MINISTRY OF ENVIRONMENTAL PROTECTION AND NATURAL RESOURCES OF UKRAINE

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Executive Summary

Environmental Impact Assessment of the Proposed activity:

Construction of Power Units #3 and #4 at Khmelnytskyi NPP Site

Pursuant to the results of the environmental impact assessment carried out in line with the Law of Ukraine "Environmental Impact Assessment", Articles 3, 6-7, 9 and 14 for the above activity on the construction of power units #3 and #4 at Khmelnytskyi NPP site, the following was established:

The environmental impact assessment procedure (hereinafter - EIA) commenced on November 26, 2018 through publishing a Notice of Proposed activity, which shall be assessed for environmental impact (document number in the Unified EIA Register (hereinafter - the Register) is 201811232231); the Environmental Impact Assessment Report (hereinafter - the EIA Report) was enrolled in the Register and the Notice of EIA Report Public Discussion was posted on January 15, 2019.

The Notice of Proposed activity was published in the newspapers “Zhyttia i Slovo” No. 97 - 98 on December 08, 2018, “Zoria Nadhorynnia” No.50 on December 13, 2018, and “Perspectyva” No.50 on December 08, 2018, it was also posted on the official Khmelnytskyi NPP website (photographic evidence available).

Since the date of the official publication of the above Notice of Proposed activity subject to the environmental impact assessment, the Ministry has received comments and proposals as to the proposed activity, the scope of research and level of details, which in particular were from the NGO Environmental Initiatives Hub EKODIIA” (No. 233 dated December 18, 2018 and No.103 dated April 17, 2018).

The Notice of EIA Report Public Discussion was published in the newspapers “Perspectyva” No.4 on January 01, 2019, “Uriadovyi Kurier” No.10 on January 17, 2020, “Holos Ukraiiny” No.10 on January 17, 2019, it was also posted on the NNEGC Energoatom and Khmelnytskyi NPP websites and Facebook (photographic evidence available).

Pursuant to the Law of Ukraine No. 733-IX dated 18.06.2020 “Amendments to Article 17 of the Law of Ukraine “Environmental Impact Assessment” to Prevent the Occurrence and Spread of Coronavirus Disease (COVID-19)” on the temporary basis, i.e. for the period and within the lockdown area, established by the Cabinet of Ministers of Ukraine in order to prevent the spread of coronavirus disease (COVID-19) in Ukraine and up to its complete abolition including 30 days after the lockdown abolition date, the public discussions of the above proposed activity shall be conducted in the form of written comments and proposals (electronic format allowed as well); for the above period, the public hearings provided for by the Law of Ukraine “Environmental Impact Assessment”, Article 7 shall not be conducted.

The proposals and comments received from the date of the official publication of the Notice of Proposed activity subject to the environmental impact assessment and related to the proposed activity, scope of research and level of details as listed in the EIA Report, as well as proposals and comments received during the proposed activity public discussions after the EIA Report was submitted are reflected in the Public Discussions Report, which is an integral part of this Executive Summary.

K3 and K4 Essential Components / Parts and Locations

Pursuant to the EIA Report, the proposed activity is the construction of K3 & K4 at Khmelnytskyi NPP site.

The EIA Report states that Khmelnytskyi NPP is located in the north of Khmelnytskyi region outside Netishyn town. Khmelnytskyi NPP site is located in Iziaslav district of Khmelnytsky region and borders Slavuta district on the left bank of the river Horyn. Netishyn is 3 km to the north of the industrial site. To the northeast from the NPP site (50 km away), there is one of the largest cities of the neighbouring Rivnenskyi region – Rivne city. 13 km to the east from the NPP site, there is Slavuta town - the district center of Khmelnytsky region.

In the north-east of the NPP site, there are treatment facilities, biological ponds and spray ponds. In the south-west, there is a construction site and a cooling pond. Water supply and off-take channels are also in the south-west of the NPP site, and behind the channels there is Outdoor Switchyard-330 and Outdoor Switchyard-750. In the south-east of the NPP site, there is a diesel locomotive and wagon depot and sludge storage, and 300 m away from them - the NPP railway station. The on-site and off-site facilities are connected by a network of hard surface roads.

The essential area of the NPP site (fenced) is 90.2 hectares. The area that includes the essential area, OSY-110, OSY-330, OSY-750 and the area with the water supply and off-take channels, located between the essential area and OSY area, is 147.0804 hectares. The NPP site is located on the lands owned by the Netishyn Town Council and Slavuta State Forestry.

The EIA Report states that Khmelnytskyi NPP was designed as a four-unit site with the total capacity of 4,000 MW.

Pursuant to the EIA Report, such facilities as the cooling pond, water supply and off-take channels, essential consumers spray system, special building, auxiliary building, gas facilities, general compressor building, radioactive waste treatment facility, administrative building, laboratory building, etc. were designed to ensure operation of a four-unit NPP. These facilities were commissioned as part of the first start-up stage along with the launch of Kh1 in 1987.

TheK3 andK4 construction site is the area on Khmelnytskyi NPP site designated for the construction of those two units.

The essential industrial buildings and structures, which ensure operational independence of each unit, include:

- Reactor Building
- Turbine Building
- Standby diesel generator (SDG) station with the diesel generators and their auxiliary systems
- Spray ponds
- Unit pump stations (UPS).

The shared buildings and structures with systems that ensure normal operation of the units are as follows:

- Special Building, that houses water chemistry process systems and liquid radioactive waste treatment systems
- Fresh nuclear fuel storage
- Solid radioactive waste storage
- Above-ground gallery passageway between the Reactor Building and Special Building, etc.

The EIA Report states that K3 andK4 construction shall make provisions for the use of existing currently incomplete facilities and structures. The construction area has been arranged,K3 and K4 construction and installation activities have been partially completed.

Prior to the moratorium on construction of new nuclear power units, the following facilities on the construction site had been partially completed (indicated as construction phases):

1) Essential K3 facilities:

- Reactor Building – partially constructed: auxiliary building – elevation 37,600, Containment made of reinforced concrete – elevation 55,800
- Turbine Building - completed

- Deaerator bay - completed
- Building for K3 electrical equipment cabinets – completed.

2) K3 service water supply structures:

- Unit pump station (UPS) - completed
- Valves chamber – base plates
- Pipelines from the UPS to Turbine Hall – completed except the UPS connections
- Filtering station – only the bottom (uncovered)
- Service water discharge to the cooling pond – a completed structure along with intake UPS - Turbine Hall pipeline connections

3) Outdoor transformer station - 70 %

4) K3 power transmission lines (individual towers) ~ 40 %

5) K3 cable trenches ~ 90 %

6) Above-ground process pipeline racks and gallery passageway (individual supports and superstructure) ~ 40 %

7) K4 essential facilities:

- Reactor Building – partially completed: auxiliary building and Containment made of reinforced concrete - elevation 20,400
- Turbine Building - elevation 13,600 (~25 %) – turbine foundation
- Deaerator bay ~ 25 %
- Building for K4 electrical equipment cabinets – completed

8) K4 service water supply structures:

- Unit pump station (UPS) - completed
- UPS - Turbine Hall pipelines – completed except the UPS connections
- Service water discharge to the cooling pond – a completed structure along with intake UPS - Turbine Hall pipeline connections

9) Outdoor transformer station - 70 %

10) K4 power transmission lines (individual towers) ~ 30 %;

11) K4 cable trenches ~ 85 %;

12) K4 above-ground process pipeline racks and gallery passageway (only individual supports and superstructure) ~ 25 %

13) SDG-4 ~ 85 % (walls – elevation 9,600)

14) SDG-5 ~ 40 % (walls – elevation 4,800)

15) Drainage pump station No.3 - completed

16) On-site roads, railways, engineering structures – partially completed.

Pursuant to the EIA Report, multiple technical condition inspections and assessments of the existing K3 and K4 buildings and structures were carried out through 2006-2009. The

inspection and assessment results and conclusions show it is possible to ensure reliable operation of the existing buildings and structures over the subsequent design life of the new Units, provided the necessary repair and restoration works are implemented in the full scope as indicated in the Inspection and Assessment Report.

Over the period of K1,K2,K3 and K4 construction, an extensive construction and installation base was developed, which originally was also intended for the completion of K3 and K4.

The structural arrangement of the existing construction site is practically identical to its initial arrangement at the time of K1 and K2 construction.

Structures and equipment transfer operations will be carried out by using vehicles and railways.

Pursuant to the EIA Report, part of temporary structures needed to completeK3 and K4 are to be partially located on the existing housekeeping area, partially - on the industrial site, but most of them – in the locations that will be temporarily free for the completion of K3 and K4 construction.

K3 and K4 expected design life is 45 years.

Pursuant to the EIA Report, the size of the sanitary surveillance zone around Khmelnytskyi NPP is 2.7 km as indicated in the Scientific and Technical Council, Project and Budget Management Report by the USSR Ministry of Energy No.34 dated March 14, 1979 – Consideration of Khmelnytskyi NPP Design that was approved by the Order of the Ministry of Energy of the USSR No. 150ПС on November 28, 1979.

The EIA Report states that on the basis of the Expert Review Conclusion on Khmelnytskyi NPP Sanitary Surveillance Zone approved by the Director General of CJSC Research Institute of Radiation Protection of the Academy of Technological Sciences of Ukraine in 2008, the 2.7 km size of the above sanitary surveillance zone was confirmed and, thus, the ecological conditions were established by following the Conclusion of the State Sanitary-Epidemiological Examination No.05.03.02-07/17573 dated March 27, 2008.

Pursuant to the EIA Report,K3 andK4 will house a double-circuit nuclear steam supply system (NSSS), which by its design is classified as a power plant working on thermal neutrons and using light pressurized water as a coolant and moderator. The unit is a two-circuit facility: the primary circuit (radioactive) is water that removes heat directly from the reactor core; the secondary circuit (non-radioactive) is steam and water that receives heat from the primary circuit and uses it to run the turbo-generator.

The primary circuit contains the reactor facility VVER-1000 Skoda JS, which is part ofK3 andK4 and is designed to generate electricity in the base load mode.

The main component of the secondary circuit is the steam turbine, type K-1000-60/1500-2M.

The turbine is a condensing four-cylinder facility (HPC + 3 LPCs) without adjustable steam removal, with separation and single-time two-stage intermediate (main) steam superheating, 1000 MW rated capacity, 1500 rpm velocity and is designed to directly drive the generator mounted on a common foundation with the turbine, type ТВВ-1000-4У3, 1000 MW capacity, 24000 V terminals voltage.

The essential technical characteristics ofK3 andK4 components are given in the EIA Report, Table 1.1.

Thermal energy is generated in the reactor core, which consists of fuel assemblies containing low-enriched uranium dioxide and burnable absorbers.

