59	58
10	Dalmatinska 1	55	56	51
16	Jug Bogdanova 3	67	65	64

Industry zone				
7.	Kraljice Jelene 22	66	65	63
30	"Grmeč" - Republic Geodetic Authority	63	59	56

School zone				
27	Zemun - High School	44	44	36

Hospital area				
13	Clinical Center	58	56	54

Recreation area				
11	Kalemegdan - Art Pavilion of Cvijeta Zuzorić	48	46	39

In the second measurement cycle, the noise level in the residential zone exceeded the permitted level at 7 measuring points for daytime as well as for evening regime, while at 8 measuring points the limit values were exceeded in the night regime. In this zone, the measured levels are higher than allowed by an average of 8.85 dB (A) per day, 7 dB (A) in the evening and 10.75 dB (A) per night.

The measurement results show that in the zone along the traffic roads the noise level was within the permissible limits at only one measuring point in all three regimes, while at 5 measuring points the noise level did not exceed the limit values in the day and evening regimes. Out of a total of 15 measuring points in this zone, the night-time noise level was exceeded at 12 locations by an average of 5.91 dB (A).

In the central parts of the city, noise was within the permissible limits at all measuring points in the evening regime, while at two locations the measured noise level did not exceed the limit values in any of the three regimes.

Noise levels measured in the school and recreation area did not exceed the limit values.

Based on deviation of indicator L_{day} , $L_{evening}$ and L_{night} of the limit values in the first measurement cycle and in the second cycle during 2017, it is concluded that at a large number of measuring points the noise level exceeds the limit values with respect to the assumed acoustic zone to which it belongs, for the night and evening and for the daytime regime.

Results of the zero condition test

To determine the zero condition, noise levels were monitored in the wider area of the Vinča complex before the works on the plants planned started. Noise measurements were performed in March 2018 at 10 measuring points by the City Institute of Public Health and in accordance with standard methods and scope of accreditation.

Table 33. Results of noise level measurements in the wider area of the Vinča landfill complex

Measurement results	
Designation of the measuring point	Noise level equivalent measured L_{AeqT} [dBA]
NM7	65.9
NM6	75.1
NM4	41.3
NM5	44.9
ST3	39.3
NM1	50.3
ST6	51.6
ST5	45.9
ST2 (1)	45.3
ST2 (2)	48.2
ST1-1	48.5
ST1-2	47.1

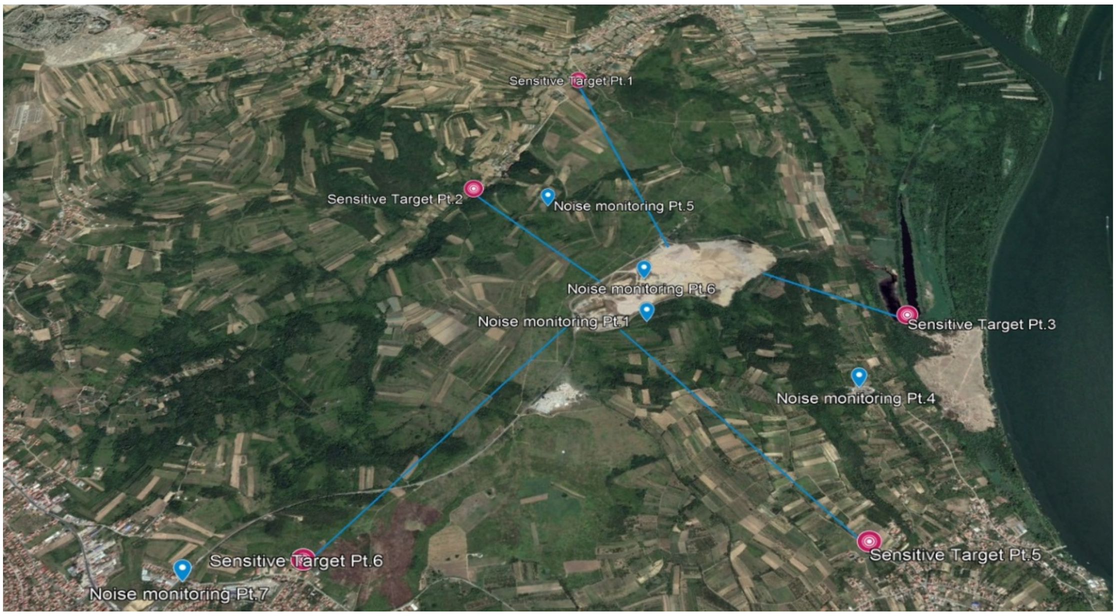


Figure 62. Spatial representation of measuring points for determining noise levels in the wider area of the Vinča landfill complex

In accordance with the Law on Environmental Noise Protection ("RS Official Gazette", No. 36/2009 and 88/2010), Regulation on noise indicators, limit values, noise indicators assessment methods, annoyance and harmful effects of environmental noise (Official Gazette of the RS, No. 75/10) and the Rulebook on the methods of noise measurement, content and scope of the noise
measurement reports (“RS Official Gazette” No. 72/10), it is estimated that:

- The measured noise level of 66 dB at the NM7 measurement point EXCEEDS the 65 dB limit, outdoors, in daytime and evening mode. According to the Regulation, this measuring site is located is in zone 5 "City center, craft, commercial, administrative zone with apartments, zone along highways, main and city roads";

- The measured noise level of 54 dB at the measurement point ST6 DOES NOT EXCEED the 65 dB limit, outdoors, during the day and evening. Likewise, the measured value of 48 dB at this measuring site DOES NOT EXCEED the 55 dB overnight limit. According to the Regulation, this measuring site is located in Zone 5 "City center, craft, commercial, administrative zone with apartments, zone along highways, main and city roads";
- The measured noise level of 54 dB at the measurement point ST5 DOES NOT EXCEED the 55 dB limit, outdoors, during the day and evening. Likewise, the measured value of 43 dB at this measuring site DOES NOT EXCEED the 55 dB overnight limit. According to the Regulation, this measuring point is located in zone 3 “Exclusively residential areas”;
- The measured noise level of 51 and 50 dB (48-hour long measurement) at the ST1 measurement point does not exceed the 55 dB limit, outdoors, during the day and evening. Also, the measured values of 40 and 37 dB at the measurement point does not exceed the 55 dB overnight limit. According to the Regulation, this measuring point is located in zone 3 “Exclusively residential areas”;
- The reference sites NM6, NM5, NM1, ST3 and ST2 are located outside the zoned areas.

5.7. BUILDINGS, IMMOVABLE CULTURAL PROPERTY, ARCHEOLOGICAL SITES AND AMBIENT UNITS

Within the project boundaries, a registered archaeological site of "Ošljane" is present, defined as a cultural property, enjoying prior protection under the Law on Cultural Goods.

The figure shows a site containing the remains of a Roman-era veteran villa. The place is located in the valley of the Ošljanski potok, west of the village of Vinča - Veliko Selo, on a mild slope on the right bank of the stream. The location is known to archaeologists for accidentally discovered Roman pottery. In 1975, the Museum of the City of Belgrade carried out small-scale investigative research. Archaeological findings contain the remains of the villa dating from the period of the second to the third century.

It is also important to stress that in the conditions issued by the Institute for the Protection of Cultural Monuments, the location of the archaeological site of Ošljane is spatially very inaccurately displayed, without a clearly defined location of the described veteran villa object. The question is where the discovered object is located within the defined zone.

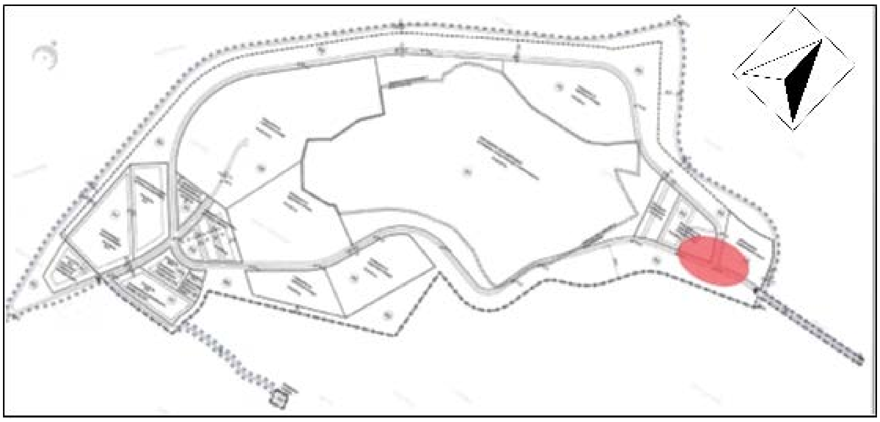


Figure . Spatial location of the archaeological site "Ošljane"

For the purpose of testing and eventual recording of potentially new, until now unexplored archaeological remains in the area of exploration, in the area of Vinča landfill, from February 9, 2017 to March 5, 2017, geophysical tests were carried out by the company Tehnohidrosfera doo from Beočin.

The objectives of the proposed geophysical examination were: to discover potential archeological objects at the sites where construction works were planned within the landfill site, considering the proximity of the Vinča and Starčevo archeological sites, as well as to form detailed orthophoto and 3D models of the wider landfill zone.

As part of the magnetometric method, a vertical inclination gradient mapping technique was applied at two locations ("Zone 1" and "Zone 2").

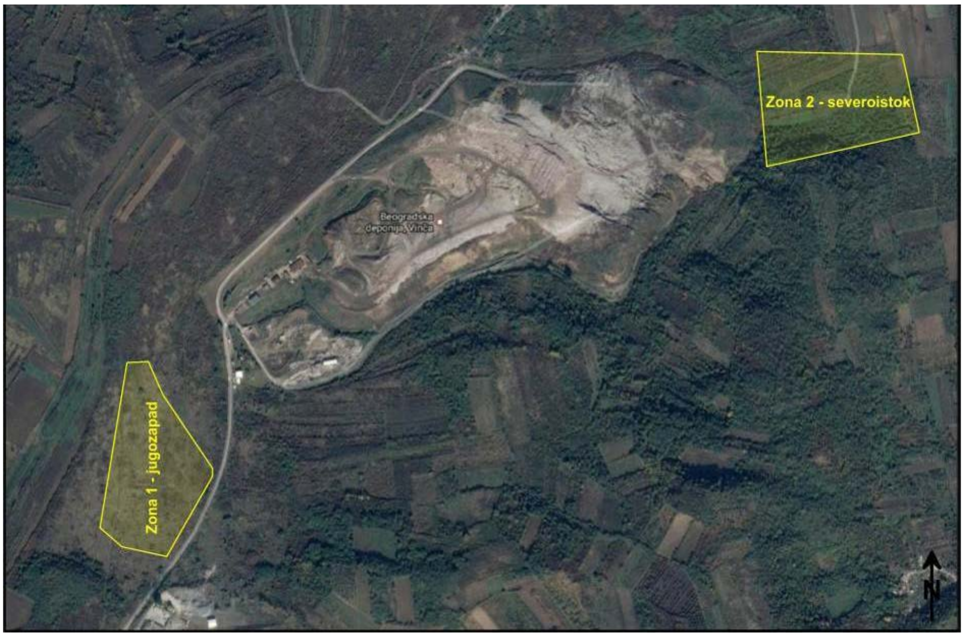


Figure 64 Spatial position of the two locations/zones at which magnetometric measuring was performed

Legend:
(Zona 1 – jugozapad) – Zone 1 – southwest
(Zona 2 – severoistok) – Zone 2- northeast

A map of the distribution of vertical gradations of the total signal for location/Zone 1 (southwest) was developed. The analysis of the high-frequency map of the part of the signal revealed a small change in the geomagnetic field on the entire area of site / Zone 1. It was concluded that there are no anomalies that may be relevant to this area of research.

The specified magnetometric data processing procedures were also applied to the site / Zone 2 (northeast), a research area on the northeast side of the landfill. Analysis of the high-frequency map of the part of the signal revealed a low intensity of geomagnetic field change over the entire site / Zone 2. This indicates the absence of significant anomalies that may be relevant to this area of research.

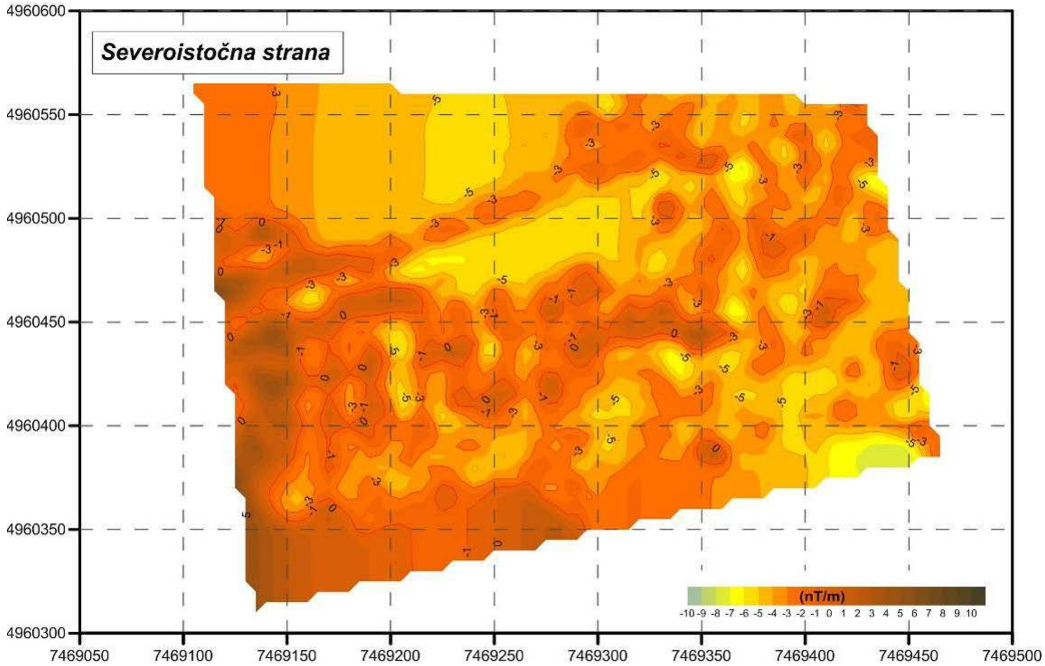


Figure 65 Total geomagnetic field intensity, Site 2 – Northeast

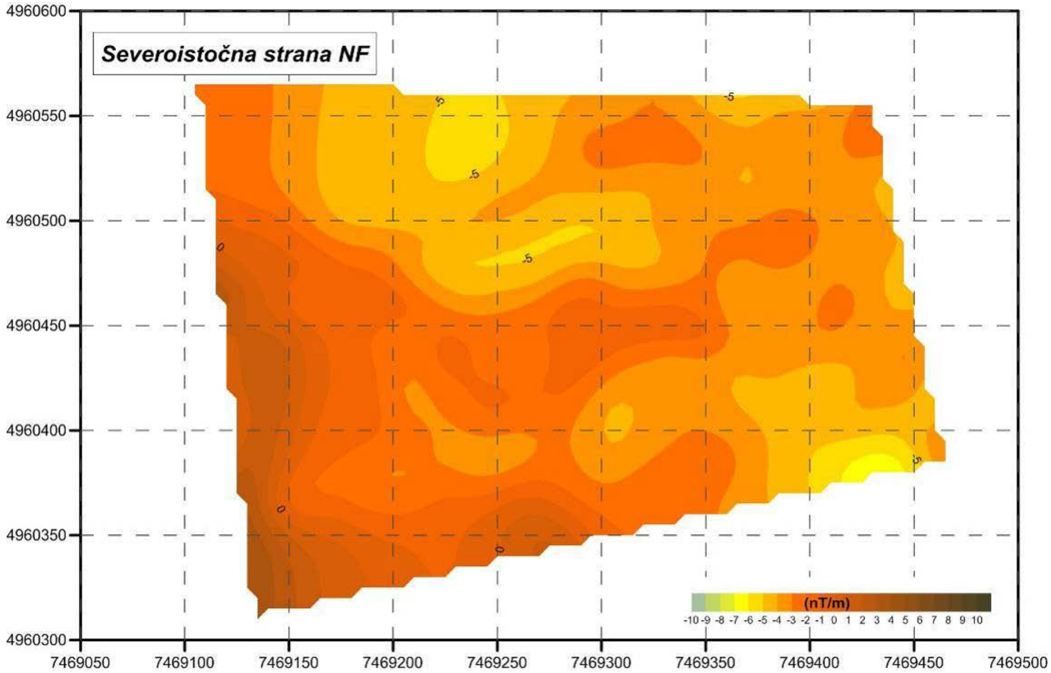


Figure 66 Total geomagnetic field intensity, low-frequency part of the signal, Site 2 – Northeast

Legend: (Severoistočna strana) – northeast side

Photogrammetric/morphometric measurements were performed on March 5, 2017, when it was moderately cloudy, which contributed to the high quality of the photographs.

