Environmental Impact Assessment Report

for

the Facility for Treatment and Conditioning of Radioactive Waste with a High Volume Reduction Factor at Kozloduy Nuclear Power Plant

SECTION 11.5

IMPACTS IN TRANSBOUNDARY ASPECT

CONTENTS

USED ABBREVIATIONS AND ACRONYMS

KNPP	Kozloduy Nuclear Power Plant
NPP	Nuclear Power Plant
ALARA	As Low As Reasonably Achievable
BNRA	Bulgarian Nuclear Regulatory Agency
BAS	Bulgarian Academy of Sciences
SE	Safe enclosure
VVER	Water-Water Power Reactor
WSS	Water Supply and Sewerage
VT	Ventilation tube
HVRF	High volume reduction factor
KPMU	Kozloduy project management unit
SG	State gazette
LLA	Long-lived Aerosols
EIAR	Environmental impact assessment report
SE RAW	State Enterprise “Radioactive Waste”
EBRD	European Bank for Reconstruction and Development
EC	European commission
PG-1	Power generation 1 (Units 1-4)
EU	European union
SEA	Safe enclosure area
PA	Protected area
BEPA	Bulgarian Environmental Protection Act
PT	Protected territory
BEEA	Bulgarian Executive Environment Agency
DECO	Decommissioning
IP	Investment proposal
STC	Secondary treatment chamber
CED	Collective effective dose
CA	Controlled area
VRF	Volume reduction factor
PTC	Primary treatment chamber
CPF	Cellulose and paper factory
IAEA	International Atomic Energy Agency
MDA	Minimum detectable activity
ISAR	Intermediate safety analysis report
MEW	Ministry of Environment and Water
MV	Motor vehicle
KIDSF	Kozloduy international decommissioning support fund for Units 1-4
BAT	Best available techniques
MA	Monitored area
NSI	National statistical institute

NTS	Non-technical summary
ROTPEA	Regulation on the order and terms for performing of environmental assessment
RPZ	Radiation protection zone
NRSF	National storage facility for low and intermediate radioactive waste
EIAR	Environment impact assessment report
BRPN	Basic radiation protection norms
CMD	Council of ministers decree
RAW	Radioactive waste
RNG	Radioactive noble gases
RIEW	Regional inspection of the environment and water
AB-2	Auxiliary building 2
SCC	Slag Collection chamber
PMF	Plasma melting facility
PT	Plasma torch
SD RAW	Special division “Radioactive waste Kozloduy”
RCC	Reinforced concrete containers
ToR	Terms of Reference
TD	Technical Design
TS	Technical Specification
EWN	Energiewerke Nord (German company)
SSRM	Stations for supervision and radiation monitoring

11.5 Impacts in transboundary aspects

11.5.0 Introduction

In November 1999, the Bulgarian Government and the European Commission signed an agreement in which the Bulgarian Government was committed to shut down and decommission Units 1-4 of Kozloduy Nuclear Power Plant (KNPP) at the earliest possible date, beginning with the closure of Units 1 and 2 at the end of 2002. A commitment for closure of Units 3 and 4 at the end of 2006 was undertaken a later date. In consequence all four units were shut down at the agreed time.

Taking into account the financial consequences of early closures, as well as the need of a competitive energy sector, the European Commission has offered a multi-annual assistance package for Bulgaria's energy sector including the nuclear energy branch. As a result, the Kozloduy International Decommissioning Support Fund (KIDSF) was established in June 2000.

In the Frame Agreements between the Republic of Bulgaria and the European Bank for Reconstruction and Development on the activities under the Kozloduy International Decommissioning Support Fund for support of nuclear installations decommissioning activities the erection of a Facility for Treatment and Conditioning of Radioactive Wastes with a High Volume Reduction Factor is also included as Project P5b.

The purpose of the KNPP PLC investment proposal is to build a “Facility for treatment and conditioning of radioactive waste with high volume reduction factor” at KNPP, using plasma technology, which will help to reduce the volume of low and intermediate level radioactive waste (Category 2) stored at different locations at KNPP site.

In order to minimize monitoring and maintenance at these locations, it is recommended that waste should be transferred and processed.

The Plasma Melting Facility (PMF) will also help to ensure that there is enough capacity in the existing RAW storage facilities at the KNPP site until the National RAW Storage Facility is built.

The selected technology for this Facility is a high energy technology able to treat a wide spectrum of RAW The following groups of RAW will be treated and conditioned at the PMF:

- RAW generated during operation of Units 1-6 KNPP and currently stored at the KNPP site;
- Additional amounts of RAW that are expected to be generated during the stages of the SE Preparation and Operation and as result of dismantling activities during decommissioning of Units 1-4 KNPP;
- Waste expected to be generated during the on-going operation of Units 5 and 6 as well as during their preparation for future decommissioning.

The Plasma Melting Facility will operate in accordance with the ALARA principles

ensuring:

- Protection of the people and minimizing of the occupational dose for the operational and maintenance personnel;
- Environmental protection.

Using the best available technologies (BAT) and the existing experience in this area, the PMF will represent an expansion of the existing NPP activities for RAW treatment and conditioning.

The requirement to use BAT is essential for minimizing the possibility of negative PMF impact on the environment and to ensure environmental protection.

On the basis of the Decision No 26 –PR/2010 by the Ministry of Environment and Water (MEW) on evaluation of the need to perform an environmental impact assessment an Environmental Impact Assessment procedure according to the Environmental Protection Act and other in the decision above mentioned acts and regulations has to be implemented.

For the purposes of the future KIDSF project, the implementation of project P5c is necessary, EIA of the construction, operation and decommissioning of the above mentioned PMF. This EIAR will be the base for the EIA procedure performed by MEW.

The purpose of this section is to perform analysis and assessment of the impacts on the environment in transboundary aspect resulting from the construction, operation and decommissioning of the PMF.

11.5.1 Alternatives for the project implementation

Alternatives by location

Site selection for a waste processing and storage facility shall be performed in such a way that the need in shipment of waste to be minimized.

The selected location of the PMF in the existing AB-2 is made on the base of technical and economical considerations, also taking into account the safety factors and factors for protection of the personnel and population health, the factors for minimal impact on the environment and the population in the area. The choice of the site has been made taking into account the interconnections among all stages of RAW generation and management. The optimal route for transportation of incoming RAW generated in the decommissioning process has been sought, so that the requirement under art. 39 of the Regulation for safety during RAW management [16] is fulfilled, according to which the facility site selection should minimize the need for RAW transportation, fulfilling at the same time the requirements under art. 38 of the same Regulation.

The site is appropriate because it was designed and licensed for the storage of radioactive waste and it is already connected to existing drainage and ventilation systems of AB-2. Thus, the needed operational status will be achieved by connection to the existing KNPP supply infrastructure.

The choice of AB-2 is not associated with acquiring new land for the project.

Alternatives for RAW transportation

The transportation of RAW within the Kozloduy NPP is not subject to special licensing and is part of the general licenses in force on the territory of plant.

In regard to RAW transportation, a routing scheme has been developed, according to which PMF will accept waste from:

- Lime sector;
- RAW processing workshop;
- Size reduction and decontamination workshop;
- Transport corridor 1;
- Transport corridor 2.

The conditioned RAW slag, produced by plasma arch, in order to reduce the waste volume will be put in 200 l drums. These drums will be transferred to SD “Kozloduy RAW”, and will later be transferred to the National Repository for low and medium level RAW after cementation in RCCs.

Alternative 0: Not realization of the investment project

"Zero" alternative means that RAW is not treated in order to obtain a high coefficient of reduction in their volume, and no reconstruction of AB-2 will be done.

Considering the current processing of the existing RAW and RAW generated from the decommissioning, the temporary storage for RCCs with conditioned RAW will not have sufficient capacity to receive all waste in the foreseeable future, before a facility outside the site is constructed. Therefore, a technology for volume reduction of the existing and newly generated waste is needed.

Alternative 0 is not acceptable in the context of the continuous dismantling activities during KNPP Units 1-4 decommissioning.

Alternative 1: Other technological options for achieving high volume reduction factors

The only other technical option to achieve a high volume reduction factor in comparison with the proposed treatment technology (PMF) is the implementation of a conventional incinerator. This can only be feasible if the untreated, pre-compacted and/or super-compacted wastes are pre-treated and sorted out into burnable and not burnable material.

This alternative will produce more risk of contamination spreading on the site area and will lead to an enormous time consumable sorting procedure.

Furthermore, another building within KNPP needs to be used for the installation of the incineration facility or even a new building must be erected for this incineration plant.

Alternative 2: Plasma Melting Facility for achieving high volume reduction factors

The proposed technology used for the PMF is based on Plasma melting that is a high-energy technology able to treat a wide range of different wastes. The advantages of the proposed PMF are:

- All operational waste existing in KNPP can be treated in one central facility.
- The waste can be treated in a single process without additional sorting infrastructure;
- A volume reduction factor higher than 50 for not pre-compacted waste, higher than 10 for pre-compacted waste and higher than 2 for super compacted waste is guaranteed;
- The resulting waste form is free from any organic material and suitable for long term storage and disposal without further treatment;
- The waste drums are fed unopened, virtually eliminating the risk of direct radiation exposure and contamination to the personnel;
- The necessary operational flexibility to treat not only the listed waste, but also waste arising during the overall decommissioning process.

The industrial experience with this proven technology related to the justification of the Best Available Techniques can be seen in EIAR chapter 11, section 11.3.

The alternative to implement a PMF on the KNPP site for treatment and conditioning of radioactive wastes with high volume reduction factor can be justified based on the

results of the assessment of the emission values for the Kozloduy PMF, the ZWILAG PMF, the CILVA incineration facility in comparison with the values shown in the BREF for BAT in this area and the EU Directive 2010/75/EU [6], taking into account the BAT requirements and the proposed mitigation measures.

11.5.2 Facility location

The investment proposal for the "Facility for treatment and conditioning of radioactive waste with high volume reduction factor" will be implemented within KNPP site. The total area of the site is approx. 2 km^2 and together with the channels for circulation and technical water supply reaches 4 km^2.

Kozloduy NPP has been constructed in north-western Bulgaria on the right bank of the Danube River 5km east of the town of Kozloduy. KNPP site is located at the 694th km from the Danube estuary at a distance of 3.7 km from the river midstream and the state border with Romania. The NPP is located in the northern part of the first non-flooded (loess) terrace of the Danube River with absolute elevation of +35.00 m. The site area is flat, with an average altitude ranging from +28.00 m to +36.00 m according to the Baltic altitude system. The lowland and the site are protected from the Danube River by an embankment reaching an absolute elevation of +30.40 m. To the north it borders on the Danube Lowland. To the south of the site the slope of the watershed plateau is relatively high (100-110 m), to the West it is about 90 m, while to the east it is relatively lower and goes down to a 30 m altitude above the sea level.

The site is located 120 km away from the city of Sofia in a direct line, and 200 km by road. The area within a 30-km radius around the site includes municipalities with the following centers: Kozloduy, Valchedrum, Hayredin, Mizia (entirely) and Lom, Byala Slatina and Oryahovo (partially). The 30-km area around the site also includes a sparsely populated part of the territory of Romania where a total of 23 settlements are located, of which 2 are towns – Dabuleni and Bechet, and 21 villages. The closest settlements to KNPP are: Kozloduy town located 2.6 km south-west, Harletz village located 3.5 km south-east, Glozhene village 4.0 km south-east, Mizia 6.0 km south-east, Butan village 8.4 km south and Oryahovo town located 8.4 km east of the site.

The regional location of Kozloduy NPP is shown on fig. 11.5.2-1.

Fig. 11.5.2-1 Regional location of KNPP site

The proposed PMF will be installed at the KNPP site and the proposed location is within Auxiliary Building – 2 (fig. 11.5.2-2), in Room BK301 at elevation level +6.30 m and Room BK039/3 at elevation level +0.00 m.

Figure 11.5.2-2 Location of AB2 at KNPP site

The designated location for PMF layout is within the Auxiliary Building – 2 (AB-2), elevation +6.30m, Room BK301. The Room is connected to the site systems providing: Electricity, Steam, Compressed air, Demineralized water, Cooling water, Nitrogen and Ventilation.

11.5.3 General characteristic of the PMF

General Plan of the PMF

AB-2 is a building designed to service KNPP Units 3 and 4 and Room BK301 is currently unused. The room is approximately 71.3 m in length, 36.4 m in width and approximately 8.45 m in total height and the floor area is served by three cranes of lifting capacities 6.30t, 4.00t and 2.00t (fig. 11.5.3-1).

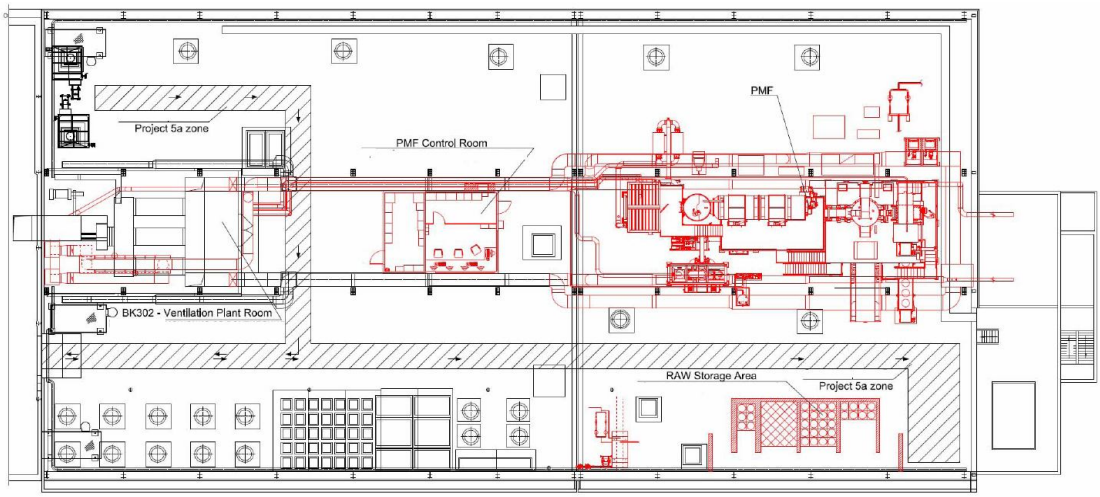

Fig. 11.5.3-1 Plan of AB-2, elevation +6.30m

The following is considered with reference to the layout of PMF and its components in this room:

- The range of the existing cranes in view of their use for the needs of the PMF design;
- The location of the protruding floor parts in Room BK301 (between axes 13 to 19);
- The roof structure support columns;
- The ventilation air ducts of the intake-extraction ventilation system at room BK301;
- The proximity of the existing transportation hatchway in the floor of room BK301, through which RAW will be loaded and unloaded.

Taking into account the existing conditions and infrastructure of the PMF, the design envisages partial reconstruction of room BK301. Such reconstruction is required due to the overall height of some of the PMF modules and the need to provide useful conditions for installation, maintenance and dismantling activities.

<u>Present and future land users</u>

The territory designated for the needs of building the PMF at KNPP includes the existing site of these units only. Release of control of territories for agricultural or forestry purposes is not expected.

In order to assess the expected impacts on the ecological and anthropogenic elements of the environment and the population resulting from the proposed activities, the impact areas around KNPP in a 30-km radius respectively, including the Romanian territories have been reviewed.