Pursuant to the EIA Report, the reactor core comprises 163 fuel assemblies (FAs), part of which contains control rods (CRs). All reactor core FAs have hexagonal cross sections.

Pursuant to the EIA Report, the fuel assemblies are designed for controlled generation and transfer of thermal energy from the surface of uranium fuel rods (UF) and uranium-gadolinium fuel rods (UGF) to the reactor coolant throughout the design life of the core without exceeding the permissible UF and UGF damage limits. The UF and UGF rods are installed into a fuel assembly frame forming a bundle of fuel rods and are designed to heat the coolant when it passes through the bundle. The fuel bundle is made of cylindrical UF and UGF rods arranged in regular triangular arrays. The UF / UFG bundle of the fuel assembly consists of 312 fuel rods, six of which are rods with burnable poison / UGF rods.

Reactor core fuel solutions provide for options with 12-month and 18-month fuel cycles. The number of fuel assemblies to be reloaded during a refuelling outage is 42 for the 12-month cycle, and 66 - for the 18-month cycle.

The FA total service life in the reactor core is 4 fuel cycles, where one fuel cycles lasts 12 months, and 3 fuel cycles – where it lasts 18 months.

Pursuant to the EIA Report, K3 and K4 are expected to use fuel manufactured by Westinghouse – RWFA as per WEC-UNFQP-005-01 (T) as the main nuclear fuel, as well as other fuels designed for the VVER-1000 reactor core (e.g., AFA, FA-2, alpha FA).

The main technical and operational characteristics of FA-WR and AFA are given in the EIA Report, Table. 1.2.

Fresh FAs manufactured by Westinghouse will be transferred in MCC-5 casks (MCC stands for Modified Core Component), each of them housing two FAs. The MCC-5 cask is designed to transport two low-enriched (up to 5-wt % ^{235}U) fuel assemblies for light water reactors (LWR).

Fresh nuclear fuel casks shall be delivered by railway.

Pursuant to the EIA Report, spent nuclear fuel, i.e., after reaching its target burnup, is removed to adjacent to the reactor spent fuel pool (SFP) inside the containment for at least 3-year period. Following appropriate conditioning leading to significant reduction in residual energy, the spent fuel will be sent to the centralized spent nuclear fuel storage located in Chernobyl exclusion zone for long-term storage (Decision No.7-03/12-98/10-17 of the State Ecological Expert Review of the EIA materials for the project Construction of Centralized Spent Nuclear Fuel Storage for VVER Reactors of Ukraine dated May 10, 2017).

Regarding theK3 and K4 Turbine Buildings, it is expected to install ASD-5600 diesel generators with 5600 kV capacity - similar to those ofK1 andK2. The total number of diesel generators to be installed is 6 (3 pcs. per each Unit).

In addition, two more ASD-5600 diesel generators will be installed within shared DG stations similar to those available for K1 andK2. Thus, the total number for the two units will be 8 DGs. The standby GDs perform the function of power supply to the NPP safety systems being independent power sources activated only under blackout conditions.

Safety systems tests are monthly based with the DGs activated to maintain the operating mode for up to 1 hour at the maximum capacity of 2200 kV. The total operating time for each DG is 12 hours/year.

Annual fuel consumption for each diesel generator is 20 t/year / 20.000 kg/year.

DG-generated pollutants are removed through separate vent pipes.

As per EIA Report, the oil supply system of the power units is designed for lubricating turbine and generator bearings, sealing the generator shafts, ensuring control and protection of turbines, and lubricating the feedwater pump units.

Air exhausters (exhaust fans) are intended for ventilation of oil system, and for creating a slight negative pressure in oil drain lines and bearing crankcase housing.

For turbine departments of Units 3 & 4, it is planned to install oil system equipment similar to that installed for Unit 2. The total number of exhausters will be 14 items (7 per each Unit).

In order to ensure NPP operation, the required fluids are supplied from the following auxiliary facilities:

- Combined gas building. The building houses the electrolysis plant, the NPP shared compressor room, the reactor containment test compressor room, and other facilities;
- Storage facilities for oxygen and inert gas cylinders;
- Outdoor area for air tanks;
- Storage facility for imported propane-butane and acetylene;
- Fuel and lubricant warehouse;
- Oil, mazut, and diesel facility.

Table 1.3 in EIA Report lists preliminary needs in main chemical agents required for operation of one NPP unit.

Chemical water treatment system was put into operation together with commissioning of Unit 1. The system includes preliminary water treatment and demineralizer facility. It will be used for filling the primary and secondary circuits of Units 3, 4 with demineralized water and making up for operational inventory losses. According to the design, the chemical water treatment system shall supply demineralized water to four power units.

The Special Auxiliary Building has 200 м^3 tanks that are used for in-house needs in demineralized water, special water treatment facilities, decontamination solution preparation plant, and chemical storage area for the special auxiliary building and reactor buildings of four power units. In addition, two condensate storage tanks with capacity of 1000 m^3 each will be installed to ensure normal operation of four power units including Units 3, 4.

As per EIA Report, the Liquid Radwaste (RAW) Storage Facility was built in the Special Auxiliary Building. It was put into operation together with commissioning of Unit 1. The storage facility was designed to receive liquid RAW that will be generated during operation of four power units.

In case of abnormal operation and emergencies in the storage facility, liquid effluents shall not be discharged to the environment.

To protect the environment and prevent radioactive contamination of groundwater, the substructure block of the Special Auxiliary Building is waterproofed. Real-time environment monitoring is implemented using a system of observation wells located outside the perimeter of the Special Auxiliary Building's storage facilities.

Deep evaporation facility (UGU 1-500) is in operation as a liquid RAW processing plant. Radioactive sources in the premises of deep evaporation facility include evaporation bottoms and fusion cake. Modular storage facility is used for temporary storage of drums with fusion cake. Modular storage is designed for temporary storage of drums containing fusion cake. The modular storage facility was put into operation together with commissioning of Unit 2.

In addition, the Special Auxiliary Building has storage facilities for temporary storage of solid radioactive waste. Their capacity was calculated with due consideration of 4 power units in operation.

With the purpose to protect the environment and prevent radioactive contamination of groundwater, the substructure block of the Special Auxiliary Building is waterproofed. Real-time environment monitoring is implemented using a system of observation wells located outside the perimeter of the Special Auxiliary Building's storage facilities.

As per EIA Report, the off-stream water reservoir (cooling pond) was created by constructing a storage dam in the valley of the Hnylyi Rih river with the purpose to cool main and auxiliary equipment of 4 NPP units. The cooling pond was designed and built as a water reservoir for NPP purposes, and its calculations were based on allowable cooling water temperature (max. 33 °C). It shall be used for removing heat from NPP equipment with capacity of 4000 MW (four power units), with due consideration of outage schedules. Industrial and natural water losses due to evaporation from the reservoir surface are made up from external source. Two power units are currently in operation. After commissioning of units 3 and 4 the heat load on the cooling pond will increase (the heat load estimation is described below on page 17).

Description and assessment of possible environmental impact of the proposed activity

The proposed activity involves the construction of K3 and K4.

During the construction of K3 and K4, main environmental impact factors will include, inter alia, emissions into the atmosphere formed during:

- Soil development for arranging sites for process equipment, structures, pipelines, other engineering networks and wells for household needs;
- Construction of road pavement;
- Welding and cutting of steel structures (installation works);
- Painting activities, and
- Use of vehicles and other construction machinery with internal combustion engines, etc.

Existing hard surface roads will be used during the construction. In addition to the existing roads, it is planned to build temporary road pavements using prefabricated reinforced concrete road slabs. In order to prevent dust formation on the roads in summer time, special watering machines will water the roads.

As per EIA Report, certain bulk materials will be transported and stored in containers. Vehicles transporting crushed stone, soil, sand, etc. shall be covered to reduce the amount of dust removed from vehicle bodies. Bulk materials will be stored by open method in enclosed areas, in summer time watering will be used to reduce dust formation. For cement storage and dispensing, filters will be installed and inert materials will be watered in dry weather. Earthworks will be performed in windless weather.

As per EIA Report, the environment impact during the operation of the proposed activity facility will involve:

1) Release to the environment of:

- Radioactive gaseous effluents;
- Non-radioactive effluents;

2) Heat and moisture emissions from cooling systems (cooling pond and spray pools) through changes in heat exchange conditions, also in the atmospheric air adjacent to the cooling pond;

3) Impact on surface water through changes in water exchange conditions of the cooling pond;

4) Noise and electromagnetic radiation.

MINISTRY OF ENVIRONMENTAL PROTECTION AND NATURAL RESOURCES OF UKRAINE considered data provided in the Environmental Impact Assessment Report, namely:

- **Proposed activity.** The proposed activity is construction of Khmelnytskyi poer units #3 & #4.

This EIA procedure did not assess the construction of 220 kV (or more) overhead lines, decommissioning of reactors;

- **Impact on atmospheric air during the implementation of proposed activity.**

As per EIA Report, the impact on atmospheric air during construction and installation activities is possible during the soil reloading, equipment installation (gas welding and painting works), and travel of vehicles.

Table. 1.19 in EIA Report gives calculation results for surface concentrations of pollutant emissions during construction works.

Air pollutant emissions during construction activities will have local impact.

The main types of air pollution during the operation ofK3 andK4, will include:

- Radioactive gaseous effluents;
- Non-radioactive effluents from the startup boiler, emergency diesel generators, and other sections.

The impact of radioactive effluents is described in the relevant section.

As per EIA Report, after commissioning ofK3 andK4 the air will be affected by emissions of non-radioactive pollutants from auxiliary process equipment, which is similar to the equipment of existing Units No. 1 and No. 2, namely:

- Emergency diesel generators forK3 andK4 (3 per each turbine building);
- Common emergency diesel generators forK3 andK4 (2 pcs):
- Oil supply systems in the turbine buildings of K3 and K4 (2 pcs).

The total number of emission sources is 91: 68 of them are stationary emissions. 3 sources are equipped with dust cleaning equipment.

Additionally, it is planned to install one diesel fuel tank (1000 m3) to provide the required amount of fuel for diesel generators. The existing number of tanks with mineral oil (9 pcs) ensures the operation of turbine systems and remains unchanged.

Description and quantities of non-radioactive pollutants emitted into the air from the main industrial site considering the existing and designed emission sources

Table 1.23 in EIA Report gives characteristics of planned emission sources for non-radioactive pollutants.