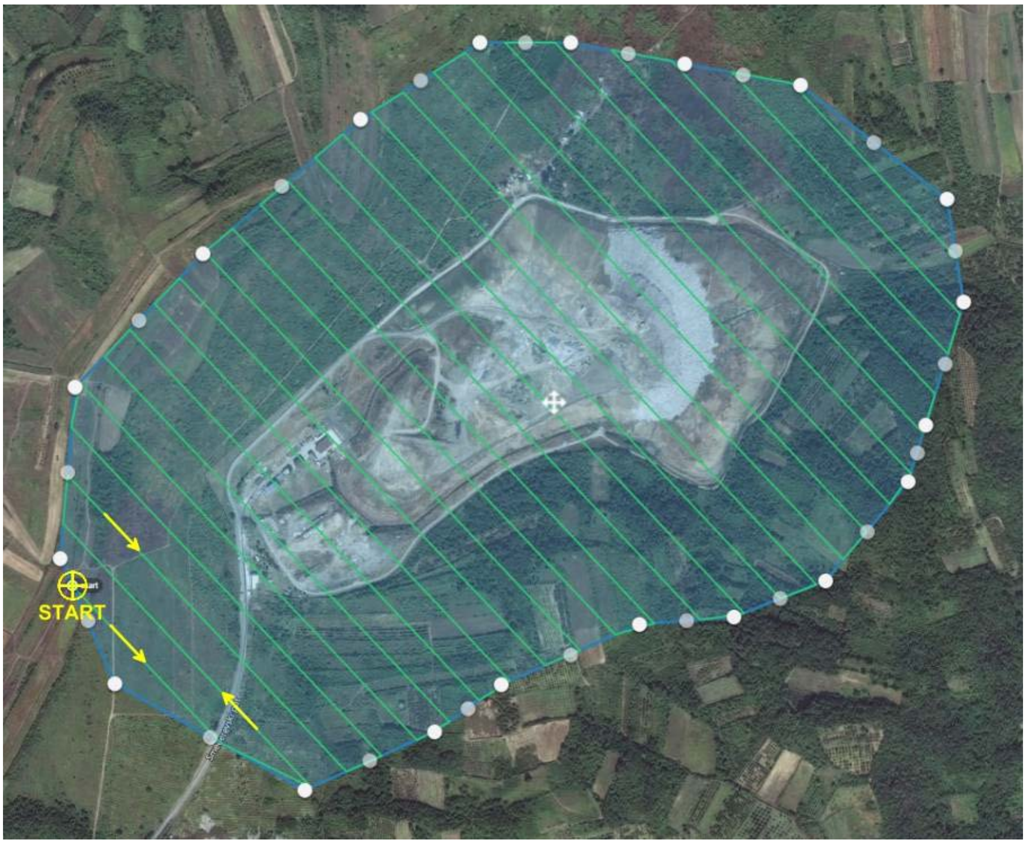


Figure 67 Wider landfill zone in Vinča with drone trajectories shown during photogrammetric measurements

The photogrammetric procedure was also applied by scanning the surface using a mapping technique. A drone equipped with a high-resolution camera flew across the wider area of the landfill. In the flight mode, it has taken 1,840 photographs. Through the synthesis of all photographs and their software processing, an orthophoto image and a 3D model of the wider landfill zone are generated. By analyzing the morphometric data, no recognizable forms and anomalies were observed indicating the existence of archeological objects in the investigated terrain.

Based on the combined results of geophysical magnetometric and morphometric researches in the exploration area of the Vinča landfill, it was concluded that there are no anomalies indicating the presence of archaeological objects and materials.

5.8. LANDSCAPE

The 5 km buffer zone can be considered as a narrower area of importance for the project in question. This is an area of a potentially significant visual contact with the components of the planned project.

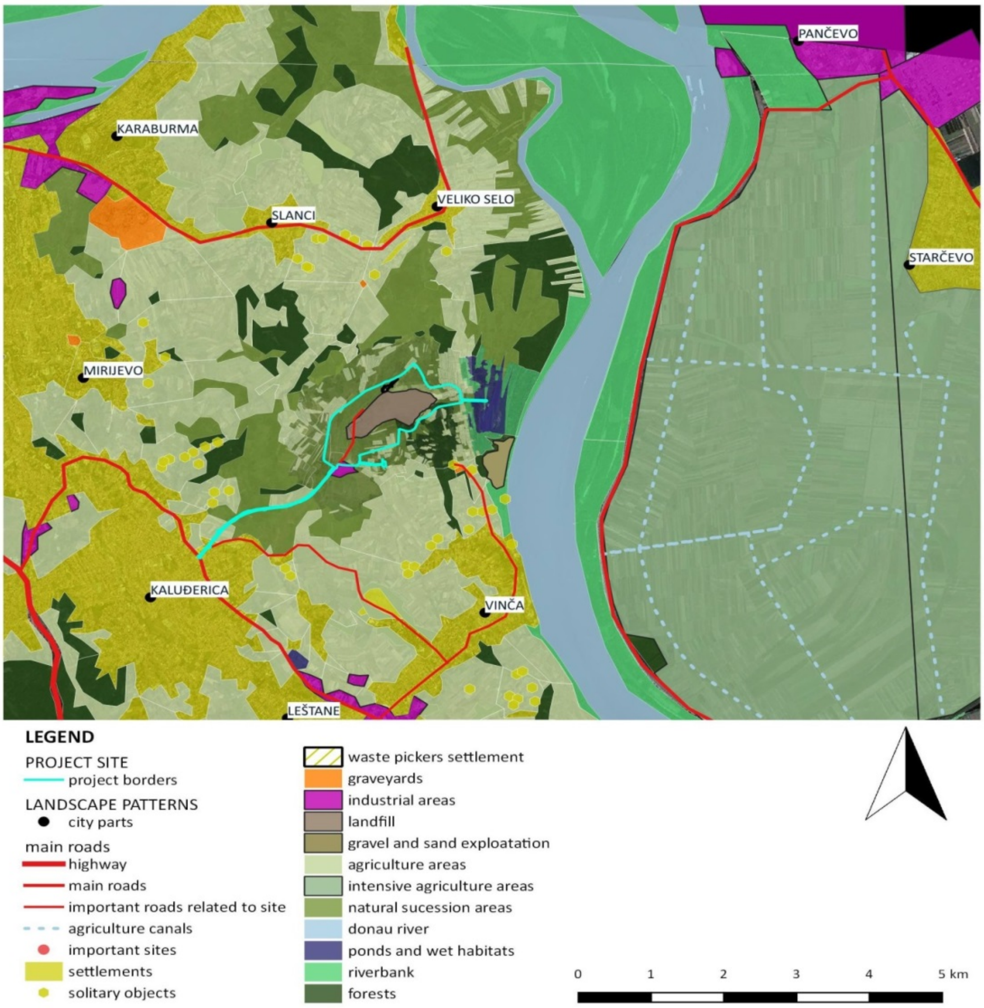


Figure 68. Landscape structure in the 5 km zone

The location of the Vinča landfill complex is located in a landscape of moderate value. This is a specific agricultural landscape strongly influenced by the natural heritage between the outskirts of Belgrade and the Danube river. The location of the complex is existing and has elements of landscape degradation. Thus, it represents a negative visual appearance that is visible in the immediate vicinity and from the agricultural territory on the east bank of the Danube.

The planned tall buildings (especially the stack that is about 60.5 m high) will be the dominant landscape element at the site in question.

6.0. DESCRIPTION OF POSSIBLE SIGNIFICANT ENVIRONMENTAL IMPACTS OF THE PROJECT

Possible impacts before the construction process begin

The pre-construction phase includes activities such as: collecting basic data and conducting investigative works, producing a draft of the project, issuing of permits (including obtaining conditions), setting up of a project location (activities at the site, which precede the construction works). Due to the type of project, no adverse impacts are expected during the pre-construction phase.

6.1. POSSIBLE IMPACTS DURING THE CONSTRUCTION PHASE

Surface and groundwater and soil

The project site is located outside the boundaries of water protection (water protection areas are those which have special conditions and prohibitions for protection of drinking water from harmful effects) and flood areas, which makes this site suitable for all activities that are part of the project

Functional unit 1 is located on diluvial deposits (loess diluvium) that are dusty-clay-sandy and have a dense structure and low permeability, and in which smaller amounts of water accumulate periodically. Loess diluvium, which is hypsometrically dominantly covered by parts of the terrain with the function of a hydrogeological aquifer, is vertically watertight. Based on the test and laboratory investigations, the results of the filter coefficients for the loess dilvium in range $Kf=1.34 \times 10^{-6}$–5.98×10^{-8} m/s. No significant amount of groundwater accumulation is expected in this medium.

Last monitored groundwater level was conducted from October 25, 2017 to March 30, 2018 on piezometers relevant to the site of the EfW / BEP plant, the mean relative water levels (depth from the surface to ground level) ranged from 17.90 to 28.00 meters.

Given the micro-location of the Functional unit 1, the distance from surface waters and flood areas, as well as the relatively low groundwater level (for the period observed - from October 25, 2017 to March 30, 2018) during the execution of construction works in Functional Entity 1, adverse impacts are not expected on the surrounding surface waterways and groundwaters.

The construction of an EfW and BEP plant may pollute groundwater and soil in the event of an accident involving the spillage or leakage of oil and lubricants from vehicles and construction machinery. Negative impacts on land and agricultural land during construction are mainly due to the irresponsible behaviour of construction workers and / or inadequate organization of the construction site.

Possible negative impacts on land and agricultural land near the construction site are as follows:

- land degradation during excavation,
- improper disposal of excavated material and soil, at and around the project site,
- discharge of liquid substances (diesel fuels, lubricants) on site from construction machinery or during their on-site maintenance / repairs, which are mainly due to the irresponsible behaviour of construction workers and / or inadequate organization of the construction site,
- to cover a larger area of land than it is necessary for setting the foundation of future construction, are some of the possible negative impacts on this environmental factor during the construction phase.

The negative impacts on the land can be prevented by a proper organization of the construction site and compliance with the protection measures provided in the study.

Flora

The construction of new facilities (EfW plant, BEP plant, new roads, etc.) will cause local but also a permanent conversion of the existing anthropogenic habitats, and some natural habitats currently present at these sites, into new anthropogenic habitat types.

Natural habitat types (shrubs, grasslands, oak forests ...) are distributed outside the planned project area, so their loss within the planned project area will not jeopardize their existence and favorable status in the wider area.

Four species of flora, protected by national regulations, have been found in the planned area: black comfrey (Simphitum Officinale L.), small-leaved linden (Tilia cordata Mill.), Red hawthorn (Crataegus laevigata (Poir.) DC) and white hawthorn (Crataegus monogyna Jacq.). These species are commercial species in Serbia, and are mainly used due to their phytopharmaceutical properties.

Black comfey is a widespread plant in Europe, including the entire territory of Serbia. A specimen was found within the planned project area during the period of compiling the zero condition report. This plant is typical of various habitats such as wet grasslands, areas near watercourses, and wetlands near trails. Given the diversity of habitats suitable for this type of plant and its widespread distribution in Serbia, it can be concluded that the removal of a specimen within the planned project area would not pose a threat to the black comfey population in Serbia. However, to reduce the overall impact of the project, a measure of moving this plant to suitable habitat was planned by the project.

The area investigated is considered to be a marginal area of distribution of small-leaved linden, located in the planned project area, as it is not typical of the Pannonian biogeographic region, but is widespread in most other European biogeographic regions and other locations in Serbia. During the research, one specimen was found within the project area. Considering the diversity of habitats suitable for this species and its widespread distribution in Serbia, it can be concluded that the removal of a specimen found within the planned project area would not pose a threat to the population of small-leaved linden in Serbia. However, to reduce the overall impact of the project, a measure of moving the tree to a suitable habitat is foreseen by the project.

Species of red hawthorn (Crataegus laevigata (Poir.) DC) and white hawthorn (Crataegus monogyna Jack.) Typical subcontinental deciduous species within the project area and the wider Vinča landfill area. This type of habitat is very well developed in the wider area, so the loss of specimens which are present in the planned project area will not significantly endanger the population of these species in Serbia. However, to minimize the impact of the project on the abundance of these species, they will be used during the formation of the green belt around the project site.

Some protected species of flora, which has not already been mentioned, may be encountered during construction. However, given that a thorough ecological survey of the terrain and the protected area has been carried out, new protected flora species are not expected. However, if so, the competent authority must be notified.

Fauna

During construction, the present fauna will be disturbed by the noise, vibrations and more frequent presence of humans. As all these types of impacts are already present on the site, their disturbance will not change significantly compared to the existing situation.

Due to habitat alteration, current mammals, reptiles, arthropods (including protected insect species) will change their distribution in search of more suitable habitats. Since suitable habitats are present in the wider area and these impacts will include a small number of specimens, this local impact will not endanger their populations.

Adult bird mortality is not expected to increase due to their mobility and adaptation of birds to the movement of vehicles in the existing landfill. If active bird nests are present within the construction area, deaths are possible. Given the number of protected and strictly protected bird species found on site, this impact should be mitigated by the removal of natural vegetation before the bird nesting period starts.

The diversity of bird fauna (some of which are protected by national regulations) within the project's planned area is largely related to habitat proximity to wetlands.

Protected natural resources

Due to the significant distances of protected areas from the construction site, the construction phase will not affect them.

Air

During the construction phase, there may be impacts on air quality due to exhaust emissions from construction machinery and dust from the construction site, especially in dry and windy periods.

As for dust emissions, with good practice, they can be reduced to a low level of significance. As for the impacts from the exhaust gases, since these types of impacts already exist at the site, they will not represent a significant change from the present and future state (work phase).

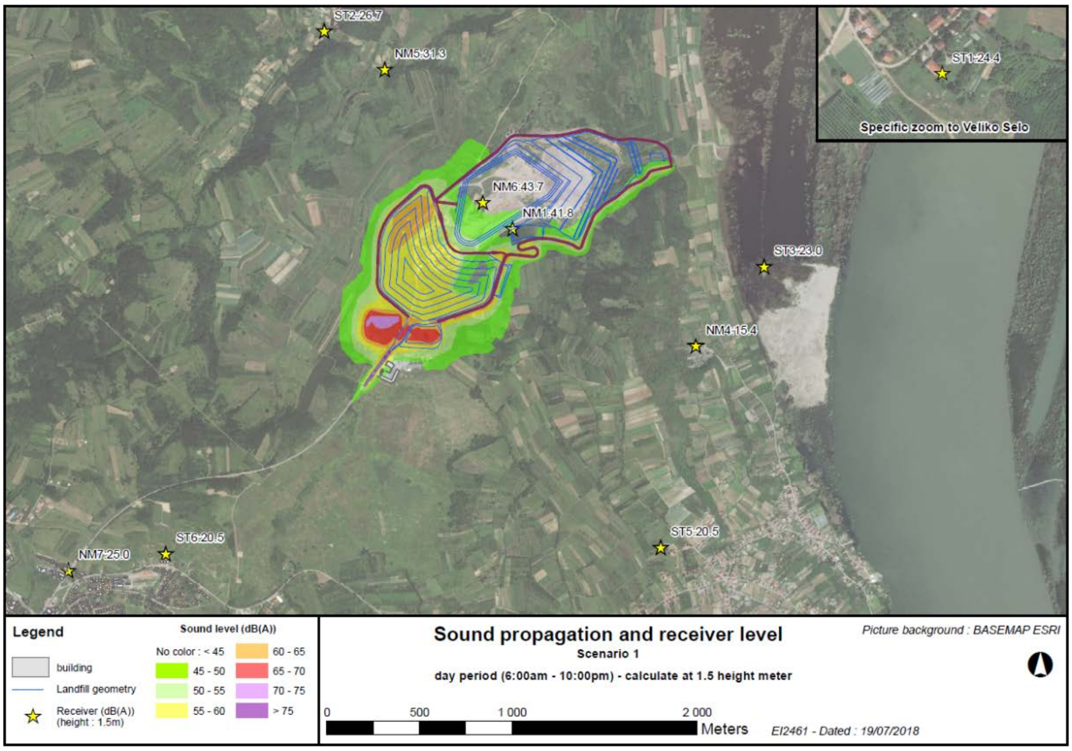
The additional traffic resulting from construction will mainly take place within the boundaries of the project, with occasional and temporary traffic outside them, to a lesser extent.

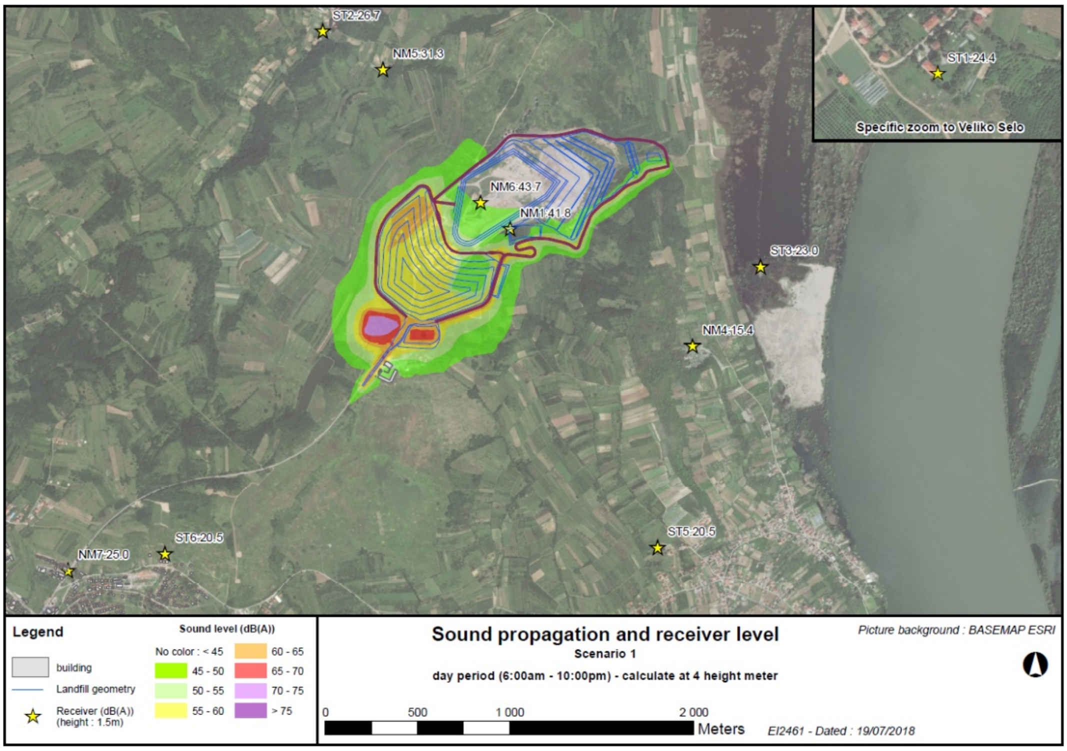
Noise

To predict the impact of noise during the construction phase of the project, 3D acoustic modelling was performed (CadnaA software version 2018). Modelling integrates the following parameters:

- the topography of the terrain,
- mobile noise sources on site (vehicles).

To model the noise levels caused during the construction phase, all noise data generated by the equipment, their level, spectrum and time activity are taken into account. The model results are shown in the following figures, with the calculation at two different heights: one at the height of a man (Scenario 1) and one at the height of 4m (Scenario 2).





Based on the modelling results, at selected locations (measurement points), the environmental noise level during the construction phase ranged from 20.5-31.3 dB (A). Relative to real measurements made at the same measuring sites (noise measurement was carried out in March 2018 at 10 measuring points by the City Institute of Public Health), the computational values were always approximately 10 dB (A) lower.

Landscape

During the construction phase of the project, there will be a change in the existing landscape in the area intended for the construction of facilities and other contents in Functional Unit 1.