Stages of the investment proposal

The proposed schedule for implementation of the IP is divided in the following 5 stages:

- **Stage 1 – 2009 – 2011** includes conceptual and technical design of PMF, including RAW manipulation, processing and conditioning equipment, and conceptual design of the auxiliary flows, the electrical power, the auxiliary equipment and the interfaces of Building AB-2;
- **Stage 2 – 2013** Production and testing;
- **Stage 3 – 2014** Execution of construction works;
- **Stage 4 – 2014** Delivery and installation: site interfaces management, leading of auxiliary flows and power supply, marking and labeling;
- **Stage 5 – 2014 – 2015** Commissioning: maintenance, inspection, testing, training and completion of the facility.

Use of energy and materials, necessary for the process

Electrical power

The annual electrical power consumption of the plasma torch is 3500 MWh based on 4000 working hours per year and electricity consumption of 875 kW.

Based on the total installed capacity of PMF (including the electrical system for preheating, before DeNOx system), the annual electricity consumption, excluding the plasma torch, is 2292 MWh.

Diesel fuel

Diesel fuel is necessary for the maintaining of the hot standby and for the process of afterburning in the STC. The maximal annual consumption of diesel fuel is 48000 liters per year.

Filter coating material

$Ca(OH)_2$ and $NaHCO_3$ are used for better dust removal from the filters with PTFE coating. The necessary amount is between 1.2 and 14 tons per year.

Ammonia

This chemical substance is used for the DeNOx system (reducing of N-oxides). The expected nominal consumption is 28000 kg (25 % solution) per year.

The capacity of the storage tank for ammonia is 0.5 m^3.

The capacity of the storage tank for ammonia is 10 m^3 at a pressure of 10 bars.

Sodium hydroxide

This chemical substance is used to absorb SO_2, HCl, HF and other acid gases from the thermal treatment processes. The annual consumption depends on the composition of the input waste for processing (for example, sulfur content in the ion exchange resins or PVC). The NaOH consumption (30 % solution) is 34 kg/h. If we assume that the average annual consumption is 10 % from the admissible limit, then the annual consumption is around 14 tons.

Technological water

Technological water is used for the scrubber and for the facility gas coolant. The expected nominal consumption is 2500 m^3 per year.

Cooling water

Cooling water is used to cool down the equipment (for example, the plasma torch). The PMF cooling system functions in closed circuits and the heat energy is transferred by heat exchangers to the existing open-circuit cooling system of KNPP. Therefore, the water consumption is limited to the amount of the possible leaks of the closed circuits system and is expected to be 2 m^3 per year.

PMF description

This section includes a brief technological description of PMF from RAW generation to the release of the processed outgoing gases in the atmosphere.

Figure 11.5.3-2 shows the general PMF location in the AB-2 building.

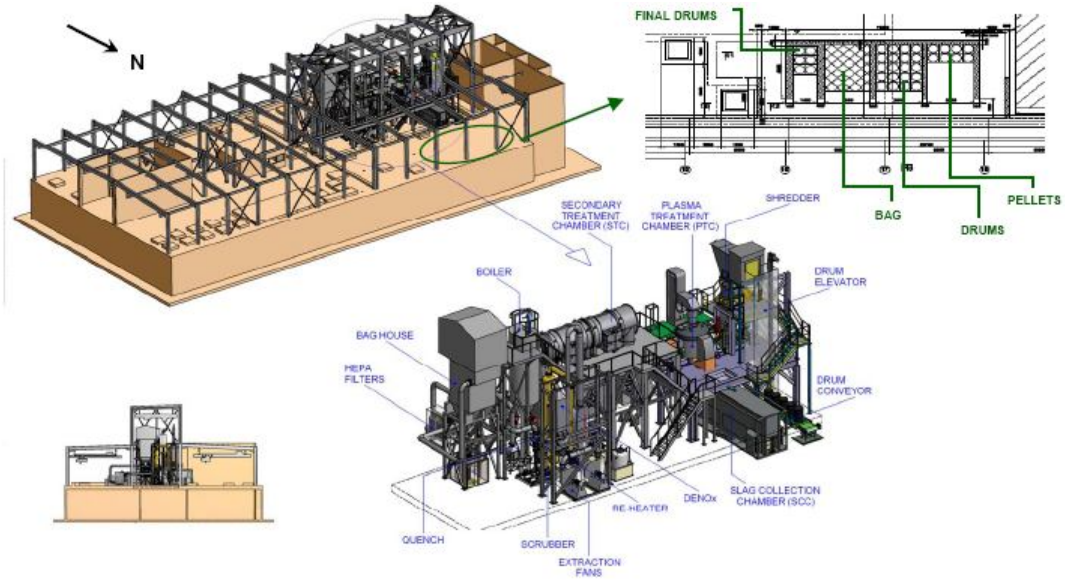

Fig. 11.5.3-2 General PMF location in the AB-2 building

Untreated waste, pre-compacted waste in 200 l drums and super compacted waste (called “untreated waste” from now on) arrive at AB-2 in KNPP waste containers through the existing lock in AB-2. The waste packages are unloaded from the container using a grab device hanging on the crane hooks of the existing crane in AB-

2 and are placed in temporary storage facilities. Fig. 11.5.3-3 shows the general technological scheme of the facility.

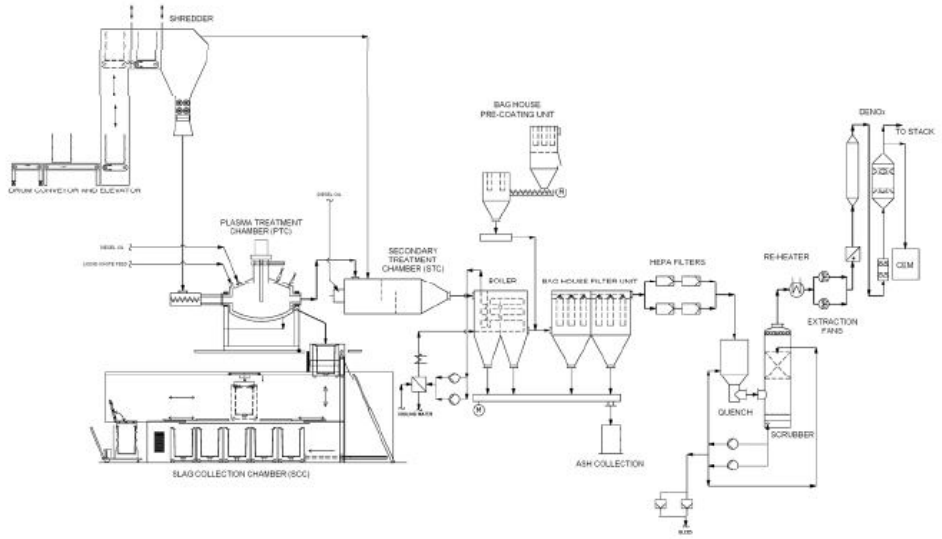

Fig. 11.5.3-3 General technological scheme of the facility

The untreated waste is taken by the grab devices, moved to the transport conveyor and from there by means of a lifting device the waste is automatically transferred to the shredder unit via an airlock. This system consists of semi-automatic conveyor (reception position with a built-in balance and loading bar), lifting device, airlock and a two-stage shredder with extrusion tube. The shredder and extrusion tube process the untreated waste into small and relatively uniform material forming a continuous feed to the Plasma Treatment Chamber (PTC, also named as Primary Treatment Chamber). The PTC is a high temperature (1100°C – 1500°C) tilting furnace. The volume of the furnace is designed to contain around 200 l of molten slag. Fig. 11.5.3-4 shows the Primary Treatment Chamber.

The PTC is designed to process approx. 65 kg/h shredded organic waste during 100 hours per week. The volume of molten slag produced daily is 170 l, which is poured into 200 l forms.

The final waste is further cooled down in the Slag Collection chamber (SCC).

The 200 l drum, which has practically no external contamination, is transported to a temporary storage facility waiting for the final disposal at another KNPP facility, waiting for the final disposal in the National Disposal RAW Facility.

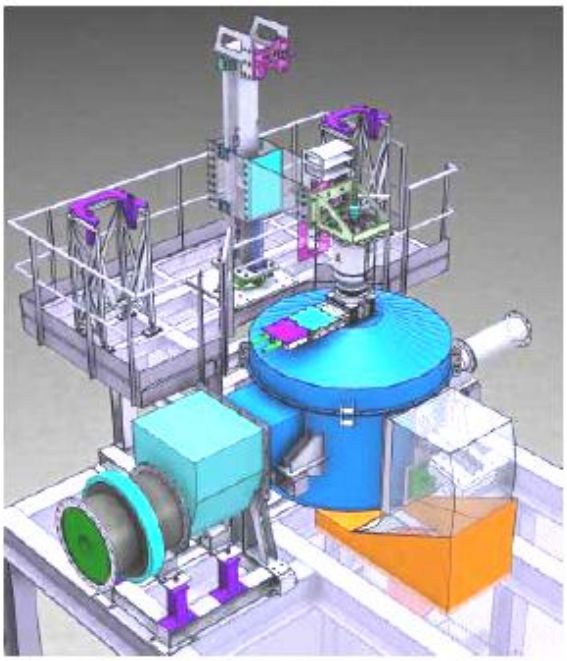

Fig. 11.5.3-4 Primary Treatment Chamber with a burner and console

The furnace operates at negative pressure of about 250 Pa(g) and has a good air-tightness so that almost no cold air is entering into the furnace. As no additional air is added to the furnace, organic waste will not burn but rather gasify. A secondary treatment chamber (STC) will burn those gases. After the STC the off-gases are directed to a cleaning system.

HEPA filters are installed to retain the radioactive particles.

The HEPA filters have efficiency of 99.97 %, and after the scrubber system efficiency of 99.995 % can be assumed, considering the activity captured in the solid products (slag and ash) and liquid products (scrubber water).

Before the flue gasses are evacuated to ventilation stack 2 (VS2) they are monitored by the continuous emission monitoring system for controlling the chemical parameters such as concentration of CO, SO_2, NOx, HCI, O_2, H_2O, NH_3 and TOC. A dust controlling device will also be installed. The design term of operation of the facility is at least forty years. Table 11.5.3-1 presents the main PMF characteristics.

Table 11.5.3-1 Main PMF characteristics

Main PMF characteristics	
Performance	250 t/year
Feeding rate (per hour)	65 kg solid waste, or 55-60 kg solid waste and 5-10kg liquid waste
Flow of flue gases	Nominal value: 1200-1400 Nm^3/h

Main PMF characteristics	
Performance	250 t/year
Effective operation	4000 h/year (40 weeks per year)
Specific radioactivity (incoming waste)	Maximal: 5.17×10^5 Bq/kg

Control of incoming RAW for processing

According to the Technical Specification [3] the radioactive waste intended to be treated in the PMF is classified as Category 2a. The Regulation for Safe Management of Radioactive Waste [5] establishes the categorization for radioactive waste generated in Bulgaria. According to this regulation, Category 2a - corresponds with low and intermediate level short-lived radioactive waste, containing mainly short-lived radionuclides (with decay period shorter or equal to that of ^{137}Cs), and long-lived alpha radionuclides with specific activity lower or equal to 4.00E+06 Bq/kg for each separate package, and lower or equal to 4.00E+05 Bq/kg in the entire RAW volume.

There are two types of waste to be processed in the PMF – incoming waste from KNPP and secondary waste generated from the PMF operation. Exceptions to this are refractories and water from the scrubber.

The PMF acceptance criteria are used as basis for control of incoming RAW.

Requirements to Waste Packages

The waste packages accepted in the PMF are as follows:

- Polyethylene bags containing untreated waste with a maximum capacity of 70 l, max weight of 20 kg per bag and maximum density of 300 kg/m^3. For volume reduction calculations an average density of 150k g/m^3 is assumed.
- Standard metallic 200 l drums containing waste compressed within the drum. The weight of empty drums is approximately 20 kg and the maximum total weight of the 200 l drum is limited up to 100 kg. For volume reduction calculations of pre-compacted RAW, a density of 350 kg/m^3 is assumed.
- Pellets resulting from the super compaction of standard metallic 200 l drums. Pellets should have a height up to 40cm and a maximum density of 2000°kg/m^3.

Waste Composition Restrictions

Solid radioactive waste to be treated by the facility shall be classified as low and intermediate level waste according to Category 2a definition and their radiological characteristics should correspond to the above described Category 2a.

Liquid radioactive waste accepted shall have a specific activity less than or equal to 4.00E+04 Bq/kg.

Contaminated soils are allowed to be treated in the PMF. Asbestos containing materials (ACM) are also allowed to be treated in the PMF. ACM should be packaged according to the internal company rules, i.e. packaged in polyethylene bags and in 200 l drums. The drums should be marked with international label stating that this waste contains asbestos. In the PMF the asbestos filters are decomposed as result of the high temperature and turn into an amorphous, glass-like substance. During this transformation of the crystalline structure of asbestos there will be no undesirable effects.

Waste that is accepted in the PMF can be divided in two groups:

- Organic waste: textile, paper, wood, polyethylene, polypropylene, polystyrene, different types of rubber, latex, plexiglass, liquids absorbed on cellulose, textile or other organic absorbent;
- Inorganic waste: glass bottles or window glass, galvanized and non-galvanized steel, all type of granulates such as concrete, sand, soil, asphalt, bricks and asbestos materials.

Restrictions for incoming waste

Metallic pieces:

Solid metallic pieces of more than 2 inches (~ 50 mm) of equivalent diameter are considered massive or big metal parts and could not be processed by the PMF. However, the waste packages can occasionally contain the following materials:

- Mild steel pipes with a diameter up to 2 inches and wall thickness of maximum 3mm;
- Hollow valve housing of cast iron or mild steel up to 2 inches in diameter;
- Mild steel plates up to 5mm in thickness and a maximum size of 300 x 300 mm;
- Mild steel bars of 300 mm length and 10 mm in diameter. A few of these elements can be processed within one package but one drum full of them is not accepted.

Halogenated and sulfonated polymers:

For RAW containing halogenated and sulfonated polymers, the estimated share of PVC and sulphur is respectively 0.5 % and 0.1 % from the total weight.

Waste flows can contain maximum 8 % PVC and 5 % sulphur from their total weight.

Packages which contain only PVC can be occasionally accepted as long as the hourly average PVC quantity is lower than 8 %.

Aluminum:

The maximum percentage of aluminium accepted in the waste is 2 % from the weight.

Aluminum content creates a lot of aluminium oxides, which are a chemical compound with a very high melting point, and cannot be melted by the plasma system.

Concrete debris:

The admissible granulometry for concrete debris is 200 mm.

Semi-volatile metals:

Semi-volatile metals like Zn, Pb are accepted in the PMF. When the waste contains low amounts of semi-volatile metals like Zn, Pb, they will be partially captured with the fly ashes in the bag filter system. When these fly ashes are treated again in the plasma furnace, part of the metals is retained in the slag and the others go to the bag filters. There is a negative balance and finally these metals are expected to be retained in the slag. If there is a high content of semi-volatile metals, the fly ashes cannot be treated in the plasma furnace. Stabilization by super-compaction and conditioning with cement is planned.

Liquids

Liquids in plastic or glass bottles of maximum 1 l are accepted into the shredder. Liquids are accepted as long as they have neutral pH value (7 ± 2).

Mineral acids such as sulfuric acids, nitric acids, etc. are not allowed for treatment.

