



**State Enterprise
«National Nuclear Energy Generating
Company «Energoatom»
SE NNEGC «ENERGOATOM»
Annex B**

**NON-TECHNICAL SUMMARY
Environmental assessment Implementation of Complex (Consolidated) Safety
Upgrade Program of Nuclear Power Plants (CCSUP)
for the period 2017-2022**

TABLE OF CONTENTS

TABLE OF CONTENTS2
INTRODUCTION3
BASIS FOR ENVIRONMENTAL ASSESSMENT OF CCSUP FOR 2017-20224
PERFORMERS5
BRIEF INFORMATION ON CCSUP IMPLEMENTATION STATUS FOR
THE PERIOD 2017-20226
THE MAIN RESULTS ON EA OF CCSUP FOR THE PERIOD 2017-2022 10
CONCLUSIONS 13

INTRODUCTION

According to the Energy Strategy of Ukraine for the period until to 2050, approved by the of the Cabinet of Ministers of Ukraine № 373-r of 21 April 2023, SE NNEGC “Energoatom” with the purpose steady of further improvement of nuclear safety, ensuring efficient and reliable performance in the energy branch, bringing safety of Ukrainian nuclear power plants to the level that meets international requirements to nuclear safety and environmental protection, implements the Complex (Consolidated) Safety Upgrade Program of Power Units of Nuclear Power Plants (CCSUP).

CCSUP was approved by the Decree of the Cabinet of Ministers of Ukraine № 1270 on 7 December 2011. In 2012 the CCSUP was supplemented with additional measures according to conclusions of the National Report of Ukraine on results of specific reevaluation of nuclear facilities situated on NPP sites (“stress-tests”), taking into account the lessons from Japanese NPP “Fukushima-Daichi” accident of March, 2011. Amendments to this resolution in 2023 (Resolution of the Cabinet of Ministers of Ukraine № 479 on 12 May 2023) set a deadline for completion of its implementation by the end of 2025.

BASIS FOR ENVIRONMENTAL ASSESSMENT OF CCSUP FOR 2017-2022

The Law of Ukraine «On ratification of Guarantee agreement (Ukraine: Complex (Consolidated) Safety Upgrade Program of Power Units of Nuclear Power Plants) between Ukraine and European Bank for Reconstruction and Development» dated 15.05.2014 № 1267-VII, which provides for the provision of credit funds in the amount of 300,000,000 (three hundred million) EUR.

The Law of Ukraine “On ratification of Guarantee agreement between Ukraine as Guarantor and European Atomic Energy Community as Lender in relation to the EUR 300,000,000 (three hundred million Euros) loan facility agreement dated 7 August 2013 between the State Enterprise “National Nuclear Energy Generating Company “Energoatom” and the European Atomic Energy Community for the implementation of the Complex (Consolidated) Safety Upgrade Program of Power Units of Nuclear Power Plants» вфєуѵ 15.05.2014 № 1268-VII.

The specified international agreements provide for the need to implement the "Plan of Environmental and Social Measures". One of the environmental measures is to carry out an environmental assessment (hereinafter - EA) of the CCSUP implementation every 5 years.

The process of EA for CCSUP is regulated by a separate regulatory act of the Company - SOU NAEK 004:2011 “Environmental Assessment of Nuclear Power Units. General Requirements for the Composition and Content of Assessment Materials”.

The environmental assessment is aimed at reviewing the environmental impacts resulting from the implementation of the CCSUP measures (taking into account the changes made to the CCSUP during 2017-2022, its measures implemented during this period, as well as the actual changes in the state of NPP operation, the state of environment and its monitoring procedures, which have taken place since the completion of the previous EA of CCSUP).

The EA does not include the issue of assessing financial costs for the implementation of CCSUP measures, assessing the impact of new construction of nuclear facilities, capacity increase of existing nuclear facilities, and lifetime extension of power units of NPP.

PERFORMERS

The EA of CCSUP was executed according to the contract concluded between the SE «NNEGC «Energoatom» and the Limited Liability Company «Scientific and production Enterprise «UKREKOPROEKT» (LLC «SPE UEP»).