Cultural Heritage

Based on the combined results of geophysical magnetometric and morphometric researches in the exploration area of the Vinča landfill, it was concluded that there are no anomalies indicating the presence of archaeological objects and materials.

Infrastructure

The construction of the new facility requires the transportation and delivery of materials to trucks along the existing road network. Potentially poorly trained or inexperienced vehicle drivers could increase the risk of an accident with other vehicles, pedestrians and equipment. Construction vehicles, as well as private vehicles on site, also pose a potential risk of collision. Potential collisions can overload the existing regional two-way road (Smederevski put).

Worker transport is also expected, but this will cause less congestion. These impacts will be temporary and limited to the construction period. Possible impacts on traffic during construction will be limited in time and space. With good traffic / logistics management, they can be reduced to a low level of importance.

During construction, the elements of the water management system and / or energy supply may be physically damaged due to an incident, which can potentially lead to negative effects (water supply interruption, electricity delivery, etc.).

Waste

Environmental pollution caused by improper waste management may result from improper disposal of construction and other wastes, or if improperly deposited and temporarily stored in the environment. By properly arranging the construction site, all potentially harmful effects, mainly related to inadequate disposal of waste, soil, construction waste, etc. will be minimal.

Different types of hazardous and non-hazardous waste will be generated during construction:

- 13 02 waste engine oils, gearbox oils and lubricants
- 17 01 concrete, bricks, tiles and ceramics
- 17 04 metals (including their alloys)
- 17 05 earth, stone and excavation material
- 20 03 other municipal waste.

To prevent negative environmental impacts at the construction site, the generated waste must be managed in such a way as to maximize its use on the site itself (ground filling, levelling, etc.), and the rest, and any generated waste must be handed over to authorized legal entities for waste management. Depending on the type of waste generated, it should be handled in accordance with regulations related to waste management.

6.2. POSSIBLE IMPACTS IN REGULAR OPERATION

Water

As the previous text of the study describes in detail the wastewater management system, both within Functional Unit 1 and at the level of the entire Vinča landfill complex, here it will only be pointed out that water from Functional Unit 1 does not flow directly into the recipient, the Danube River, and that all technological/leachate wastewater is in the recirculation system.

All other water (clean atmospheric from roofs and other clean surfaces, conditionally polluted and treated atmospheric water, treated oily water, sanitary-fecal, etc.) is discharged through the internal sewage network to the connection at the boundary with the planned Unit K3 and then to the appropriate lagoons and/or treatment within that Unit, before being discharged into the final recipient.

Based on the above and with the planned protection measures, no negative impacts on the surface and groundwater are expected.

Soil

The potential contamination of soil inside, and especially outside of Functional Unit 1, depends on the flue gas treatment system functioning, i.e. on the emission of powders from defined emitters at the EfW plant and their deposition on (agricultural) soil. The planned/designed flue gas cleaning systems are efficient and comply with the law, therefore no significant impact on the land is expected.

In the regular operation of the project, potential impacts on the soil are also possible due to the dispersal of waste from waste delivery vehicles, the separation of dust from handling surfaces, internal and external roads, etc.

Flora and fauna

Regular operation of the plant in Functional Unit 1 will have no negative effects on the flora, fauna and

Light emission may have adverse effects on birds and bats, but with the application of protective measures, these impacts will be minimized.

Air

In order to determine the project impact on air quality, air dispersion study was conducted, taking into account:

- Five-year detailed meteorological data,
- Precise topography,
- Full description of significant air pollutant emission sources (localization, flow and concentration of pollutants, operating hours ...)

The cutting edge MSS model (Micro Swift Spray) was used for hour-by-hour modelling over the entire year in order to calculate, on each cell of the area being modeled (12 x 9 kilometers, 50 meters step): mean, maximum and several percentiles for exceeding the threshold (depending on pollutants and relevant regulations).

Complete description of the MSS model and its selected parameters is presented in Appendix 20. The source description, depending on the operational phase (see appendix 7), is given in Appendix 8. Given the worst case scenario, only situation 3 was modeled for further research: this situation involves the nominal operation of all major sources (EfW plants, BEP, CDW, flares, landfill) as well as maximum emissions from intermittent operations (mainly LTP).

Scenario		Period	Plant						
Worst case	Scenario 3	From 2022. Until 2025.	EfW	BEP	Flare platform – Flare 1	Flare platform – Flare 2	CDW	LTP	Landfill operations
			Nominal 8200 h	Nominal 8060 g	Temporary 1402 h, nominal 8035 h	Temporary 1402 h	Nominal 2080 h	Nominal 7900 h	Trucks in new landfill

The following table presents the results for the “worst year”, obtained by modelling.

Table 34. Results of air quality modelling – the Operational phase, The worst year, Scenario 3 (Source: ESIA, Egis, ver. 03)

Air quality standard and exceeding limit allowed (when applicable)[µg/m³]				Spatial maximum for mean annual value (µg/m3)	Number of exceeding (days/year)	Frequency of exceeding (hour/year)	Maximum concentration in time and space (µg/m3)	Baseline (µg/m3) **Pollutant**	Total concentration (µg/m3) **Mean period**	IFC criteria (25% AQS) **Serbia AQS**
Pollutant	**Mean period**	**Serbia AQS**	**Allowed exceeding limit**							
SO_2	1 hour	350	*24 times a year*			0	55	SO_2	1 hour	350
	24 hours	125	*3 times a year*		0		5		24 hours	125
	1 year	50		0.9					1 year	50
NO_2	1 hour	150	*18 times a year*			3	352	NO_2	1 hour	150
	24 hours	85					28.7		24 hours	85
	1 year	40		1.0					1 year	40
PM10	24 hours	50	*35 times a year*		0		9,6	PM10	24 hours	50
	1 year	40		0.35					1 year	40
$PM_{2.5}$	1 year	20 (phase 2)		0.31				$PM_{2.5}$	1 year	20 (phase 2)
CO	24 hours	5,000					69	CO	24 hours	5,000
	1 year	3,000		1.57					1 year	3,000
Benzene*	1 year	5		0.0006				Benzene *	1 year	5
Lead	24 hours	1			0		0.04	Lead	24 hours	1
	1 year	0,5		0.0012					1 year	0.5

Note: Only pollutants with regulated concentrations of ambient air are included

All criteria are met. It should be noted that the benzene standard for Serbia is closed due to its high baseline concentration, which represents more than 92% of this threshold. It should be taken into consideration that with the future development of the regulation on motor vehicle emissions (to approximate EU standards), the value obtained in the baseline test, mainly caused by the movement of cars / trucks, will be increased. The contribution of the project is negligible.

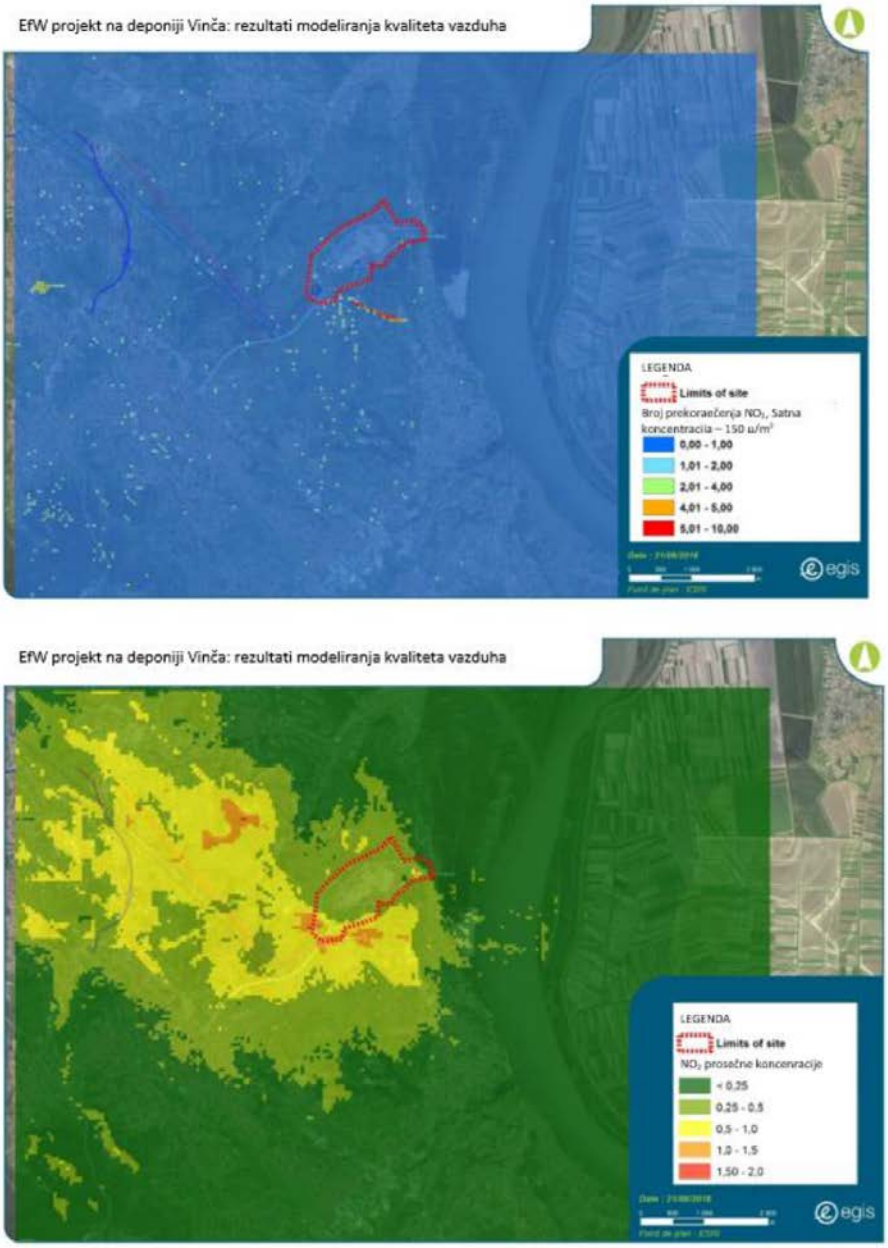


Figure 69. Modeled number of exceeding in terms of NO_2 concentration, hour-by-hour (Source: ESIA, Egis, ver. 03)

Particular focus was on dust dispersion and application of dust near the project. This topic requires a different type of modeling, derived by calculating dispersion using ADMS 5 (UK equivalent of US-EPA Aermod, recognized as the alternative model to US EPA guidelines. Meteorological data represent a five-year dataset from the nearest meteorological station (Belgrade Airport, “Nikola Tesla”, 2012-2016).

Topography is given by Copernicus Data and buildings are not considered for volume or surface sources (ADMS limitation). The following maps show the estimated dust deposits and concentrations of total suspended particles (TSP).

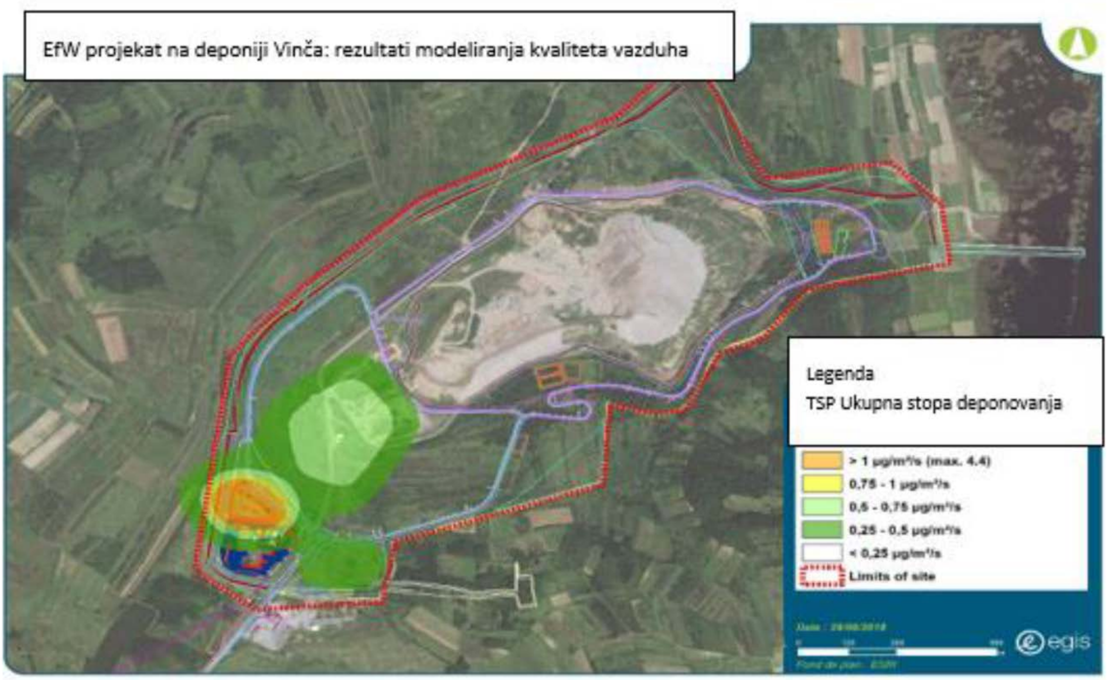


Figure 70. Modeled TSP - total deposition rate,
(Source: ESIA, Egis, ver. 03)

At off-site boundaries, the deposition rate is less than 1 mg/m^2/s (less than 32 g/m^2/year). This deposit will be in the southwest part of the site, in a very limited area. This implies that the contribution to the top soil will be low and the potential contamination with powders (which mainly contain heavy metals from IBA sources) will be negligible.

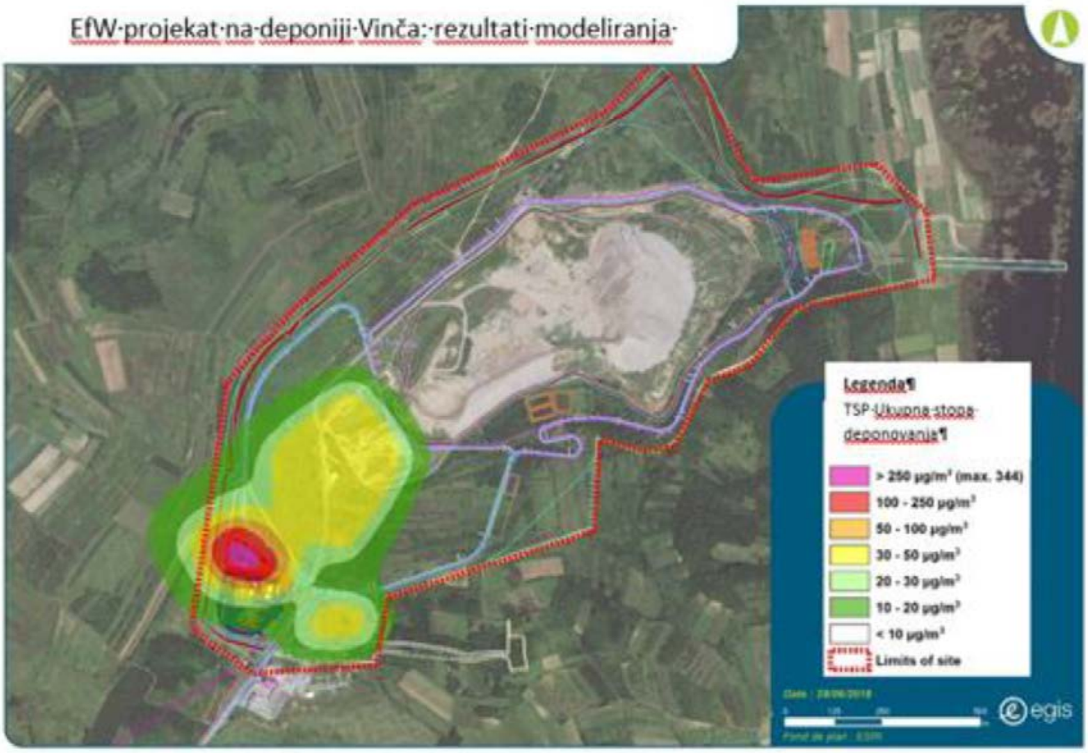


Figure 71. Modeled TSP concentrations, (Source: ESIA, Egis, ver. 03)

The mean TSP concentration does not exceed 50 mg/m^3 in the immediate vicinity of the site boundaries and it is goes quickly below the TSP concentration of 10 mg/m^3 (less than 150 meters from the complex boundaries). Therefore, the impact will be limited and defined.

Unpleasant odors

On-site odor assessment was carried out by a survey of EGIS experts on and around the site, on several different days (7 December 2017, 16 January 2018, 15 March 2018, 5 June 2018). Using the sense of smell, the researcher concludes that the odor exposure is medium to large at the landfill and small to negligible (from the boundary up to 200 meters from the complex boundary).

Since housing is not in close proximity to the landfill (minimum distance is greater than one kilometer), receptor sensitivity can be defined as low.

In conversations with people who were encountered during measurements and monitoring (air, noise, water), several of them described the inconvenience due to odor. Some of the smells can be specifically attributed to trucks that bring fresh waste to the landfill complex.
The project in question envisaged the evacuation of air from the hall with a waste hopper to the boiler plant. This air is used as the primary air for combustion of municipal waste in the boiler so that the odor emission will be minimized. Municipal waste will be brought in trucks specially designed for this purpose (closed vehicles) to avoid the emission of dust and odors from vehicles into the air during transport.

As the project envisages evacuation of air from the Reception Hall with the waste bin to the boiler (part of the primary air system), it can be reasonably concluded that there will be drastic reduction of odor emissions around the Reception Hall, especially in relation to the current situation.

Noise in the environment

To quantify the potential impact of noise produced by project in regular operation, modeling was applied based on:

- initial ambient noise and noise level measured "in-situ" and
- estimated noise of future activities (calculated noise level)

The ambient noise impact of the project was calculated by 3D acoustic modeling (software CadnaA, version 2018). Modeling integrated the following parameters:

- topography
- constructed facilities
- existing noise sources
- natural and artificial obstacles/barriers

The modeling results are shown in the following figures (day and night situations).