Pollutant Code	**Pollutant Description**	**Gross emissions of pollutants, t/year**
01002/110	Vanadium and its compounds in terms of vanadium pentoxide	0.027100
-/112	Sodium tungstate (in terms of tungsten)	2.00E-07
01003/123	Iron and its compounds (in terms of iron)	0.059100
01104/143	Mangan and its compounds converted to mangan dioxide	0.004270
01005/146	Copper and its compounds in terms of copper	0.000250
-/150	Sodium hydroxide (sodium hydroxide, caustic soda)	0.000140
01006/164	Nickel and its compounds in terms of nickel	0.000030
01010/203	Chromium and its compounds in terms of chrome trioxide	0.000330
-/214	Calcium hydroxide (slaked lime, powder lime)	0.239400
04001/301	Nitrogen oxides (nitrogen oxide and dioxide) converted to nitrogen dioxide	11.328660
04004/302	Nitric acid	0.006060
04003/303	Ammonia	0.000130
15003/316	Chlorine gas and vapor compounds, if not included in Class I, in terms of hydrogen chloride	0.002120
05004/322	Sulfuric acid (H2804) [sulfuric acid]	0.002104
-/323	Amorphous silicon dioxide (Aerosil--175)	0.001280

Table 1

Pollutant Code	**Pollutant Description**	**Gross emissions of pollutants, t/year**
05001/330	Sulfur dioxide (dioxide and trioxide) converted to sulfur dioxide	4.622300
06000/337	Carbon oxide	7.145900
16001/342	Fluorine and its vapor and gaseous compounds converted into hydrogen fluoride	0.002660
16000/343	Easily soluble fluorides (e.g., NaF) and their compounds converted to fluorine	0.005500
16000/344	Fluorine and its compounds (in fluorine equivalent)	0.003160
11041/621	Toluenes	0.000880
-/1061	Ethyl alcohol	0.018000
11007/1401	Acetone	0.006800
13101/703	Benzopyrene	0.000014
18001/857	Chlorofluorocarbons (Freon-12)	0.005000
18001/859	Hydrofluorochlorocarbons (Freon-22)	0.150000
-/1314	Propionic aldehyde (propanal)	0.001000
11049/1325	Formaldehyde	0.128800
-/1531	Capronic acid	0.006400
11012/2005	Hydrazine hydrate	0.000020

-/2704	Gasoline (petroleum, low-sulfur in terms of carbon)	0.053000
-/2735	Mineral petroleum oil (spindle, machine, cylinder, etc.)	1.809470
-/2754	Saturated hydrocarbons C12-C19 (solvent RPK26611, etc.) in terms of total organic carbon	3.717631
03000/2902	Substances in the form of suspended solids undifferentiated by composition	1.092560
-/10190	Sulfur hexafluoride	0.035000
-/10226	Titanium dioxide	0.000040
-/10265	Emulsol (composition: water - 97.6%, sodium nitrite - 0.2%, soda ash - 0.2%, mineral oil - 2%)	0.006270
11000/-	Non-methane volatile organic compounds (NMVOC)	0.019400
Sub-total:		***30.500780***
12000/410	Methane	0.005800
4002/-	Nitric (1) oxide [N20]	0.001200
7000/-	Carbon dioxide	148.687000
Total greenhouse gases:		***148.694000***
Total for the enterprise:		***179.194780***

As per EIA Report, air emissions of non-radioactive pollutants (including designed sources) increase by 12.899638 t/year. The main pollutants are nitrogen oxides (nitrogen oxide and dioxide) in terms of nitrogen dioxide, carbon monoxide and saturated hydrocarbons C12 – C19 (solvent RPK-26611, etc.) in terms of total organic carbon.

Dispersion for designed sources was calculated considering the existing sources and without taking into account the background concentrations, thus environmental conditions for the proposed activity have been established.

As per EIA Report, dispersion calculations considered non-simultaneous operation of equipment, namely, non-simultaneous testing of safety systems (operation of emergency diesel generators). Thus, the following sources were excluded from the calculation: Nos. 301, 302 for Unit 1; Nos. 303, 323 for Unit 2; No. 304 – a common diesel generator for Units 1 and 2; Nos. 512, 513, 517, 518, 519 - mobile diesel generators; Nos. 3021,3211 for Unit 3; Nos. 3221,3231 for Unit 4; and No. 3241 - a common diesel generator for Units 3 and 4.

Table 1.25 in EIA Report gives calculation results for air pollution from the designed sources, taking into account the existing sources on the main site of Khmelnytskyi NPP;

- **Impact on soils and geological environment during the implementation of proposed activity**. As per EIA Report, the impact of Khmelnytskyi NPP on the geological environment within the NPP site was almost completely specified during the construction and commissioning of facilities that are part of Unit 1 complex. We should take into account that most of these facilities are included in the complex of Units 3 & 4 (cooling pond with intake and discharge canals, pumping stations, housing construction in Netishyn town, etc.). The most vulnerable element of the geological environment is groundwater.

As per EIA Report, soil degradation processes associated with the construction of Khmelnytskyi NPP are applied only to the NPP site. Their presence in the 30-kilometer area around KhNPP has little to no relation to NPP operation.

As per EIA Report and according to estimations, the complex of Khmelnytskyi NPP structures occupies 3074.7 hectares (including 2171.8 ha occupied by the cooling pond and 90.2 ha occupied by NPP site), which is 1.1% of the area of the entire 30-kilometer zone. With the start-up of Units 3 & 4 this figure will not increase, since their commissioning does

not require additional land allocation. Thus, potential changes in physical-chemical and water-physical properties of soils may occur due to the impact of already constructed facilities, as well as due to increased emissions and releases after the commissioning of Units 3 & 4.

Pursuant to the EIA Report, in order to obtain data on the target area radioactive contamination, soil samples have been taken and measured for their gamma-emitting radionuclide concentration.

Pursuant to the EIA Report, the target area was contaminated with ^{137}Cs due to the Chernobyl accident - from 2 to 10 kBq/m2. The total contamination is mainly represented by the contamination density within 1 to 5 kBq/m.

The obtained ^{40}K concentration in the soil shows that the specific activity of this radionuclide in the soils of the target area varies from 40 to 700 Bq/kg. The lowest values are typical for mechanical composition of light soils (sod-podzolic, sandy, and sandy loam soils). The heavier the mechanical composition of the soil, the higher the ^{40}K concentration.

Pursuant to the EIA Report, the concentration of ^{232}Th and its derivatives are as follows: the specific activity of this radionuclide in the target area varies from 5 to 50 Bq/kg. The wide range of the specific activity is explained by the large diversity of the soil cover in the target area. Similarly to ^{40}K, the ^{232}Th concentration in the soil is determined by the parent rock, it increases with the increase of mechanical composition of the soil.

Target area concentration of ^{226}Ra, which is a derivative of ^{238}U, is as follows: the Clarke concentration in the soil is about 30 Bq/kg; the range of this radionuclide concentration in the upper layer of the adjacent to Khmelnytskyi NPP soils varies from 3 to 40 Bq/kg.

The list of measures to prevent or limit the potential impact of Khmelnytskyi NPP on the geological environment of the industrial site and Khmelnytskyi NPP itself is considered as effective; no further development of exogenous geological processes is envisaged.

- **Impact of the proposed activities on the aquatic environment**. Pursuant to the EIA Report, no additional sources of negative impact on the aquatic environment can arise during K3 andK4 construction activities. Temporary household and storage facilities onK3 andK4 construction site are equipped with water supply and sewerage systems. The source of domestic and drinking water for the temporary household and storage facilities is provided from existing systems. Sewage will be discharged into existing sewerage systems. No generation or discharge of return waters into the environment is envisaged.

To ensure safe and reliable operation of power units as well as protection of the environment specific liquid radwaste treatment facilities are provided to clean primary and secondary coolant of radionuclides under all modes of unit operation. Specific systems of these facilities provide for reverse supply of treated coolant to the primary circuit.

According to the Environmental Impact Assessment report, deminiralizing units are provided to carry out treatment of the secondary coolant and maintain its standard quality. Upon the treatment and given the absence of radioactive substances waters are discharged from demineralizing unit to cooling pond.

Pursuant to Environmental Impact Assessment report in case the activity is detected in Deminiralizer unit regeneration water, and discharge of water is unacceptable under such activity (reference level is 2-10-10 Ci/dm^3 or 7,4-103 Bq/m^3) alkaline regeneration waters are transferred to holdup tanks, since radioactivity of these waters is determined by Cs-137

isotope. In case of activity present acid waters shall be transferred to recoverable liquid radwaste system located in special auxiliary building.

Discharge of regeneratio water to cooling pond is carried out in accordance with a special permit. Radiation monitoring of tanks is done periodically through sampling including further laboratory treatment.

According to EIA report averaged volume of waste water from demineralizer working for two power units amounts to 45500 m /year. Thus, after commissioning of Khmelnytskyi 3 and 4 overall predicted volume of discharges will be 91000 m /y.

According to EIA report discharges from the site, town of Netishyn and buffer area are transferred to site specific sewage treatment facility to undergo biological treatment and aftertreatment in maturation ponds. Design capacity of sewage facilities amounts to 20,0 thous.m/day, actual average load to sewage facility is 13,0 - 15,0 thous. m /day.

Residual rainfalls from Khmelnytskyi 3&4 are discharged to cooling pond which reduces the need in additional service water by 0.08 mln.m3/year (average year based on weather conditions). Part of the effluents from Khmelnytskyi 1&2 are transferred to drilling waste disposal site and then after settling transferred to clarified water return system for chemical water treatment that reduces significantly need in chemical water treatment of fresh service water. Roof runoffs from main buildings and adjacent territory are discharged to inlet channel of service water supply system and used in NPP cycle.

Flushing water of decanters are transferred to sludge tank. After settling in the sludge tank clarified water (94%) is returned to chemical water treatment for reuse or discharged into cooling pond.

According to EIA report, oily waste at the site are subject to treatment at “Kristal” facility located on startup boiler based on the following pattern: accumulation and averaging in receiver tank, settling, and pre-treatment using mechanical and carbon filter. Water purified from oils and oil products are transferred to inlet channel to replenish loss of water in the cooling pond, and entrapped oil products are transferred for incineration to startup boiler.

Plant site is equipped with drain network to drawdown ground water. Drained ground waters are regularly pumped to main circulating water cooling system via pumping stations DNS 1-4 in automatic mode. In addition, a specific drain station is available at the site of spray cooling pond pumping drain water to “A” group consumer system.

According to EIA report, surface water can be affected in the places of direct contact of NPP process components and facilities with public surface water bodies, so cooling pond is a potential source of water pollution within NPP impact area.

The river Hnylyi Rih in the mouth reach area where NPP cooling pond has been built, is a tributary of the river Horyn. Average long-term amount of effluents is 24,12 mln.m^3. All effluents of the river Hnylyi Rih are accumulated to the cooling pond.