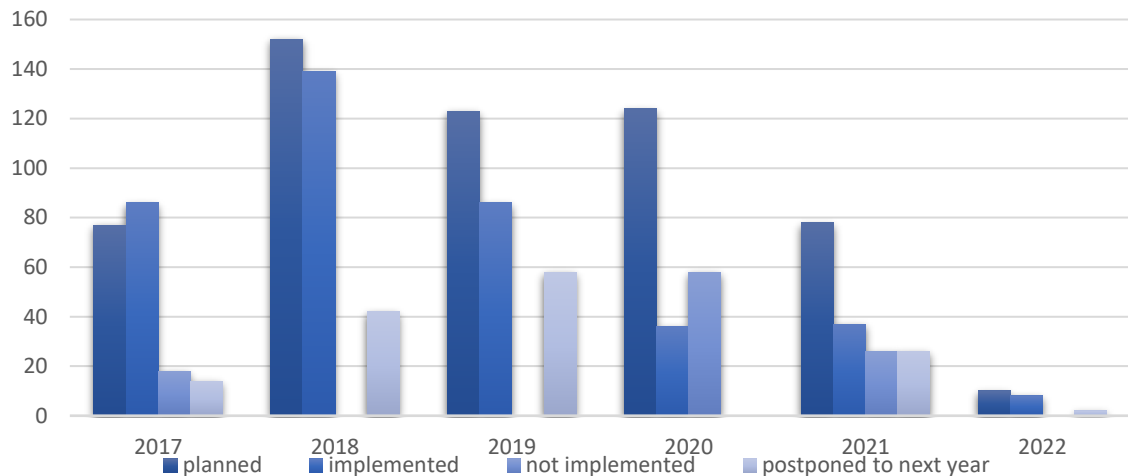
Table 1 – Experts involved in EA

Field of competencies	ІІІБ
General	BOLBAT Dmitro – director for LLC «SPE UEP». Diploma HK №28561651, specialty: Industrial and civil construction. Professional qualification: master's degree. Certificate №230 dated 15.11.2019 on advanced training on the topic "Environmental impact assessment (EIA) in Ukraine: features and first implementation experience. Strategic environmental assessment"
Ecological certification issues	BOLBAT Alina – design engineer for 1 category. Diploma M18 № 095635. specialty: law Professional qualification: master's degree. Qualification Certificate AP №016058 for responsible executor of certain types of work (services) related to the creation of architectural objects Certificate №KEA-18-277 on professional development "Environmental impact assessment (EIA) in Ukraine: features and implementation experience. Strategic environmental assessment"
Ecology management and audit	BULGAK Anastasia – ecologist. Diploma M20 №110255, specialty: ecology Educational and professional program «Ecological control and audit» Certificate № 227 dated 15.11.2019 on professional development "Environmental impact assessment (EIA) in Ukraine: features and implementation experience. Strategic environmental assessment"
Non radioactive waste management	VOLOSHINA Natalia – ecologist. Diploma HK № 45541737, specialty: ecology and environment Professional qualification: specialist. Educational and professional program «Ecological geology» Certificate № 231 dated 15.11.2019 on professional development "Environmental impact assessment (EIA) in Ukraine: features and implementation experience. Strategic environmental assessment"
Radiation safety and radioecology	ATAEV Sergiy – design leading engineer. Diploma PB 23428294, specialty: ecology and environment Professional qualification: master's degree. Qualification Certificate AP 012978 for responsible executor of certain types of work (services) related to the creation of architectural objects
General ecological issues	NOSIK Marina – ecologist. Diploma HK №34961915, specialty: ecology and environment Professional qualification: specialist.
Social and labor protection issues, PR	BILOUS Yan – ecologist. Diploma M21 №010704, specialty: ecology and environment, balanced nature management Professional qualification: master's degree

BRIEF INFORMATION ON CCSUP IMPLEMENTATION STATUS FOR THE PERIOD 2017-2022

A total of 1295 measures are planned to be implemented under the CCSUP. Since the beginning of SSCUP implementation (as of January 17, 2018) 760 measures have been implemented.

During the reporting period of 2017-2022 the 417 measures were implemented.