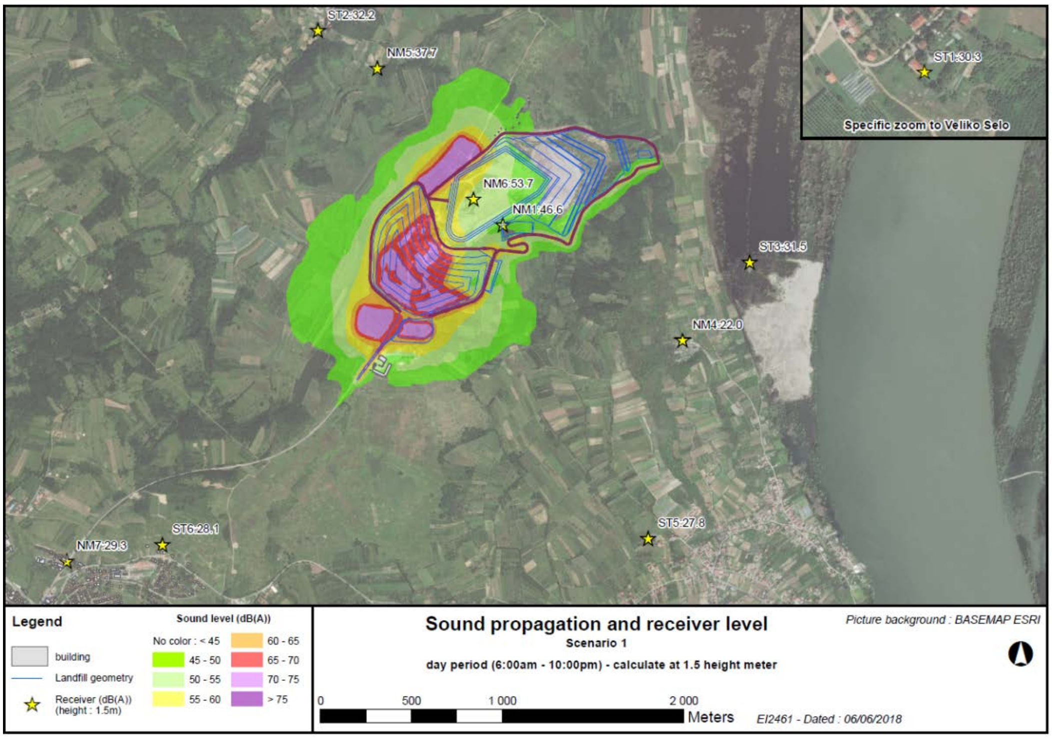


Figure 72. Sound propagation to environment in operation mode – day period

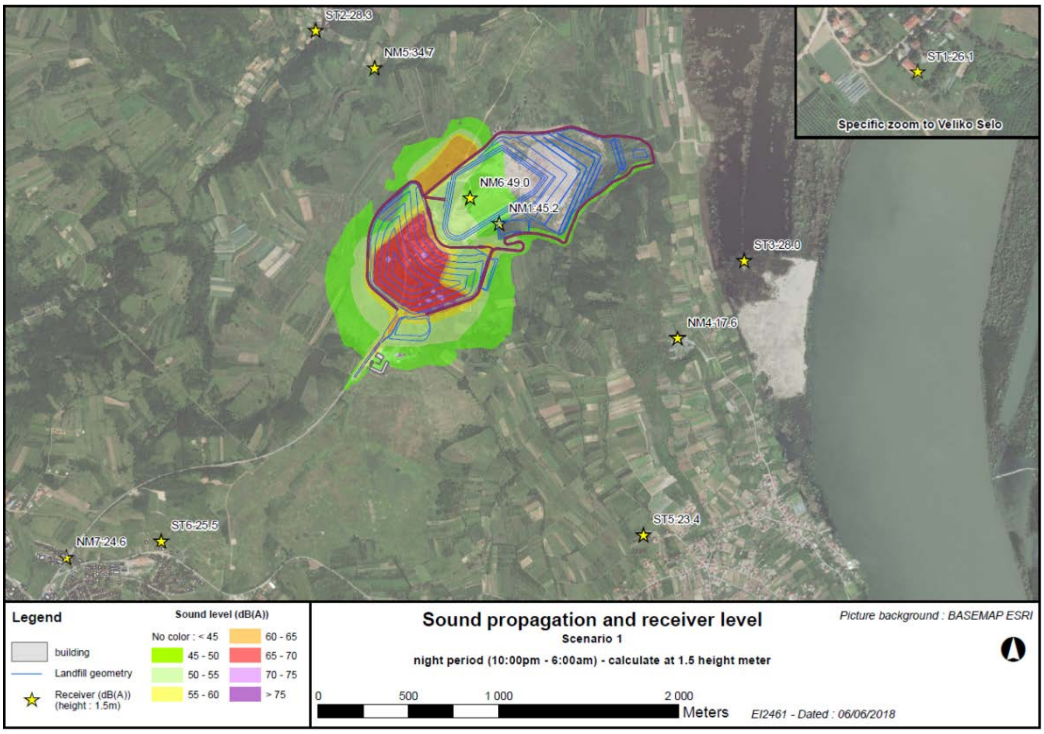


Figure 73. Sound propagation to environment in operation mode – night period

Based on the modeling results, the environmental noise level during the regular operation phase ranged from 28.7-38.6 dB (A) at selected locations (measurement points). Compared to the real measurements made at the same measuring points, the computational values were always 10-15 dB (A) lower.

In all sensitive places, the contribution of the project will be negligible and no threshold will be exceeded due to the project contribution.

Landscape

Major changes will occur as a result of the built structures of the EfW plant. Vinča landfill complex is located outside settlements and roads. Due to the highland area, from the north, west and south, and due to the location in the stream valley, the visibility of the project will be relatively small.

The zone of conditional visibility includes Belgrade suburban settlements (Veliko Selo, Slanci, Mirijevo, Kaluđerica and Vinča) that surround the location of the landfill in Vinča, at a distance of 1.5-3 km. Views from buildings in these settlements will be partially obstructed by relief, other buildings and vegetation, but it is likely that the EfW stack (about 60.5 m high) and the boiler house (about 55 m high) will be visible. Due to its height, the stack will be visually appealing point and a spatial feature.
Due to the relief conditions, i.e. flat terrain, it is possible that the EfW stack will be visible from the settlements Starčevo and Omoljica, which are located on the left side of the Danube at a distance of about 7 km east of the Vinča landfill site. However, the distances and dense forests on the banks of the Danube woule reduce direct line of sight.

Some views of the landfill complex and the EfW plant, both from nearby and from a distance, will be obstructed by the green belt. However, some objects, especially the stack, will be visible from a distance, and this cannot be prevented due to the height of the plant.

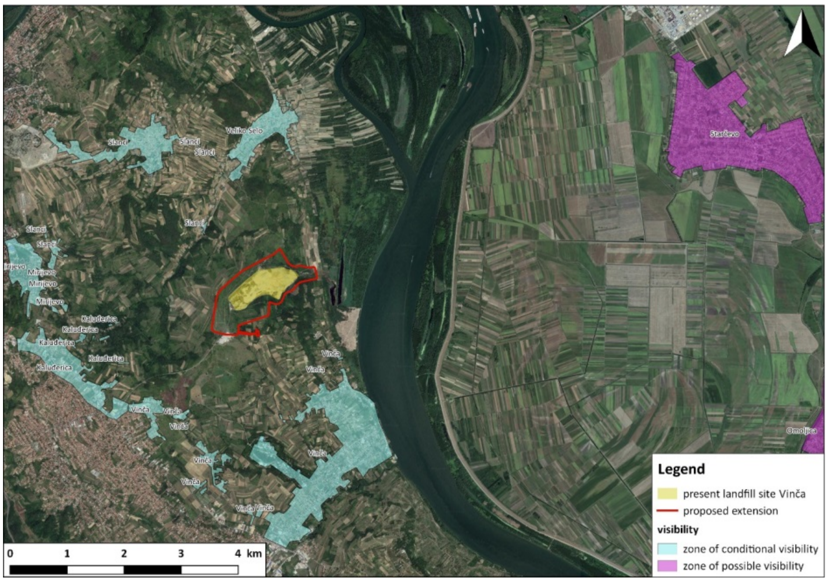


Figure 74. Landscape visibility of the Vinča landfill site

Access road

Currently, the total annual traffic from the existing landfill to public roads is approximately 135.348 vehicles and includes waste and fuel deliveries. According to available data, the future traffic estimate is 143.959 vehicles, which includes waste and fuel deliveries, as well as reagent deliveries and deliveries of materials sent from the site. Therefore, in line with the above facts, it is expected that the future traffic (deliveries) will increase by approximately 6%.

Waste management

Environmental pollution caused by improper handling of waste can occur in the event of improper site management or improper disposal of produced waste. Solid waste from flue gas treatment, index number 19 01 07*, APCR containing dangerous substances, index number 19 01 13* and boiler dust containing dangerous substances, index number 19 01 15*, will be stored in silos specially designed for this purpose, thus preventing the release of APCR (powder material) into the air before the solidification and chemical stabilization process.

The stabilized material will be in solid form, preventing release into the air and the process will bind heavy metals, preventing the penetration of substances into the soil and aquatic environment.

All waste from the waste incineration process and operational waste will be selectively stored in a facility equipped with a sealed floor, which prevents the ingress of substances into the soil and aquatic environment, and with containers suitable for particular type of waste, after which it will be transferred to legal entities with waste management permits required by the law.

The activities at the site likely expected to produce waste will be planned, designed and implemented to first prevent the generation of waste or limit the amount of waste produced and their negative impact on the environment. In order to prevent negative environmental impacts at the site, as well as the effects of the final waste disposal, all waste must be managed so that maximum material and/or energy is recovered or reused and the rest of the non-hazardous and hazardous waste must be disposed of through authorized legal entities.

Waste generated during operations such as office waste, packaging, hazardous waste, etc. will be sorted, separated and, depending on the type of waste, further treatment will be carried out in accordance with the regulations related to waste management.

6.3. IMPACT OF THE PROJECT ON CLIMATE CHANGE

The impact on climate change is shown for a comprehensive project planned at the site of the Vinča landfill complex, which contains three basic implementation phases:

- construction of plants for energy utilization of municipal waste and landfill gas
- construction of a new landfill and
- closing, rehabilitation and reclamation of existing waste landfill

The potential impact of the project on climate change is directly related to the total greenhouse gas (GHG) emissions. The GHG emission calculation shall take into account the emitted, used and released quantities of these gases:

- Direct emissions from:
    - EfW plants (from waste incineration and energy use)
    - Equipment used on site (fuel use)
- Indirect emission from vehicles on site
- GHG emissions are reduced through energy recovery at the EfW plant:
    - Through the production of electricity,
    - Through the production of heat

Table 35. GHG emissions – (for the entire Vinča landfill complex)

Emitter	*GHG*	2015	2025	2035	2050	2075
Old landfill	*Total*	585999	342754	44226	-	-
	Captured		210075	33170		
	Released		132679	11057		
Newly designed landfill	*Total*		187962	210075	4423	3317
	Captured		121622	132679	3317	2211
	Released		66339	77396	1106	1106
EfW			**120595**	**120595**	**120595**	**120595**
Location (electricity and fuel)			39587	39587	39587	39587
Avoided (electricity and heat)			- 233767	- 233767	- 233767	- 233767
TOTAL		585999	125433	14868	- 72479	- 72479

The project will have positive impact on greenhouse gas emissions, owing to electricity and heat production and significant reduction in CO_2 emissions from the old landfill. Huge continuous improvement of greenhouse gas emissions (due to landfill remediation, switching to the emission control process and heat and power generation) will result in more than 11.4 million tons of CO_2 saved in global period 2025-2046. The mean annual GHG reduction is equivalent to more than 111.150 passenger cars a year or 247.400 acres of forest (Source: US EPA GHG Calculator, September 2017).

6.4. IMPACT OF CLIMATE CHANGE ON THE PROJECT

The impact of climate change on the EfW plant was analyzed in accordance with the guideline (Source: Non-paper Guidelines for Project Managers: Making vulnerable investments climate resilient) on how to increase the project's resilience to climate change. The aim of the analysis is to determine the sensitivities and exposure of the project to primary and secondary climatic impacts, to finally assess the potential risk of the project and, depending on the risk, to identify and evaluate adaptation options to reduce the risk.

The analysis can be evaluated through seven modules shown in the table below.

Table 36. Modules in the climate resilience process

Module	*Module description*
1	Sensitivities analysis
2	Exposure evaluation
3	Vulnerability assessment (incorporates Module 1 and 2 outputs)
4	Risk assessment
5	Identification of adaptation options
6	Appraisal of adaptation options
7	Integrate adaptation action plan into the project

According to the applied guidelines, Modules 1 to 3 are used to assess the vulnerability of the project to climate change.

Following the analysis, it was concluded that all vulnerabilities were negligible and that no further measures were required, nor is required the use of modules 4 to 7 involving risk assessment, identification of options for responding to vulnerabilities and risks, and modification of the project concept.

According to the analysis, the project is not significantly vulnerable to the estimated primary and secondary effects of the predicted climate changes.

6.5. CUMULATIVE EFFECTS WITH OTHER PLANTS

The following Functional Units (K1-K5) are planned within the Vinča landfill construction complex:

K1 - area for construction of facilities for municipal waste energy utilization;
K2 - platform for construction waste and construction waste treatment;
K3 - area for construction of new sanitary landfill for municipal waste (new landfill body);
K4 - reclaimed area (area of existing landfill body), supporting structure and internal roads
K5 - facilities used for sanitary landfill, municipal wastewater treatment plants, inert waste landfill, internal roads and protective green belt.

The wider area of the Vinča landfill complex is mainly used for agriculture, however some of the parcels are now abandoned (there is agricultural land succession). The forests are reduced to smaller parts of the forest and those in alluvial areas along the Danube. A small area of agricultural land is located directly next to the landfill.

The asphalt production plant is located south of the landfill body (about 400 m). Larger industrial areas are located in the western parts of Belgrade at a considerable distance. They are 5 km southwest, west and northwest in relation to the landfill.

The high voltage block is located 3 km northwest of the landfill.

The most important industrial zone is located in the southern part of Pančevo. There is an oil refinery, a chemical industry complex and a river port. In relation to the landfill, they are located about 8 km north-east, on the left bank of the Danube.

Considering all planned activities at the site of the entire Vinča landfill project and in the immediate vicinity, it is not expected that the impacts of the project will be of such magnitude that they can cause significant cumulative impacts with other plants.

7.0. ENVIRONMENTAL IMPACT ASSESSMENT IN THE CASE OF AN ACCIDENT

Hazards/accidents at industrial plants, as unexpected events with undesirable short or long-term effects on safety and human health and the environment, may result from natural risks at the site, technical and technological risks, characteristics of raw materials, equipment, chemicals, products, intentional or unintentional external influences, but most often human factors.

7.1. NATURAL RISKS

In the wider area of the Vinča landfill, the following natural risks are possible: landslides, floods and earthquakes.

Landslides

According to data from the Landslide Cadaster in Belgrade, unstable slopes, including areas affected by active, calm and repaired landslides, cover an area of approximately 377 km^2. Large-scale landslide occurrences were observed in the area of hills and hilly terrain south of the Sava and Danube rivers (on the Sava slope, in Duboko-Umka direction, in the narrower urban area, on the right Danube slope (Karaburma, Višnjica, Vinča, Ritopek, Grocka) and at the valley sides of the right tributaries of the Sava and Danube rivers.

Colluvial process was developed on the Danube slope. Landslides are mostly active and their depths are very large, i.e. exceed 10-15m. The landfill extension in this part of the field should not be planned.

The landslide process in the Ošljanski creek valley is less developed, and the local landslides are much smaller in size and depth (on average 3-5 m), and the scattering intensity is not large. Four landslides can be distinguished in the subject area, including:

1. Landslide in the basin of the southern arm of the Ošljanski creek. Landslides are mostly active. The estimated slip depth is about 3-5 m. Under conditions of inadequate technogenic influence, the sliding process can be activated.
2. A landslide on the right slope in the lower part of the Ošljanski creek. This landslide is somewhat larger in terms of the affected area and somewhat more complex, however, it is calm in natural conditions. Inadequate technogenic influences can reactivate the process.
3. The landslide at the site "Todorovic Vineyard" (north of the existing landfill) is in one small part an active landslide, while in most of the terrain there are no clear traces of earlier movements. As with previous landslides, inadequate operation can also cause the sliding process to reactivate.

Floods

The Vinča landfill is located 1.6 km west of the Danube River. The closest surface water stations to the project area (located on the Danube River) are: Zemun, Pančevo and Smederevo.

The table below shows the maximum levels of the Danube River at the stations closest to the Vinča landfill.

Table 37. Maximum recorded water levels

Station	Level "0" (m)	Maximum recorded water level (cm)	Maximum water level expressed in meters above sea level
Zemun[1]	67.87	783	75,7
Pančevo[2]	67.33	777	75,1
Smederevo[1]	65.36	845	73,8
1 – Period 1972 – 2016, 2 – Period 1992 – 2016			

The lowest part of the Vinča landfill is located at about 85 meters above sea level, which is about 10 meters higher than the maximum water level evacuated in the wider observation area, so it can be concluded that there is no risk of flooding.

Earthquakes

Based on the presented seismic hazard maps (Source; www.seismo.gov.rs), according to the macroseismic intensity parameter, the territory of the city of Belgrade is in zone VI-VIII MCS (Merkalli scale).

7.2. EXTERNAL RISKS

External risks of relevance to the locality of the project are related to deliberate action aimed at causing extensive material damage and/or endangering human lives (terrorist act) or as a result of a "domino" effect caused by an accident at other industrial facilities in the environment.

Based on available data provided to the Ministry of Environmental Protection by the operator of Seveso plants/facilities, it was determined that there are no Seveso plants/facilities within the area covered by the Detailed Regulation Plan (DRP) of the Vinča sanitary landfill, while in the territory of the city of Belgrade, to which the city municipality of Grocka belongs, there are large number of Seveso facilities, but the effect of potential chemical accidents in them does not pose a danger to the area within the DRP. On the contrary, the area covered by the said Detailed Regulation Plan may be endangered by the effects of a chemical accident from the territory of the neighboring city of Pančevo, in the worst-case scenario of an accident at the Seveso plant of HIP "Azotara" doo.

The area covered by the DRP of the Vinča sanitary landfill is in the zone of toxic ammonia clouds, which represents possible result of the worst case scenarios established by this company, partly for the immediately dangerous to life or health IDLH concentration (300 ppm of ammonia) over a 30-minute exposure period and partly for a concentration of 0.1 IDLH (30 ppm of ammonia) over a 30-minute exposure period.