The NPP has the following water intake facilities taking water from public surface water sources:

- cooling pond makeup pumping station from the river of Horyn
- cooling system makeup pumping station from the river of Horyn
- accumulation of effluents of the river Hnylyi Rih to NPP cooling pond.

According to EIA report, water pumping station to make up cooling pond is designed to take water from the river of Horyn at the flow rate of 30 m^3/s. In 1998, due to tense water management situation the intake of waters from the Horyn to the plant needs was limited by sanitary flow rate of 6 m^3/s (permit to special water consumption). To prevent violation of established sanitary flow rate cooling pond is made up only during spring flood (March - April). Makeup of cooling pond through the runoff of the Horyn is not allowed during other periods. Another time, NPP water consumption is carried out due to active capacity of the cooling pond.

Pursuant to EIA report, open joint stock company "Lviv Orgres" has carried out hydrochemical estimate of cooling pond water quality given the increased capacity of the plant up to 4000 MW. The estimate was prepared using mathematical modeling program for average dryness of the year (50%) for the first and second target years and salt balance year.

Based on the results of the estimate change of concentration of such main ingredients as total hardness of water (5,90-7,60 mg-equ/dm^3), number of calcium ions (73,85-104,99 m/dm^3), and bicarbonate ions (231,57-330,32 mg/dm^3) can be pointed out.

Comparative analysis of mineralization of cooling pond under the operation of 4 power units based on data provide by open joint stock company "Lviv Orgres" as well as data on actual condition of the cooling pond under operation of two power units are given in Table 5.2 of EIA report.

Pursuant to EIA report, based on the results of hydrochemical estimate of cooling pond water quality, commissioning of K3&K4 will result into estimated increase of the scope of heated water transferred to cooling pond facilitating increase of temperature, increase of water evaporation, and creation of conditions to increase content of total mineralization.

During first couple of years after the commissioning mineralization will slowly increase, and in the future the content of main mineralization ions will stabilize and acquire values below maximum allowable concentration.

Pursuant to EIA report, cooling pond is designed based on allowable water cooling temperature (no more than 33 °C), to remove heat from equipment operated at NPP of 4000 MW (4 power units) taking into account main equipment outage schedule. Under the most unfavorable "hot" climatic conditions and the most unfavorable wind conditions the analysis of calculations performed by Ukrainian Scientific and Research Institute of Environmental Issues demonstrated that critical temperature of 33,0 °C is practically achieved during operation of two power units already (water intake temperature is 32,45 °C). During operation of three power units it will increase up to 33,66 °C, and four units - up to 37,23 °C, in this regard ecological conditions for proposed activity are established.

According to the EIA report, the construction of flow-control dam with a length of 1300 m was planned, based on the results of heat balance calculations of the cooling pond and using a mathematical model (UkrNDIEP) taking into account the degree of influence on the hydrothermal regime of the cooling pond and ensuring stable operation of NPP in the most unfavorable weather conditions in warm season and in connection with which the ecological conditions for the proposed activities were established.

The construction of the dam with a length of 1300 m allows to increase the cooling efficiency of water in the pond and guarantee appropriate temperature conditions for the operation of four power units even in the most unfavorable "scorching" hydro meteorological conditions with a margin of 2-3 °C as well as ability to generate additional electricity based on the change in power at the terminals of the generator.

The construction of such a dam also allows to practically avoid a significant dependence of the cooling pond temperature on the most unfavorable wind situations with westerly winds of 3-6 m/s.

According to the EIA report, groundwater regime monitoring network includes 189 wells.

According to the EIA report, the human-induced impact of K1 andK2 had almost no effect on the groundwater level, but affected its chemical composition and temperature as a result of infiltration of industrial water into the soil due to leaks from water supply communications.

It should be emphasized that according to the monitoring data, chemical and thermal pollution of groundwater as well as hydraulically related to it in the upper part of the Upper Proterozoic aquifer is localized only within the NPP industrial site; on the periphery of the site not changed (i.e. not disturbed by human-induced factors) values of chemical composition and temperature of groundwater are recorded.

At the same time, not all the groundwater within the industrial site is polluted, there are only disconnected local areas where groundwater is characterized by high mineralization and temperature.

Seasonal fluctuations in groundwater level were 0,5 m in 2017, 0,56 m in 2016, 0,7m in 2015, 0,52m in 2014, 0,72 m in 2013, 0,73m in 2012 on average. Groundwater levels are stable and respond only to seasonal climate change.

The difference in groundwater temperature within the industrial site is 10.0 °C. Background temperature is 9,0°C-10,0°C. The water temperature of the Upper Proterozoic aquifer is also above the background in some areas, as well as the temperature of groundwater. Background temperature is 10,0°C. The range of temperature fluctuations within the industrial site is 10.5 °C, maximum temperature is 20.5 °C. The increase in groundwater temperature is a consequence of leakage and infiltration of heated industrial water (mainly during the discharge into the cooling pond); groundwater heating is local in nature and does not spread outside the industrial site.

The chemical composition of groundwater has not changed significantly in recent years. According to the monitoring data, mineralization was:

- ground water - 605,26 mg/l in 2017, 541,19 mg/l in 2016, 552,91 mg/l in 2015, 423,72 mg/l in 2014, 406,42 mg/l in 2013, 342,36 mg/l in 2012.

- Upper Proterozoic aquifer - 586,68 mg/l in 2017, 620,99 mg/l in 2016, 564,97 mg/l in 2015, 487,38 mg/l in 2014, 475,4 mg/l in 2013, 401,11 mg/l in 2012.

- **Impact on flora and fauna, as well as nature reserves during the implementation of proposed activities.** According to the EIA report, the work carried out to assess the ecological status of the biocenoses of the near area of the station shows that the transformations of forest groups are anthropogenic in nature. Typically structured boreal pine forests (corresponding layered structure, age over 60 years, with a characteristic species composition, etc.) occupy about 20% of the area in the 10-kilometer zone, i.e. significant areas compared to other natural vegetation types, and effectively perform a stabilizing role.

Typical broad-leaved structure forests occupy about 5% of the area in the 10-kilometer zone and about 7% in the 30-kilometer zone. Taking into account the same forests, but with a disturbed structure, as well as pines, spruces, oaks, introduced species, meadows in place of hornbeam-oak forests, i.e. potential broad-leaved forest vegetation, these areas within a 10-kilometer zone occupy about 13 %.

Hydrogenous-type plant communities (alder and willow forests, swamps and peat meadows, swamps and ponds with water-coastal vegetation) occupy about 25% of the area in the 10-kilometer zone and about 11% in the 30-kilometer zone. They are characterized by distortions of varying degrees, so it is impossible to divide them by the degree of transformation.

Completely transformed agrocenoses with the participation of fruit and berries and urban phytocenoses occupy almost a third of the 10-kilometer zone and about 60% of the 30-kilometer zone.

According to the EIA report, natural vegetation in the near area of the station (10 km) occupies more than 60% and in the surveillance area its share drops to 35%. The share of agricultural lands and settlements increases with the distance from NPP, which is normal in terms of protection against possible accidents, as natural phytocenoses around the station stabilize the situation faster and are a buffer for human settlements and agricultural lands in the proposed emergency scenarios.

According to the EIA report, the commissioning of K3&Kh4 and the accident-free operation of four units of Khmelnytskyi NPP will not have a negative impact on the overall species diversity of invertebrates and insects. There will be some changes in the water entomocomplex of the cooling pond due to the increase in water temperature.

According to the EIA report, there are 47 territories and objects of various degrees of protection on the territory of the Khmelnytskyi NPP surveillance area, which occupy more than 3,000 hectares. Seven of the 47 territories and objects of the nature reserve fund are of national importance, the other 40 – of local. According to the Decree of the President of Ukraine № 420/2013 dated August 2, 2013, the national nature park “Male Polissia” (area of about 8762,7 hectares) was created on the territory of Khmelnytskyi region. It includes most of the southern and south-eastern part of the near area of Khmelnytskyi NPP.

Moreover, the cooling pond is included in the objects of the Emerald Network of Iziaslavsko-Slavutytskyi - UA0000123.

- **Impact on climate and microclimate during the implementation of proposed activities.** According to the EIA report, the nuclear power plant is a source of significant heat release. Approximately two-thirds of the thermal energy produced by the reactor cannot be used to generate electricity and is discharged into the environment.

In the cooling system of NPP heat releases in heat exchangers are transferred to circulating cooling water, which dissipates heat into the atmosphere through the cooling pond for the main cooling system of the turbine compartment, the cooling system of group "B" consumers and spray ponds for the cooling system of group "A" consumers.

The total amount of heat released into the cooling pond and in the spray ponds is given in Table. 1.28 of the EIA report.

Estimated heat releases from power units № 1-4 into the cooling pond are given in Table. 5.5 of the EIA report.

The environment is also affected by water, which enters the atmosphere due to additional evaporation and drops carried away by the wind.

Estimated values of additional evaporation from the cooling pond are given in Table. 5.8 of the EIA report.

The specific estimated values of water losses due to evaporation and carrying away by the wind from the spray ponds and the cooling pond are given in Table. 5.10 of the EIA report.

According to the EIA report, the spray pond water losses are given in the tables without taking into account the shutdown of power units for scheduled repairs. With account of the number of hours of the installed capacity use, equivalent to 7200 hours per year, water losses under the average annual mode will be:

- carrying away - 202,5 m^3 /h
- evaporation - 99 m^3 /h.

The water losses in the average winter mode will be:

- carrying away - 270 m^3 /h
- evaporation - 92,5 m^3 /h.

Annual water losses of spray ponds will amount to 2.41 million m^3 / year. Total cooling pond and spray pond water losses constitute 55.53 million m^3 / year. According to the EIA report, anthropogenic greenhouse gas emissions from the proposed activities will amount to 148.694000 t / year. According to the EIA report, the largest changes in air temperature will be observed in winter and will be 3.9 °C at a distance of 0.1 km from the water edge, at a distance of 0.5 km - 1.6 °C; in other seasons they are much lower and at a distance of 0.5 km could reach 1.1 - 1.4 °C.

The largest changes in the elasticity of water vapor are observed in summer at a distance of 0.1 km - 4.8 hPa, the smallest changes are observed in winter - 1.0 hPa; at a distance of 1.0 km in summer these changes can reach 2.1 hPa, in winter - 0.6 hPa.

During the commissioning of theK3&Kh4, the cooling systems will impact the microclimate increasing the additional evaporation and, consequently, humidity. Increased evaporation, especially in the cold season, will lead to the formation of so-called "surface fogs". An increase in the number of days with fog and ice loading should be expected. The impact of cooling systems will primarily affect the microclimate of the air above the water area, and will spread to a relatively small area around them.

The impact zone of the cooling pond is within 1.0 km, of spray ponds – within 0.3 km.