Diag.1 - Summarized information on the state of CCSUP measures implementation

Table 2 - Implementation of the originally planned CCSUP measures as of the end of 2022

Separated subdivision	Unit	The total number	Implemented	Remainder
ZNPP	ZNPP-1	77	70	7
	ZNPP-2	77	70	7
	ZNPP-3	76	66	10
	ZNPP-4	76	69	7
	ZNPP-5	76	67	9
	ZNPP-6	77	45	32
	station-wide	3	2	1
	Total	462	389	73
RNPP	RNPP-1	54	47	7
	RNPP-2	53	46	7
	RNPP-3	79	76	3
	RNPP-4	79	72	7
	Station-wide	5	5	0
	Total	270	246	24
KhNPP	KhNPP-1	79	75	4
	KhNPP-2	79	71	8
	Station-wide	4	3	1
	Total	162	149	13
SUNPP	SUNPP-1	53	50	3
	SUNPP-2	53	47	6
	SUNPP-3	77	58	19
	Station-wide	5	5	0
	Total	188	160	28
In general		1082	944	138

Table 3 - Implementation of the additional CCSUP measures as of the end of 2022

Separated subdivision	Unit	Total amount	Implemented	Remainder
ZNPP	ZNPP-1	12	9	3
	ZNPP-2	12	9	3
	ZNPP-3	12	8	4
	ZNPP-4	12	8	4
	ZNPP-5	12	7	5
	ZNPP-6	12	5	7
	station-wide	3	2	1
	Total	75	48	27
RNPP	RNPP-1	15	10	5
	RNPP-2	15	10	5
	RNPP-3	12	10	2
	RNPP-4	12	8	4
	Station-wide	3	2	1
	Total	57	40	17
KhNPP	KhNPP-1	12	10	2
	KhNPP-2	12	8	4
	Station-wide	2	1	1
	Total	26	19	7
SUNPP	SUNPP-1	16	12	4
	SUNPP-2	17	12	5
	SUNPP-3	12	6	6
	Station-wide	2	1	1
	Total	47	31	16
Company		8	1	7
In general		213	139	74

The reasons for the failure to implement the CCSUP measures are the difficulties the Company faces each year in implementing the CCSUP (in particular, delays in the development of design and estimate documentation due to its low quality, lengthy bidding procedures, lengthy state expertise due to the technical complexity of the CCSUP measures, breach of contractual obligations by the supplier, a limited number of contractors with qualified personnel to perform special works, and staff outflows).

In 2020 the main number of unfulfilled measures was due to 2 reasons:

A delay in receiving the next tranche of credit funds from Euratom and EBRD. Due to the prolonged blocking of credit funds by creditors, the next tranche of 100 million EUR was received only on 23 May 2020;

Force majeure due to the introduction of quarantine due to the COVID-19 pandemic, which prevents suppliers from fulfilling their obligations under the concluded contracts: purchasing imported equipment, timely deliveries, relocation of personnel to perform work, etc;

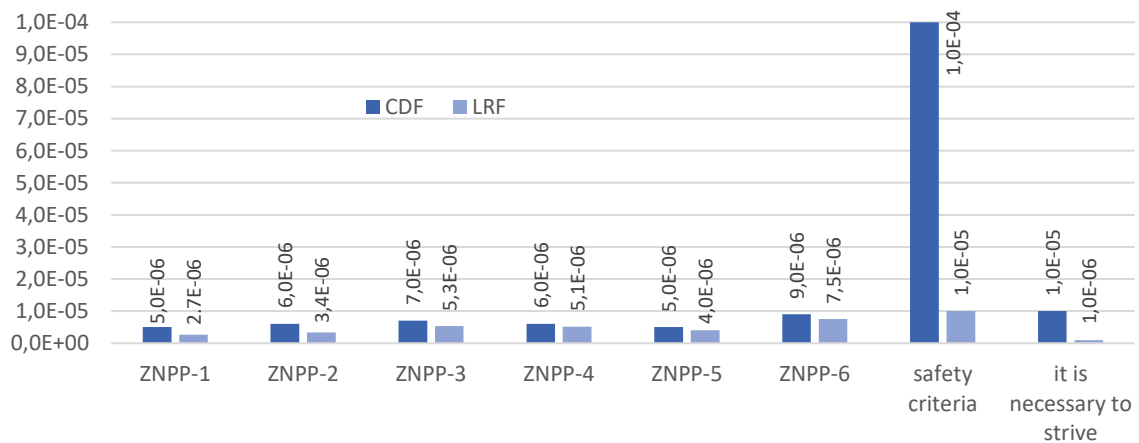
On 24 February 2022, the Russian Federation launched a large-scale armed aggression against Ukraine and throughout Ukraine by the Law of Ukraine on 24 February 2022 № 2102-IX "On Approval of the Decree of the President of Ukraine "On the imposition of martial law in Ukraine" № 64/2022 (as amended) martial law was introduced.