This accident scenario is at grade IV - regional accident level, and the probability of occurrence is estimated to be low (4.7x10-7/yr.). HIP "Azotara" doo Pančevo has adopted the Decision on approval of the Safety Report and the Plan of accident protection (5 August 2016), which describes the identified accident scenarios, accident impact zones and prevention measures by the operator for accident prevention.

7.3. TECHNICAL AND TECHNOLOGICAL RISKS

The technical-technological risks at industrial plants are related to the wear of the installed equipment, fatigue of material and technological process. The project in question is being implemented with new, certified equipment, proven, conventional technological procedures in accordance with the best available techniques, thus the mentioned risks are minimized.

Nonetheless, technical-technological risks are always present in all industrial plants, including EfW and BEP plants with associated facilities within Functional Unit 1.

Accidents due to present substances

The following table lists all the substances present in Functional Unit 1, with a description of the site in process, estimated quantities and risks, at the EfW and BEP plants.

No.	Plant	Substance	Origin	Location	Characteristics	Quantity	Risk of fire	Risk of explosion
1	EFW	Municipal waste	Municipal waste	Hopper	Thermal capacity, from 6.000 kJ/kg to 12.000 kJ/kg	Hopper capacity 6.714 m^3	X	
2	EFW	IBA	IBA	IBA plateau	Slag off the grid	Around 4.700 m^3 (max capacity 9.100 m^3)		
3	EFW	Atmospheric waters	IBA	IBA plateau	Atmospheric waters from IBA plateau	Lagoon 800 m^3, + inflow pool 260m^3		
4	EFW	Diesel fuel	Main fuel tanks	Operating platform	Fuel for process purposes	Two tanks 60 m^3 each (120 m^3)	X	X
5	EFW	Diesel fuel	Fuel tank	In the container	Daily tank for DEA	Around 2 m^3	X	X
6	EFW	Diesel fuel	Fuel tank	In the turbine hall	Daily tank	Around 2 m^3	X	X
7	EFW	Diesel fuel	Fuel tank	For PP pumps	Daily tank for two pumps	Around 2 m^3	X	X

8	EFW	Urea (NH_2CONH_2, 40% solution)	Tank	DeNox plant	Liquid substance	Tank 45 m^3		
9	EFW	Charcoal (powdered)	Silo	Outdoor silo	Powdered charcoal	110 m^3	X	X
10	EFW	Milk of lime, $Ca(OH)_2$	Silo	Outdoor silo	Hydrated lime	200 m^3		
11	EFW	APCR	APCR silo	Outdoor silo	Flue gas treatment residues	2 silo 200 m^3 each		
12	EFW	Nitrogen	Nitrogen high pressure bottle	Next to baghouse filter	Inert gas	2 bottles 150L each		
13	EFW	Oil (control)	Control oil in generator and turbine	Turbine hall	Liquid substance	1 m^3	X	
14	EFW	Oil (for lubrication)	In generator and turbine lubrication system	Turbine hall	Liquid substance	12 m^3	X	
15	EFW	Hydrazine hydrate (20% solution)	Water preparation	Plastic barrel, Water treatment plant	To remove oxygen from the boiler feed water	150L		
16	EFW	Trisodium phosphate, (Na_3PO_4)	Water preparation	Plastic barrel, Water treatment plant	Boiler corrosion inhibitors	150L		
17	EFW	Antiscalant solution	Preparation of demi water	Plastic barrel, Water treatment plant	Anti-foaming	100L		

18	EFW	Hydrochloric acid	Water preparation plant	Plastic barrel, Water preparation plant	For neutralization	1 m^3		
19	EFW	Sodium bisulfite, 25% solution	Preparation of demi water	Plastic barrel, Water treatment plant	Dechlorination of RO filters	100L		
20	EFW	Sodium chloride	Preparation of demi water	Water preparation plant	For water softening	4 barrels 200L each		
21	EFW	Softener	Preparation of demi water	Water preparation plant	For water softening	4 containers 350L each		
22	EFW	Hydrogen	TOC monitoring	Process gas emission control container	Gas	2 bottles 50L each	X	X
23	EFW	Calibration gas	Monitoring of gas emissions on the emitter	Process gas emission control container	Gas	2 bottles 50L each	X	
24	EFW	Fly ash	APCR silo	APCR fly ash stabilization	Powdery substance	2 silos 100 m^3 each		
25	EFW	Cement	APCR silo	APCR fly ash stabilization	Powdery substance	1 silo 100 m^3		
26	EFW	Drain water	APCR stabilization	APCR fly ash stabilization	Landfill Leachate water used to mix with APCR and Cement	2 tanks 30 m^3 each		
27	EFW	Transformer oil	110/11kV transformer	Outdoor	Transformer oil	Tank around 1 m^3	X	

28	EFW	NOVEC 1230, pressurized gas	Automatic fire extinguishing system	Per design	Gas	Around 28 bottles 150L each		
29	EFW	Lubricants	Equipment	Lubricant storage	Lubricant for engine bearings	Optionally		
30	EFW	Ethylene glycol, solution	Cooling system	Warehouse for chemicals	Antifreeze	200L	X	
31	EFW	Oil (hydraulic)	Hydraulic systems	Warehouse for chemicals	Liquid substance	Around 1.300L	X	
32	BEP	Charcoal (granular)	Silo	Outdoor silo	Solid substance	3 silos 10 m^3 each	X	
33	BEP	Transformer oil	Transformer	Outdoor	Transformer oil	2 tanks 1 m^3 each	X	
34	BEP	Ethylene glycol, solution	Cooling system	Outdoor container	Liquid substance	1 tank 1,5 m^3		
35	BEP	Oil (motor)	Motor plant	Outdoor container	Liquid substance	2 tanks 1,5 m^3 each (for new and waste oil)	X	
36	BEP	Urea (NH_2CONH_2, 40% solution)	Urea dosing system, SCR DeNox	Outdoor container	Liquid substance	1m ^{3} plastic container		

Based on the table and reported types and quantities of hazardous substances and the Rulebook on the List of hazardous substances and their quantities and criteria for determining the type of document produced by the seveso industrial installation or complex operator ("Official Gazette of RS" 41/10, 51/15 and 50 / 18), Functional Unit 1 does not store hazardous substances (defined by the Rulebook) in quantities that define the installation as a "higher order" installation, that is, a high-risk installation.. Based on the prior notification on the types and quantities of hazardous (seveso) substances and chemicals present or found in the plant, it is the responsibility of the Project leader to contact the competent Ministry for determining the obligation for the type of SEVESO document produced for the industrial installation in question.

The storage of the substances shown in the table is defined in detail in the project and technical documentation in accordance with the professional regulations and rules.

Generally, all technical gases are shipped in standard steel bottles from an authorized supplier and returned after use. Wire cages with a canopy are used for the storage of the bottles, protected from direct sun exposure and uncontrolled access.

Liquid substances are stored in warehouses, closed facilities, in suitable packaging (e.g. in double- walled tanks for the energy-generating product / fuel, IBC containers, metal / plastic barrels, etc.), as well as silos for liquid reagents (e.g. urea solution). Liquid substances packaging is stored in appropriate facilities such as reinforced concrete bundwalls (for fuel), reinforced concrete hopper (for raw materials / waste), warehouses, workshops, utility rooms, etc.

All hydrotechnical facilities such as tanks for receiving oil (under the transformer), tanks for receiving waste water (process and oily), separator of grease and oil (oil pit), etc. are of reinforced concrete and watertight, as well as open air plateaus (e.g. plateaus for ripening and depositing slag in the IBA zone).

All powdery and easily suspended substances (from flue gas treatment plants - APCR, reagents - hydrated lime, activated charcoal) is stored in aboveground steel freestanding silos.

All silos for the storage of powdery substances are standard with appropriate associated bag filters to prevent emissions of powdery substances during the filling.

Waste Delivery Accidents

The municipal waste delivered to the EfW plant will be transferred through the inlet hopper directly into a thermo-process hopper with a capacity that allows continuous operation for up to 5 days. Deliveries of waste will be managed between the EfW plant and the landfill residues to avoid reaching the maximum capacity of the hopper. Therefore, even in the event of a failure of the thermal processing installation, it is still possible store the waste until the plant is restarted.

Accident at gas purification system installations

Due to the absence of moving / rotating elements in the process, there is a low likelihood of an accident occurring at flue gas treatment systems at the EfW plant and at landfill gas treatment systems at the BEP plant, In the event of an accident of any element of the installation (e.g. reagent dispensers, fans, gas analyzer, etc.), the plant will automatically execute a controlled shut -down (stopping waste dosing and gas flow).

Bag filters are separated into 8 compartments: If a delay / accident is detected in the dust collection / transport system OR if the exceedance of output concentrations in the continuous emission monitoring system is detected, then the compartment in which the problem has occurred can be isolated by silencers (for example, baghouse puncture or a clogged dust collector). filters or clogged dust collector). The load of the EfW plant can be reduced to adjust the flue gas flow after one or more baghouse compartments are closed.

7.4. FIRE RISK

A crash accident that may occur during the regular operation of an EfW plant is a fire that is associated with a long waste time in the waste hopper (e.g. longer periods of operation of the plant with reduced waste incineration capacity, downtime / failure of cranes with grapples, etc.).

The lower layers of stored waste can create conditions for anaerobic fermentation and methane generation, the stored waste may also contain flammable components and the like. These conditions can lead to the formation of mass inflammation in the lower layers of waste.

To avoid this situation, the hopper will be equipped with a digital thermal camera to monitor the waste layers in the hopper in specific cycles. The hopper fire extinguishing system is based on a water and foam system. It is planned to equip the hopper with an automatic extinguishing system, which can cover the waste layer with foam.

The extinguishing system will ensure:

- distribution of sprinklers in such a way as to provide coverage of the entire surface of the hopper,
- the ability to control fire extinguishers from the control panel located in the control room,
- the capacity of the fire extinguishing tank with the appropriate substance (foam) will allow the fire extinguishing activities to be maintained for at least 120 minutes,
- The roof of the hopper has a smoke extraction system installed (fire and emergency ventilation) installed.
- Fire sprinklers will also be installed in the hopper directly through the waste feeder.

Fire risk is also present in other parts of the EfW plant (boiler room, turbo plant, transformers ...) as well as at BEP plant.

The fire can also be the result of human error or malfunction of equipment used in plants. Steps should be taken to avoid such a threat: by training employees in the field of fire protection, safety and occupational safety, by protecting equipment from unauthorized access, and full compliance with fire safety regulations.

It should be noted that when extinguishing a fire, environmental standards against pollution do not apply. This is an emergency where every effort must be made to minimize potential losses in human lives and material goods.

The risk of water generated during fire extinguishing (firewater)

Land and surface water may be at risk of firewater. The planned ways of managing firewater are as follows:

- firewater in the waste hopper and unloading area will be collected inside the hopper. The waste hopper is watertight in order to eliminate the risk of contaminated water entering the soil and aquatic environment,
- drainage of water from the interior of the building and the outer plateau for flue gas purification treatment will be carried out by drainage canals and sewage network to the waste water pit, and if this pit is filled, it will be discharged into the lagoon for leachate water (which is outside the Functional unit 1 and is a part of another project),
- the firewater drainage system from open areas outside buildings (except the plateau for flue gas purification) will be directed with atmospheric waters to the atmospheric water lagoon (which is outside Functional unit 1 and is a part of another project).

7.5. RISK OF HUMAN-CAUSED ACCIDENTS

Statistically, most of the crash accidents occur due to human errors caused by insufficient training, unclear operating procedures and / or negligence. In order to prevent these situations and avoid or reduce possible injuries at work, it is necessary to:

- Perform appropriate training and testing of operators of plant and equipment,
- Define clear procedures for working on equipment and handling inconsistent work of the plant and equipment with short operational instructions for handling emergency situations,
- Prohibit the eating and alcoholic beverages in the workplace as well as working under the influence of alcohol, drugs and certain medications at the plant,
- Define transport routes and place appropriate notification, warning and prohibition signs on roads, critical points in the plant and workplace,
- Limit the speed of movement of the vehicle in the functional complex,
- Provide employees with necessary protective equipment and install cabinets with basic first aid supplies,
- Conduct periodic controls on the application of the defined instructions for operating the plant, etc.

If the prescribed measures for using personal protective equipment observed, the risk to the safety and health of workers will be minimal.

8.0. DESCRIPTION OF THE MEASURES PROVIDED FOR THE PREVENTION, REDUCTION AND REMOVAL OF THE HARMFUL ENVIRONMENTAL IMPACT OF THE PROJECT

8.1. MEASURES PROVIDED FOR BY LAW AND OTHER REGULATIONS, NORMS AND STANDARDS AND DEADLINES FOR THEIR IMPLEMENTATION

Legislation and EU directives governing waste management, waste incineration and emission of pollutants into the environment are numerous and are partly presented in the section presenting the documentation used for the project study.

The implementation of the provisions arising from the legislation is binding on the Project Leader, regardless of the protection measures provided in this study.

Also, guidelines for the project in question are also binding and derive from EU directives, BAT reference documents, international conventions and agreements to which the Republic of Serbia is a signatory.

Environmental measures arising from laws, regulations, standards and other documents, on which the preparation of project technical documentation is based, are defined by the conditions of the competent authorities and institutions.

The implementation of the project in accordance with the revised and adopted technical documentation, with the control and supervision of the competent administrative bodies, also ensures the implementation of environmental protection measures arising from legal regulations, standards, norms, etc.

8.2. MEASURES TO BE TAKEN IN THE EVENT OF AN ACCIDENT

There are many types of measures to be taken in the event of an accident and can be categorized as follows:

- Accident prevention measures
- Accident preparedness measures
- Accident arrangements and
- Accident remediation measures

These measures are dealt with in great detail by documentation prepared by the operator of the seveso-plant, in accordance with the legal regulations which is binding on the Project Leader after the construction of the plant.

Based on the above, the Project Leader shall:

- Comply with technical documentation in all stages of realization, especially for the realization of the fire protection project
- Develop procedures and operational instructions for dealing with accidents
- Train workers in handling accidents situations
- Develop appropriate emergency response schemes
- Designate those responsible for taking steps in the event of accident
- To visually mark places with hazardous substances with appropriate signs to inform about, warn against and prohibit certain activities at critical places in the plant
- Perform proper installation for the supply and distribution of water for fire protection
- Perform appropriate stable fire extinguishing installation (external and internal hydrant installation) in accordance with the project
- To carry out other suitable fire extinguishing installations (drencher and sprinkler system as well as inert gas extinguishing system) in accordance with the project
- Set manual and transportable mobile extinguishers for first signs of fire in accordance with the project
- Perform appropriate installation to control the leakage of flammable and explosive gases
- Perform proper video surveillance and smoke and flame detection installation with a sound- light signal alarm
- Set appropriate central for fire alarm and fire response
- Test the knowledge of employees in the field of fire protection in accordance with the training program approved by the competent MIA body
- Occasionally, in accordance with the training program, conduct trainings and exercises simulating accident situations
- Regularly service mobile fire extinguishers for first signs of fire and check the safety of the hydrant network. Inspection and service must be performed by authorized companies
- In the event of a small-scale fire / accident, immediately respond with suitable installed / set equipment. This is the obligation of all employed persons at the place of accident, except in the case of danger to their own life
- Evacuate highly flammable materials from the area affected or likely to be affected by fire
- In the event of an accident, use all available extinguishing agents and means for preventing the spreading of fire
- In the case of large-scale fires, activate a stable fire extinguishing system and notify the competent authorities of the accident.
- If it is assessed that the fire cannot be safely contained and extinguished with existing means and forces, immediately inform the competent MIA - Emergency Sector;
- Upon assessment of the situation, the responsible person shall also inform other emergency services (ambulance), Poison Control Center, competent republic authorities, local self-government bodies and the local population, in accordance with the adopted procedure in case of accident
- -act on the orders of professional services when they arrive

- It is obligatory to monitor basic environmental factors during the accident
- After an accident, make a report of an accident with mandatory measures to prevent the same or similar accident from happening again
- Depending on the extent and consequences of the accident, monitor affected environmental factors post-accident
- It is the responsibility of the Project Leader to provide the means for recovery after the accident and for any consequences in accordance with the established accident recovery project
- The project documentation envisages a Fire Protection System consisting of the following:
  - Water tank,
  - Water pumping stations,
  - External and internal hydrant networks,
  - Installations with spray water.
- Supply of water for extinguishing is provided by:
  - from two 685m^3 tanks with a constant flow of water,
  - via "B" connection type for fire extinguishers from fire trucks.
- Water distribution is foreseen through the fire protection pumping plant
- The pumps are sized to satisfy the most unfavorable quenching zone while operating both external and internal hydrant networks.
- Two pumps with a diesel engine with a capacity of 11,350 lit / min (3,000gal / min) are planned for continuous operation of the sprinkler installation for a duration of 120 minutes.
- The hydrant network of the plant is annular designed to meet the water supply of max. 2269 l / min for simultaneous operation of external and internal hydrant network.
- In order to increase the safety and efficiency of fire extinguishing and to protect equipment vital in the process, installations for automatic fire extinguishing of water are envisaged in the following facilities: the hopper, the boiler room building, turbine building and fire water pumping station.
- The project envisages a stable fire-fighting installation with water as a fire extinguisher with automatic and manual activation.
- A sprinkler system and a drencher system have been adopted for fire protection in the facilities. In the whole area, which is to be protected against fire, a pipe line is planned:
  - with sprinkler nozzles under the ceiling of premises,
  - with drencher nozzles for structural protection,
  - with sprinkler nozzles to protect equipment,
  - with three fire extinguisher monitors in the hopper.
  - automatic inert gas extinguishing system is provided in power plant facilities (transformers, critical electrical equipment)
- All roads, turnovers and plateaus to be used in the event of the need for intervention of fire trucks are planned in accordance with the current Rulebook on technical standards for access roads, turnovers and landscaped plateaus for fire trucks in the vicinity of facilities at increased risk of fire (”Official Gazette FRY”No. 8/95):
- The facilities will be protected by an internal hydrant network and / or appropriate fire protection according to their contents.