Liquids with flash-point higher than 55°C (motor oil, diesel fuel, hydraulic oil, etc.) are accepted.

Flammable liquids (highly volatile solvents, kerosene, etc.) with flash-point lower than 55°C are not allowed. If these liquids are brought by chance into the shredder, the risk of an explosion will be avoided by nitrogen blanketing and the purging device of the RAW feeding system.

Drums containing only one kind of material, as for example PVC or construction materials

Occasionally waste packages with only one kind of material can be processed taking into account other restrictions (e.g. size) stated above.

Consecutive treatment of drums with one kind of material should be avoided. The best results are obtained by treating e.g. one drum with concrete debris followed with different drums containing organic material. The best operational results from the point of view of energy consumption and formation of slag is to treat a mixture of waste with low caloric value (e.g. concrete debris) and drums containing waste with high caloric value (e.g. organic waste).

In case of PVC materials in the waste, the chlorine will be captured in the absorption solution in the scrubber. Therefore, the PVC quantity can be calculated and, if necessary, respective corrective measures should be applied.

Spent resins

Spent resins free from liquids or with adsorbed liquids are accepted. The spent resins have to be delivered in plastic bags with a weight up to 20 kg or in drums containing maximum 20 kg spent resins and the remainder is normal organic waste.

As spent resins can contain significant amounts of sulphur, the maximum feed rate accepted is 20 kg each 4 hours of continuous operation. During feeding with resins containing sulphur, the blow down of the scrubber unit has to be raised to 1000 l/h.

For spent resins not containing sulphur the maximum feed rate is limited up to 20 kg/h. The PMF shall not be used for treatment of the following materials

- Sludge;
- Radioactive wastes categorized as high level waste;
- Reinforced concrete containers containing drums and/or pellets immobilized with cement;
- Refractory.

Control of the releases into the environment

Control of radiological characteristics of gaseous emissions will be done after the extraction fans of the off-gas and in the outlet pipe of the PMF extraction system. Because the radioactivity in one cubic meter flue gas is below detection limits for most detection apparatus, one needs a concentration technique in order to obtain a detectable signal. Therefore, an isokinetic sample is taken and sent over a paper filter (e.g. diameter 10 cm). The sample lines are heated with electrical tracing. Each 24 hours the filter is changed and put into alpha, beta counter with low background. By subtracting the activity of a basic sample filter (air contains also natural activity e.g. ^{224}Ra and daughter isotopes) the released activity can be calculated.

For obtaining a good flow pattern and representative measuring results, the radiological sampling module will be placed 8 hydraulic diameters after the last obstruction (e.g. bend) and 6 hydraulic diameters before the next obstruction.

Non-radioactive emissions will be controlled by a Continuous Emissions Monitoring (CEM) system. CEM is installed at the end of the PMF before the connection to AB-2 ventilation system.

The measured parameters are CO, SO_2, NOx, HCl, O_2, H_2O, NH_3 and TOC. By individual and conventional instruments temperature, pressure and flow are also measured. The parameters CO, SO_2, NOx, HCl, H_2O and NH_3 are measured by a FTIR spectrometer.

O_2 is measured by a ZrO_2 oxygen sensor. A Multi Flam-ionization detector (FID) is installed for continuous measurement of the hydrocarbons (TOC).

The system is compact and suitable for easy handling and operation. It will be built in a separate cabinet. Necessary calibration gases and calculation software is provided. Results are available for real-time display. Half hour and daily values will be presented corrected to temperature 273 K, pressure 101.3 kPa, 11 % oxygen and dry gas, so a comparison with emission limits can be made.

Control of the liquid releases in the existing special drainage system of AB-2

The water discharge will come from three sources: boiler, torch and furnace coolants. If the water is treated with anti-corrosive products to minimize pipe corrosion, then the

water change period might be longer. The water will be delivered to different tanks according to the radioactivity levels. The use of these tanks allows the flow rate to be controlled according to the requirements of the normal operational mode.

The indicated water sources are closed water systems and they will not contain radiation contamination, but only slight chemical contamination. If the water is maintained properly, it could last several years.

Liquid radioactive waste is not continuously generated and their discharge shall be controlled. The liquid RAW from the scrubber are sent to a scrubber tank, which controls the flow rate within the required limit of 100 l/h. Prior to discharge, the liquid passes through a 5µm filter.

Fresh water is added from the top of the scrubber depending on the level into the scrubber tank, and a circulation pump circulates the water through the unit.

Scrubber water is collected into this scrubber tank. Other possible waste water, for example from decontaminated 200 l drums, can also be transferred to the scrubber tank. Part of the water evaporates into the scrubber unit and a maximum of 100 l/h is transferred to the drainage system of KNPP by means of an evacuation pump. Into the pressure line of the evacuation pump a 5µm filter unit is installed, which filters the water before it arrives at KNPP drainage system.

This filter device is a double bag filter (one in operation; one in stand-by) with disposable polypropylene filter bags of 5µm mounted in a stainless steel housing for in line filtration. Used bags will be sent with other burnable RAW to the plasma furnace. A pH-meter controls the pH to keep it higher than 8 by addition of NaOH by means of a dose pump. Based on the admissible sulphur and PVC content into the incoming waste, the salts concentration into the evacuated liquid can be several grams per liter.In case of failure of the circulating pump the evacuation pump can take over the circulating function.

Quality control of the immobilized radioactive waste

Considering the maximum specific activity in the incoming waste, the isotope share in the slag (85 %), the average density and volume reduction for each type of waste package, the maximum activity estimated in a 200 l drum containing 170 l of vitrified waste is 9.1E+08 Bq (see table 11.5.3-2).

Table 11.5.3-2 Activity of vitrified waste in 190 l forms

Type of waste	Average density (kg/m^3)	Specific activity (Bq/kg)	VRF	Activity/drum (Bq)
Untreated waste	150	5.17E+5	81	9.10E+08
Pre-compacted waste	350		22	5.75E+08
Super-compacted waste	1500		2	2.24E+08

When the treated waste mould is in the 200 l drum, the finally treated drum is checked to determine whether its characteristics are stable enough to allow its storing in the PMF temporary storage area and to verify that the RAW generated from PMF is Category 2a waste, using:

- Measurement of dose rate due to gamma photons by means of a dose rate meter in contact and at one meter distance;
- Measurement of removable surface contamination, both alpha and beta-gamma, in order to ensure that the surface of the drum is not contaminated and can be safely handled.
- Use of an average dose rate value to assess the spectrum of the vitrified waste, in accordance with the following procedure:
  - Assessment of alpha and beta emitters can be done using available KNPP representative scaling factors of the waste stream treated in the PMF;
  - The relation between the activity and the dose rate depends on the density of the slag, which will vary according to the composition of the incoming waste treated in the PMF. Therefore, estimated values should be determined for different slag densities.

At the end of the process a robust conditioned product is obtained free from liquids and organic material and free from external contamination and ready to be transferred to the standard 6 m^3 container for further conditioning.

The final PMF drums transferred to KNPP comply with the following requirements, which are part of the immobilized waste acceptance criteria:

- The free water content should not exceed 1 % of the weight;
- No explosive or pyrophoric substances, materials and ingredients should be present;
- No biological waste should be present;
- No organic solvents, oils, grease or other oil-containing materials should be present;
- The solid material shall be packed in a secured, waterproof, corrosion-resistant and mechanically rigid package.

The rest of requirements are fulfilled after final drums conditioning, which consists in embedding the drums with concrete into KNPP containers.

Personnel

The operating organization will present a suitable organizational structure for the PMF operation. This organizational structure will be documented with clear directions for management or communications. The functions, duties and qualifications for each position in the structure will be described.

The PMF will be commissioned, operated and kept in compliance with written procedures. These procedures and instructions will be based on the design and

technical documentation (PMF operation manual), on the operational limits and conditions and on the results from the testing performed before commissioning of the facility.

These procedures should include the necessary actions for execution of the operational activities in all operational modes, including during deviations from the normal operation.

The actions of the personnel in cases of design basis accidents and beyond design basis accidents will be determined in instructions, based on the final Safety analysis report, on the operational limits and conditions and on the additional analyses of the facility behavior under emergency conditions.

The human error possibility will be limited by suitable training and application of effective procedures. The PMF operation and repair personnel will receive clarifications regarding the safety aspects during PMF operation. They will be instructed about the functioning and proper management of each subsystem and component of the PMF, the consequences of failures or errors and the corrective actions in case of failures or errors. They will be taught how to react appropriately in case of deviations from normal operation that can occur in systems management, and special attention will be paid to the emergency preparedness procedures. The training will be performed according to the Training program, prepared in advance, including theoretical and practical aspects of training in the course of everyday work.

Besides of a shift supervisor and an assistant shift supervisor, the following personnel may be necessary:

- During the shift period (Three shifts per day): Three operators per shift for ensuring continuous process and supply of the waste conveyor. They will be assisted by a part time radiation protection officer.
- During day time: Two additional operators for receiving and unloading the waste containers. The different waste packages will be properly stored waiting for their processing during the next upcoming shifts.

For the maintenance and control staff, the following man power is estimated:

- the equivalent of one man-year for control and measuring instrumentation and PLC control;
- 1/2 man-year for electrical control and 1/2 man-year for mechanical control.

During the shutdown periods, operational maintenance and cleaning is done by the operators, and they will also assist the maintenance personnel.

Main processes during PMF decommissioning

After final termination of the PMF operational phase, its decommissioning will be accomplished in a way that ensures radiation protection and safety of the personnel and the population as well as environmental protection.

Decommissioning operations may result in the removal of existing components or systems, decontamination of components and the cutting and handling of large pieces of equipment. Because these actions have the potential to create new hazards, the

impacts on safety of these activities shall be assessed and managed so that these hazards are mitigated and are kept within acceptable limits and constraints.

International safety standards related to the design and operation of nuclear facilities (e.g. IAEA Safety Guide GS-G-1.2) [6] indicate that a general plan for decommissioning, covering issues such as strategies to be used, expected radiation doses and the amount of waste to be produced, should be prepared at the design stage of the facility. Such information will be relevant to optimize the design of the facility in order to reduce the amount of waste that will be produced at decommissioning stage as well as the doses of workers that could be involved in the related tasks.

In the same way, Bulgarian legislation establishes in the Regulation on safety during decommissioning of nuclear facilities that a Preliminary Concept and Plan for Decommissioning will be developed during the design phase of a nuclear facility.

This Decommissioning Concept should be submitted in support of the Design Approval application for the PMF, compliant with the requirement of Regulation on safety during decommissioning of nuclear facilities [7].

The primary purpose of the Decommissioning Concept is to ensure that facility designers are cognizant of decommissioning during the initial design of a facility. Thus, where design choices that would enhance decommissioning are available for types of materials and system components, and location of components, these choices should be made.

Decommissioning Concept [8] has been prepared for the PMF, summary of which is presented below.

Decommissioning Concept

There are three main internationally recognized strategies for decommissioning of nuclear facilities. These are 'immediate dismantling', 'deferred dismantling (safe enclosure)' and 'entombment'.

In general, entombment is not a recommended decommissioning option, and strategy selection is a choice between immediate and deferred dismantling.

There are a number of factors to be considered when deciding on the preferred decommissioning strategy, but at present, the emerging international trend is more towards immediate dismantling. According to Principle No 5 of Radioactive Waste Management [9], the period of decommissioning shall be such that it does "not impose undue burdens on future generations" in terms of both additional health and safety risks and financial requirements. This favors immediate dismantling as preferred option for decommissioning.

Considering the expected residual activity in the PMF during decommissioning, deferral of decommissioning activities may not significant reduce the activity of the remaining nuclides or radiation exposure of workers during decommissioning activities. In line with the option for immediate dismantling of equipment outside of the safe enclosure area in the updated Decommissioning Strategy for KNPP Units 1-4,

immediate dismantling is considered as the preferred option for the PMF decommissioning.

The availability of waste management infrastructure for treatment and conditioning of decommissioning waste and of the Radioactive Waste National Repository for the time of PMF decommissioning, assumed in the updated Decommissioning Strategy for KNPP Units 1-4, has been also considered when selecting PMF decommissioning strategy.

End goal of the PMF decommissioning activities is to return the area where PMF was located to a condition as close to the pre-installation condition as possible, while protecting human health, the environment, and complying with regulatory requirements.

The decommissioning process is divided into three phases with different duration of realization according to ISAR [2] as follows:

1. Preparatory activities – 5 weeks;

2. Decontamination and dismantling activities and management of wastes - 18 weeks;

3. Final investigation - 2 weeks.

Estimated inventory of radioactive and other dangerous materials in the facility

All incoming radioactive waste and final waste produced in the PMF are classified as Category 2a. Therefore, contamination levels during the decommissioning are commensurate to this waste category.

The estimation is based on several assumptions regarding the following factors:

- Dust loading (g/m^3), which is the concentration of dust in air available for surface deposition.
- Deposition coefficient for aerosols and reactive gases, which is the coefficient used to estimate the amount of radioactive material deposited on the system surface.
- Radioactivity decay during operation time according to waste radionuclide content and their decay period.
- Cleaning factor, which is the part of the surface contamination removal due to the cleaning.

For the estimation purposes the facility can be divided in five parts depending on the radiological characteristics of the accepted waste during the PMF operation. The estimation of activity deposited in each one is as follows:

- Shredder system 106.7 Bq/cm^2;
- Refractory:
  - PTC $2.55\ 10^9$ Bq;
  - STC $3.62\ 10^8$ Bq;
  - Elbow $2.07\ 10^7$ Bq.

- Metal off-gas equipment until bag house 18.5 Bq/cm^2;
- Ash confinement negligible;
- Pouring confinement negligible.

Assuming an internal surface of 25 m^2 in the shredder system and of 200 m^2 in the metal off gas equipment, the following total inventory results are received:

Metal waste susceptible to be decontaminated 64 MBq;

Refractory: 3 GBq.

Regarding hazardous materials coming from PMF decommissioning, they are preliminary estimated as follows:

- NH3: 200 l;
- Oils: 1033.6 1;
- NaOH: 1000 1;
- Lead: 7000 kg.

RAW management during the decommissioning

Management of RAW generated during nuclear facility decommissioning shall be performed in accordance to the legislation on RAW management [5]. In particular, the required radioactive waste acceptance criteria specified in Attachment 3 of the Technical Specification for the PMF [3] will be considered.

RAW produced in the decommissioning activities will be classified and sorted according to their physicochemical and radiation characteristics.

Criteria for clearance, reuse-recycle and/or management as conventional waste of material coming from decommissioning will be defined according to applicable Bulgarian regulations.

The generation of radioactive waste shall be kept to the possible minimum, in terms of both its activity and volume, by appropriate design measures and operating and decommissioning practices. This includes the selection and control of materials, the recycle and reuse of materials, and the implementation of appropriate operating procedures. Emphasis should be placed on the segregation of different types of waste and materials to reduce the volume of radioactive waste and facilitate its management.

According to their residual activity, the materials resulting from the decommissioning activities can be classified into the following groups:

1. Clean materials – Materials located outside the Radiation Controlled Area and not susceptible to be contaminated. Clean materials, which are not hazardous or toxic, will be managed as conventional waste and disposed of in conventional urban or industrial waste dumps;

2. Waste materials able to be cleared – Materials located in the Radiation Controlled Area but with low probability of containing residual radioactivity.