Russia's military aggression imposed a direct effect on the activities and condition of NNEGC "Energoatom", in particular, for the implementation of all investment projects, including the CCSUP.

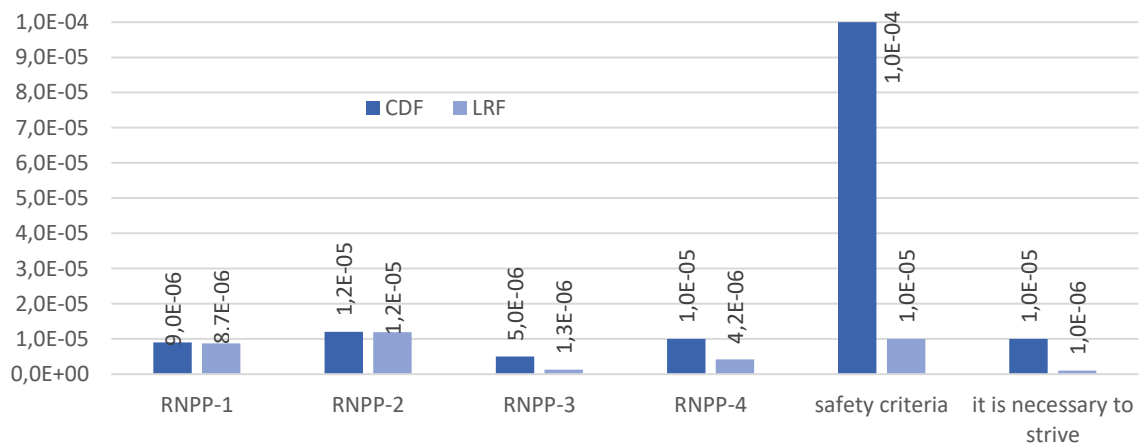
Force majeure circumstances related to the military aggression of the Russian Federation against Ukraine resulted in significant damage to industrial enterprises and infrastructure, disruption of logistics, reduction in the number of personnel of design, construction, installation and commissioning organizations due to mobilization and forced evacuation, which made it impossible to fulfill obligations under the concluded contracts for the supply of necessary equipment, materials, cable and wire products and other goods, as well as failure to perform works and services.

Due to force majeure, the scope of scheduled preventive maintenance of almost all power units was revised and significantly reduced. In connection with the seizure of the city of Enerhodar, including the Zaporizhzhia NPP site, by Russian military groups in early March 2022, all investment projects at ZNPP, including CCSUP activities, were suspended for security reasons.

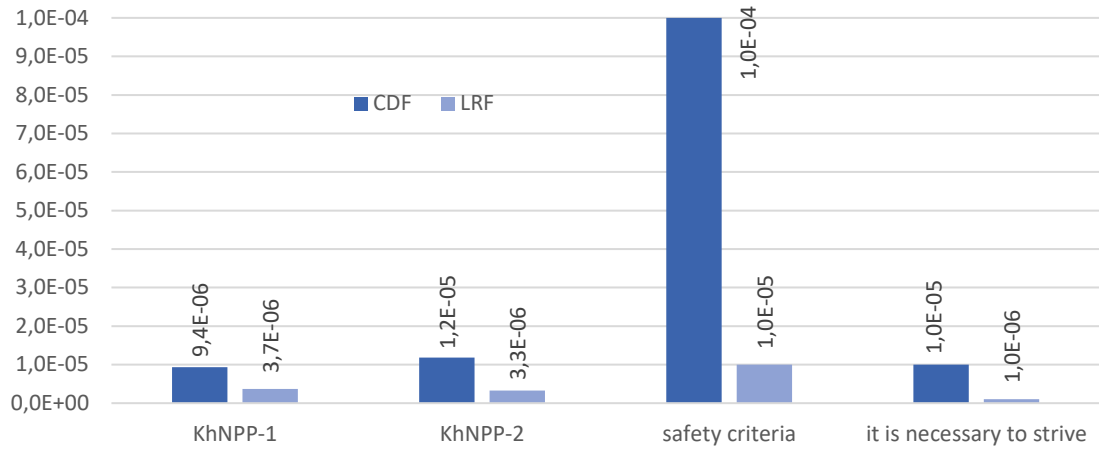
According to the results of the CCSUP's measures implementation and the periodic reassessment of the power units safety, the safety criteria are shown in the following diagrams - the core damage frequency (CDF) and the large release frequency (LRF).