- The facilities will be provided with fire protection with all the necessary mobile firefighting equipment.
- A small number of people works in the facilities, and regardless of this fact it is planned that employees or visitors can be evacuated safely from each facility.
- Walls and materials will be selected in accordance with applicable fire protection regulations.
- Where appropriate, container type facilities (at BEP plant) will be covered by fire detection and methane explosive concentration installations.
- Installation of hand-held portable fire extinguishers for first signs of fire is planned at appropriate locations.
- The fire alarm system consists of a central unit, automatic detectors, manual detectors, input / output modules, alarm sirens with flashes and installation cables.
- Manual fire alarms are also provided for direct alarm.
- Containers of BEP plants are included in installations for detecting fire alarms and detecting explosive gas concentrations with a notification to the central unit at the EfW plant.
- The fire control panel and the gas control panel of the BEP plant are networked with the fire control panel in the EfW plant.

In accordance with the ATEX Directive, which is transposed by the Regulation on Preventive Measures for Safety and Welfare at Work Due to the Risk of Explosive Atmospheres ("Official Gazette of the RS", No. 101/2012), appropriate ATEX certified electrical and mechanical equipment must be installed in hazardous areas with a certificate of product conformity, in accordance with the Rulebook on Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres (Official Gazette of the Republic of Slovenia, No. 1/13).

8.3. ENVIRONMENTAL PLANS AND TECHNICAL SOLUTIONS

During the development of the project, many environmental measures have already been integrated into the Project itself. In addition, in order to reduce or avoid negative impacts, as well as to improve positive impacts, in this chapter, due to the complexity of the project, the planned protection measures are given in tables.

Project preparation phase

Given the complexity of the Project, it is the responsibility of the Project Leader to comply with the provisions of national law, the guidelines given in the EU Directives and to apply the BAT provisions in the conception of the project and in the selection of equipment.

National legislation is defined by laws, regulations and rulebooks, among which are the following basic areas of application:

- planning and construction of facilities
- environmental protection
- protection of safety and health
- protection of nature and biodiversity
- protection of cultural heritage
- protection against fire and crash accidents
- protection of air, water and soil

In the project preparation and realization phase, it is the responsibility of the Project Leader to ensure any conditions from the competent authorities and institutions.

In all subsequent stages of project development, the requirements and guidelines given for the technical project documentation in the terms of the competent authorities and institutions must be complied with.

Pre-construction phase - site construction

Water and soil
- Provision of temporary facilities for construction site workers (offices) is foreseen
- A sufficient number of chemical toilets are to be provided as well as their emptying by an authorized company.
- Containers for municipal and other types of waste and packaging are to be provided as well as their regular emptying.

Landscape and noise
- Determine areas - green area that should not be used during the construction phase.
- Mark the area, and if necessary enclose the space (deep pits) where the construction will take place.

Construction phase

Water

- Protective foils, tubs, etc. should be placed on all the plateaus where accidental leakage of liquid substances can be expected.
- On all plateaus and places where accidental leakage of liquids (diesel fuel, oil, chemicals, etc.) can be expected, appropriate drains towards the strainer and / or grease and oil separator..
- Store petroleum products required for the operation of machinery in storage facilities intended for that use to prevent any leakage, in accordance with regulations..

Soil and agricultural soil

- Provide an area for depositing excavated material and soil within the construction site.
- Perform site planning on the site
- Ensure organized movement and manipulation of vehicles and work machines within the construction site, with minimal use of green areas.
- Refuel vehicles and construction machinery at designated locations.
- Keep vehicles and equipment in good working order to prevent oil and fuel leaks.
- Provide equipment / material for the collection and disposal of possibly spilled petroleum products.
- Dispose of the contaminated adsorbent using suitable packaging and treat it as hazardous waste.
- Potentially contaminated soil must be stored separately from clean soil.
- Apply mitigation measures to protect water.

Biodiversity

- Natural vegetation removal in the planned project area should be carried out strictly from early September to late February to protect the fauna of birds nesting on the site.
- Plants belonging to protected species of hawthorn (Crataegus laevigata (Poir.) DC) and white hawthorn (Crataegus monogyna Jack.) will be used to form the green belt.
- The cover of natural vegetation must be preserved wherever possible, especially by using a minimum area for operation / manipulation.
- All highly invasive species present in the project area should be removed.
- Regularly remove highly invasive species from all areas if they occur (especially ambrosia (Ambrosia artemisiifolia).
- All necessary protective measures must be taken during the execution of works, in the case of occurrence of strictly protected species.
- It is forbidden to intentionally kill and capture strictly protected species and disturb the species during the breeding and nursing periods.

Air

- Putting up effective barriers around works producing dust or around site boundaries
- All vehicles should turn off the engines in the event of prolonged breaks
- Wash or clean all vehicles before leaving the construction site
- All cargo entering and leaving the location must be covered.
- Transportation vehicles must meet the best local standards for exhaust emissions.
- Use water to "bring down" the construction site dust, especially in summer and during windy periods.
- Minimize activities that produce clouds of dust.
- Take excess soil off site.

Noise

- Turn off the engines during work breaks and when the machine is not directly involved in construction works

Landscape

- Use green area on the construction site as little as possible. Restore potential damage to green areas not planned for site activities.
- After the completion of the construction phase, the land returns to its original state and the green surfaces should be planted in accordance with the greening project.
- During excavation, the surface layer of soil will be separated, and in later stages used for the rehabilitation of the terrain after the completion of works.

Traffic and transport

- Develop a traffic management plan on and off site. Provide temporary alternative access points to the complex as needed.
- Plan truck routes to avoid traffic jams - "rush hours “
- It is necessary to place warning and notification signs along the truck traffic route.
- Trucks carrying bulk material (soil, sand, gravel, etc.) must be covered with tarpaulin to prevent it from being spilled during transport.
- Before leaving the construction site, especially in the rainy season, it is mandatory to remove mud from the wheels.

Waste

- The waste generated during construction will be sorted at the location (municipal, plastic, cardboard, metal, hazardous waste etc.), using appropriate packaging (bags, bins, containers).
- Establish a temporary plateau at the construction site to set up appropriate packaging for the generated waste.
- Ensure the regular removal of generated waste from the construction site.
- Hire legal entities with the appropriate waste management permit for the removal of generated waste from the construction site.
- Construction site waste management is the responsibility of the contractor.

Regular operation phase

- Provide a system for monitoring and keeping records of all incoming waste by type and quantity.
- Provide a system for monitoring and keeping records of all emissions from the complex.
- Provide a system for monitoring the basic environmental factors.

Water

- Buried diesel fuel tank must have a double wall and the bundwall must be made of watertight reinforced concrete.
- The bundwall must be of sufficient volume to accommodate the total amount of fuel stored.
- In accordance with the design, in all areas where liquid leakage may occur (diesel fuel, oil, chemicals, etc.), appropriate drains must be installed with drainage for treatment in the strainer and / or grease and oil separator,
- Separators / strainers for grease and oil separators should be regularly maintained / emptied.
- The contents of the oil and grease separator should be managed by the Operator with the appropriate permit to manage this type of waste.
- All surfaces where liquid substances (oil derivatives, chemicals, etc.) are expected to be handled must be concreted or asphalted.
- On these surfaces, an adequate collection and discharge of water to the designed treatment system should be provided.
- Due to occasional large daily rainfall, the condition of the bordering canals should be monitored and regularly maintained.
- Atmospheric, unpolluted water is to be discharged via adequate sewage outside the complex in accordance with the project.
- Atmospheric, potentially contaminated water is to be discharged with appropriate sewage for treatment in accordance with the project.
- Industrial waste water is to be discharged with appropriate sewage for treatment in accordance with the project.
- Sanitary fecal water is to be discharged for treatment.
- In accordance with the project documentation, unpolluted atmospheric water and treated technological wastewater are to be maximally used by means of a recirculation system.
- Proper monitoring of all water flowing into the natural recipient should be insured.
- Monitoring of the recipient water should be provided.
- An authorized and accredited laboratory / legal entity should be entrusted with the monitoring of the water.
- All buried objects, as well as parts of buried objects, should be made of waterproof concrete.

Soil and agricultural soil

- Regular inspections of surface water drainage systems are necessary to ensure that surface water does not accumulate at the site and spill over into the surrounding soil.
- Provide adequate adsorbents for the collection of spilled liquids (petroleum products, chemicals, etc.).
- Provide suitable packaging (e.g. metal barrels) for receiving contaminated adsorbent.
- Handle contaminated adsorbents as hazardous waste materials, in accordance with the report on the previously performed characterization of this type of waste, in accordance with the law.
- Provide a place for temporary disposal of packaging containing the collected hazardous waste.
- The collection of the generated waste should be entrusted to a legal entity with an appropriate waste management permit.

Biodiversity

- Regularly remove highly invasive species from all surfaces if they reappear.
- External light sources should be directed downwards, i.e. be pointed at the working areas.

Air

- The discharge of gases, vapors and aerosols into the atmosphere is done through defined emitters, in accordance with the project.
- Prior to discharge into the atmosphere establish appropriate waste gas treatment systems in accordance with the project.
- The project envisages systems for reducing PM, NOx and GHG emissions into the atmosphere.
- Equip all defined emitters with a measuring point (for sampling) in accordance with legal regulations / standards.
- Provide adequate air monitoring on all defined emitters.
- Entrust air monitoring to an authorized and accredited laboratory / legal entity.
- Provide an air evacuation system above the waste receiving hopper and its treatment to reduce odors.
- Store bulk materials (lime, activated carbon, etc.) in silos, in accordance with the project.
- The silos must be equipped with their own system (filter) at the top, to reduce the emission of powdery substances.

Provide reduction of diffuse emission of dust from the complex by applying water spray tanks, especially in dry and windy periods

Noise

- Shut off the engine of the delivery van on the complex during breaks and longer standing.
- Provide adequate personal protective equipment for all the employees who are in active contact with noise sources.
- Provide suitable enclosures, anti-vibration washers and sound insulation on equipment that is a significant source of noise and vibration.

- In facilities with noise-transmitting equipment, keep the door leading outside closed.
- Limit the movement speed of vehicles outside the complex.

Landscape

- Within the green space, it is necessary to remove and replace damaged or dry vegetation with the same specimen of the species, in accordance with the green action project.

Traffic and transport

- Follow the Traffic Management Plan on and off the site.
- Organized and controlled movement of vehicles must be within the defined routes.
- Place vehicle speed limit marks at the complex.
- It is obligatory to wash the wheels on waste vehicles and other delivery vehicles in the exit zone before going on a public road.

Waste

- Develop a Waste Management Plan.
- Waste generated during work, such as office waste, packaging, hazardous waste,
- etc. is sorted at the point of origin.
- Depending on the waste type (non-hazardous/hazardous), dispose of it properly in a suitable packaging.
- Store waste packaging on the defined surfaces and in facilities (depending on the type of waste), in accordance with the Waste Management Plan.
- Solid waste from combustion gas treatment, index no. 19 01 07 *, APCR containing dangerous substances, index no. 19 01 13* and boiler dust containing dangerous substances, index no. 19 01 1*, store in silos intended for this purpose, to prevent the emission of APCR (powdery substance/ fly ash) into the air before the process of solidification and chemical stabilization.
- Clinker from the bottom of the boiler plant is temporarily stored on a plateau in the IBA zone, pending the construction of a landfill for the residues resulting from waste treatment at the EfW plant.
- Keep waste chemicals in their original packaging and store them together with chemical packaging in the hazardous waste facility / room.
- Special waste streams should be stored in accordance with the legislation and the Waste Management Plan.
- The project envisages a laboratory for the control of waste to be incinerated in the boiler plant.
- Waste control also includes checking of the waste documentation, the owner of waste, the type, quantity, and the report on the waste that is to undergo thermal treatment / incineration, etc.
- The report on examination of the waste that is to undergo thermal treatment is developed by the authorized and accredited laboratory, in accordance with the legislation.
- If the waste delivered for incineration does not correspond to the “permitted” types of waste for thermal treatment, it is temporarily disposed of in the “quarantine

zone“planned at the Vinča landfill complex, but outside the boundaries of the Functional Unit 1.

- The waste from the quarantine zone that does not meet the conditions for incineration is returned to the owner of that waste.
- The monitoring system must include the production of biogas and leachates and their treatment in accordance with the applicable regulations and good industrial practices.

- The structural stability and watertightness of the top cover system should be monitored regularly.
- Due to the possible high volume of daily precipitation, the condition of the perimeter canals should be monitored and regularly maintained.
- Regular inspections of surface water drainage systems are required to ensure that the surface water drainage is not accumulated at the site.
- Provide adequate adsorbents to collect any spilled liquids (petroleum products, chemicals, etc.).
- Provide adequate daily coverage of land-filled waste to prevent the dispersion of light fractions from the landfill body (dust, paper, bags, etc.) and reduce rainwater infiltration.
- Surplus land from excavation works will be reused at the site.
- In order to prevent seagulls from gathering in large numbers and feeding at the site, the active areas of the new landfill should be covered on daily basis.
- Regularly check the compactness of the enclosure around the landfill to prevent large mammals from entering the project site.
- Regularly remove highly invasive species from all surfaces if they reappear.
- Mowing at the landfill complex should be done only once a year to allow for succession of natural grassland communities and to prevent seagulls from using this area as a loafing habitat.
- Enable the development of high herbaceous vegetation wherever possible (near roads, canals, lagoons).
- The covered areas of the active new landfill, which will not be used for at least a month, should be planted with a mixture of fast-growing grass.
- Flue gas parameters should be monitored regularly and in accordance with the legislation.
- Monitor gas collection and combustion systems to control and prevent gas loss.
- Effectively cover and use the material placed on the received waste to prevent odours from spreading.
- Provide adequate personal protective equipment for all the employees who are in active contact with noise sources.
- Within the green space, it is necessary to remove and replace damaged or dry vegetation with the same specimen of the species.
- The wheels on the vehicles are to be washed in the landfill reception/control area before entering a public road.

Technology risk

Project preparation phase

- In the initial phase, draft a project of preparatory works with the mandatory section relating to fire protection and safety measures and occupational safety and health measures.

Construction phase

- Train the workers on the procedures in the accident situations (leaking of oil derivatives, chemicals, powdery substance cloud, fire, etc.)
- Provide adequate adsorbents for the collection of liquids (petroleum products, chemicals, etc.) in case of spillage.
- In the event of an accident, remove the contaminated soil and treat it as hazardous waste.
- Prevention of erosion of protective slopes / slants.
- Prevention of occupational injuries by adequate organization of construction materials (collapsing of the construction materials on the workers, etc.).
- Proper storage of the material that is prone to falling, rolling, etc.

Regular work phase

- Set up appropriate notice boards, warnings and bans on certain activities (e.g. smoking bans, mandatory use of personal protective equipment, danger of high voltage, high temperatures, etc.).
- Design and implement a video surveillance system.
- Design and implement gas, smoke and fire detectors at critical locations in the plant.
- Design and implement an automatic fire extinguishing system.
- Design and implement a sound and light alarm system.
- Design and implement a system of external and internal hydrant network.
- Install mobile initial fire extinguishers in critical locations, in accordance with the project.
- Maintenance of the fire protection equipment by authorized companies.
- Mobile fire extinguishers must be easily accessible.
- Install first aid cabinets.
- Develop an Accident Protection Plan, in accordance with the type of documentation developed by Seveso plant operators.
- Develop a fire protection project.
- Provide roads for fire trucks.
- Provide escape routes in the event of an accident / fire and a safe meeting place.

Social aspects

Project preparation phase

- Resettlement Action Plan and Livelihood Restoration Action Plan have been developed.
- The implementation of the Action Plan is the responsibility of the City of Belgrade.

Construction phase

- Prevent or reduce impacts from construction sites on the surrounding households / settlements.

- The Action Plan defines the briefing of the companies and waste collectors about the expected onset and duration of each phase of the project.
- Encourage contractors to hire local workforce.
- Identify seasonal workers and ensure that their position is not less favourable compared to that of other workers performing similar functions.
- Place the entry ban and other warnings at the entrance to the construction site in visible places.

Regular work phase

- Provide educational material and increase awareness on waste management.
- Organize panel discussions with the stakeholders (population, local communities, NGOs...) and familiarize them with the risks, the protective measures applied, the benefits of the project, etc.
- Ensure cooperation with the local health care facility.
- Provide worker / employee complaint mechanisms.
- Prohibit the entry of unauthorized persons, citizens and especially children.
- Provide basic vocational training program and special courses for workers / employees.
- Train the workers on "good neighbourhood" policies to avoid causing distrust in the operation of the project.

Technical solutions

The selected technical and technological solutions are in accordance with the recommendations of the BAT reference documents, as discussed in Chapter 3.3.

Water

- Conditionally unpolluted atmospheric precipitation will be discharged into the internal system of mainly open channels for receiving atmospheric precipitation throughout the Vinča complex, directed towards the clean water lagoon located on the landfill complex.
- The water from clean water lagoon is used to wet the surfaces of the complex to reduce dust on the complex.
- Technologically and atmospherically contaminated water is collected in the leachate and recirculated within the EfW plant process, while the excess will be treated in the leachate treatment plant before it is discharged into the effluent stream.
- Sanitary-sewage (foul) wastewater is treated at the wastewater treatment plant located at the landfill complex.
- All surfaces where liquid leakage may occur (diesel fuel, oil, chemicals, etc.) are made of concrete / asphalt with the adequate drainage to the grease / oil precipitator / separator.
- The EfW plant is designed to maximize water reuse.
- In the event of large daily volumes of precipitation, the wastewater lagoon will be connected to the leachate lagoon at the landfill where the wastewater will be treated.
- Industrial wastewater is also used in the APCR (fly ash) stabilization process. All process / industrial water is in the leachate recultivation system.