Solid materials classified as „able to be cleared" initially or after a decontamination process will be transferred to the free release measurement facilities at KNPP site in order to verify the compliance with permitted clearance levels;

3. Radioactive Waste Materials - containing activity or externally contaminated.

- Category 1 - transitional waste that can be cleared from regulatory control after appropriate processing and/or temporary storage for a period not longer than five years, while the waste specific activity is reduced below clearance levels;

Radioactive waste classified as Category 1 will be transferred to the on-site interim storage area for this kind of waste to wait for decay and reach clearance levels.

- Category 2a - low and intermediate level short-lived waste, containing mainly short-lived radionuclides.

Metal material will be placed in 6m^3 containers or 200 l drums and will be transferred to the existing decontamination facilities to reduce residual contamination and reclassify the material as able to be cleared.

PTC and STC refractory removed during the decommissioning phase will be placed in 200 l drums and super-compacted, as planned for refractory removed in maintenance activities during the operation stage.

Compactable waste, such as technological waste, will be placed in 200 l drums and further pre-compacted and super-compacted in the waste processing facilities.

The dust and slag generated during PMF cleaning in decommissioning phase, particularly in the off-gas system will be collected in 200 l drums and subsequently supercompacted.

Insulation of the cables will be stripped and granulated with a cable treatment machine and placed in 200 l drums, leaving the remaining metal material clean.

The hazardous waste, although not radioactive, must be managed by authorized agents, and disposed of in a specific storage site on KNPP territory.

Considering the qualitative classification of the groups described above and considering different types of materials, the amount of radioactive waste and materials able to be cleared has been estimated and presented in table 11.5.3-3.

Table 11.5.3-3 Solid Residual material inventory (kg)

Type of material	Able to be cleared (kg)	Radioactive waste (kg)
Metal materials	171097	32115
Concrete	148100	16400
Cable	3164	330
Compactable	1992	
TOTAL	**324353**	**48845**

In addition to the primary waste produced in the PMF decommissioning, some secondary waste will be produced as a consequence of the implementation of the decommissioning activities:

- Dust and ashes from PMF cleaning;
- Metal debris from cutting activities;
- Technological waste, such as protective clothes, polyethylene plastic (PE) foils from temporary confinements for decontamination activities, etc.

11.5.4 Description of the Protected Areas and Protected Territories in 30km area around Kozloduy NPP in Romanian territory

Three protected areas are located within the 30-km are around the Kozloduy NPP. Protected area ROSCI0045 is under the Directive on the conservation of natural habitats and of wild flora and fauna and Protected Areas ROSPA0010 and ROSPA0023 are under the Birds Directive.

Their location towards Kozloduy NPP site is given in fig**.** 11.5.4-1.

Fig. 11.5.4-1 Protected Areas under the Birds Directive on the left bank of the Danube in the area of Kozloduy NPP

<u>Protected area ROSCI 0045</u>

Protected area codenamed ROSCI0045 Koridorul Zhiului occupies an area of 71394°ha. It is situated in Dolj, Olt, Mehedinti, Gorj District.

The territory in the PA is distributed by land cover classes in the following groups: rivers, lakes (16 %), wetlands (11 %), farmland (14 %), pastures (15 %), other cultivated areas (2 %), deciduous forests (38 %), forest habitat (4 %).

General characteristics

The territory located along the middle and the lower stream of the river Jiu, includes some of the most rare and representative relict samples of European-type lawn evolved to a lesser extent (coordinates: 23 ° 30 '02 "and 24 ° 14' 05" east longitude, 43 ° 42 '01 "and 44 ° 54' 55" north latitude, 128 km length, direction NNW-SSE). Field crosses 4 (27 %) of 15 green areas (Getti plateau and plain-Gavanu Burdea, Romanian forest steppe plane Danube valley) of the Continental biogeographical region of Romania. The difference in altitude varies from 50 to 405 cm. The area encompasses many ecosystems with a total area of 147540 ha, most of which natural 33543 ha (23%), with significant local diversity and abundance times above average, typical for the Romanian forest, which gives it exceptional geographic significance.

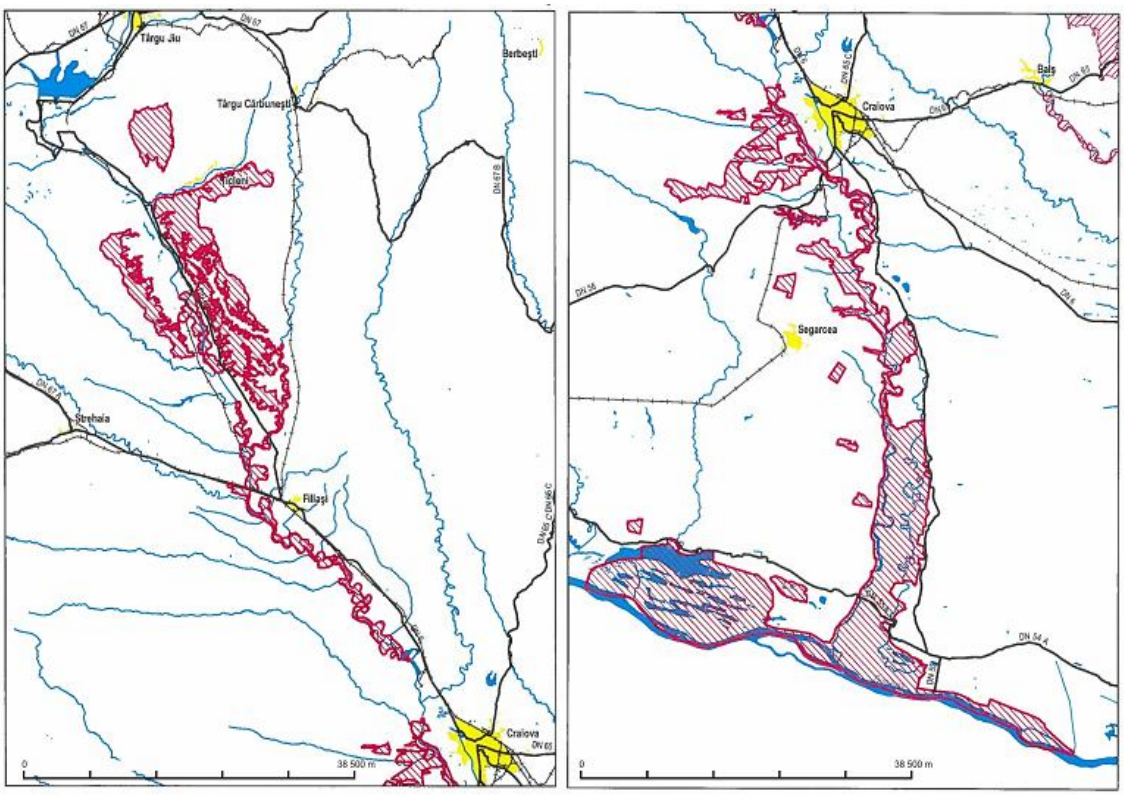

Fig. 11.5.4-2 Protected Area ROSCI0045 (source: Monitorul official al Romaniei, Porteal, Nr. 98 bis/7.II2008

Protected area ROSPA0010

Indicative denomination of the site: ROSPA0010 Bistret River (Bistreț) (1915.6 ha) – Dolj County

Land cover (type and percentage): Rivers, lakes (90 %); swamps (8 %); pastures (2 %)

The species listed in Annex I of the Birds Directive which could be affected adversely during the IP implementation, PMF construction at KNPP, are:

1. Dalmatian Pelican *(Pelecanus crispus)* – globally endangered species with 3-59 migrant birds and global assessment mention B. The species inhabits the wetlands of Bistretsu where its hunting area is and where it stays for the night and rests next to the sand spits of the adjacent islands of Danube River. No significant adverse impact on the species is predicted.

2. Great White Pelican *(Pelecanus onocrotalus)* – migrant species with 50-150 migrant birds and global assessment mention B. During migrations the species inhabits the wetlands of Bistretsu, where its trophic area is and where it stays for the night and rests next to the sand spits of the adjacent islands of Danube River. No significant adverse impact on the species is predicted.

3. Little Cormorant (*Phalacrocorax pygmeus)* – wintering and passerine species with 15 wintering and 1000 passing birds and global assessment mention A. No significant adverse impact on the species is predicted.

4. Eurasian Spoonbill (*Platalea leucorodia)* – nesting (34-41 couples) and passerine species (180-211 specimens.) with global assessment mention C. The species inhabits the wetlands of the Danube river valley. No significant adverse impact on the species is predicted.

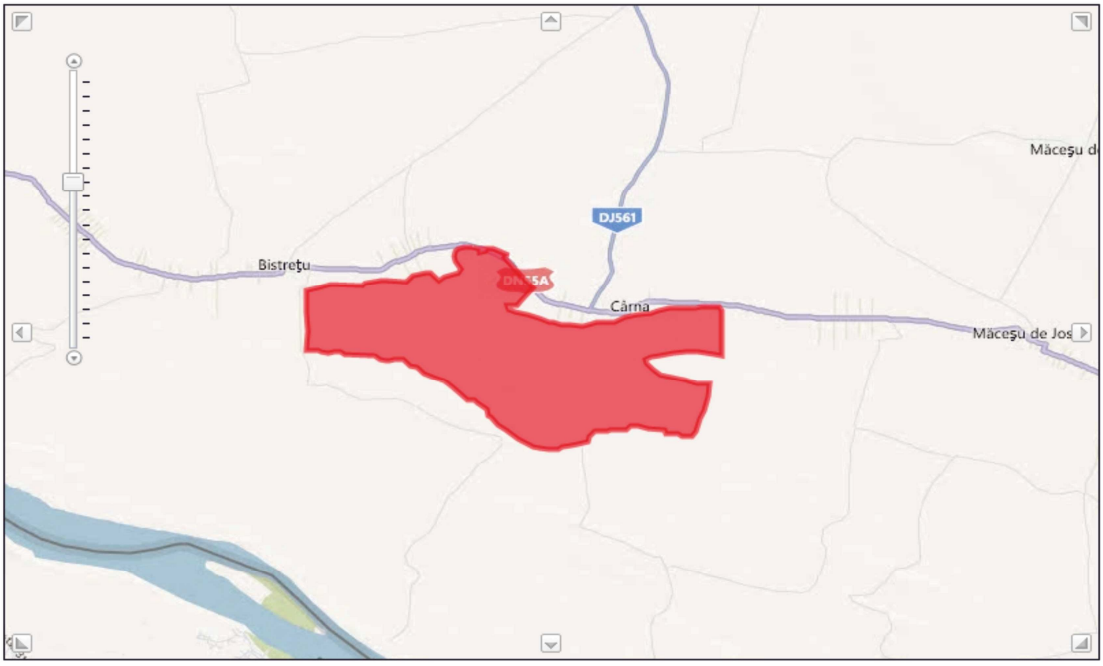

Fig. 11.5.4-3 Protected Area ROSPA0010 *(source: http://natura2000eea.europa.eu)*

Protected area ROSPA0023

Indicative denomination of the site: ROSPA0023 Jiu River –Danube River Confluences (Confluența Jiu – Dunăre) (21999.9 ha) - Olt, Dolj Counties

Land cover (type and percentage): rivers/lakes (17 %), crops/arable land (22 %), pastures (11°%), other arable fields (4 %), broadleaved forests (40 %), transition forests (6 %).

The species listed in Annex I of the Birds Directive which could be affected adversely during the IP implementation, PMF construction at KNPP, are:

1. Dalmatian Pelican *(Pelecanus crispus)* – globally endangered species with 3-59 migrant birds and global assessment mention B. The species inhabits the wetlands of Bistretsu where its hunting area is and where it stays for the night and rests next to the sand spits of the adjacent islands of Danube River. No significant adverse impact on the species is predicted.

2. Little Cormorant (*Phalacrocorax pygmeus)* – wintering and passerine species with 15 wintering and 1000 passing birds and global assessment mention A. No significant adverse impact on the species is predicted.

3. Eurasian Spoonbill (*Platalea leucorodia)* – nesting (34-41 couples) and passerine species (180-211 specimens.) with global assessment mention C. The species inhabits the wetlands of the Danube river valley. No significant adverse impact on the species is predicted.

4. White Stork (*Ciconia ciconia)* - – nesting (20-30 couples) and passerine species with global assessment mention C. The species inhabits the wetlands of the Danube river valley. No significant adverse impact on the species is predicted.

In conclusion it can be summarized that the protected areas on both sides of Danube River are interconnected and form a complex ecological system, which shall be considered as a whole. The adverse impact on it due to the implementation of the IP is assessed as insignificant.

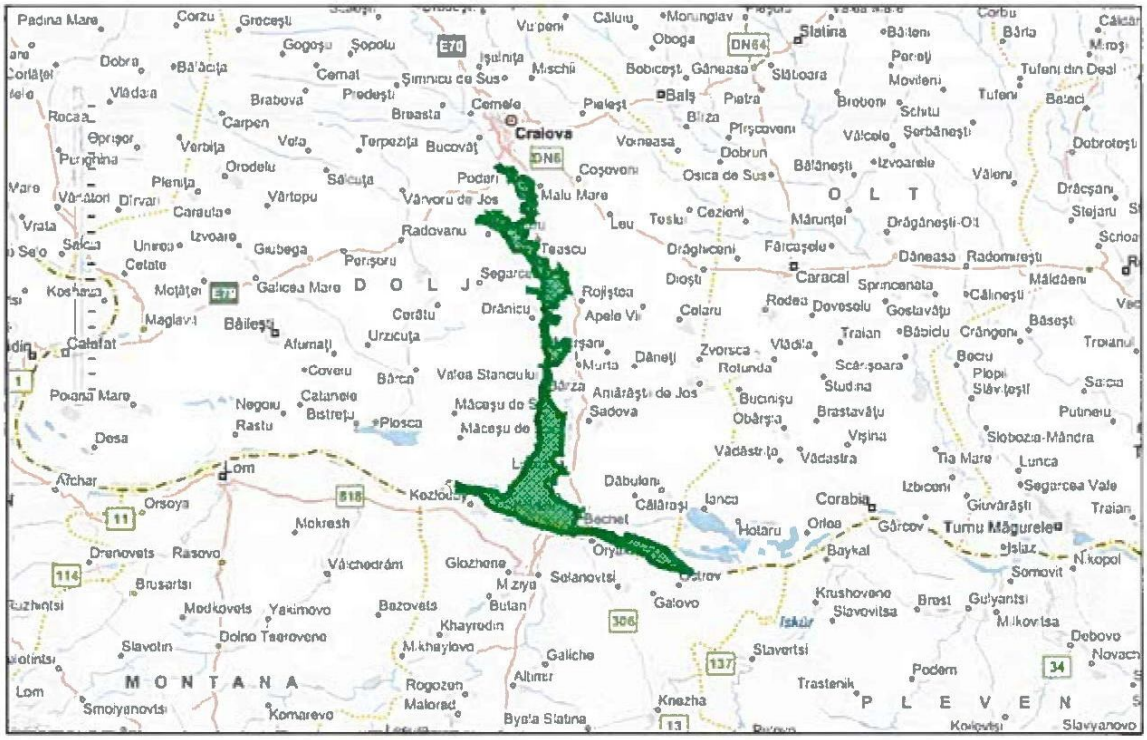

Fig. 11.5.4-4 Protected Area ROSPA0023 *(source: http://natura2000.eea.europa.eu)*

Detailed description of the PA and PT on the territory of Romania is presented in the IP CAR, section 11.4 of this chapter.