According to the EIA report, such changes in air temperature and humidity due to the operation of cooling systems during the commissioning of Khmelnytskyi NPP will not have a significant impact on the microclimate of the surrounding area.

- **Impact on the social environment during the proposed activities.** According to the EIA report, the construction of Units# 3, #4 provides new jobs in Netishyn and the Khmelnytskyi NPP region and will contribute to the influx of qualified personnel and increase the general level of education and qualification of the population.

During the construction of power units # 3, #4, the social infrastructure will be additionally developed with social and household facilities being constructed. In addition, deductions of 10% of the construction cost for the development of the infrastructure of the observation area are envisaged.

According to the EIA report, the cultural heritage sites will not be damaged by the construction of Units # 3,# 4 of Khmelnitsky NPP, as they are located outside the area planned for the industrial site of the station. New access roads, a landfill and other new infrastructure will not affect cultural heritage sites.

According to the EIA report, the level of ecological risk stemming from radiation impact during normal operation and postulated accidents at Khmelnytskyi NPP beyond the borders

of the Sanitary Protection Zone (the SPZ) as well as individual risks of stochastic effects to the public, are caused by radiation impact of aerosol releases from Khmelnytskyi NPP and do not exceed the levels set out in the *Radiation Safety Standards of Ukraine (NRBU-97/D-2000*). Risks of deterministic effects equal zero.

According to the EIA report, the public living near NPP may receive a radiation dose from gas aerosol emissions from NPP, which does not exceed 4% of the dose constraint, i.e., less than 40 micro Sv/y; however, that dose is formed through all exposure pathways. The assessment, which have been performed making allowance for conservative conditions, demonstrated that on the SPZ border, an annual effective dose to the critical group of population made up 0.6 micro Sv with regard for all exposure pathways. The maximum estimated effective dose to an individual is 2.8 micro Sv/y received at 0.5 km east of the nuclear power plant. The cumulative effective dose is lowering to hundredths of a micro Sievert at the distance of 25 km from the plant.

Individual effective doses to the public, resulting from a maximum design basis accident: conservative assessments, performed with consideration for all exposure pathways, demonstrated that the mean lifetime individual dose to the public might reach 80 micro Sievert on the SPZ border. Cs, ^{95}Zr, ^{95}Nb isotopes are major dose-forming radionuclides.

According to the EIA report, conservative assessments, performed for a beyond design basis accident taking into account all exposure pathways, demonstrated that the mean lifetime individual dose to the public might reach 2.2 mSv on the SPZ border. Cs and I isotopes are major dose- forming radionuclides.

- **Environmental impact of noise and vibrations during proposed activity.**

According to the EIA report, main building of unit #3 and unit #4, several auxiliary production buildings and structures together with power unit No. 3 and power unit No. 4 are put into operation on NPP site along with extension of some individual buildings.

According to the EIA report, the rotating equipment (a turbine-generating unit, pumping units, ventilation facilities) as well as relief equipment installed in those buildings and structures, are the source of sound exposure to the maintenance personnel in such buildings.

- **Environmental impact of radiation during proposed activity**

Gaseous, solid and liquid radioactive products, which contain radioactive substances, are produced during NPP operation.

According to the EIA report, against the background of global fallouts, no impact of radioactive releases and discharges from Khmelnytskyii NPP on the radiation situation in the Khmelnytskyii NPP area, arising throughout the plant operation period, was revealed, as evidenced by results of the environmental targets monitoring.

Based on the dose limit quota, permissible discharges (PD) and permissible releases (PR) are set for each NPP. The PD and PR values are calculated and approved following the procedure as specified by the Ministry of Health Protection of Ukraine.

The migration of radioactive nuclides across the environment and food chains is considered in establishing the PD and PR values, along with the land utilization structure and the actual use of water bodies (any recreational use, fishing and fish-breeding, irrigated farming, water bodies for livestock watering, availability of flood plain meadows, and so on).

It is not expected that permissible releases and discharges will be exceeded during normal operation of NPP. The release limit for Khmelnytskyi NPP is shown in Table 1.6. of the EIA

report. The release limit is set for the entire NPP regardless the number of power unit in operation.

The radiation impact from power units No. 3 and No. 4 supplements the impact caused by running NPP in operation.

Emissions of radioactive gaseous substances will be released from:

- special off-gas cleaning system (the SGCS) for process blowdowns;
- ventilation systems.

The SGCS incorporates autonomous systems of gas drying, cooling and cleaning through coal filters. The efficiency of cleaning is, at least, 2.5 order of magnitude (as for Xe-133). Emissions from the SGCS and ventilation of the reactor hall premises get into a stack of the reactor building no less than 100 m in height. Gaseous releases from the ventilation system of the liquid radwaste treatment building's premises get into the liquid radwaste treatment building's stack no less than 100 m in height.

The total radionuclide emission during normal operation of KhNPP is specified in Table 5.11 of the EIA report.

A regulatory level of gaseous radioactive material releases is secured by the required technical solutions approved at the designing stage, involving:

- selection of equipment and process flow diagram;
- availability of schemes of normal operation and emergency systems;
- dedicated measures undertaken during radioactive material handling;
- air cleanup and removal scheme that is supported by the following key measures:
- removed air containing radioactive isotopes is cleaned up with aerosol and iodine air filters;
- cleaning of process blowdowns is performed by passing them through filters where most radioactive isotopes of xenon and krypton decay.
- Release of air from the restricted rooms of the instrumentation department and the liquid radioactive waste treatment building after special off-gas cleaning, which is regulated by ecological conditions for the conduct of proposed activities, is performed in a controlled manner through stacks with a height of 100 m, which provide an appropriate dispersion of the released radionuclides in atmospheric air less than the permissible concentration value.
- Arrangement of a sanitary protection zone.

The data on the amount and nuclide content of releases from one power unit, as well as total release from stacks of Khmelnytskyi NPP with consideration for commissioning of power units #3 and # 4 (for four power units), are given in Table 1.7 of the EIA report.

According to the EIA report, the sources of radiation within the primary circuit of a power unit are as follows:

- Nuclear fuel decay products;
- Structural material corrosion products;
- Activation products.

According to the EIA report, during normal operation of a reactor facility, any release of elements from under the FA cladding or a partial rupture of that cladding leads to ingress of a certain amount of fission products to the primary coolant. A small amount of radioactive products may ingress also to the primary coolant as a result of neutron activation of structural metals. The processes of erosion and corrosion of activation products facilitate the transfer of such materials to the primary coolant. The tritium contained in the primary coolant is a very important component of such activation products.

According to the EIA report, a tritium release from the primary coolant is possible under the circumstances of:

- availability of controlled leaks;
- discharge of the primary coolant to the primary (coolant) drain tanks.

The tritium (3H) is the radioactive isotope of H, with a half-life of 12.34 years. The tritium is produced in reactors of VVER-type NPPs:

- as a product of ternary fission just during fission of nuclear fuel;
- as a result of the reaction of neutrons with deuterons, which are present in the primary coolant in the form of D2O;
- as results of various reactions of fast neutrons with structural materials of the reactor core;
- as a result of activation of boric acid in the primary circuit.

The dissolved products of fission and activation are withdrawn from the coolant through the ion exchange processes that entail originating the ion exchange resins of the primary purification system (SVO) facilities. As a result of regular replacements of such resins, liquid and solid radioactive wastes are produced.

During normal operation and in the event of design basis accidents at unit No. 3, unit No. 4 and the liquid radioactive waste treatment building, there may be the following sources of potential radioactive discharges:

- radioactive discharges to spray pools through Group A service water systems;
- regeneration water of the condensate demineralizer;
- hot shower drains;
- laundry sink drains, SVO unit’s drains, water drains from the work-shop area in the liquid radioactive waste treatment building;
- laboratory drains, waste waters after equipment and room decontamination;
- last rinsing waters from laundries;
- unbalanced waters.

The monitoring of releases and discharges to the environment, the monitoring of the radiation situation on site, in the sanitary protection zone and the observation (radiation monitoring) area of NPP, as well as monitoring of radioactive contamination of environmental targets, are performed by means of the radiation monitoring systems of a power unit and by the automated radiation situation monitoring system (ASKRO).

- **Environmental impact during a maximum design-basis accident and a beyond-design basis accident at the facility of the proposed activity.** An accident associated with a double-ended rupture of the primary coolant pipe is considered as a maximum design-basis

accident. In addition, accidents of radioactive waste handling systems are considered as other design-basis accidents.

As a determinative BDBA, an accident was selected, which is caused by a guillotine rupture of the primary coolant circuit (DN 2x850) with a failure of active emergency core cooling systems while the spray system remains operable. As a result, the integrity of containment is maintained. That accident is characterized by high dynamics of progression and the lack of effective accident management actions, which would prevent the transformation of such accident into the accident with severe core damages. According to the outcomes of the beyond design basis accident analysis (BDBAA), the frequency of such designed accident is $5.4*10^{-9}$ that is below the safety criteria imposed by the state safety standards for nuclear power plants.

According to the EIA report, the calculations, made as a part of different assessments of the regional environmental condition in the event of a maximum design basis accident (MDBA) and a beyond-design basis accident, allowed for the worst weather conditions: Pasquill atmospheric stability class F, wind speed of 1 m/s, wind direction to the town of Netishyn. The deposition rate of radioactive isotopes of elemental iodine is 0.02 m/s, that of aerosols is 0.008 m/s, that of organic iodine is 0.0005 m/s. No case of calm weather during MDBA was considered because, under the given circumstances, the diffusional transfer of admixtures in air would prevail over the wind driven transfer. However, a still-air cloud is formed around the source of release, and a limited territory appears to be contaminated because of deposition of radionuclides.

According to the EIA report, the assessment of radiological condition of the region during emergencies was carried out using the data on characteristics of integral releases. In the event of MDBA, the leak through the containment, associated with a release of 0 m in height and 8 hours in length, constitutes the source of radioactive emissions.

The expected releases of major dose-forming radionuclides to the atmosphere under the conditions of MDBA are shown in Table 5.12 of the EIA report.

The expected releases to the atmosphere of major dose-forming radionuclides in the event of BDBA are shown in Table 5.13 of the EIA report.

According to the EIA report, the permissible levels of radionuclide content, resulting from aerial contamination during early stages of accidents, may be exceeded. At the distance of up to 30 km from the source of release, the radioactive contamination of agricultural products may exceed minimum levels for justification of the intervention and actions on limiting the consumption of local agricultural products;

- **Spent fuel management during proposed activity.** According to the EIA report, a reactor core consists of the array of components of the reactor core with uranium-gadolinium fuel, designed to generate thermal power, and engineered means for heat removal and power output control within reactor facilities. That array is a combination of fuel assemblies (FAs), absorber rods of the reactor protection and control systems, which provide for safe operation of the reactor and fulfill interdependent operational functions within its core.
As generation of thermal power proceeds, the concentration of fissile feed material ^{235}U in fresh nuclear fuel, loaded into the reactor, decreases with a simultaneous accumulation of fission products, and new fissionable materials including isotopes of plutonium, are accumulated.