- The project does not envisage the discharge of effluent from the EfW plant into the natural recipient, but will be collected through the process wastewater network at several sites within the plant and reused in the process.
- Several receiving pits / lagoons are foreseen for the collection of contaminated wastewater from the EfW plant:

  - IBA (incinerator bottom ash) receiving lagoons, with the capacity of $60m^3$
  - IBA lagoon, with the capacity of 800 m3
  - Waste water pit, with the total capacity of 330 m3
- The wastewater lagoon will collect the following wastewater:
  - wastewater from a water treatment plant;
  - water from the boiler, which is discharged from the condensate tank and the tank with atmospheric precipitation into the pit (a part of the condensate from the tank is returned to the cycle);
  - waste water resulting from the floor washing in the process areas (including boiler house, turbine hall, water treatment plant area, etc.)
  - atmospheric precipitation from the reagent storage area, fly ash storage area and from the flue gas treatment area, where ash, APCR or reagent presence is possible.
- The wastewater basin consists of several zones: sedimentary chambers, with the receiving unit for flow equalization, recultivation chambers and storage chambers (buffer).
- The water intended for reuse will be transported by pump from the recultivation chamber to the following consumers in the process:
  - bottom ash extractor (for ash cooling purposes) and
  - combustion system, APCR.
- Under normal operating conditions, all wastewater will be consumed / recultivated at the EfW plant.
- The clean water from the process (the concentrate from the water treatment plant and from the water and steam sampling system) is discharged into the sewage network and further discharged into the atmospheric precipitation lagoon (cleanwater lagoon) at the landfill complex.

Air

- A vertical waste incineration boiler with the optimized energy utilization and NOx reduction in the boiler furnace has been selected.
- NOx reduction system from waste gases contains the following:
  • The system for transferring 40% of the urea solution from the truck to the urea storage tank.
  • Urea solution tank.
  • The pumps for transporting urea solution from the tank to the boiler furnace.
  • The demineralized water system, which is used to dilute the urea solution and flush the system.
  • The compressed air system used to spray urea solution and to cool injectors.
  • The injection system, which injects urea solution into the boiler furnace.
- At the EfW plant, the waste combustion is carried out in combination with an SNCR (Selective Non-Catalytic Reduction) system that also significantly reduces NOx emissions.

- In air heaters, most gases released from the waste are immediately oxidized at high temperatures when mixed with the residual air from the furnace.
- The consumption of the urea solution is controlled so that the NOx emission level is kept at a constant temperature within the permissible limits.
- Solidification and Chemical Stabilization Plant: the APCR silo, the cement silo and the silos for the solidification process will be hermetically sealed to prevent air emissions.
- Each silo will be equipped with filters to prevent dust emissions.
- The activated carbon silo used in the waste gas treatment process will be hermetically sealed.
- The silo is equipped with the filter to prevent dust emissions.
- IBA process: IBA (ash and clinker from the bottom of the boiler plant) will be processed directly after cooling with water.
- The treatment of IBA with high moisture content reduces the emission of dust and odors into the air.
- A baghouse filter is provided to reduce the emission of powdery substances.
- The incinerator debris removed by baghouse filters still contains components of unreacted lime. Part of the dust from the baghouse filter is returned to the reaction channel, thus maximizing the recirculation of the reagent / lime used.

Waste

- The planned areas and the facility for temporary storage of all generated waste types (non-hazardous and hazardous), outside the boundaries of the Functional Unit 1.
- The "quarantine" procedure has been put in place to reduce the risk of the "unexpected" waste. The suspicious waste is sent to the quarantine zone. This area is used for suspected non-compliant waste (prohibited waste), outside the boundaries of the Functional Unit 1.
- The quarantine procedure includes the following steps and is defined by the following procedure:
  - Identification of suspected waste on the weighbridge.
  - Identification of radioactivity in the control area, which is outside the boundaries of the Functional Unit 1
  - The open dump can be checked in the control area by having a worker on the weighbridge inspect the waste (visually) or by using video cameras.
  - Random checks will be carried out on site, especially of the waste going to the EfW plant.
  - The identification of suspicious waste at the EfW (Waste hopper) facility.
  - The prohibited types of waste, which may be present in the waste hopper, may be checked by the operator visually from the crane or on installed video cameras from the control room.

Biodiversity

- The location of the entire Vinča landfill complex will be fenced with a suitable wire fence to prevent medium and large animals from entering the complex.
- The greening of the area will be carried out in accordance with the Green Action Project.

Creating protective greenspace

The protective greenspace is not in the strict sense the subject of this study, but in order to mitigate some of the negative impacts of the plants and associated facilities in the Functional Unit 1, it is also one of the technical protection measures. The protective greenspace:

- mitigates the visual effect in the immediate vicinity of the complex
- stabilizes the land
- prevents unfavourable air currents on the complex
- depreciates horizontal wind gusts
- reduces spreading of the dust from plateaus and internal roads
- reduces the level of noise generated from the complex

The protective greenspace in the Functional Unit 1 shall be realized in accordance with the Exterior Design Project.

The Project envisages smaller areas for greening, while the larger green area, in the form of a protective belt, is anticipated around the complex.

Two-row seedlings and a lawn are foreseen in the parking lots.

8.4. OTHER MEASURES THAT MAY HAVE THE EFFECT OF PREVENTING OR REDUCING HARMFUL EFFECTS ON THE ENVIRONMENT

In the construction phase:

- The archaeological site "Ošljane" is a resource that enjoys preliminary protection under the Law on Cultural Heritage. In order to protect the archaeological site "Ošljane", during the execution of any earthworks or construction of new facilities, the Investor is obliged to ensure permanent archaeological supervision and protective archaeological interventions should the archaeological objects or facilities be found.
- In accordance with the Terms of Preservation, Maintenance and Use of Cultural Resources and Resources Enjoying Prior Protection and the Conditions of the Institute for the Protection of Cultural Monuments of the City of Belgrade (arch.no. P2249/14 dated 23rd of July 2014) the envisaged archaeological supervision is performed in accordance with the special program, which takes place at the Institute for the Protection of Cultural Monuments of the City of Belgrade, and in cooperation with the Project Leader.
- If an archaeological site is discovered, it is possible to require the archaeological works and site conservation, the relocation of the findings or displacement of parts of the project. The Project Leader is to respond to the possible requirements of the Institute for the Protection of Cultural Monuments.
- Also, if archaeological material is discovered during the works anywhere in the planned project area, under the Articles 28 and 29 of the Law on Cultural Property ("RS Official Gazette", No. 71/94, 52/11 – Second Law, 92/11 - Second Law), it is obligatory to inform the Institute for the Protection of Cultural Monuments of the City of Belgrade and to act in accordance with their instructions

In the regular work phase:

- If odour problems are detected outside the enclosure, conduct a preliminary investigation of the concentration of odour-bearing substances to determine the origin and mode of odour dispersion outside the complex
- The investigation must also include the proposal for additional odour reduction measures
- In the case of persistent odour problems occurring outside the boundaries of the complex, odour investigation should be performed according to the European Standard EN 16841-2: 2016 or the European Standard EN 16841-1: 2016 (depending on the odour and possible source) in order to characterize the odour, sources and the conditions of origin.
- It is the responsibility of the Project Leader to regularly replace filter fillings, especially the activated carbon filters in the EfW and the oxidation catalyst at the BEP plant.
- The replacement of the filter filling is to be entrusted to the equipment supplier or to the authorized maintenance staff.
- The spent (contaminated) activated charcoal should be temporarily stored in the hazardous waste storage facility on the Operational Platform (which is the subject of another project or other impact assessment study), until it is handed over to the operators with the appropriate permit to manage this type of waste.

- Based on the prior notification on the types and quantities of hazardous (seveso) substances and chemicals present or found in the plant, the Project Leader is obliged to contact the competent Ministry for determining the obligation on the type of SEVESO document to be developed for the plant in question.
- Characterize the solidifiers and define the final disposition in accordance with the established waste character.
- Characterize the stabilized clinker from the boiler plant (IBA) and define the final disposition according to the established waste character.
- Replace baghouse filters in the EfW plant during the planned overhaul – filter baghouse replacements.
- Three landfill gas filters in BEP plant use activated charcoal: the filter is filled with
- fresh activated charcoal from above, while the spent activated charcoal is discharged at the bottom. The adsorption rate is monitored, and even when the adsorption rate drops below 80%, fresh activated charcoal must be introduced. The process is to empty 50% of the filter filling height and reset it to 100% so as to move the filling top to the bottom of the silo.

9.0. ENVIRONMENTAL IMPACT MONITORING PROGRAM

The purpose of the environmental impact monitoring - monitoring is to carry out regular sampling and laboratory analysis of the affected samples over a specified time interval in accordance with the legislation. Then, on the basis of the defined limit values, the impact on the environmental factors examined is determined and, if necessary, the measures are defined to reduce the observed negative impacts.

Also, based on the results of the monitoring, the process parameters can be corrected to harmonize (or improve) the operation of the plant with the designed and / or legal values. The monitoring monitors the main environmental factors:

- air
- water
- soil and
- environmental noise level

The monitoring frequency and parameters of pollutants are defined by the legislation for each of the environmental factors listed.

All of the above will be contained in the Monitoring Plan, which the Project Leader is obliged to develop.

9.1. AN OVERVIEW OF THE STATE OF THE ENVIRONMENT BEFORE THE PROJECT IS OPERATIONAL AT LOCATIONS WHERE ENVIRONMENTAL IMPACTS ARE EXPECTED

The overview of the state of the environment prior to the start of the project, in “zero state”, is described in detail in section 5.0. The description of the environmental factors that are likely to be significantly at risk due to the implementation of the proposed project.

9.2. PARAMETERS, PLACES METHOD AND FREQUENCY OF MEASUREMENT OF DETERMINED PARAMETERS

The monitoring plan is intended for the entire project of the new landfill in Vinča, which includes the facilities and contents in all planning units from K1 to K5. The monitoring plan shall include the following:

- The quality and quantity of the raw process water (generated from landfill bodies and collected in leachate lagoons)
- The quality and quantity of treated leachate and other water (before discharge into the effluent stream
- The quality and quantity of internal atmospheric water
- Groundwater quality
- Landfill stability, peripheral embankment and dam
- Concentration of air emissions

- Air quality
- Noise levels in the environment
- Meteorological parameters i
- Bird populations

Since the subject of this study is the planning unit K1 (EfW and BEP plant with the accompanying facilities), an excerpt from the Monitoring Plan (for monitoring air quality and environmental noise levels) is given below.

Air monitoring involves the following:

- Monitoring of air emissions (from the defined emitters) and
- Ambient air monitoring (around Vinča landfill complex)

Air emissions monitoring

In accordance with the requirements of the EU Directive (2010/75 / EU on industrial emissions from Annex V part 3), the operational parameters of the stack / emitter at the EfW plant and the emissions of pollutants into the air will be monitored by a continuous monitoring system.

The continuous monitoring system is equipped with the devices and sensors for the continuous measurement of concentrations of pollutants (SO_2, NO_x and powdery substances) in the gas outgoing stream. The boiler plant is equipped with the measuring devices that enable control and maintenance of process parameters (O_2 percentage, infrared pyrometer, temperature, fan speed, pressure, etc.). All measurements are stored in the central control unit.

In addition to the planned continuous monitoring on the defined emitter, the Project Leader is obliged to perform regular monitoring of the pollutant emissions at that particular emitter and at the BEP plant emitter by the authorized and accredited laboratory / institution, in accordance with the legislation.

All measured values at the emitters are compared with the limit values defined in the Regulation on limit values of pollutant emissions from the combustion plant ("Official Gazette of RS", No. 6/16).

Emissions control of dioxins and furans

Polychlorinated dibenzodioxin / Polychlorinated dibenzofurans (PCDD / PCDF) and polychlorinated biphenyls (PCBs)

The measurement of PCDD / PCDF and dioxin-like PCBs is covered by a number of EN standards. EN 1948-1: 2006 describes isokinetic sampling by the filter / condenser method, the dilution method or the probe cooling method [49, CEN 2006]. Subsequently, EN 1948-2: 2006 covers extraction and purification [70, CEN 2006]. Finally, EN 1948-3: 2006 and EN 1948-4: 2010 deal with the identification and quantification of PCDD / PCDF and dioxin-like PCBs, using the GC-MS isotope solution [41, CEN 2006], [51, CEN 2010].

In addition to these standards, CEN / TS 1948-5: 2015 technical specification describes long-term sampling of PCDD / PCDF and PCB. Similar to the use of sorbent traps for mercury measurement, this long-term sampling aims to determine average concentration levels over a long period, usually four weeks. CEN / TS 1948-5 relies on the same sampling principles as EN 1948-1 [216, CEN 2015]. The European Commission has endorsed these technical specifications as a new action under the Union's 2015 European Standardization Work Program [222, COM 2016]. Sampling time for PCDD / PCDF measurement is usually six to eight hours [24, EU 2010], [49, CEN 2006].

According to IED Annex VI for waste incineration plants and according to EN 1948-1: 2006, the measurement results for PCDD / PCDF are expressed in units of ng I-TEQ / m3, where I-TEQ stands for International Toxic Equivalents. obtained by applying the International Toxic Equivalence Factor (ITEF; also called the International Toxic Equivalency Factor).

These factors indicate the toxic potential of a single PCDD or PCDF congener relative to the toxic effect of 2,3,7,8-TCDD (Tetrachlorodibenzodioxin), which is the congener with the highest toxicity. Industrial Emissions Directive (IED) I-TEF kits for 17 PCDD / PCDF congeners, including 2,3,7,8-TCDD [24, EU 2010], [49, CEN 2006].

If there is a need to cover dioxins similar to PCBs, it is advisable to use the ng WHO-TEQ / m3 unit, which stands for WHO toxic equivalents (WHO-TEFs, also called WHO toxic equivalents), in addition to TEFs, include toxic equivalent factors for 12 dioxin-like PCBs. Another difference between the two concepts is that WHO-TEQs differ from I-TEF for several PCDD / PCDFs [50, Van den Berg et al. 2006], [51, CEN 2010].

On the stack emitter of the EfW plant, continuous monitoring / sampling of dioxins and furans in flue gas is planned. In addition, flue gas samples will be analyzed by an accredited laboratory in accordance with a monitoring program. The contractor guarantees the performance of the EfW plant for the above parameters up to a maximum of 0.1 ng (I-TEQ / m^3) as defined by the EU Waste Incineration Directive.

Ambient air monitoring

Ambient air monitoring sites with a passive sampler (sampler) will be installed within 3 km around the boundaries of the Vinča landfill complex. Monitoring of the following parameters is provided: PM_{10}, HF, NO_2, SO_2, HCl, Hg, BTEX and heavy metals during the construction and regular phases of the project.

Since NO_2 and PM_{10} representative indicators of pollution originating from construction and technological activities, ambient air monitoring is focused on these parameters.
In the construction phase, these parameters will be monitored in 2 fifteen-day cycles per year, one in winter and one in summer.

In the regular work phase of the project, these parameters will be monitored over 6 fifteen-day cycles throughout the year.

Other specified parameters (HF, SO_2, HCl, Hg, BTEX and heavy metals) will only be monitored in the most unfavorable time period (winter period), one fifteen day cycle.

Figure 75. Ambient air monitoring site locations

The stated frequencies of ambient air quality measurements may be revised after a three-year period of operation of the installation, if the measurement results report does not show legally defined exceedances and if new measurement frequencies are acceptable with respect to monitoring representativeness.

The aforementioned monitoring is carried out by an authorized and accredited laboratory / institution, in accordance with legal regulations.

All measured values are compared with the limit values defined in the Regulation on monitoring conditions and air quality requirements ("Official Gazette of RS", No. 63/13).

Monitoring of environmental noise levels

Environmental noise monitoring will be carried out in the wider area of the Vinča Landfill Complex according to the plan, at 4 measuring sites, with an annual frequency during the construction phase and the regular operation phase of the plant.

The aforementioned monitoring is carried out by an authorized and accredited laboratory / institution, in accordance with legal regulations.

All measured values are compared with the limit values defined in the Decree on Noise Indicators, limit values, methods for assessing noise indicators, disturbances and adverse effects of environmental noise ("Official Gazette of the RS", No. 75/10).

Accident monitoring and post-accident monitoring

- All plant and accident detection and alarm system performances shall be registered with the DCS and reported to the plant operators.
- Monitoring of environmental factors during the accident is mandatory
- After an accident, a report of the accident shall be made with mandatory measures to prevent the same or similar accident from happening again
- Depending on the extent and consequences of the accident, post-accident monitoring of the affected environmental factors shall be performed
- It is the responsibility of the Project Operator to provide means for the remedy of the accident and the consequences caused, in accordance with the designed accident recovery project

Monitoring of environmental pollution due to waste generation

Following the construction of the project, it is the responsibility of the Project Operator to comply with the Law on Waste Management ("Official Gazette of RS", No. 14/16) and the Law on Integrated Prevention and Control of Environmental Pollution ("Official Gazette of RS" No. 25 / 2015), obtains the Waste Management Permit, ie the Integrated Waste Management Permit.

As part of the procedure for issuing the above mentioned waste management permits, the Action Plan of the Waste Management Plant with defined obligations of waste management and of waste reporting will be developed.

The inlet waste at the EfW plant has the characteristics of municipal solid waste. The prohibited types of waste that cannot be treated at the plant are:

- hazardous waste
- hazardous medical waste
- liquid waste and
- industrial waste that is not similar to municipal waste by characteristics

The table gives examples of prohibited waste. The table is not exhaustive, so there may be other types of prohibited waste, which will be further defined in the Action Plan.

The table also provides exceptions in the case of small quantities of prohibited waste that can be treated at the plant, subject to all restrictions given under the conditions and approvals of the competent authorities and/or provided that the said types of prohibited waste cannot be practically isolated.

Table 38. Prohibited Waste Types and Exceptions

Prohibited waste	**The list of exceptions, ie. acceptable items per truck (delivery) of prohibited waste:**
Vehicles and vehicle parts, such as engine blocks, etc..	Parts of abandoned vehicles <15 kg, if not hazardous waste
Batteries	No exceptions

Non-hazardous liquid waste, septic tank contents	Any quantity less than 20 liters per delivery.
Bulky waste such as mattresses and large	No exceptions
Animals and animal by-products, slaughterhouse waste	Any bodies of dead animals or parts of the same <25 kg per delivery.
Car tyres	Less than 2 per delivery.
Truck tyres	No exceptions
Insulating materials such as stone wool, asbestos, calcium silicate sheets, ceramic fibers, large carpets, etc.	No exceptions
Appliances	No exceptions
Refrigerators, air conditioners and freezers	No exceptions
Electrical and Electronic Waste (WEEE)	1% of total waste if mixed with household waste, not including household appliances and refrigerators / freezers / air conditioning
Hazardous waste listed in the Official Gazette of RS no. 36/09, 88/10, 14/16. (including poisons, medicines, caustic substances, acids, hazardous paints, cutting oils, motor oils, cleaning fluids, horticultural chemicals and batteries, hazardous laboratory waste, etc.)	If mixed with household waste
Sludge from neutralization pits and detoxification and neutralization pastes (workshops, metal surface treatment plants, electroplating)	No exceptions
Extremely flammable, combustible or explosive materials	No exceptions
Radioactive waste	No exceptions
Asbestos	No exceptions
Clinical waste (contagious, pathological or hazardous)	No exceptions

10.0. NON-TECHNICAL OVERVIEW OF THE STUDY

The non-technical presentation of data from individual chapters of the Study is given as a separate document and is an integral part of this Study.