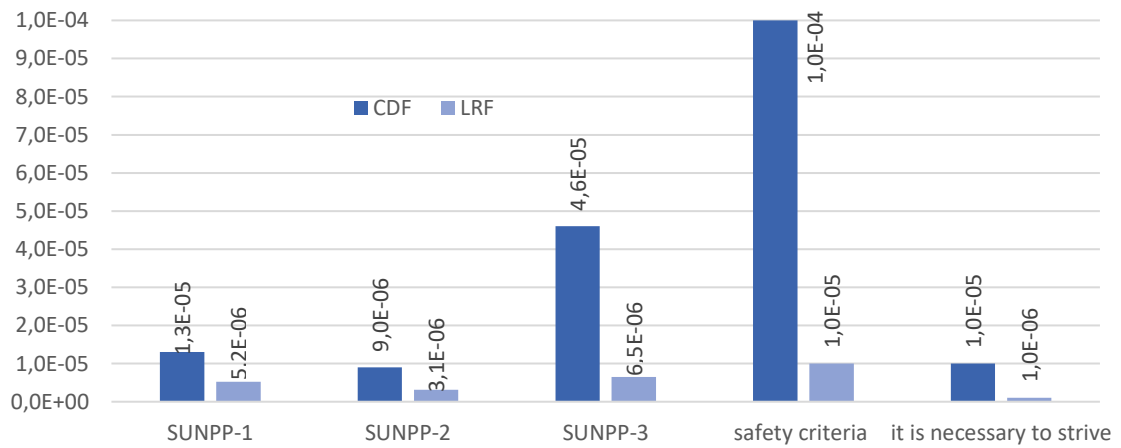
Diag. 2 – Safety criteria achieved for ZNPP



Diag. 3 – Safety criteria achieved for RNPP



Diag. 4 - Safety criteria achieved for KhNPP



Diag. 5 - Safety criteria achieved for SUNPP

THE MAIN RESULTS ON EA OF CCSUP FOR THE PERIOD 2017-2022

The main impact of the NPP on the environment during NPP's power units operation has been relating with emissions of radioactive and non-radioactive substances into the atmospheric air, discharges of radioactive and non-radioactive substances into surface water bodies, generation of radioactive and non-radioactive waste, etc.