After attaining the designed burnup depth, nuclear fuel is withdrawn from the reactor facility and becomes spent nuclear fuel (SNF), which cannot be further used for power generation in the reactor core of such type.

All spent nuclear fuel (SNF) is stored within containment. The capacity of a storage facility, i.e., a spent fuel pool, provides for cooling and treatment of SNF for the period of at least three years. Moreover, a spent fuel pool allows the space to accommodate nuclear fuel after complete unloading of the reactor core in case of emergency. Using high-density spent fuel storage racks permits to increase the usable space of a spent fuel pool.

After being stored in a spent fuel pool for at least 3 years, spent fuel can be transported to a central spent fuel storage facility for a long term storage (Conclusion No. 7-03/12-98/10-17, dated 10.05.2017, issued by the State Ecological Expert Review based on materials of the Environmental Impact Assessment for the Project on "*Construction of a Central Storage Facility for Spent Fuel from VVER NPPs in Ukraine*").

A refueling machine is deployed for unloading the spent fuel assemblies from reactor, to load fresh fuel into the core, and to transfer spent fuel assemblies from racks to casks for their further removal from the reactor building. A polar crane is deployed for handling a can for fresh fuel and a cask with spent fuel, when dispatching SNF from the reactor building.

Nuclear fuels are transported across NPP site by specialized railway vehicles.

- **Waste management (including the management of radioactive waste) during proposed activity.**

Wastes produced during construction of buildings and structures of on-site facilities include:

- unsorted scrap iron;
- concrete waste in pieces;
- crushed reinforced products;
- oil-polluted wiping materials;
- metal cans smeared with paint.

During welding, the following types of waste are produced, such as:

- welding rod hulls and stubs;
- paperboard packages for welding rods;
- welding slag;
- household garbage.

During construction of industrial facilities, any resulting wastes are stored in a household garbage dump located in the specially allotted territory.

A list of waste, which may arise from construction activities, is given in Table 1.26 of the EIA report.

According to the EIA report, on-site sources of liquid and solid non-radioactive wastes arising at KhNPP are as follows:

- industrial & domestic effluents treatment facilities;
- sludge collector.

Any industrial & domestic effluents from NPP site, the “unrestricted” area, constructions yards within NPP area, NPP residential settlements and construction yards outside NPP area, are delivered through gravity pipeline to the specified pumping stations and then removed through a discharge pipeline to the industrial and effluents treatment facilities which are located in the north-western part of the site.

Industrial & domestic effluents treatment facilities are designed to provide a complete treatment of biological sewage, followed by the tertiary treatment of sewage effluents in waste stabilization ponds. Once treated, sewage waters pass to a cooling pond of the NPP service water system.

The productive capacity of the existing industrial & domestic effluents treatment facilities is 20,000 m^3/day.

According to the EIA report, after commissioning of units No. 3 and No. 4, the volume of industrial & domestic effluents, delivered to the industrial & domestic effluents treatment facilities, will be 6.57 million m^3 a year (18,000.00 m^3/day). Therefore, the productive capacity of the existing industrial & domestic effluents treatment facilities will be enough to receive and treat domestic effluents from buildings of units No. 3 and No. 4.

Industrial & domestic effluents treatment facilities are expected to be equipped with aerobic stabilizers for treatment of sediments from preliminary sedimentation tanks and excess activated waste sludge. Aerobic-fermented and compacted sediments are moved to sludge drying beds for further drying and stockpiling and then delivered to sludge composting fields with forced aeration and waterproof covers. After such treatment, the composted sludge (compost) can be utilized as a fertilizer in the agricultural sector. The efficiency of composting fields is 7-9 m^3 of compost per day (2,900 m^3 per year).

The sand depositing in sand catchers at the industrial & domestic effluents treatment facilities, is passed to sand fields, which are designed to fit a full capacity of the industrial and domestic effluents treatment facilities totaling 20,000 m^3/day.

In accordance with the EIA report, the sludge collector receives the following sewage effluents:

- rainwaters from the water-intake territory of the administrative building, the area of united auxiliary building and power unit No.1, resulting from low intensity rains, as well as contaminated surface water resulting from heavy rainfalls;
- blowdown waters from clarifiers of the chemical water treatment (the CWT). Rainwaters from the water-intake territory of power units No. 3 and No. 4 are supposed to be discharged to the cooling pond. Therefore, it is not expected that the volume of suspended substances from rainwaters, which are trapped in the sludge collector, will increase.

In accordance with the EIA report, blowdown waters of clarifiers are passed to the sludge collector. After settling in the sludge collector, the clarified water (94 %) returns to the CWT cycle for reutilization. For two power units, the volume of sludge waters discharged to the sludge collector - according to the KhNPP information - is 240 m^3/day or 10 m^3/h. However, the amount of sludge depositing in the sludge collector, is 372 t/y (417 m^3/y). The total capacity of the sludge collector is 27, 8674 m^3. The pumping capacity of the existing pumping station for clarified sludge waters is 45 m^3/h.

According to the EIA report, waters with a high salt content, including floor drains and shower drains, are recycled by the distillation method with further purification of the resulted distillate by ion-exchange filters. The purified distillate is passed to be reused for SVO needs. Once

obtained from evaporation, the concentrate (evaporator bottoms) is delivered to evaporator bottoms tanks of the area for interim radioactive waste storage.

According to the EIA report, the project provides for the active drains system to collect uncontrolled leaks of the contamination control area's systems, as well as engineering drains, and waters after external decontamination of equipment and rooms of the access control area, and to prevent any uncontrolled ingress of radioactive waters to the environment. Each restricted room of the reactor building and the liquid waste treatment building has gully traps installed to receive waters getting onto the floor of a room.

Floor drains are directed to the active drains system tanks through gravity feed pipelines. All rooms where there are gully traps have moisture warning devices installed. Waters, collected by the active drains system and active drains pumps, are transmitted to SVO-3.

Liquid radioactive wastes include:

- concentrate of evaporation during distillation of floor and laundry drains (evaporator bottoms) from treatment evaporators;
- spent ion-exchange resins of SVO filters;
- sludge from a floor drain sedimentation tank and a floor drains sump tank. The resulted wastes are transferred to the interim storage area for liquid radioactive waste.

Quantities of liquid radioactive waste are evaluated:

- evaporator bottoms of evaporators (expressed in terms of the equivalent amount of dry salts) from one power unit -58 m^3/y;
- discharge of filtering materials from one power unit - 23 m^3 /y, including the low level waste - 1 6 m^3 /y.

According to the EIA report, a reference level of the evaporator bottoms generation during operation of one power unit at KhNPP, was set to be equivalent to 262 m^3/y.

According to the EIA report, after commissioning of power units # 3 and # 4, the estimated maximum increase in the indicator of generation of evaporation bottoms and the molten salt concentrate shall not exceed the reference level of generation of evaporation bottoms and that of the molten salt concentrate – no more than 50- 60 m^3 /y.

Solid radioactive wastes are generated in the process of normal operation of NPP and during maintenance or in the event of accidents.

Category 1 and category 2 wastes are collected and put into polyethylene bags or multiple layers paper bags at the places of their generation, and are dispatched to the areas for interim storage of solid radioactive wastes where they are loaded into metal containers. Category 3 waste is collected and put into a special canister at the place of its generation; they are not accumulated, but moved directly to the storage. The packaged waste are transported to the areas of temporary collection of RAW, which are located at the SVO unit at level 18.000 in room c-504; in the workshops section at level 0.000 in room M-117; in the reactor building at level 0,000 in room ГА-101; during scheduled outage at level 36.600 in room ГА-701 and in room ГА-308 at level 13.200. Three storage facilities are envisaged to accommodate solid radioactive wastes, providing their storage in the liquid radioactive waste treatment building, in a separate solid radwaste storage and treatment building (a SRWSF), and in the modular storage facility. Once filled, collectors-containers are moved to the SVO unit's storage facility

in the liquid radioactive waste treatment building. Wastes are transported by a specialized vehicle from -20;

- **Transboundary impact of the proposed activity's facility during proposed activity.**

The transboundary impact of the proposed activity's facility is likely to occur because of transfer of a radioactive release.
According to the EIA report, the assessments of effects of the transboundary transfer of a radioactive release are carried out by building a mathematical model of dispersion of gas & aerosol radioactive releases during normal operation of Khmelnytskyi NPP and during emergencies, and by evaluating the dose loads to the public with the help of the three-dimensional contamination field.

According to the EIA report, during normal operation of Khmelnytskyi NPP, the radiation impact on neighboring countries will be significantly lower than dose constraints set for the public (within the range of 0.2-0.3 micto Sv*year^{-1}) during operation of nuclear facilities in neighboring countries.

According to the EIA report, the calculations of potential transboundary transport of an emergency radioactive release, which occurs in the event of a hypothetic accident at KhNPP, were made for standard meteorological conditions with the help of the atmospheric transport model LEDI. For all accidents, the time of release is conservatively taken equal to 1 hour. In case of longer release duration, the dispersion of pollutants and the time of reaching the detection point will be substantial, and, accordingly, the radioactive contamination of the territory and dose loads will be smaller.

The following scenarios of typical accidents, which may occur at one of KhNPP units, were selected for further calculations:

- a maximum design basis accident (MDBA) with a double-ended rupture of the primary coolant pipeline;
- a beyond design basis accident (BDBA) caused by a guillotine break of the primary coolant circuit with a failure of active emergency core cooling systems (ECCS) and the spray system remaining operable.

During accidents, the public safety criterion is a basic criterion for evaluation, so, the evaluation was carried out with using annual individual effective doses. For individual exposure to the public, the main dose limit shall not exceed an effective radiation dose of 1 mSv per year.

According to the EIA report, during MDBA, a release through containment is a source of radioactive emissions. The effective height of a release was taken equal to 0 m. The duration of a release was taken equal to 1 hour.

The total release of radionuclides during an accident with a double-ended rupture of the primary coolant pipeline is shown in Table 5.15 of the EIA report.

The assessment of consequences of accidents in the territory of neighboring countries is described in the EIA report, pages 196-217.

As regards the territory of Byelorussia, under meteorological scenario 1, if a conservative method applies, the cumulative individual doses to reference groups of the public at the reference point (on the border with Ukraine) will be 0.13 micro Sv*year $^{-1}$ for adults and 0.12 micro Sv *year^{-1} for children. In case of precipitation fallout in the territory of Byelorussia,

the estimated effective doses to adults and children will increase and reach 0.65 micro Sievert *year^{-1}.