11.0. TECHNICAL DEFICIENCY DATA

During the preparation of the Study, no technical deficiencies were identified which would cause the functioning of the Project to endanger the environment. There is also no lack of expertise in the design and implementation of environmental measures.

12.0. BASES FOR THE DEVELOPMENT OF THE STUDY

Legislation

- Law on Environmental Protection (Official Gazette of RS, Nos. 135/04, 36/09, 72/09 and 14/16);
- Law on Environmental Impact Assessment ("Official Gazette of the RS", Nos. 135/04, 36/09, 72/09 and 43/11 - US decision and 14/2016);
- Law on Planning and Construction ("Official Gazette of the RS", No. 72/09, 81/09-ed., 64/10 US decision, 24/11, 121/12, 42/13 US decision, 50 / 13-US decision and 98/13-US decision, 132/2014 and 145/2014, 23/15);
- Law on Land Protection ("Official Gazette of RS", No. 112/15);
- Law on Waters ("Official Gazette of RS", Nos. 30/10, 93/12 and 101/16);
- Law on Water Regime (Official Gazette of the Federal Republic of Yugoslavia No. 59/98 and Official Gazette of the RS, No. 105/05);
- Law on Air Protection ("Official Gazette of RS", Nos. 36/09 and 10/13);
- Law on Chemicals (Official Gazette of the RS, No. 36/2009, 88/10, 92/11, 93/12 and 25/15);
- Law on Waste Management ("Official Gazette of RS", No. 39/09, 88/10 and 16/16);
- Law on Packaging and Packaging Waste ("Official Gazette of the RS", No. 39/09);
- Law on Environmental *Noise Protection* ("Official Gazette of RS", No. 36/09, 88/10);
- Law on Nature Conservation ("Official Gazette of the RS, No. 36/09, 88/10 and 91/10 – corr.14/2016);
- Law on Cultural Property ("Official Gazette of RS", No. 71/94)
- Law on Fire Protection ("Official Gazette of RS", No. 111/09 and 20/15);
- Law on Standardization (Official Gazette of the RS, No. 36/09);
- Law on Flammable Combustible Liquids and Flammable Gases ("Official Gazette of RS", No. 54/15);
- Law on Integrated Prevention and Control of Environmental Pollution (Official Gazette of RS, Nos. 135/04 and 25/15);
- Law on Strategic Environmental Impact Assessment ("Official Gazette of RS", Nos. 135/04 and 88/10);
- Law on Occupational Safety and Health (("Official Gazette of RS", No. 101/05, 91/15 and 113 of 17/17);
- Rulebook on the Contents of the Environmental Impact Assessment Study ("Official Gazette of the RS" No. 69/05);
- Rulebook on Mnner and Conditions for Measuring the Quantities and Examining the Quality of Waste Water and the Contents of Reports on Performed Measurements ("Official Gazette of RS", No. 33/16);
- *Rulebook* on *the* Designation of *Surface Water* and *Groundwater Bodies* (("Official Gazette of RS", No. 96/10);
- Rulebook on Parameters of Ecological and Chemical Status of Surface Waters and Parameters of Chemical and Quantitative Status of Ground Waters ("Official Gazette of RS", No. 74/11);
- Rulebook on the Manner of Designation and Maintenance of Sanitary Protection Zones for Water Supply Sources ("("Official Gazette of RS", No. 92/08);
- Rulebook on Determining Reclamation Areas and their Boundaries ("Official Gazette of RS", No. 38/11);
- Rulebook on Determining Water Entities and their Boundaries ("Official Gazette of RS", No. 8/18);
- Rulebook on Noise Measurement Methods, Content and Scope of Noise Measurement Reports ("Official Gazette of RS", No. 72/10);

- Rulebook on the Form of Waste Movement Document and Filling in Instructions ("Official Gazette of RS", No. 72/09, 114/13);
- Rulebook on the Form of Hazardous Waste Movement Document, the Form of Prior Notification, the Manner of their Submission and Filling in Instructions ("Official Gazette of RS", No. 17/2017);

Rulebook on Waste Categories, Examination and Classification ("RS Official Gazette" No. 56/10);

- Rulebook on the Form of a Daily Record and Annual Waste Report with Filling in Instructions ("RS Official Gazette", No. 95/2010, 88/2015);
- Rulebook on Forms for Reports on Packaging and Packaging Waste Management ("RS Official Gazette" , No. 21/2010);
- Rulebook on Amendments to the Rulebook on Forms for Reports on Packaging and Packaging Waste Management ("RS Official Gazette", No. 10/2013);
- Rulebook on Technical Standards for Access Roads, Loops and Paved Areas for Fire Engines Near High Fire Risk Facilities ("Official Gazette of the SFRY", No. 8/95);
- Rulebook on Technical Standards for Fire-Fighting Hydrant Network ("Official Gazette of the SFRY", No. 30/91);
- Rulebook on Technical Regulations for Design, Construction, Operation and Maintenance of Gas Boilers ("Official Gazette of the SFRY", Nos. 10/90 and 52/90);
- Rulebook on Technical Standards for the Protection of Objects against Atmospheric Discharge (Official Gazette of the Federal Republic of Yugoslavia, No. 11/96);
- Rulebook on Technical Standards for Low Voltage Electrical Installations ("Official Gazette of the SFRY", No. 3 / 88,54 / 88 and 28/95);
- Rulebook on Technical Standards for Fire Protection of Electrical Power Generation Plants and Facilities ("Official Gazette of the SFRY", No. 74/90);
- Rulebook on Technical Standards for Stable Installation for Fire Notification ("Official Gazette of the SFRY", No. 87/93);
- Rulebook on Mandatory Fire-Resistance Certification of Typical Building Structures and Requirements to Be Fulfilled by Organizations of Associated Labour authorized for attestation of these products ("Official Gazette of the SFRY", No. 24/90);
- Rulebook on Preventive Measures for Safe and Healthy Work When Using Work Equipment ("Official Gazette of RS", No. 23/09, 123/12 and 102/15);
- Rulebook on Preventive Measures for Safe and Healthy Work when Using Personal Protective Equipment ("Official Gazette of the RS", No. 92/08);
- SRPS EN 2 (en) - 2011 Classification of Fires;
- SRPS Z.C0.005 - 1979 Classification of materials and goods depending on their behavior in a fire;
- SRPS Z.C0.012 - 1980 Determination of categories and degree of of the fire hazards of materials; - SRPS U.J1.220 - 1981 Standard symbols for designs;
- SRPS U.J1.240 - 1995 -Degree of fire resistance of a buildings;
- SRPS TP19 2003 - Fire protection of industrial buildings - Analitically required fire resistance time;
- Rulebook on Non-Ionizing Radiation Exposure Limits ("RS Official Gazette", No. 104/09)
- Rulebook on Conditions, Manner and Procedure for Waste Oil Management ("Official Gazette of RS", No. 71/10)
- Rulebook on the List of Electrical and Electronic Products, Measures Restricting or Prohibiting the Use of Electrical and Electronic Equipment Containing Hazardous Substances, the Manner and Procedures for Management of Waste Originating from Electrical and Electronic Products ("Official Gazette of RS", No.99/10)
- Rulebook on the List of Hazardous Substances and their Amounts and Criteria for Determining the Type of Documents Produced by the Operator of Seveso Installation or Establishment (Official Gazette of the RS, No. 41/10, 51/15)
- Rulebook on Technical Standards for Building Construction in Seismic Areas (Official Gazette of the SFRY, Nos. 31/81, 49/82, 29/83, 21/88 and 52/90)
- Rulebook on Technical Standards for Hydrant Fire Extinguishing System Installations ("RS Official Gazette", No.3 / 2018)
- Rulebook on the Methodology for the Development of Rehabilitation and Remediation Projects, Official Gazette of RS no. 74/2015)
- Rulebook on Hazardous Substances in Water (" Official Gazette of SRS ", no. 31/82),
- Rulebook on Reference Conditions for the Types of Surface Waters (Official Gazette of the RS, No. 67/11),

- Regulation on Occupational Safety and Health on Temporary or Mobile Construction Sites (Official Gazette of RS, No. 14/09, 95/10);
- Regulation on Limit Values for Pollutants in Surface and Ground Waters and Sediment and Timeline for Reaching the Values ("Official Gazette of RS", No. 50/12);
- Regulation on Limit Values of Priority Substances and Priority Hazardous Substances Polluting Surface Waters, and the Deadlines for their Reaching ("Official Gazette of RS", No. 24/14);
- Regulation on the Amount of Water Fees ("Official Gazette of RS", No. 14/18);
- Regulation on Emission Limit Values for Pollutants in Waters and Deadlines for their Reaching ("Official Gazette of RS", No. 67/11, 48/12 and 1/16);
- Regulation on Limit Values for Pollutants, Harmful and Hazardous Substances in Soil ("Official Gazette of RS", No. 30/2018);
- Regulation on Measurements of Air Pollutant Emissions from Stationary Pollution Sources ("Official Gazette of RS", No. 5/16);
- Regulation on Limit Values of Emissions of Pollutants into the Air from Combustion Plants ("Official Gazette of RS", No. 6/16);
- Regulation on Limit Values of Air Pollutant Emissions from Stationary Pollution Sources, except for Combustion Plants ("Official Gazette of RS", No. 111/15);
- Regulation on Noise Indicators, Limit Values, Noise Indicator Assessment Methods, Annoyance and Harmful Effects of Environmental Noise ("Official Gazette of the RS", No. 75/10).
- Regulation on Disposal of Waste on Landfills ("Official Gazette of the RS", No. 92/10)
- Regulation on Types of Activities and Installations for which Integrated Permits are Issued ("RS Official Gazette", No. 84/05).

List of technical documentation

Mark	The name of the project
0	THE MAIN VOLUME
1/1	ARCHITECTURE DESIGN Main buildings
1/2	ARCHITECTURE DESIGN Turbine building and electrical facilities
1/3	ARCHITECTURE DESIGN Technical facilities
2/1	CONSTRUCTION DESIGN Main Objects
2/2	CONSTRUCTION DESIGN Boiler room
2/3	CONSTRUCTION DESIGN Turbine building and compressor station
2/4	CONSTRUCTION DESIGN Electrical building
2/5	CONSTRUCTION DESIGN CWP
2/6	CONSTRUCTION DESIGN Workshop, DENOX building warehouse
2/7	CONSTRUCTION DESIGN Pump stations
2/8	CONSTRUCTION DESIGN T 11KV Building and Transformer 11/110kV
2/9	CONSTRUCTION DESIGN Auxiliary facilities
2/10	CONSTRUCTION DESIGN Flue Gas Purification System Facilities
2/11	CONSTRUCTION DESIGN Flue Gas Purification System Facilities-Foundations
2/12	CONSTRUCTION DESIGN Air cooled condenser
2/13	CONSTRUCTION DESIGN Disposal of slag
2/14	CONSTRUCTION DESIGN Supporting walls and fence
2/15	CONSTRUCTION DESIGN Road project
3/1	HYDROTECHNICAL INSTALLATIONS External hydrotechnical installations
3/2	HYDROTECHNICAL INSTALLATIONS Fire protection system
3/3	HYDROTECHNICAL INSTALLATIONS Internal hydrotechnical installations - Main buildings
3/4	HYDROTECHNICAL INSTALLATIONS Internal hydrotechnical installations Processing and technical facilities
4/1	ELECTRICAL INSTALLATIONS
4/2	ELECTRICAL INSTALLATIONS Construction of electrical power installations
5/1	TELECOMMUNICATIONS AND SIGNAL INSTALLATIONS Measurement, regulation and control system
5/2	TELECOMMUNICATIONS AND SIGNAL INSTALLATIONS Telephone system and Lan network

5/3 TELECOMMUNICATIONS AND SIGNAL INSTALLATIONS Access control system and video surveillance system
5/4 TELECOMMUNICATIONS AND SIGNAL INSTALLATIONS General and alarm sound system
5/5 TELECOMMUNICATIONS AND SIGNAL INSTALLATIONS Management system for technical systems and installations in buildings
5/6 TELECOMMUNICATIONS AND SIGNAL INSTALLATIONS Fire detection and alarm system

6/1 MACHINE INSTALLATIONS Boiler installation with an incinerator
6/2 MACHINE INSTALLATIONS Turbine plant
6/3 MACHINE INSTALLATIONS Chemical Water Treatment CWT)
6/4 MACHINE INSTALLATIONS Heat transfer plant
6/5 MACHINE INSTALLATIONS Flue Gas Purification Systems (FGT Flue Gas Treatment)
6/6 MACHINE INSTALLATION DESIGN Dispatch and treatment of incinerator slag
6/7 MACHINE INSTALLATIONS Solidification and dispatch of APCR thermogenic waste
6/8 MACHINE INSTALLATION Liquid fuel system
6/9 MACHINE INSTALLATIONS Compressed air system
6/10 MACHINE INSTALLATION Thermal installations
6/11 MACHINE INSTALLATION Stable mechanical fire protection installations
8 TRAFFIC AND TRAFFIC SIGNALIZATION
9 EXTERIOR DEVELOPMENT
10 PREPARATION WORKS
E3 FIRE PROTECTION DETAILED REPORT

Contents of technical documentation

	Design Subproject	FC 1/1 (EfW Plant)	FC 1/2 (BEP Plant)
	Type of Project	*Project Contents*	
0.	MAIN VOLUME	YES	YES
1.	ARCHITECTURE DESIGN	All buildings belonging to the EfW plant within the KP 1 plot	-
2.	CONSTRUCTION DESIGN	All facilities belonging to the EfW plant within the KP 1 plot line, including roads, plateaus and retaining walls. Plateau, foundation and channel project for the installation of a landfill gas plant (FC 1/2)	-
3.	HYDROTECHNICAL INSTALLATIONS	All hydro-technical installations within KP 1regulation plot line including: -External hydraulic installations -Fire water system (exterior and interior of the system) -Interior hydrotechnical installations in main buildings -Interior hydrotechnical installations in process	-
4.	ELECTRICAL INSTALLATIONS	-Project of Power plants belonging to the EfW plant -Project construction electrical installations	Project of energy plants belonging to the BEP plant
5.	TELECOMMUNICATIONS AND SIGNAL INSTALLATIONS	-I & C EfW plant system -The phone system and the Lan network -Access control system and video surveillance system - General and alarm sound system (PAGA system) -Management system for technical systems and installations in facilities	
6.	MACHINE INSTALLATIONS	The process and machine design of the EfW plant including the following systems: -The boiler installation - The turbine installation	Process and machine design of BEP plant

		-NoX reduction system -Flue gas purification system -Delivery and treatment of incinerator slag -Solidification and shipment of thermogenic waste (APCR) - Boiler liquid fuel system - Compressed air system -Heating, ventilation and cooling system -Stable fire protection installations - Connection to the district heating system - Connected pipelines	
7.	MACHINE INSTALLATIONS	The project includes traffic within the plot KP 1	
8.	EXTERIOR DEVELOPMENT	Exterior development of the plot KP 1.	
9.	FIRE PROTECTION DETAILED REPORT	EfW Fire Protection Detailed Report	BEP Fire Protection Detailed Report

Legal acts

- EPS Distribution Network Operator Belgrade/Center, ROP-MSGI-3997-LOC-1-HPAP-8/2019 of 09.04.2019
- Elektromreža Srbije Transmission Network Operator ad, ROP-MSGI-3997-LOC-1-HPAP-7/2019 of 26 March 2019.
- PUC “Belgrade Water Supply and Sewerage” - Water Supply, ROP-MSGI-3997-LOC-1-HPAP-9/2019 of 19.03.2019.
- PUC Public Utility Company "Belgrade Water Supply and Sewerage" - sewerage, ROP-MSGI-3997-LOC-1-HPAP-11/2019 of 19.03.2019
- PUC Public Utility Company "Belgrade Water Supply and Sewerage" - protection of water sources, ROP-MSGI-3997-LOC-1-HPAP-10/2019 of 19.03.2019
- Telekom Srbija, a.d., ROP-MSGI-3997-LOC-1-HPAP-3/2019 of 22 March 2019
- PUC “City Waste Disposal”,”Gradska čistoća” ROP-MSGI-3997-LOC-7-HPAP-12/2019 of 13.03.2019
- Institute for the Protection of Cultural Monuments of the City of Belgrade, ROP-MSGI-5396-LOC-1-HPAP-17/2019 of 29.03.2019
- Institute for Nature Conservation of Serbia, ROP-MSGI-3997-LOC-1-HPAP-18/2019 of 26.03.2019
- MIA Belgrade, Emergency Management Sector, Directorate of Emergency Management Belgrade, ROP-MSGI-3997-LOCH-2-HPAP-1/2019 of 25.04.2019
- MIA Belgrade, Emergency Management Sector, Directorate of Emergency Management Belgrade, ROP-MSGI-3997-LOCH-2-HPAP-2/2019 of 25.04.2019
- Belgrade: Secretariat for the Environment Protection, ROP-MSGI-3997-LOC-1-HPAP-6/2019, of 19 March 2019
- Ministry of Defense, ROP-MSGI-3997-LOC-1-HPAP-17/2019 of 14.03.2019.
- Civil Aviation Directorate of the Republic of Serbia, ROP-MSGI-3397-LOC-1-HPAP-16/2019 of 26.03.2019
- Ministry of Agriculture, Forestry and Water Management - Republic Water Directorate, ROP-MSGI-3997-LOC-1-HPAP-4/2019 of 28.03.2019
- Ministry of Health, Sector for Sanitary Control, Department of Sanitary Inspection ROP-MSGI-3997-LOC-1-HPAP-5/2019 of 21.03.2019

- Republic Institute for the Protection of Cultural Monuments No.1-351/2019-1 of 12.03.2019 ROP-MSGI-3997-LOC-1-HPAP-15/2019 of 12.03.2019.

ANNEXES

are given under Volume 2 - Legal acts and drawings, September 2019 and are an integral part of the Study