11.5.4.1 General description of the Romanian Protected Area ROSPA0010 (Bistret) under the Birds Directive

General characteristics

Type of Habitats	Coverage %
Inland water bodies (Standing water, Running water)	90.00
Bogs, Marshes, Water fringed vegetation, Fens	8.00
Improved grassland	2.00
Total	100 %

Other characteristics

Located in the south of the Oltenia region and of the Dolj County (at a distance of about 4 km from the Danube River), the protected area includes the fish-breeding complex Dunăreni-Bistreț having a surface of 2030 ha and the lagoon complex Bistreț-Cârna-Nasta-Nedela with a surface of 22,000 ha and very rich flora and fauna. The fish-breeding basins in Dunăreni-Bistreț are the result of the systematization works of the lagoon complex Bistreț-Cârna-Nasta-Nedela and are of special scientific interest from the ornithologic point of view, as they attract large avifaunistic diversity. Although they cannot fully replace the disappeared humid and aquatic natural ecosystems, these modified habitats still fulfill a number of favorable conditions especially for species of zoophaguous aquatic birds in general and ichthyophagous birds in particular. The placement on an important migration route, the varied and considerable tropic offer as well as the decrease of natural aquatic ecosystems turn the fish-breeding basins in Dunăreni-Bistreț into important temporary or occasional resting places for the migratory and sedentary bird species dependent on the aquatic environment. The value of the fish-breeding basins as nesting places is moderate, so that they can only partially substitute the large marshes existing here before the changes due to fish-breeding activities. The scarceness of adequate nesting places is compensated by the richness of trophic resources leading to a maximal utilization of the existing green space (reed islands and willows on the lake, riverine vegetation) by means of storied nesting and nesting in mixed colonies.

Quality and importance

The site shelters a large number of bird species of the following categories:

a) Number of species in Annex 1 of the Bird Directive: 24

b) Number of other migratory species in the Annexes of the Convention on Migratory Species (Bonn convention): 72 species.

c) Number of globally threatened species: 7.

During the migration period, the site is important for all waterfowl species.

The place is important for wintering ducks and geese.

During the migration period, the place is inhabited by over 20,000 waterfowl; it is possible to apply for a place of international importance under the Ramsar Convention.

Vulnerability

Situated in the in spill area of the Danube, the site is flooded whenever the flow rate of the Danube is very high. Fish-breeding and fishing activities carried out inside the site have a direct and indirect negative impact on the aquatic birds' populations of this area.

Conservation status

The site has not been designated as a protected area by national law.

Ownership

75 % private property and 25 % state property.

Site management

Site management organization:

There are no legally constituted site management structures.

Management plan:

There are no site management plans.

BIRDS listed on Annex I of Council directive 79/409/EEC – 23 species.

The bird species, subject to protection in PA Bistret, are presented in table 11.5.4.1-1.

Table 11.5.4.1-1 Bird species, subject to protection in PA Bistret

CODE	NAME	POPULATION				SITE ASSESSMENT			
		Resident	Migratory			Population	Conservation	Isolation	Global
			Breed	Winter	Stage				
A229	*Alcedo atthis*	12 p				D	C	C	C
A042	*Anser erythropus*			4 i	4 i	A	B	B	A
A209	*Ardea purpurea*		16 p			D	B	C	B
A024	*Ardeola ralloides*		50 p			D	B	C	B
A060	*Aythya nyroca*		25-34 p	75 i	15 i	C	B	C	B
A021	*Botaurus stellaris*		20 p			C	B	C	B
A396	*Branta ruficollis*				20 i	D	B	C	B
A031	*Ciconia ciconia*		6 p		180 i	D	B	C	B
A030	*Ciconia nigra*			1 i	48 i	D	B	C	B
A081	*Circus aeruginosus*		12-24 p	4 i		D	B	C	B

		POPULATION				SITE ASSESSMENT			
			Migratory			Population	Conservation	Isolation	Global
A082	*Circus cyaneus*			1 i		D	B	C	B
A038	*Cygnus cygnus*				20 i	C	B	C	B
A027	*Egretta alba*		11 p	26 i		D	B	C	B
A072	*Egretta garzetta*		75 p			D	B	C	B
A131	*Him. himantopus*				78-90 i	D	B	C	B
A022	*Ixobrychus minutus*				20 i	D	B	C	B
A068	*Mergus albellus*			3 i		C	B	C	B
A020	*Pelecanus crispus*				31-59 i	C	B	C	B
A019	*Pelecanus onocrotalus*				50-150 i	C	B	C	B
A393	*Phal. pygmeus*			15 i	1000 i	C	A	C	A
A034	*Platalea leucorodia*		120-166 p		400-450 i	D	B	C	B
A032	*Plegadis falcinellus*		34-41 p		180-211 i	C	B	C	B
A132	*Recurvirostra avosetta*				44-77 i	D	B	C	B

11.5.4.2 General Description of the Romanian Protected Area ROSPA0023 Confluența Jiu – Dunăre under the Birds Directive

General characteristics

Table 11.5.4.2-1 General Description of the Romanian Protected Area ROSPA0023 Confluența Jiu – Dunăre under the Birds Directive

Type of Habitats	Coverage %
Inland water bodies (Standing water, Running water)	17.00
Extensive cereal cultures (including Rotation cultures with regular fallowing)	22.00
Improved grassland	11.00
Other arable land	4.00
Broad-leaved deciduous woodland	40.00
Woodland habitats (general)	6.00
Total coverage	**100 %**

Other characteristics

The Jiu floodplain presents itself as a territory rich in habitats. Here there can be encountered riparian forests and copses, meadows, grasslands, agricultural areas, humid areas – marshes and canals and numerous anthropogenic habitats, all concentrated on this surface, in order that they mingle and may sometimes be difficult to delimit. Here, the presence of water bird species can be remarked, that found the appropriate living and reproduction conditions.

Quality and importance

This area hosts a significant number of protected bird species. According to the data we have the following categories:

a) Number of species in Annex 1 of the Bird Directive: 34.

b) Number of other migratory species in the Annexes of the Convention on Migratory Species (Bonn convention): 77.

c) Number of globally threatened species: 5.

During the migration period, the place is inhabited by over 20,000 waterfowl; it is possible to apply for a place of international importance under the Ramsar Convention.

Vulnerability

The extension of the anthropologically modified surfaces and the pollution of the watercourses have a negative impact on the bird species of this area.

Conservation status

The site has not been designated as a protected area by national law.

Ownership

Combined private and state property.

Site management

Body responsible for the site management:

There are no legally constituted site management structures.

Site management plans:

There are no site management plans.

BIRDS listed on Annex I of Council directive 79/409/EEC – 32 species.

Bird species (32), subject to protection in PA ROSPA0023, are presented in table 11.5.4.2-2.

Table 11.5.4.2-2 Bird species in PA ROSPA0023

CODE	NAME	POPULATION				SITE ASSESSMENT			
		Resident	Migratory			Population	Conservation	Isolation	Global
			Breed	Winter	Stage				
A229	*Alcedo atthis*				6-8 i	D	C	C	C
A255	*Anthus campestris*		10-20 p			D	B	C	C
A089	*Aquila pomarina*		4-8 p			D	C	C	C
A209	*Ardea purpurea*				10-30 i	D	C	C	C
A021	*Botaurus stellaris*		2-4 p			D	B	C	B
A133	*Burhinus oedicnemus*		10-20 p			D	C	C	C
A403	*Buteo rufinus*	2-4 p	2-4 p			C	B	C	B
A224	*Caprimulgus europaeus*		120-150 p			D	C	C	C
A196	*Chlidonias hybridus*				200-300 i	D	C	C	C
A197	*Chlidonias niger*				50-100 i	D	C	C	C
A031	*Ciconia ciconia*		60-80 p			D	C	C	C
A030	*Ciconia nigra*		20-30 p			C	B	C	B
A081	*Circus aeruginosus*		6-10 p			D	C	C	C
A231	*Coracias garrulus*		46-50 p			D	C	C	C

		POPULATION				SITE ASSESSMENT			
			Migratory						
A122	*Crex crex*		100-150 p			D	C	C	C
A238	*Dendrocopos medius*		100-130 p			D	C	C	C
A429	*Dendrocopos syriacus*		90-120 p			D	C	C	C
A027	*Egretta alba*				20-30 i	D	C	C	C
A072	*Egretta garzetta*				150-200 i	D	C	C	C
A321	*Ficedula albicollis*		300-400 p			D	C	C	C
A075	*Haliaeetus albicilla*		1-2 p			D	C	C	C
A131	*Himantopus himantopus*				20-30 i	D	C	C	C
A022	*Ixobrychus minutus*		12-20 p			D	B	C	B
A177	*Larus minutus*				100-150 i	D	C	C	C
A246	*Lullula arborea*		RC			D	C	C	C
A073	*Milvus migrans*		2-4 p			D	C	C	C
A020	*Pelecanus crispus*				30-70 i	B	B	C	A
A393	*Phalacrocorax pygmeus*			40-70 i		C	B	C	B
A034	*Platalea leucorodia*				150-200 i	D	C	C	C
A132	*Recurvirostra avosetta*				30-40 i	D	C	C	C
A193	*Sterna hirundo*				150-250 i	D	C	C	C
A166	*Tringa glareola*				1000-2000 i	D	C	C	C

11.5.4.3 General Description of the Romanian Protected Area with code ROPSCI0045 "Coridorul Jiului" under the Habitats Directive

General characteristics

PA ROSCI0045 "Coridorul Jiului" under Directive 92/43/EEC for the protection of natural habitats and of wild fauna and flora is type K. The Pa total area is 71394.0000 ha. It is located at an altitude between 6 and 332 m and is connected with two other PA under NATURA 2000 – ROSPA0010 and ROSPA0023 under the Birds Directive.

In terms of land cover classes, the territory of the protected area is sub-divided into the following groups:

Land cover classes Coverage	***%***
Water inland areas (not running and running waters)	12.0
Water inland areas (not running and running waters)	4.0
Swamps, marshlands, vegetation alongside the banks of water basins, bogs	11.0
Extensive grain crops (including rotation crops periodically let lie fallow)	14.00
Improved pastures (artificially created from grass mixtures)	15.00
Other lands	2.00
Broad-leaved deciduous forests	38.00
Forest habitats	4.00
Total coverage	***100***

The main purposes of the protected area are related to preserving the area of the natural habitats and the species habitats and their populations which are subject to protection within the boundaries of the protected area.

11.5.4.3.1 Types of vegetation and natural habitats which are subject to protection in the protected area

The following habitats and species are included in the standard form as subject to protection in the area:

TYPES OF HABITATS from Appendix I of Directive 92/43/EEC

CODE App.	*NAME*	*% coverage*	*Represent.*	*Relative surface*	*Conservation status*	*Global assessment*
3130	Oligotrophic to mesotrophic standing waters	*0.50*	*B*	*C*	*B*	*B*
3270	Rivers with muddy banks with *Chenopodion rubri* p.p. and *Bidention* p.p. vegetation	*0.10*	*B*	*C*	*B*	*B*
6260	* Pannonic sand steppes	*0.10*	*B*	*B*	*B*	*B*
6440	Alluvial meadows of river valleys of the *Cnidion dubii*	*1.00*	*B*	*B*	*B*	*B*
6510	Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*)	*1.00*	*B*	*C*	*B*	*B*
1530	* Pannonic salt steppes and salt marshes	*3.00*	*B*	*B*	*B*	*B*
9130	*Asperulo-Fagetum* beech forests	*1.70*	*B*	*C*	*B*	*B*
9170	*Galio-Carpinetum* oak-hornbeam forests	*0.40*	*B*	*B*	*B*	*B*
91E0	* Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*	*0.10*	*A*	*B*	*B*	*A*

	(*Alno-Padion, Alnion incanae, Salicion albae*)					
9110	*Luzulo-Fagetum* beech forests	*1.00*	*A*	*B*	*B*	*B*
91M0	Pannonian-Balkanic turkey oak –sessile oak forests	*6.80*	*A*	*B*	*B*	*B*
91Y0	Dacian oak & hornbeam forests	*3.00*	*A*	*C*	*A*	*A*
92A0	*Salix alba* and *Populus alba* galleries	*3.70*	*A*	*B*	*B*	*B*
91F0	Riparian mixed forests of *Quercus robur, Ulmus laevis* and *Ulmus minor*, *Fraxinus excelsior* or *Fraxinus angustifolia*, along the great rivers (*Ulmenion minoris*)	*0.50*	*A*	*B*	*B*	*B*

Note: The * symbol denotes a habitat type which is of priority importance as far as its protection is concerned.

The following assessments are given according to the adopted indicators of the habitats in the Standard Form:

3130 Oligotrophic to mesotrophic standing waters with vegetation of Littorelletea uniflorae and/or Isoeto-Nanfjuncetea. Here lowland pioneer communities of annual plants, growing on drying wet sediments in shallow edges of ponds and along the major rivers are formed. The representation of the habitat is assessed as good, in terms of relative area it is class C 2 > = p > 0; the equated extent is “good protection” and the total assessment of the site is “good value”

3270 Rivers with muddy banks with Chenopodion and Bedintion p.p. Pioneer and ruderal communities are formed on muddy banks along the rivers. The plants usually grow in favorable conditions during the summer. The representation of the habitat is assessed as good, in terms of relative area it is class C 2 > = p > 0; the equated extent is “good protection” and the total assessment of the site is “good value”.

6260 Pannonian sand steppes. Habitat occupies moving, alluvial sands, which develop terophytic communities and tufted perennial grasses and subshrubs. The representation of the habitat is assessed as good, in terms of relative area it is class B 15 > = p > 2 %; the equated extent is “good protection” and the total assessment of the site is “good value”.

6440 Alluvial meadows of the alliance Cnidion dubii in river valleys. Floodplain habitat along the rivers, which after the withdrawal of water during the summer period develops hygromesophytic communities with rich species composition. The representation of the habitat is assessed as good, in terms of relative area it is class B 15 > = p > 2 %; the equated extent is “good protection” and the total assessment of the site is “good value”.

6510 Lowland hay meadows. Habitat is most often formed on rich alluvial meadow soils and earth, which develop plant communities dominated by grasses and rich grass variety. The representation of the habitat is assessed as good, in terms of relative area it is class C 2 > = p >0; the equated extent is “good protection” and the total assessment of the site is “good value”.

1530 * Panonian salty steppes and salty marshlands. Habitat is formed in the peripheral parts of the marshes and river valleys. Salinisation is most often associated with spring floods and summer drought. Vegetation consists of annual and perennial typical and atypical halophytes. The representation of the habitat is assessed as good, in terms of relative area it is class B 15 > = p > 2 %; the equated extent is "good protection" and the total assessment of the site is "good value".

9130 Beech forests of the type Asperulo-Fagetum. Mesophytic beech forests growing on neutral or near neutral soils, characterized by a rich species composition. The representation of the habitat is assessed as good, in terms of relative area it is class C 2 > = p > 0; the equated extent is "good protection" and the total assessment of the site is "good value".

9170 Oak-hornbeam forests of the type Galio Carpinetum. Mixed mesophytic forests dominated by Quercus petraea agg. and Carpinus betulus. The representation of the habitat is assessed as good, in terms of relative area it is class C 2 > = p > 0; the equated extent is "good protection" and the total assessment of the site is "good value".