Table 4 - Volumes of generation and storage of solid radioactive waste, m³

Year	NPP	Low-level		Mid-level		High-level	
		generated	storage	generated	storage	generated	storage
2017	Company	1 268,5	37 414,7	48,4	3 113,2	4,7	218,7
	ZNPP	516,4	8 213,4	22,8	889,2	0,3	99,8
	RNPP	279,7	7 741,5	14,3	387,3	3,7	91,7
	SUNPP	338,2	15 985,1	8,0	1 703,6	0,3	16,5
	KhNPP	134,2	5 474,7	3,3	133,1	0,4	10,7
2018	Company	1 228,2	37 977,6	55,3	3 172,6	3,7	222,3
	ZNPP	582,8	8 242,8	28,9	877,0	1,9	101,7
	RNPP	308,2	8 014,1	16,2	403,5	1,2	92,8
	SUNPP	179,6	16 088,4	8,0	1 756,8	0,4	16,9
	KhNPP	157,6	5 632,3	2,2	135,3	0,2	10,9
2019	Company	1 382,9	38 194,2	35,8	3 208,4	4,4	317,7
	ZNPP	638,9	8 175,0	1,8	878,8	1,6	103,3
	RNPP	290,7	8 053,8	24,7	428,2	2,3	95,1
	SUNPP	245,0	16 124,8	8,0	1 764,8	0,4	17,3
	KhNPP	208,3	5 840,6	1,3	136,6	0,1	102,0
2020	Company	1 440,5	38 380,6	86,4	3 258,2	8,0	234,6
	ZNPP	636,2	7 920,7	57,6	903,4	1,9	105,2
	RNPP	434,3	8 345,5	17,7	442,3	5,5	100,5
	SUNPP	238,0	16 142,8	10,8	1 775,6	0,4	17,7
	KhNPP	132,0	5 971,6	0,3	136,9	0,2	11,2
2021	Company	1 189,4	38 428,8	274,2	12 779,9	3,9	238,4
	ZNPP	550,0	7 824,7	194,2	6 537,6	2,4	107,6
	RNPP	228,0	8 346,1	45,4	3 113,6	0,7	101,2
	SUNPP	226,4	16 101,4	10,0	1 785,6	0,7	18,3
	KhNPP	185,0	6 156,6	24,6	1 343,1	0,1	11,3
2022	Company	543,5	30 742,3	74,9	6 316,6	5,1	132,4
	ZNPP	*	*	*	*	*	*
	RNPP	264,9	8 392,8	38,2	3 151,2	4,3	102,0
	SUNPP	157,3	16 071,6	10,0	1 795,6	0,6	18,9
	KhNPP	121,3	6 277,9	26,7	1 369,8	0,2	11,5

* In connection with the invasion by Russian military groups in early March 2022 of Energodar including the Zaporizhzhya NPP's site there are no data

Table 5 - Volumes of generation and storage of liquid radioactive waste, m³

Year	NPP	Evaporated bottom		ion exchange resin, sludge		Spent filter materials		Salt cake *	
		generated	storage	generated	storage	generated	storage	generated	storage
2017	Company	1 051,0	5 994,0	16,1	272,6	9,1	1 529,5	281,0	8 716,7
	ZNPP	671,0	2 957,0	5,5	175,0	5,5	344,4	179,4	4 932,6
	RNPP	380,0	3 037,0	5,0	20,8	3,6	577,3	77,6	2 507,8
	SUNPP	73,0	2 727,0	0,0	0,0	0,0	427,0	0,0	0,0
	KhNPP	86,0	368,2	5,6	76,8	0,0	180,8	24,00	1 276,3
2018	Company	1 305,4	9 208,6	15,8	289,9	9,4	1 538,7	221,2	8 953,0
	ZNPP	764,0	3 115,0	3,2	175,0	3,2	347,4	140,0	5 072,6
	RNPP	312,0	2 976,0	3,2	24,0	1,2	578,5	57,2	2 565,2
	SUNPP	116,0	2 736,0	0,0	0,0	0,0	427,0	0,0	0,0

Year	NPP	Evaporated bottom		ion exchange resin, sludge		Spent filter materials		Salt cake *	
		generated	storage	generated	storage	generated	storage	generated	storage
2019	KhNPP	113,4	381,6	9,4	90,9	5,00	185,8	24,00	1 315,2
	Company	1 289,2	8 908,8	20,8	317,7	16,2	1 518,9	247,0	9 208,8
	ZNPP	723,0	2 880,0	1,0	175,0	1,0	348,6	180,8	5 253,4
	RNPP	321,0	2 813,0	3,8	27,8	9,2	557,5	45,8	2 611,0
	SUNPP	92,0	2 755,0	0,0	0,0	0,0	427,0	0,0	0,0
2020	KhNPP	153,2	460,8	16,00	114,9	6,00	185,8	20,4	1 344,4
	Company	1 204,6	8 513,4	12,8	336,6	6,5	1 525,4	235,7	9 465,2
	ZNPP	777,0	2 476,0	0,0	175,0	0,0	348,6	186,6	5 440,0
	RNPP	229,0	2 879,0	0,6	28,4	6,5	564,0	13,1	2 626,8
	SUNPP	103,0	2 752,0	0,0	0,0	0,0	427,0	0,0	0,0
2021	KhNPP	95,6	406,4	12,2	133,2	-	185,8	36,00	1 398,4
	Company	1 145,2	8 701,8	16,4	360,2	10,0	1 535,4	0,0	0,0
	ZNPP	741,0	2 693,0	0,0	175,0	8,0	356,6	0,0	0,0
	RNPP	202,0	2 810,0	2,0	30,4	2,0	566,0	0,0	0,0
	SUNPP	95,0	2 784,0	0,0	0,0	0,0	427,0	0,0	0,0
2022	KhNPP	107,2	414,8	14,4	154,8	-	185,8	0,0	0,0
	Company	380,6	5 926,4	8,2	196,4	3,0	1 181,8	0,0	0,0
	ZNPP	**	**	**	**	**	**	**	**
	RNPP	214,0	2 733,0	2,2	32,6	3,0	569,0	0,0	0,0
	SUNPP	77,0	2 799,0	0,0	0,0	0,0	427,0	0,0	0,0
2022	KhNPP	89,6	394,4	6,00	163,8	0,0	185,8	0,0	0,0