In the event of MDBA, under meteorological scenario 2, the estimated individual effective doses at the detection point in the territory of Poland will be about 0.04 micro Sievert *year^{-1} for both age groups; in case of snowfall during transfer of radioactivity, the individual effective doses to adults and children will be 0.3 micro Sievert *year^{-1} .

In the event of MDBA, under meteorological scenario 3, the estimated individual effective doses at the detection point in the territory of Poland will be 0.18 micro Sievert *year^{-1} for adults, and 0.43 micro Sievert *year^{-1} for children.

Under meteorological scenario 3A, in case of a rainfall, the estimated individual effective doses at the detection point on the border between Ukraine and Poland (in the center of a plume) will be 16.9 micro Sievert *year^{-1} for adults, and 29.1 micro Sievert *year^{-1} for children.

In the event of BDBA, under meteorological scenario 1, the cumulative individual radiation doses to reference groups of the public at the detection point in the territory of Byelorussia will reach 2.6 micro Sievert *year^{-1} for adults and 3.9 micro Sievert *year^{-1} for children; in case of precipitations, they will be 7.5 micro Sievert *year^{-1} and 8.7 micro Sievert *year^{-1}, respectively. Under meteorological scenario 2, the estimated individual effective doses at the detection point in the territory of Poland, will be 0.8 micro Sievert *year^{-1} for adults and 1.2 micro Sievert *year^{-1} for children; in case of a snowfall, they will be about 3 micro Sievert *year^{-1} for the both age groups. Under meteorological scenario 3, the estimated individual effective doses at the detection point in the territory of Poland will be 5.8 micro Sievert *year^{-1} for adults, and 25.6 micro Sievert *year^{-1} for children. Under meteorological scenario 3A, in case of a rainfall in Poland during the radioactivity transfer, the estimated individual effective doses at the detection point on the border between Ukraine and Poland (in the center of a plume) will be 177 micro Sievert *year^{-1} for adults and 683 micro Sievert *year^{-1}for children.

Therefore, the computations, which were made with the help of the mesogrid model of the atmospheric transfer LEDI, demonstrated that in case of any accident under review, the limit of an individual effective dose to members of the reference group in the territories of neighboring states (Byelorussia and Poland) will not be exceeded. In case of precipitations in the territory of Poland, scenario 3A is the most critical among all meteorological scenarios. Under all meteorological scenarios under review, Iodine-131 is the main dose-forming radionuclide in the event of postulated accidents.

Also, taking into consideration all information, comments, remarks and proposals, which were received during public consultations (a report on public consultations, supplemented with a table making reference to either complete or partial incorporation or well-justified rejection of comments and proposals is an integral part of that conclusion), [we] consider it acceptable /~~inacceptable~~ to carry out the proposed activity in view of the following:

Based on the assessments, given in the EIA report, which address probable impacts on environmental targets (atmospheric air, water and land resources, soils, climate factors, physical structures, landscapes, and levels of noise, thermal and vibration contamination, waste management (including radioactive waste management), spent nuclear fuel management, during MDBA and BDBA, and impacts in a transboundary context), a

cumulative impact of the proposed activity, under normal operation, is ecologically acceptable.

Based on outcomes of the EIA report, it has been established that the main impact the proposed activity may produce is expected to affect the water environment and arise from radioactive waste management activities. Given that ecological conditions, prescribed for the proposed activity, are met subject to normal operation of KhNPP power units No. 3 and No. 4, the above-mentioned impacts on environmental targets can be specified as ecologically acceptable.

Ecological Conditions for Pursuing the Proposed Activity

1. The following conditions of the use of territory and the natural resources during preparatory and construction activities and pursuing of the proposed activity are established for the proposed activity, namely:

1.1. During preparatory and construction activities the following ecological conditions are established:

- prior to pursuing the proposed activity, determine and establish sanitary protection zone considering operation of four power units of Khmelnytskyi NPP and in compliance with the technical solutions of proposed activity;
- prior to implementation of the proposed activity, inspect the technical condition of existing buildings and structures of the cooling water reservoir's dam (the inspection results shall be published on the own web site);
- prior to pursuing the proposed activity, carry out research as for availability of the species of flora and fauna included in Resolution#6 (1998) of the Convention on the conservation of European wildlife and natural habitats (hereinafter – Bern Convention) and types of natural habitats included in Resolution #4 (1996) of the Bern Convention, groupings of the Green Book of Ukraine in the cooling water reservoir; in case of their presence, add information concerning set of the special measures on their preservation (the results shall be published on the own web site);
- prior to implementation of the proposed activity, provide additional information that concerns calculation of the water resources balance on the Horyn river, taking into account operation of four power units of KhNPP till the end of their operation life, taking into account the water resources balance on the Horyn river carry out hydro thermal calculations of the cooling water reservoir, provide that information to the Ministry of Environmental Protection and Natural Resources of Ukraine and to publish on the own web site;
- prior to implementation of the proposed activity, prepare concept of safe decommissioning of power units #3 and #4 of Khmelnytskyi NPP in view of location, specifications of the selected reactors and technical solutions on radioactive waste and spent nuclear fuel storage;
- prior to the start of the proposed activity, ensure publishing on the own web site of conclusions of the Preliminary Safety Assessment Report;
- arrange for collection, treatment and disposal of rain and melt waters;
- implement proposed activities on protection and rational use of water resources;

- pipes of special sewage shall be made of stainless steel, be laid in channels coated with carbon steel with epoxy coating;
- during warm season, water adjacent territory on the regular basis to reduce environmental impact for the period of work performance;
- not to exceed the maximum allowable values of concentration of the pollutants in the atmospheric air;
- take measures to minimize emmissions of pollutants to the atmospheric air while performing process operations;
- wet dust suppression shall be carried out during civil works ;
- take measures to reduce noise and vibration during implementation of proposed activities
- take measures to prevent exceeding of the normal level of noise on the border of the nearest residential development;
- take measure to exclude ground contamination;
- take measures to prevent and reduce development of the hazardous processes and phenomena;
- treat wastes in compliance with the Law of Ukraine "On Waste", permitting documents and concluded contracts, with the specialized organizations in the field of waste treatment including hazardous waste;
- maintain primary current accounting of quantity, type and composition of waste that are accumulated at the enterprise and submit statistic reports thereof;
- transport out waste generated in the course of operation in compliance with contracts concluded with the dedicated organizations;
- it is prohibited to mix wastes for treatment of which the relevant technology exists in Ukraine;
- preparatory and civil works shall be performed by qualified construction and installation organizations with industrial safety and environmental protection measures been observed.
- ensure reliable sealing of machinery, process pipelines and valves;
- use machinery which is only in good working condition;
- cover materials during road transportation, in particular, fine grained materials, to avoid leaks or emissions of dust ;
- construction of cooling towers is prohibited;
- operation of transport and other mobile vehicles and units, where the content of pollutants in the exhaust gases exceeds standards or levels of harmful impact of physical factors;
- technologic inspection, washing and filling of the construction machinery shall be carried out at the dedicated industrial site with solid water tight coating;

- implement the proposed activity in compliance with the Water and Land Codes of Ukraine;
- it is prohibited to start implementation of the proposed activity without studying of presence of species and habitats that are listed as those subject to protection in the Iziaslavsko-Slavutskyi site (UA0000123) of the Emerald Network in the territory of implementation of the proposed activity;
- ensure long-term conservation of the natural habitats and natural fauna and flora species, which are subject to special protection in Europe and are specified in the standard data form proposed by the public in the territory of the Iziaslavsko-Slavutskyi site (UA0000123) of the Emerald network;
- carry out activity in line with the Law of Ukraine: "On natural environment protection";
- carry out activity in line with the Law of Ukraine "On natural reserve fund" ;
- carry out proposed activity in line with the regime of protection and use of territories and ecological network structures;
- carry out proposed activity in line with the Law of Ukraine "On the Red Book of Ukraine"
- observe other environmental measures envisaged by respective production documents of the company;
- provide for availability of the obligatory insurance agreement pursuant to CMU's Resolution #953 dated 23.06.2003 "On Obligatory Insurance of Civil Liability for Nuclear Damage".
- ensure environmental impact assessment in case of changes of the proposed activity subject to environmental impact assessment in compliance with CMU's Resolution #1010 dated 13.12.2017 "On Approval of Criteria to Determine the Proposed Activity which is not Subject to Environmental Impact Assessment, and Criteria to Determine Expansion and Changes of Activity and Facilities which are not subject to Environmental Impact Assessment"

1.2. In the course of the proposed activity the following ecological conditions are established:

- it is prohibited to operate power units beyond 45 years ;
- 15 years prior to the end of the lifetime of KhNPP units# 3 and #4, ensure development of measures and plan for decommissioning of those power units (with the public involved), approve the developed programme in the part of implementation of the dates and implement them scrupulously (the results shall be published on the own web site and web sites of the local governments of the relevant administrative and territorial units);
- provide for organization of collection, treatment and disposal of the rain and melt waters;
- provide for maintaining water temperature in the cooling pond at the level of 33ºC;
- discharge of contaminated radioactive waters in the water objects is prohibited;
- provide for collection of all non-organized water leaks by the special sewage network;

- prevent disposal of waste, rain and melt waters to the terrain;
- water resources shall be managed based on Article 49 of the Water Code of Ukraine;
- water intake from the Horyn river for NPP needs shall be carried out from March till April, in the other months the intake may be possible in case of emergency only;
- apply water saving processes (organize return water supply)
- discharge of the waste waters into the water objects shall be allowed only if the standards of the maximum allowable concentrations and established standards of maximum allowable discharge of pollutants are available;
- releases of pollutants by the stationary sources of an enterprise shall be possible provided the permission for releases is available, and shall not result in exceeding of sanitary standards at the boundary of the SPZ;
- releases of pollutants by the stationary sources of an enterprise that are not subject to regulation and not accounted by the state shall not result in exceeding of sanitary standards at the boundary of the SPZ;
- provide for laboratory and instrumental measurements of pollutant release parameters after putting the proposed activity structure in operation;
- provide for uninterruptable efficient performance and maintaining in good condition the equipment of release treatment, carry out regular performance monitoring of the gas treatment facilities;
- not to exceed allowable standard levels of noise, ultrasound and infrasound in production premises, as established in the state sanitary standards;
- take measures to reduce noise and vibration in pursuing the proposed activity;
- take measures to prevent exceeding of the standard level of noise at the boundary of the closest residential housing;
- observe requirements of the Land Code of Ukraine concerning rational land utilization and conservation;
- provide for implementation of technical solutions and measures to prevent soil contamination;
- provide for observance of radiation and sanitary regulations of the radiation background at the boundary of the SPZ;
- provide for leak tightness of the closed circuits with radioactive medium with them to be continuously monitored;
- provide for decontamination of the removed air that contains radioactive isotopes on aerosol and iodine filters;
- provide for continuous measurements for the presence of inert gases, aerosols and iodine in the air being removed;
- provide for maintaining pressure in the containment vent system below the atmospheric one that guarantees containment air flow through the filters with its activity constantly monitored under conditions of primary circuit leaks ;