91E0 Alluvial forests with Alnus glutinosa Fraxinus excelsior (Alno-Padion,Alnion incanaeqSalicion albae.) Riparian forests growing of rich alluvial soils, periodic flooded. The representation of the habitat is assessed as excellent, in terms of relative area it is class B 15 > = p > 2 %; the equated extent is "good protection" and the total assessment of the site is "good value".

9110 Beech forests of the type Luzulo-Fagetum. Beech forests growing on poorer acidic, dry to fresh soils. Characterized by poorer species composition and significant participation of mosses. The representation of the habitat is assessed as excellent, in terms of relative area it is class B 15 > = p > 2 %; the equated extent is "good protection" and the total assessment of the site is "excellent value".

91M0 Balkan-Pannonian Quercus dalechampii forests. Xerothermic oak forests dominated by Quercus ceris, Quercus frainetto and Quercus petraea agg. The representation of the habitat is assessed as excellent, in terms of relative area it is class B 15 > = p > 2 %; the equated extent is "good protection" and the total assessment of the site is "good value".

91Y0 Dacian oak and elm forests. The representation of the habitat is assessed as excellent, in terms of relative area it is class C 2 > = p >0; the equated extent is "good protection" and the total assessment of the site is "good value".

92A0 Riparian galleries of Salix alba and Populus alba. Waterlogged habitats of riparian forest communities dominated by willows and poplars. The representation of the habitat is assessed as excellent, in terms of relative area it is class B 15 > = p > 2 %; the equated extent is "good protection" and the total assessment of the site is "good value".

91F0 Riparian mixed forests of Quercus robur, Ulmus laevis, or Fraxinus angustifolia along the big rivers. Periodically flooded mixed deciduous forests. The representation of the habitat is assessed as excellent, in terms of relative area it is class

B 15 > = p > 2 %; the equated extent is “good protection” and the total assessment of the site is “good value”.

Plant species from Annex II of Directive 92/43/EEC are not included in the PA Standard Form as subject to protection. Plant species from the group "Other significant plant and animal species" related to the protection and management of the object, are not included either.

11.5.4.3.2 Animal species subject to conservation

Invertebrates (*Invertebrata*)

Arthropod (*Arthropoda*)

Insects (*Insecta*)

Dragonflys (*Odonata*)
1042 Large White-faced Darter –*Leucorrhinia pectoralis*
1045 Coenagrion ornatum –*Coenagrion ornatum*
1044 Coenagrion mercuriale
This species is wrongly classified for Bulgaria and is eliminated from the lists of protected species. Probably it is the same for the Romanian fauna species, taking into account the spreading area of the species.

Beetles (*Coleoptera*)

1013 Carabus hungaricus

Vertebrates (*Vertebrata*)

Damselfishes - Pisces/Osteichthyes

2491 Danube (*Alosa immaculate - A. pontica*)

This species is transitory and enters into its reproduction stage during the month of May, moves together in big schools in the upper water strata. In the past it was a species of economic value and was subject to massive fishing, because of which the current status of the species does not allow its use for economic purposes. The regulations for the fishing of this fish take into account its breeding period and the quantities fished are relatively small and for satisfying household needs and in small quantities for the market in the towns on the Danube River. During the last 10 years this species demonstrates a trend towards stabilization of its stock, a conclusion drawn by us based on the relatively constant catches after the end of the fishing ban.

1130 Cyprinidae -*Aspius aspius*

According to the Standard form, this is rare species, of low density but in good conservation status. Based on our data obtained through 42 studying the catch of fishermen, in the region of Kozloduy Islands, we found constant catches of specimens of various ages of the Cyprinidae species, which are evidence of the relatively stable conservation status of this species. This predator is easy to spot even by eyesight when observing the shoreline area of the river during sunset. Chasing its prey, this predator is shearing the water surface with its pectoral fin.

1124 Whitefin gudgeon – *Gobio albipinnatus*

In the Standard form, this species is said to be frequently encountered and in good populational and good conservation status.

2522 Ziege – *Pelecus cultratus*

This is an extremely rare species for the Danube River. From its status of an economically significant species, its density has fallen to the brink of survival. According to the Standard form, this species is frequently encountered but the source of the information is unclear.

1134 Fish linn – *Rhodeus sericeus amarus*

It is encountered on a massive scale in all the appropriate water basins. The species co-habitates with the fresh water shells, in which it lays its eggs.

1149 Spined loach – *Cobitis taenia*

It is not encountered in Bulgaria, It is found in the North. In Bulgaria and along the Danube River, the species C. elongatoides is encountered (Bacesku & Maier, 1969). The data is from Kottelat, M. & J. Freyhof (2007).

2555 Balon's ruffle – *Gymnocephalus baloni*

1157 Stripped ruffle – *Gymnocephalus scraetzer*

These two species are described in the Standard form as frequently occurring and in stable environmental conservation status. Both are deep-water species and inhabit the bottoms covered with coarse gravel.

1159 Zingel zingel – *Zingel zingel* and 1160 Zingel streber – *Zingel streber*

Both these species are reported in the Standard form to be rare but in excellent environmental conservation status. These cold-loving species are active during the winter months and in early spring, when they reproduce. During the rest of the year, they hide in the deep river pools and their identification is difficult and infrequent.

1146 Golden spinned loach - *Sabanejewia aurata balcanica*

1145 Eurasian Weather Loach –*Misgurnus fossilis*

<u>Amphibians (*Amphibia*)</u>

1188 Fire-bellied toad – *Bombina bombina*

The information from the Standard form about this species is that its density has not been determined. The species is frequently encountered in the shoreline area of the river, where the Fire-bellied toad can be scientifically proven from a distance by its melodious sound signals. The species is especially frequently occurring in the island's territories, where small and shallow swamps are formed and preserved over the entire year.

Reptiles (*Reptilia*)

1220 European pond turtle – *Emys orbicularis*
A typical species for the river and the island territories. Isolated specimens are caught in winters and fishing nets, where they die. Very frequently specimens of this species are killed for no obvious reason because of erroneous perceptions about the primary food of the species.

Mammals (*Mammalia*)

1355 European Otter –*Lutra lutra*
According to the Standard Form, the territory of the protected area is inhabited by undefined number of specimens. No specific methodology for identification has been described, but over such a big and rich in food area a higher density should be expected. The data on this species is scarce and incidental for this specific region but the studies in other regions of the country have shown an increase in the density of the species.

1335 European Ground Squirrel - *Spermophilus citellus*
This rodent living in colonies inhabits pastures or grassy embankments and avoids wetlands. The colonies are located on well shine on mainly hilly terrains with southern or eastern aspect. The species is currently relatively rare because of changes in the mode of cultivation of pasture cattle because of the intensive and chemical introducing agricultural. For the Romanian PA it is designated as common species.

Quality and importance of PA
The PA territory belongs to the priority areas for conservation of the continental biodiversity and has great significance. Although it covers only 0.5 % of the national forest area in Romania and 0.6 % of natural areas, it includes: natural forest habitats protected by Romanian and European legislation (9 of 28 types); forest formations (22 of 50); forest types identified in the country (97 of 306). Jiu Valley is one of the Trans-Balkan corridors for migrating birds (Bulgarian Central-European path), followed by a significant number of birds. Together with the resident birds, 135 of 406 bird species in Romania are identified in the Jiu corridor, 114 of which are protected by the Romanian and European legislation.

Vulnerability of PA

The location within three counties and near Craiova city provides a reasonable Plan for territory development (PTD), based on which the General development plan (GDP) of the near settlements can be updated every ten years. Once updated, the GDP allows the development of a Regional development plan (RDP) resulting in a Detailed development plan (DDT). DDT development aims to harmonize all current and future interests to this diverse territory, in which the proportion of forest fund (34 %) and forests (33 %) cannot be reduced, as well as other categories of land containing natural areas protected by EU and Romanian legislation. Thus, pollution, urbanization, agricultural activities and other destructive effects of human intervention in the environment can be reconciled with the essential requirements and activities for sustainable development and biodiversity conservation carried out by man.

11.5.5 Assessment of the possible impacts during the construction, operation and decommissioning of PMF on the protected areas

The assessment of the probability and extent of the impact of the investment proposal on the subject and objectives in the examined protected areas is based on comparative analysis, on the forecasted changes and on the expert assessment of their impact on the existing biological diversity in certain parts of their territory. The assessments are presented in detail in the Compatibility assessment report, section 11.4 of this chapter (items 5.5, 5.6 and 5.7).

11.5.5.1 Description and analysis of the impact of the Investment Proposal on the Romanian Protected Area with code ROSPA0010 under the Birds directive

The description and analysis of the impact of the investment proposal on the types of natural habitats and species that are subject to protection has been performed sequentially and separately as follows:

On the habitats subject to protection

In the Standard Form for the protected area, there are no habitats types subject to protection in it included.

On the bird species subject to protection

The territories, in which an adverse impact from the implementation of the Investment Proposal on the bird species subject to protection in the protected area can be expected, can be divided into two regions:

A. Region of the Kozloduy NPP site and the areas between it and the protected area.
On the very site of Units 1 to 4 of Kozloduy NPP no bird species are identified, which are subject to protection in the protected area. Exception is Long-legged Buzzard (*Buteo rufinus*) that does not nest on the Kozloduy NPP site but only passes in flight over it in search of food in the neighboring terrains.

Based on this information it can be concluded that there will be no considerable adverse impact on the bird species subject to protection in the protected area.

B. Protected area region, the Eastern part of which lies in the 12-km controlled area of Kozloduy NPP

The species subject to protection in PA Bistret are 23. The opinion as to the existence or non-existence of an adverse impact on them is expressed in two steps. In the first step, the adverse impact is assessed qualitatively only (not expected-expected) - table 11.5.5.1-1:

Table 11.5.5.1-1 Expected adverse impact on the bird species subject to protection under Item 3 in the protected area as a result of the implementation of the Investment Proposal

No	Species	Comprehensive assessment	Extent of the adverse impact	
			Not expected, because:	Expected:

No	Species	Comprehensive assessment	Extent of the adverse impact	
			Not expected, because:	Expected:
1.	*Alcedo atthis*	C	**2**	
2.	*Anser erythropus*	A		+
3.	*Ardea purpurea*	B	**1**	
4.	*Ardeola ralloides*	B	**1**	
5.	*Aythya nyroca*	B	**2**	
6.	*Botaurus stellaris*	B	**2**	
7.	*Branta ruficollis*	B		+
8.	*Ciconia ciconia*	B		+
9.	*Ciconia nigra*	B	**2**	
10.	*Circus aeruginosus*	B	**2**	
11.	*Circus cyaneus*	B	**1**	
12.	*Cygnus cygnus*	B	**2**	
13.	*Egretta alba*	B	**2**	
14.	*Egretta garzetta*	B	**2**	
15.	*Him. himantopus*	B	**2**	
16.	*Ixobrychus minutus*	B	**2**	
17.	*Mergus albellus*	B	**2**	
18.	*Pelecanus crispus*	B		+
19.	*Pelecanus onocrotalus*	B		+
20.	*Phalacrocorax pygmeus*	A		+
21.	*Platalea leucorodia*	B	**2**	
22.	*Plegadis falcinellus*	B	**2**	
23.	*Recurvirostra avosetta*	B	**2**	
Total			**30**	**6**

The designations in the "Not expected, because:" column:

1. The species **does not occur** in the habitats, which are part of the terrain of the Investment Proposal or in the immediate proximity, over the entire year or over a specific season.

2. The species may occur in the habitats, which are part of the terrain of the Investment Proposal or in the immediate proximity, but this happens irregularly, on an infrequent basis, accidentally and/or is denoted in the Standard Form for the protected area with a total assessment of "D".

3. The species may occur regularly over the entire year or over a specific season in the habitats from the terrain of the Investment Proposal but does not use these habitats because of the proximity of an asphalt-paved road, a populated settlement or another reason.

4. The species only flies over the terrain of the Investment Proposal on a regular basis during feeding or migration.

5. The species is synanthropic or insensitive to anthropogenic impacts arising from the implementation of the Investment Proposal.

The quantitative assessment of the adverse impact from the implementation of the Investment Proposal on the six bird species subject showed above is performed separately for each specific species as follows:

1. Little white-fronted goose *(Anser erythropus)* – this is a rare wintering species in Bulgaria. According to the standard form there is data about 4 wintering birds in the PA Bistrets with comprehensive assessment A. Although the Kozloduy NPP site is located 3 km to the east of the spending-the-night location (the marshlands at Bistretsu in Romania and the sand spits on the islands) and the feeding locations (Zlatiata), there is a rare possibility of small herds or single birds to fly over Kozloduy. No adverse impact is expected.

2. *Branta ruficollis* – regular wintering species in the protected area. According to the standard form there is data about 20 passing birds in the PA Bistrets during migration with comprehensive assessment B. The main direction of migration over PA "Zlatiata" is a northwest-southeast. There is a rare possibility of small herds or single birds to fly over Kozloduy. No adverse impact is expected.

3. White stork *(Ciconia ciconia)* – a common nesting species nesting in the villages around the Pa. According to the standard form there is data about 6 nesting couples and 180 birds during migration with comprehensive assessment B. The main migratory direction is northwest-southeast. Small flocks or single birds may fly over the Kozloduy NPP site on infrequent basis only, because of which no adverse impact is expected.

4. *Pelecanus onocrotalus* – nesting, overflowing and passing species. According to the standard form there is data about 50-150 birds during migration with comprehensive assessment B. Small flocks or single birds may fly over the Kozloduy NPP site on infrequent basis only, because of which no adverse impact is expected.

5. Dalmatian Pelican *(Pelecanus crispus)* – constantly world endangered species. According to the standard form there is data about 31-59 birds during migration with comprehensive assessment B. During its migration it reaches considerable concentrations (between 150 and 252 specimens) in Protected Area “Island near Gorni Tsibur” Code: BG0002008. It hunts in the neighbouring Romanian marshlands and stays for the night and rests next to the sand spits of the adjacent islands. Representatives of this species may fly over the Kozloduy NPP site on infrequent basis only, because of which no adverse impact is expected.

6. *Phalacrocorax pygmeus* – constantly world endangered species. According to the standard form there is data about 153 passing and 1000 wintering birds with comprehensive assessment A. It reaches concentrations in Protected Area “Island near Gorni Tsibur” Code: BG0002008. It hunts in the neighbouring Romanian marshlands and stays for the night and rests next to the sand spits of the adjacent islands. Representatives of this species may fly over the Kozloduy NPP site on infrequent basis only, because of which no adverse impact is expected.

The *Otis tarda* species is also reviewed. Although it is not included in the standard form of PA Bistrets, it is included in the standard form of PA Zlatiata as a nesting species without constant nesting area. No adverse impact is expected, since this species is rarely expected to be seen at the KNPP site.

Because of all of the above, it can be said that the implementation of the Investment Proposal will not exert adverse impact on the bird species subject to protection in PA Bistrets under the Birds Directive.

Fragmentation

KNPP site is located about 1km north-east of the protected area. Therefore, no fragmentation of the territory of the protected area as a result of the implementation of the Investment Proposal is expected.

Disruption of the species composition

Not expected.

Chemical changes

Not expected

Hydrological changes

Not expected

Geological changes

Not expected.

Other changes

Not expected.

11.5.5.2 Description and analysis of the impact of the investment proposal on the Romanian Protected Area with code ROSPA00023 under the Birds directive

The description and analysis of the impact of the investment proposal on the types of natural habitats and species that are subject to protection has been performed sequentially and separately as follows:

On the habitats subject to protection

In the Standard Form for the protected area, there are no habitats types subject to protection in it included.