* from 2021 salt cake is classified as a solid radwaste

** In connection with the invasion by Russian military groups in early March 2022 of Energodar including the Zaporizhzhya NPP's site there are no data

Table 6 – Volume of generation of non radioactive waste, tons

Year	NPP	I danger class	II danger class	III danger class	IV danger class	total
2017	Company	41,3	266,1	1155,2	38 870,6	66 846,0
	ZNPP	8,7	46,4	57,7	7 696,9	7 809,7
	RNPP	14,0	26,2	6,6	28 502,8	28 549,6
	SUNPP	16,1	142,0	1 004,8	873,9	28 549,6
	KhNPP	2,53	51,46	86,07	1 797,0	1 937,07
2018	Company	63,8	330,3	1 478,6	62 500,9	64 373,6
	ZNPP	7,8	145,5	541,7	8993,6	9 688,6
	RNPP	31,7	62,8	11,7	51 138,7	51 244,9
	SUNPP	21,3	88,7	870,5	820,7	1 801,2
	KhNPP	2,98	33,28	54,71	1 547,9	1 638,9
2019	Company	59,5	519,4	1 093,1	47 647,7	49 319,8
	ZNPP	9,6	75,7	227,6	8 125,0	8 437,9
	RNPP	42,9	98,3	21,5	35 100,5	35 263,2
	SUNPP	4,5	65,1	789,2	1 715,8	2 574,6
	KhNPP	2,49	280,33	54,79	2 706,4	3 044,0
2020	Company	54,7	369,4	1 839,7	43 736,5	46 000,4
	ZNPP	6,34	102,6	592,3	9 757,5	10 458,7
	RNPP	38,9	159,9	9,5	30 299,0	30 507,3
	SUNPP	6,3	34,6	1 039,7	1 249,8	2 330,4
	KhNPP	3,15	72,3	198,2	2 430,2	2 703,9
2021	Company	97,4	534,9	1 128,3	14 826,9	16 586,6
	ZNPP	5,3	14,3	84,1	6 791,4	6 895,1
	RNPP	83,2	75,4	6,7	2 421,8	2 587,1
	SUNPP	6,9	84,6	941,0	2 465,9	3 498,4
	KhNPP	2,01	360,56	96,54	3 146,8	3 606,0
2022	Company	29,57	299,7	206,5	20 282,0	20 817,8
	ZNPP	*	*	*	*	*

Year	NPP	I danger class	II danger class	III danger class	IV danger class	total
	RNPP	22,4	81,2	5,8	13 947,5	14 056,9
	SUNPP	3,5	60,6	146,6	1 712,6	1 923,3
	KhNPP	3,67	157,9	54,1	4 621,9	4 837,6

* In connection with the invasion by Russian military groups in early March 2022 of Energodar including the Zaporizhzhya NPP's site there are no data

Table 8 – Volume of emissions of non-radioactive substances into the atmospheric air, tons