- organized decontaminated air releases from the premises of the contamination control area of the reactor hall and special building shall be administered via ventilation stack not less than 100 m high;
- the proposed activity shall be carried out with emission monitoring system at each vent stack, the monitoring is continuous and uses central system as well as individual tools;
- provide for monitoring of iodine radioactive aerosol concentration upstream and downstream of the ventilation system filters;
- envisage special gas treatment system intended for effluent gases of the equipment containing radioactive medium;
- monitor continuously the air that is evacuated from the vent stacks for the radioactive gas content;
- provide for the gas treatment on ^{133}Xe –at least 2.5 order of magnitude;
- provide for the specific activity of the service water downstream the ECCS heat exchangers with alarm signal being sent to the operator's panel;
- potentially contaminated waste water can be treated in the special water treatment system to be reused in the plant cycle;
- premises of special water treatment, liquid radioactive waste collection station, containing radioactive media and waste shall have metal pad or be cladded with stainless steel up to the premise's potential flooding level;
- reactor hall radioactive water is subject to decontamination at the plant facilities located at the special building, and liquid radioactive waste shall be transported to the special building by rack laid stainless pipelines that prevents transported substances release into environment;
- all handling operations with solid radioactive waste shall be accompanied with radiation monitoring to ensure radiation safety of the plant staff;
- in case of excess level of mineralization and concentration of biogenic elements in the water of the cooling water reservoir, blow down the cooling water reservoir to retain them at the level not higher than maximum allowable concentration determined by the sanitary standards;
- maintain temperature modes at the settlement target by dilution of blowdown water that is controlled by respective water temperature measurements;
- waste management is exercised according to the Law of Ukraine "On Waste" , permitting documents and agreements executed with specialized organization in the field of waste management, including hazardous waste;
- radioactive waste management shall be exercised in compliance with the Law of Ukraine "On Radioactive Waste Management", permitting documents;
- observe Order#84 of the State Nuclear Regulatory Committee of Ukraine dated July 1, 2010 "On Approval of the Procedure of Radioactive Material Exemption of Regulatory Control in the Framework of Practical Activity" registered in the Ministry of Justice of Ukraine on August 20, 2010 under No. 718/18013;

- arrange for dedicated and appropriately equipped places for temporary storage of each type of waste according to their hazard characteristics and according to the requirements of applicable sanitary standards and regulations;
- ensure maintaining of primary current accounting record of quantity, type and composition of waste and submission of the statistical reporting as required by law;
- it is prohibited to mix wastes for which the respective treatment technology exists in Ukraine;
- use only serviceable process equipment;
- in case of necessity, repair of machinery, equipment, etc. as envisaged to be used in implementation of the proposed activity shall be carried out in the designated areas and organized places;
- equip the territory of the object of proposed activity with non-destructive coating impermeable for hazardous substances (asphalt, concrete, expanded clay concrete, polymer concrete);
- pursue proposed activities, provided all permitting documents are available;
- appoint persons (of appropriate sociality) responsible for observance of environmental protection legislation requirements;
- ensure compliance with requirements on explosion and fire hazard related proposed activity in accordance with the Ukraine's legislation;
- ensure reliable sealing of the machinery, process pipelines and valves;
- use equipment made of corrosion resistant materials in manufacturing process;
- operate equipment and networks in technically sound operating condition;
- ensure long-term conservation of natural habitats and nature's flora and fauna species that are subject to special protection in Europe and are specified in standard data form proposed by the public of Iziaslavsko-Slavutskyi site (UA000123) of the Emerald network;
- in case of finding the fact of exceeding any monitored indicator, take measures to bring the manufacturing process to the normal condition, ensure urgent notification of the authorized central body and carry out response activities as appropriate;
- ensure assessment of the environmental impact in case of changes in the proposed activity subject to assessment of environmental impact as stipulated by Resolution #1010 "On Approval of Criteria of Definition of the Proposed Activity not subject to Environmental Impact Assessment, and Criteria of Definition of Expansion and Changes of Activity and Facilities (Objects) that are not subject to Environmental Impact Assessment" dated December 13, 2017.

2. The following conditions on prevention of emergency situations and elimination of their consequences are established for the proposed activities, namely:

- in case of emergency or abnormal situations, characteristics of quantitative and qualitative impact on environmental components, compensation measures shall be determined according to the procedure as required by applicable legislative regulations and instruments;

- envisage, in case of emergency, a number of logistic and technical measures aimed at confinement and elimination of the situation occurred and exclusion of environment contamination;
- ensure availability of clear regulation and required number of tools for confinement and elimination, in full scope, in order to minimize potential negative impact of any emergency on natural environment;
- maintain the indoor fire water pipeline of the building in due condition, provide it with primary fire extinguishing tools;
- arrange for fire safety training of the staff at the enterprise;
- carry out periodic inspection and repair of the process equipment and structures.

3. The following conditions are established for the panned activity regarding transboundary effect of the proposed activity *, namely:

- at the "Design" stage: present special technical solutions and measures on safety level upgrading up to modern safety standards in view of comments and proposals provided by the affected states in the course EIA in transboundary context, as well as safety enhancement aspects in compliance with the Complex (Consolidated) Safety Upgrade Programme of nuclear power plants, approved by Resolution #1270 of the Cabinet of Ministers of Ukraine dated December 7, 2011;
- carry out inspection of the technical condition of existing buildings and structures for units #3 and #4 prior to the beginning of the "Design" stage, determine appropriate aging mechanisms of buildings and structures, develop aging program on the "Design" stage and take respective measures for monitoring of technical condition of buildings and structures;
- perform necessary analysis of safety, of DBA and BDBA in view of effective international safety standards that have to be applied to KhNPP-3,4 construction project;
- ensure access for public and affected parties to materials on technical condition of existing buildings and structures and technical solutions on safety level upgrading to the modern safety standards taking into account comments and proposals from affected states in the process of environmental impact assessment in a transboundary context accepted on the "Design" stage;
- carry out periodic safety reassessment of nuclear installations according to the national and international standards in the field of nuclear energy utilization and radiation safety.

4. The economic entity is hold responsible for implementation of the following compensatory measures **, namely:

- carry out activities in compliance with the national law in the field of nuclear energy utilization and radiation safety.

5. The economic entity is hold responsible for prevention, avoidance, mitigation, elimination, restriction of the environmental impact of the proposed activity, namely:**

- carry out organizational; economic, ecological and other measures aimed at rational use and protection of lands, their protection from harmful anthropogenic impact;

- carry out repair of the road surface to reduce infiltration of the surface waste water contaminated with oil products into the soil and ground water ;
- execute (extend the term of) agreements for waste treatment with the other specialized enterprises;
- carry out activities in such way that ensures conservation of natural complexes and facilities (objects), rare and endangered species of flora and fauna;
- ensure ecological safety, rational use of natural resources, compliance with environmental legislation;
- ensure design and construction of wing dam with the aim to reduce temperature and establish favorable hydrothermal regime in the water storage reservoir.

6. The business entity is assigned the responsibilities for the post-project monitoring, namely:**

- prior to the implementation of scheduled activity to develop, approve and submit to the authorized Central Body and the State Environmental Inspectorate of Ukraine the plan of the post-project proposed activity monitoring (the plan shall include data regarding the subject of post-project monitoring, its frequency, reporting terms and sampling point with identification of geographic coordinates), in addition, to provide a copy of the Conclusion of the sanitary and epidemiological service for the determination and establishment of a sanitary protection zone;
- ensure continuous automated monitoring of the radiation state at the NPP site and in the observation area;
- ensure continuous automated monitoring of gamma background in the observation area with continuous data transmission online on our own website;
- ensure monthly monitoring of the water temperature of the cooling reservoir;
- perform monthly monitoring of quantitative and qualitative indicators of pollutants in the atmospheric air at the border of specified sanitary protection zone;
- monitor biological objects of surface water (monitoring biocenosis and populations) every six months;
- monitor the state of sludge and bottom sediments on a quarterly basis;
- monitor the condition of the foundations of buildings and structures annually;
- carry out laboratory and instrumental control of emissions of pollutants from stationary controlled sources of emissions (monthly);
- monitor proposed activity impact on the state of soils within sanitary protection zone (monthly);
- organize periodic sampling at controlled sources of pollutant emission into the atmospheric air, measure and control the concentrations of pollutants on a monthly basis;
- carry out hydrogeological monitoring of the groundwater regime, its temperature and chemical composition in the territory of the proposed activity (monthly);

- monitor the quality of domestic and industrial water, its radiation background before being discharged into the sewerage network (cooling reservoir) on a monthly basis;
- in case of exceedance of any indicator relative to which monitoring is carried out, take appropriate response measures and ensure that the authorized central body is promptly informed.

Post-project monitoring results (Post-project monitoring reports) shall be submitted every six months during the next month after the reporting to the authorized central body and the central office of the State Environmental Inspectorate of Ukraine, as well as to ensure the publication of the results (copies of laboratory studies of environmental parameters performed as part of post-project monitoring) on the own website. Post-project monitoring is carried out during the operating lifetime of the proposed activity object from the beginning of the implementation of the proposed activity.

Note: *If during the implementation of economic activity a significant negative impact of this activity on the life and health of the population or the environment is revealed, and if such an impact was not assessed when carrying out an environmental impact assessment and/or significantly changes the results of an assessment of the impact of this activity on the environment, the decision to carry out such a proposed activity is to be cancelled by a court decision, and the activity is to be terminated.*

7. The business entity is assigned the responsibility for additional environmental impact assessment at the other design stage, namely:**

- additional environmental impact assessment for the proposed activity is not envisaged if environmental conditions are met.

The conclusion on the environmental impact assessment is binding for execution. The environmental conditions stipulated in this conclusion are mandatory.

The conclusion on the environmental impact assessment becomes invalid after five years in the event that no decision has been made on the preforming of the proposed activity.

/signed/

L. Kotiash

Department Deputy Director –

Head of the Section for Development of State Policy in the Environmental Control
Department of Environmental Assessment, Control and Environmental Finance

/signed/

R. Shakhmatenko

Deputy Minister

* If a transboundary impact procedure was carried out
** If such a need arises from the environmental impact assessment