On the bird species subject to protection

The territories, in which an adverse impact from the implementation of the Investment Proposal on the bird species subject to protection in the protected area can be expected, can be divided into two regions:

A. Region of the Kozloduy NPP site and the areas between it and the protected area.
On the very site of Units 1 to 4 of Kozloduy NPP no bird species are identified, which are subject to protection in the protected area.

Exception is Long-legged Buzzard (*Buteo rufinus*) that does not nest on the Kozloduy NPP site but only passes in flight over it in search of food in the neighbouring terrains.

Based on this information it can be concluded that there will be no considerable adverse impact on the bird species subject to protection in the protected area.

B. Protected area region, the Eastern part of which lies in the 12-km controlled area of Kozloduy NPP

The species subject to protection in the PA are 32. The opinion as to the existence or non-existence of an adverse impact on them is expressed in two steps. In the first step, the adverse impact is assessed qualitatively only (not expected-expected) - table 11.5.5.2-1.

Table 11.5.5.2-1 Expected adverse impact on the bird species subject to protection under Item 3 in the protected area as a result of the implementation of the Investment Proposal

No	Species	Comprehensive assessment	Extent of the adverse impact	
			Not expected, because:	Expected:
1.	*Alcedo atthis*	C		+
2.	*Anthus campestris*	C	**2**	
3.	*Aquila pomarina*	C		+
4.	*Ardea purpurea*	C	**2**	
5.	*Botaurus stellaris*	B	**2**	
6.	*Burhinus oedicnemus*	C	**2**	
7.	*Buteo rufinus*	B		+
8.	*Caprimulgus europaeus*	C	**1**	
9.	*Chlidonias hybridus*	C	**2**	
10.	*Chlidonias niger*	C	**2**	
11.	*Ciconia ciconia*	C		+
12.	*Ciconia nigra*	B	**2**	
13.	*Circus aeruginosus*	C	**2**	
14.	*Coracias garrulus*	C	**2**	
15.	*Crex crex*	C	**1**	
16.	*Dendrocopos medius*	C	**1**	
17.	*Dendrocopos syriacus*	C	**1**	
18.	*Egretta alba*	C	**2**	
19.	*Egretta garzetta*	C	**2**	
20.	*Ficedula albicollis*	C	**1**	
21.	*Haliaeetus albicilla*	C		+
22.	*Himantopus*	C	**2**	
23.	*Ixobrychus minutus*	B	**2**	
24.	*Larus minutus*	C	**2**	
25.	*Lullula arborea*	C	**1**	
26.	*Milvus migrans*	C	**2**	

No	Species	Comprehensive assessment	Extent of the adverse impact	
			Not expected, because:	Expected:
27.	*Pelecanus crispus*	A		+
28.	*Phalacrocorax pygmeus*	B		+
29.	*Platalea leucorodia*	C	**2**	
30.	*Recurvirostra avosetta*	C	**2**	
31.	*Sterna hirundo*	C	**2**	
32.	*Tringa glareola*	C	**2**	
Total			**27**	**7**

The designations in the "Not expected, because:" column:

1. The species **does not occur** in the habitats, which are part of the terrain of the Investment Proposal or in the immediate proximity, over the entire year or over a specific season.

2. The species may occur in the habitats, which are part of the terrain of the Investment Proposal or in the immediate proximity, but this happens irregularly, on an infrequent basis, accidentally and/or is denoted in the Standard Form for the protected area with a total assessment of "D".

3. The species may occur regularly over the entire year or over a specific season in the habitats from the terrain of the Investment Proposal but does not use these habitats because of the proximity of an asphalt-paved road, a populated settlement or another reason.

4. The species only flies over the terrain of the Investment Proposal on a regular basis during feeding or migration.

5. The species is synanthropic or insensitive to anthropogenic impacts arising from the implementation of the Investment Proposal.

The quantitative assessment of the adverse impact from the implementation of the Investment Proposal on the seven bird species subject showed above is performed separately for each specific species as follows:

1. *Alcedo atthis* – permanent species. According to the standard form there is data about 6-8 birds during migration with comprehensive assessment C. Single birds may visit the KNPP area and mainly the discharge channel, but negative impact is not expected.

2. *Aquila pomarina* – nesting, overflowing and passing species. According to the standard form there is data about 4-8 nesting couples with comprehensive assessment C. The main migratory direction is northwest-southeast. Small flocks or single birds may fly over the Kozloduy NPP site on infrequent basis only, because of which no adverse impact is expected.

3. Long-legged Buzzard *(Buteo rufinus)* – nesting, overflowing and passing species. According to the standard form there is data about 2-4 nesting couples with comprehensive assessment B. Single birds may fly over the Kozloduy NPP site on infrequent basis only, because of which no adverse impact is expected.

4. White stork *(Ciconia ciconia)* – a common nesting species nesting in the villages around the Pa. According to the standard form there is data about 60-80 nesting couples comprehensive assessment C. The main migratory direction is northwest-southeast. Small flocks or single birds may fly over the Kozloduy NPP site on infrequent basis only, because of which no adverse impact is expected.

5. *Haliaeetus albicilla* – nesting, overflowing and passing species. According to the standard form there is data about 1-2 nesting couples comprehensive assessment C. single birds may fly over the Kozloduy NPP site on infrequent basis only, because of which no adverse impact is expected.

6. Dalmatian Pelican *(Pelecanus crispus)* – constantly world endangered species. According to the standard form there is data about 30-70 birds during migration with comprehensive assessment A. During its migration it reaches considerable concentrations (between 150 and 252 specimens) in Protected Area "Island near Gorni Tsibur" Code: BG0002008. It hunts in the neighbouring Romanian marshlands and stays for the night and rests next to the sand spits of the adjacent islands. Representatives of this species may fly over the Kozloduy NPP site on infrequent basis only, because of which no adverse impact is expected.

7. *Phalacrocorax pygmeus*- constantly world endangered species. According to the standard form there is data about 40-70 wintering birds with comprehensive assessment B. It reaches concentrations in Protected Area "Island near Gorni Tsibur" Code: BG0002008. It hunts in the neighbouring Romanian marshlands and stays for the night and rests next to the sand spits of the adjacent islands. Representatives of this species may fly over the Kozloduy NPP site on infrequent basis only, because of which no adverse impact is expected.

The *Otis tarda* species is also reviewed. Although it is not included in the standard form of PA Bistrets, it is included in the standard form of PA Zlatiata as a nesting species without constant nesting area. No adverse impact is expected, since this species is rarely expected to be seen at the KNPP site.

Because of all of the above, it can be said that the implementation of the Investment Proposal will not exert adverse impact on the bird species subject to protection in PA Bistrets under the Birds Directive.

Fragmentation

KNPP site is located about 1 km north-east of the protected area. Therefore, no fragmentation of the territory of the protected area as a result of the implementation of the Investment Proposal is expected.

Disruption of the species composition

Not expected.

Chemical changes

Not expected.

Hydrological changes

Not expected.

Geological changes

Not expected.

Other changes

Not expected.

11.5.5.3 Description and analysis of the impact of the investment proposal on the Romanian Protected Area Coridorul Jiului with code ROSCI0045 under the Birds directive

The assessment of the extent of trans-border impact of the investment proposal for construction, operation and decommissioning of PMF combined with contamination from the decommissioning of KNPP Units 1-4 and in cases of accidents and incidents during the IP implementation is based on an assessment of the impact on each of the criteria for Favorable Environmental Protection Status – population in the area, area of the habitats in the area (where there are specific habitats of smaller areas but important in significance, they are taken into account separately), quality of the habitats (structural and functional parameters), future perspectives (other important parameters). Account is taken separately of other structural and functional parameters, such as the overall functional role of the area for the connectedness of the network – bio-corridor function, geographical connectedness.

A 10-grade assessment scale is used for determining the extent of the impact and this scale makes it possible to take into account the various parameters of the significance of a given impact in respect of the standard indicators for assessment of the extent of the impact.

Impacts on vegetation and habitat types in PA Coridorul Jiului with code ROSCI0045

There is no information on specific observations conducted on radioecological status of vegetation and habitats in PA Coridorul Jiului with code ROSCI0045 in relation with the KNPP impact assessment. The EIAR results from the performed monitoring of the environment components in the KNPP 30-km area on the territory of Romania lead to the conclusion that significant change in radioecological status and in Romania as result of the plant has not been found.

The assessment of the degree of impact of the investment proposal on the protected area is formed based on indicators: direct destruction of parts of habitats; impact on the boundary zones of the habitats; fragmentation (segmentation of habitats) upon PMF construction, operation and decommissioning combined with pollution with harmful substances from decommissioning of Units 1-4 of Kozloduy NPP and in the cases of accidents and breakdowns during the implementation of the investment proposal.

The assessments are presented in a table format, where, for the sake of simplicity, we have not included the parameters for Favorable Conservation Status (FCS), about which it is assumed that they have no regard to the suspected impacts. The assessment from the table serves for identification of the extent of impact.

Table 11.5.5.3-1 Impacts on habitats 3130, 3270, 6260, 6440, 6510, 1530, 9130,

9170, 91E0, 9110, 91M0, 91Y0, 92A0, 91F0

Parameters Impacts	Total area	Species composition	Invasive species
Direct destruction of the habitat	The implementation of the investment proposal is not expected to cause any direct destruction of habitats	There is no likely impact	There is no likely impact
Boundaries (eco-tone) of the habitat	There is no likely impact on territories adjacent to the habitat	There is no likely impact	There is no likely impact
Fragmentation	There is no likely impact	There is no likely impact	There is no likely impact
Risk of Fire	There is no likely impact from the construction and operation of the facilities.	There is no likely impact	There is no likely impact
Risk of accidental pollutions from breakdowns	There is a very little likely impact.	There is a very little likely impact.	There is a very weak little impact.

Based on estimated impacts upon the habitats subject to protection in the PA, the impact of the investment proposal is assessed as low in degrees (1-3), and it can be avoided without any special measures in PMF construction, operation and decommissioning, other than the best practices for PMF construction, operation and decommissioning and in case of accidents and incidents during the implementation of the IP.

The complex analysis of the potential impact of the investment proposal allows to be concluded that the implementation of the IP will not have a negative impact on the vegetation and habitats in PA Coridorul Jiului with code ROSCI0045.

Loss of habitats and individuals

Destruction of parts of natural habitats 3130, 3270, 6260, 6440, 6510, 1530, 9130, 9170, 91E0, 9110, 91M0, 91Y0, 92A0, 91F0 is not expected.

Fragmentation

Not expected.

Disruption of the species composition

Not expected

Chemical changes

Not expected

Hydrological changes

Not expected

Geological changes

Not expected

Other changes

Not expected, unless in cases of accidents and incidents.

On animal species

The possible negative impacts can be grouped in two main areas according to the different animal habitats. Subject to protection are typical hydrobionts – fish, larvae of dragonflies, amphibian species – red-bottom toad, common pond turtle, otter, as well as typical terrestrial species such as the Hungarian level runner and Souslik.

The separate elements subject to IP vary in nature, course of action and duration. The eventual radioactive contamination resulting from accidents or errors in the mechanisms of inactivation and conservation of the reactors are of greatest influence on the animal species. Regardless of the programs developed for precise and safe decommissioning, safety alternatives in cases of emergency situations must be developed as well. The consequences of such pollution are unpredictable for the fauna as a whole. Given the characteristics of the river ecosystems damage can be carried and transmitted over long distances. Genetic modifications due to the increased radioactive background can have disastrous consequences. This impact is paramount in importance and duration. Other effects that may arise during the implementation of IP are associated with contamination of the environment with various organic hazardous substances. Especially dangerous are the soluble chemicals when entering water. In these cases there may be impacts over large distances along the rivers and entering of these substances in closed basins or low flow basins.

Indirect impacts of possible implementation of IP will be of secondary importance and in some cases may be neglected, given their insignificance.

The increased motor traffic can be estimated as negligible. Noise, light pollution and exhaust fumes from fuels are impacts accompanying the implementation of any IP, and they can be neglected in this case.

It can be concluded that in case of **possible IP implementation great attention should be paid to the protection of the animal species and habitats from radioactive contamination of the region and accidental spill of fuels and other hazardous substances**. Especially dangerous are the soluble chemicals when entering water, since they can affect many animal species and habitats.

In case of force majeure a program for taking immediate measures regarding the protection of animal species must be pre-developed. Natural disasters - earthquakes, high water wave as well as a possible terrorist act are included in this category. The last possible impacts are subject to a separate action plan in case of emergency and for each type of impact there must be concrete actions leading to a reduction or complete prevention of possible damage to the species subject to conservation in PA. This

document will not consider force majeure situations, which are subject to settlement by other regulations.

The above possible actions are valid for normal proceeding of the IP for PMF commissioning.

Loss of habitats and individuals

Destruction of habitats for species subject to conservation in the PA is not expected. The mouth of the River Jiu is situated above the NPP, and there are two islands that are a major barrier for most potential impacts that may arise in connection with any course of the Danube.

Fragmentation

Not expected.

Disruption of the species composition

Not expected.

Chemical changes

Not expected.

Hydrological changes

Not expected.

Geological changes

Not expected.

Other changes

Not expected, unless in cases of accidents and incidents.

General conclusion for the protected areas on the Romanian coast of the Danube River in the KNPP area

The following areas from NATURA 2000, protected under the EU Directive on the conservation of natural habitats and of wild fauna and flora, are situated on the Romanian coast of the Danube River in the KNPP area:

- ROSPA0010 Bistreț (Birds Directive)
- ROSPA0023 Confluența Jiu – Dunăre (Birds Directive)
- ROSCI0045 Coridorul Jiului (Habitats Directive)

On the basis of all present of the above, a conclusion can be drawn that subject to strict adherence to the adopted technology for PMF construction, operation and decommissioning and subject to strict compliance with the already exist mitigating measures envisaged for prevention, reduction or termination of the harmful impact on the environment, the implementation of the Investment Proposal **will not** have significant adverse impact the following protected areas part of **NATURA 2000 network of R. of Romania**: ROSPA0010 Bistret River and ROSPA0023 Jiu River-

Danube River Confluence under the Birds Directive and Protected Areas ROSCI0045 Corridor of Jiu River under the Habitats Directive.

These PA are described in Chapter 3 (detailed description and analysis of elements of the environment) from EIAR and are assessed in Chapter 4 (identification, analysis and assessment of expected impacts) from EIAR on the Investment Proposal.

These PA are also described in section 4 of the integrated assessment of compatibility of the investment proposal with protected areas NATURA 2000 network. In section 5 from the same document the extent of negative impact on the subjects and objects of protection in them has been assessed.

It is not known whether the use of the Bulgarian Ordinance on assessment of compliance is applicable in assessment of Romanian protected areas. In the EC document on Article 6 regarding the protected areas from NATURA 2000 it is stated that "... In some cases the assessment according to Directive 85/337/EEC (according to the changes with 97/11/EC) can reconcile the assessment under Article 6 (3) ...".

The official approach based on the "Multilateral Agreement of the countries of Southeastern Europe for the implementation of the Convention on EIA in a Trans-boundary Context", Article 6, § 1, has not been implemented to this moment. No joint working group has been formed between the country of origin and the affected country for determining the detailed rules for communication and consultation. Therefore, the only possible way for assessment was to include it in the EIAR and CAR.