Year	NPP	total	carbon dioxide
2017	Company	230,1	478,7
	ZNPP	16,7	-
	RNPP	34,8	109,2
	SUNPP	137,7	319,1
	KhNPP	40,9	50,4
2018	Company	236,3	4 282,5
	ZNPP	31,5	1 234,4
	RNPP	38,3	52,6
	SUNPP	90,7	591,6
	KhNPP	75,8	2 403,9
2019	Company	136,8	1 241,3
	ZNPP	29,8	941,4
	RNPP	35,4	42,0
	SUNPP	35,4	212,5
	KhNPP	36,2	45,4
2020	Company	137,8	1 410,0
	ZNPP	29,7	992,0
	RNPP	38,6	247,8
	SUNPP	34,9	156,2
	KhNPP	34,6	14,0
2021	Company	127,4	1 793,5
	ZNPP	31,5	1 247,9
	RNPP	24,9	164,2
	SUNPP	35,6	202,4
	KhNPP	35,4	179,0
2022	Company	132,7	3 635,5
	ZNPP	*	*
	RNPP	35,7	825,2
	SUNPP	37,7	356,4
	KhNPP	59,3	2 453,9

* In connection with the invasion by Russian military groups in early March 2022 of Energodar including the Zaporizhzhya NPP's site there are no data

CONCLUSIONS

The main impact of the NPP's operation on the environment has been relating with emissions of radioactive and non-radioactive substances into the atmospheric air, discharges of radioactive and non-radioactive substances into surface water bodies, generation of radioactive and non-radioactive waste, heat emissions etc.

The CCSUP is not aimed at increasing NPP production capacities, therefore, no significant increase or decrease in heat emissions, water evaporation and dust emissions from the NPP, as well as the volume of water used for cooling purposes is expected as a result of its implementation.

CCSUP's realization in 2017-2022 did not lead to an increase in vehicle use and a corresponding increase in emissions from mobile sources.

The CCSUP reduces the risks of emergencies and accidents at NPPs and, accordingly, the risk of environmental pollution. In addition, certain CCSUP measures will also mitigate the consequences of accidents and reduce potential releases of radioactive and non-radioactive pollutants into the environment, which demonstrates the positive impact of CCSUP implementation.

Impact on the surrounding social environment

The implementation of the CCSUP required the involvement of external workers (subcontractor personnel) who are exposed to radiation and non-radiation factors and risks that exist at any NPP. According to the Ukrainian legislation, occupational safety and health measures are applied to all employees (internal, external, permanent and temporary) involved in activities at the NPP site. The purpose of such measures is to prevent the risks of accidents and excessive radiation exposure.

The main basic safety criteria are improved as a result of CCSUP implementation. Reduction of accident risks will lead to a decrease in the level of psychological burden on personnel and the population associated with work or residence near NPPs, which will have a positive impact on the psychological state of workers and the population of the adjacent territories. For this impact to be effective, it is necessary to raise public awareness of the CCSUP to understand the consequences of its implementation.

Impact on the man-made environment

Under normal conditions NPP operation does not have a negative impact on the environment.

In the event of design basis accidents at NPPs, including IPAs, the negative impact on the environment will not exceed permissible limits and will not require any special measures.

Also, there is no significant impact of the environment on NPP operation.

Impact of design accidents caused by military actions of the RF

Massive missile attacks by Russian military groups on substations, power lines, and other facilities of Ukraine's energy system in 2022 resulted in so-called blackouts, or complete power outages, at nuclear power plants.

Prompt actions of the NPP employees to respond to the emergency, implementation of measures for emergency power supply of the NPP from diesel generators, allowed to avoid accidents. As a result of unscheduled operation of diesel generators and boiler units of the PCC, emissions of pollutants into the atmosphere temporarily increased due to additional fuel consumption. The impact of these design basis accidents on the environment was within the permissible limits and did not lead to significant environmental risks outside the unit containment and NPP area.

Assessment of possible transboundary impact of CCSUP measures

The CCSUP is not aimed to and not lead to an increase in electricity production. As a result, no additional emissions and discharges of pollutants associated with the CCSUP measures into the air and water environment are expected during further NPP operation. The CCSUP also has no significant impact on the amount of radioactive and other waste generated at NPPs.

After the CCSUP implementation, in general, environmental risks are reduced due to:

- decrease the probability of accidents;
- decrease the potential consequences of accidents through improved control, management and monitoring equipment, which contributes to early warning of accidents and better management of emergency situations.

Decreased accident risks indicate an overall reduction in the risks of potential transboundary impacts. Thus, the impact of the of CCSUP's measures is positive.