11.5.6 Description and analysis of the probability and extent of the impact on the environment, the human health and socio-economic aspects during the construction, operation and decommissioning of the investment proposal

In chapter 4 are described and assessed all possible impacts from IP construction, operation, and decommissioning. Part of the tables for impact description and assessment is the assessment of *Transboundary type of impact.*

In chapter 4.1.5 are summarized all possible impacts in transboundary aspect due to environmental components and factors. As result of the assessment of the assumed impacts on people and environment during the implementation of the PMF facility (construction, operation and decommissioning) it can be summarized that no transboundary impacts are expected.

A. Population in the 30-km zone of the Kozloduy NPP living on the territory of Romania

According to the data provided by experts from Romania 75150 people live in 19 settlements within the Romanian part of the 30-km area. For 4 settlements falling under within this area no data was submitted for their population. But it should be borne in mind that the average population of villages in this part of the country. Probably the total number of population is about 80 thousand people (table 11.5.6-1).

Table 11.5.6-1 Number of the population in the 30-km zone of the Kozloduy NPP living on the territory of Romania

Settlement	Population (number of people)
v. Ostroveni	5255
v. Gighera	3208
v. Valea Stanciului	5736
v. Călăraşi	6282
t. Bechet	3917
t. Dăbuleni	12819
v. Piscu Vechi	2713
v. Sadova	8489
V .Gângiova	2630
t. Măceşu de Jos	1433
t. Măceşu de Sus	1427
t. Bistreţ	4336
v.Goicea	2774
v. Bârca	4024
v. Vela	2033
v. Nedeia	1380
v. Sarata	2139
v. Listeava	1612
v. Horezu Poenari	2943

B. Health status of population within 30-km zone of Kozloduy NPP in Romania

The 30-km zone from the Romanian coast of the Danube includes 18 settlements.

Currently, the working population is around 110000 people and is distributed mainly in the following economic activities:

- 38 % are employed in industrial production;
- 15 % are employed in trade and services;
- 10 % are employed in the transport system;
- 8 % in education;
- 5.7 % work in the healthcare system.

Ministry of Health, through the Radiation Laboratory of Hygiene and regional health center in Bucharest in cooperation with local institutions, carry out systematic monitoring of health status for the period 1999 – 2010.

Below data provided by the Romanian side is presented. Data on the monitoring carried out on 78323 residing within a 30-km zone of observation shows:

1. The distribution of population by age shows that the percentage of population over 60 years is much higher than the average data for the country.

2. In all the years of the observation period, mortality of the population in the surveillance zone is lower than the mortality data for the entire Romanian population.

3. Data related to illnesses from ionizing radiation shows:

- Throughout the entire monitored period the solid cancer mortality in the surveillance zone is lower than the average data for the country.
- The occurrence of illnesses of solid cancers in the surveillance zone is also lower compared with the data for the whole country;
- Mortality from leukemia and lymphoma in the surveillance zone is rising after 2008. However, no data on the dynamics of this indicator in relation to the entire population of the country;
- The incidence of illnesses of all types of leukemias and lymphomas, twelve years throughout the observation period, in terms of population in the area show a gradual increase. Since 2007, this increase is significant. When comparing this frequency with the frequency in four regions around nuclear plants, the highest incidence of solid cancer and lymphomas are found in the area near Kozloduy. However these values do not exceed those established in respect of the entire population of Romania.

The results of the dynamics of total mortality rate and incidence of solid cancers in the surveillance zone are lower than the average data for the country. The increase in mortality and incidence of leukemias and lymphomas in recent years among the observed population can be associated with a large percentage of people over 60 years. This is confirmed by data from the ten-year radiological monitoring of atmospheric aerosols and deposited on the surface water of the gamma background

(performed in SSMR four points - Turnu Severin, Beckett, and Craiova Zimnitsa) show values much lower than the norms.

In conclusions it can be stated that the health status of the population in 30-km zone around Kozloduy NPP in Romania is not different from that of the entire population of the country.

11.5.7 Assessment of the expected impacts on the environment and the people as a results of the construction, operation and decommissioning of the PMF at Kozloduy NPP

During PMF construction

Below is the assessment of the direct impacts during building of PMF; the described impacts are related to the main PMF data.

Health risk

Non-radiation impacts

The health impact on the population by non-radiation factors could be caused by:

- **Noise.** The Construction site is not an organized source of noise. Transportation traffic will be slightly increased - not more than 3-4 trucks, which will not run every day. There is no route indicated in the investment proposal. The increase of noise during the supply of the PMF modules at KNPP will be negligible and it will not cause an increase of the existing noise level in the populated areas, through which the modules will be transported. In this regard, unfavourable effects or increase of the discomfort are not expected.

- **Dust.** Negligible increase of the transportation traffic will not cause an increase of the non-organized dust emissions generated by the vehicles passing through the populated areas.

- **Toxic substances**. Source of toxic substances are the flue gases generated by the motor vehicles. During the combustion the diesel fuel emits: Irritating gases - mainly sulphur and nitrogen dioxide; toxic gases - mainly carbon oxide and dioxide; carcinogens - tar, hydrocarbons etc. Additional emissions generated by the transportation related to the construction will be negligible as well.

Radiation impacts

During the construction of the PMF no RAW will be delivered from or treated by the NPP, thus excluding the negative impact on the health of the radiation factors. The PMF construction activities will not have an unfavorable health effect on the population on the Romanian territory.

Socio-economic impact

Non-radiation impacts

The partial construction activities which will be performed at KNPP site for the adjustment of the existing AB-2 building to the PMF needs cannot have any positive or negative socio-economic influence on the population in the KNPP 30-km area in Romania.

Radiation impacts

The nature of the PMF construction activities does not imply using any radioactive materials. Therefore, there should not be any conditions and possibilities for radiation impact on the population and the economy. The same applies to an even greater extent to the population in the KNPP 30-km area in Romania, meaning that there is no practical possibility of radiation impact on that part of the Romanian population.

Emissions in the air

Non-radiation impacts

Taking into consideration the fact that the Plasma Melting Facility will be installed in the existing building the construction will be mainly related to a change of the height of the roof of the building, restructuring of the room and installation activity. As a result of this within the construction period no excavation and embankment works, transportation and disposal of earth etc. are foreseen, so a big amount of dust is emitted to the atmospheric air. Construction activities are related to the reconstruction of the building as a result of which no generation of dust emissions is expected. Air pollution during the construction will be a result only of the spent gases emitted by the engines into the atmosphere by the internal combustion engines (ICE) of the machines executing construction and transportation activities. Main pollutants, which will be emitted, are: CO_2, CO, NOx, SO_2, CnHm and dust. Emissions, as expected during the construction, will affect mostly the construction site and they will not impact the air quality in the closest areas. Therefore, pollution of the air in transboundary aspect is not expected.

Radiation impacts

Analysis of the activities foreseen during the construction of the PMF shows that no impact caused by radiation factors is expected outside of the construction area, thus no transboundary impact is expected.

Emissions in the surface and groundwater

Non- radiation impacts

During the construction phase limited waste water quantities will be generated mostly in the cleaning process. They will be polluted mainly with suspended substances. Waste waters will not be a problem neither for the NPP sewage system, nor for treatment facilities of the power plant. Characteristics of the impact are similar to the above. There will be some impact, but it will be limited within the site of Kozloduy NPP. Sewage waters generated during the construction will not compromise the quality of the surface waters in the adjacent basins. They will not impact the underground waters as far as all sewage water flows will be collected and deviated for cleaning to the needed extent, and after that they will be discharged in the Danube.

Radiation impacts

Analysis of the activities foreseen during the construction stage of the PMF shows that during this stage no impact on the surface and groundwater caused by radiation factors is expected. At this stage the installation will not be commissioned, due to which the generated sewage waters will be only residential waters and sewage waters

generated during the construction process with expected pollution of the suspended particles.

Waste

Non- radiation impacts

During the construction waste is generated from the clearing and reconstruction of the site for building and assembly of the PMF. This is solid waste from inert construction materials (bricks, concrete pieces, wooden pieces, and reinforcement), metal scrap waste, package waste and municipal waste. Impact on KNPP site and on the Romanian territories is not expected.

Impacts from physical factors

Non- radiation impacts

During the construction, unfavorable impact in transboundary aspect by physical factors (noise, vibrations, dust, and toxic gases) is not expected.

Impacts on soils and earth bowels

Soils

Non- radiation impacts

The PMF construction and installation period does not involve any major construction activities. Earth moving activities will not be performed in this period, which are the common source of impact on soils in the construction phase. The PMF will be serviced by the existing road network and infrastructure and does not require construction of new ones. In the commissioning phase of the PMF no air and water pollutants will be generated, which eliminates the soil contamination.

Non- radiation impact on the soils in the neighboring Romanian territories is not possible.

Radiation impacts

Radiation impact on the soils in Romania is not expected.

Earth bowels

Impact on the earth bowels and the geological foundation cannot be expected due to the PMF construction, because the proposed PMF location is within AB-2.

On the land use

Non- radiation impacts

The IP does not imply construction activities – no new buildings, roads, etc. will be built. The PMF will be installed in the existing KNPP building, which will be in the controlled area (CA). The facility will be delivered in modules, which will be assembled on spot. The use of an existing crane is planned in the process of delivery of the facility elements. These facts show that in the period of PMF operation new lands will not be used; appropriation of land or change in the land use is not required.

Radiation impacts

Radiation impact on the land use in the 30-km area in neighboring Romania in not expected either.

Landscape

Non- radiation impacts

During the PMF construction negative impacts on the landscape elements are not expected. Significant construction activities in the construction period are not expected, because the new facility will be located in an existing building in KNPP territory.

Non- radiation impacts on the landscapes in neighboring Romania are not expected.

Radiation impacts

No radiation impacts on the landscape are expected during the construction stage, because the foreseen activities will be executed in rooms of the controlled area. In case of compliance of the technical requirements there will be no pollution sources, so no radiation impacts on the landscape of the neighboring Romanian territories are expected.

Flora

Non- radiation impacts

In the PMF construction phase impacts on the flora on KNPP site and the nearby territories, including Romania, are not expected.

Radiation impacts

Radiation impacts on the flora on KNPP site and the nearby territories during construction are not expected. Radiation impacts on the flora in the 30-km area in neighboring Romania are not expected either.

Fauna

Non- radiation impacts

The building activities in the PMF construction phase may cause noise pollution and increased anthropogenic presence around the AB-2 building. There is a small possibility of chasing away individuals and damage to the normal population structure. Generally, impact on the fauna on KNPP site and the nearby territories, including Romania, is not expected.

Radiation impacts

Radiation impacts on the fauna on KNPP site and the nearby territories during construction are not expected. Radiation impacts on the fauna in the 30-km area in neighboring Romania are not expected either.

Protected territories and protected areas

Non- radiation impacts

The performance of the main PMF installation activities during construction is not expected to impact the protected territories and protected areas including those on Romanian territory.

Radiation impacts

Radiation impacts on the protected territories and protected areas in the 30-km area in neighboring Romania are not expected either.

Cultural heritage

Non- radiation impacts

Impact on the cultural heritage including the nearby territories during construction is not expected.

Radiation impacts

The PMF commissioning includes only installation activities in an existing building in KNPP territory, which are not a source of radiation contamination. Therefore, radiation impacts on the cultural heritage on KNPP site and the nearby territories during construction are not expected. Radiation impacts on the cultural heritage in the 30-km area in neighboring Romania are not expected either.

<u>During PMF operation</u>

The assessment of the direct impacts during PMF operation is summarized below.

Health risk

Non- radiation impacts

During the PMF operation impacts from conventional factors (noise, vibration, dust, toxic gases) in transboundary aspect on the population of Romania are not expected.

Radiation impacts

In the Investment proposal it is declared that the HEPA filters have efficiency of 99.97 %, and after the scrubber system efficiency of 99.99 % can be assumed, considering the activity captured in the solid products (slag and ash) and liquid products (scrubber water). Taking into account the use of the best protection techniques and consequent use of ALARA principle, the dose rate due to inhalation and absorption is very low.

Subsequently, during the PMF operation impacts from radiation factors in transboundary aspect on the population of Romania are not expected.

Socio-economic impact

Non- radiation impacts

In socio-economic aspect negative non-radiation impacts on the Romanian population could not be expected.

Radiation impacts

The PMF installation in room BK301 of AB-2 is a prerequisite for a smooth operation of the facility in terms of nature preservation.

This argument is also supported by the fact that PMF and AB-2 are located in KNPP CA, which is in reality an "isolated area". The application of the best technologies during PMF operation, as well as the strict keeping of the ALARA principle, is the condition for not allowing any radioactive contamination of the PMF and KNPP sites. The keeping of these conditions gives no reason to expect radiation impacts on the population and the economy during PMF operation in the KNPP 30-km area both in Bulgarian and Romanian territories.

Emissions in the air

Non-radiation impacts

From all operation phases the harmful substances emissions as a result of the plasma and secondary treatment will be most significant. Emissions are also possible during pouring of the mould and cleaning of the facilities. Unorganized emissions will be formed during transportation of waste and the containers with vitrified waste. One organized source of harmful substances emissions will operate during the period of PMF operation. The PMF cleaning gases will be released through a 150 m stack. Non-radiation impacts during PMF operation are not expected including on Romanian territory.

Radiation impacts

The radionuclides in the air are generated mainly in the process of treatment and transfer and are emitted through the System for purification of flue gases. The flue gases are released through VS-2 (stack height 150 m [9]) together with the gases from KNPP Units 3 and 4 and gases from the AB-2 ventilation system. The share of the PMF flue gases in the overall release from the tube is 0.17 % [9] and the total released activity is 6.03E+6 Bq/year, corresponding to 1.25°Bq/Nm^3 [8]. Radiation impacts during the PMF operation are not expected including on Romanian territory.

Emissions in waters

Non-radiation impacts

The PMF is planned to use industrial and potable water; the sources are the ones existing at the moment, according to the issued water use permits. The PMF cooling system operates in "closed circles" and the water consumption is limited to the amount of the possible leaks and is expected to be around 2 m^3 per year. It can be concluded that the quantities of industrial and potable water used are within the permitted limits.

Based on the planned PMF technology, the generated waste waters, which are around 2510 m^3 per year, include the technological water for the scrubber and the cooling water for the facility. These industrial waters are expected to be insignificantly polluted with chemicals.

Radiation impacts

The activity of the waste water is expected to be the same as the minimal detectable activity (MDA) 1 Bq/l. Given the fact that the annual quantity is 400 m^3, the quantity released in the KNPP purification system is 400 Bq/year [9].

Considering the treatment of blow-down water from the scrubber and the water from the cooling module in the KNPP system for purification of waste waters, the activity released in the Danube is much lower than 400 Bq/year, meaning it is insignificant.

Impacts from physical factors

Non-radiation impacts

During the process of operation of the PMF the generation of the following types of waste is expected: Production waste, Hazardous waste, and Domestic waste. This waste will be properly treated according the approved procedures, consequently no impact from conventional waste generation is expected including in transboundary aspect.

Radiation impacts

The radiation exposure of the operation personnel is described in detail and calculated in the ISAR [8]. Considering the use of the best protection techniques and the continuous application of the ALARA principle the dose rate from inhalation and swallowing is very low.

The total CED for the operation and the maintenance personnel based on the radiation background in AB-2 is calculated as a forecast to be 18.964 mSv/year. The individual dose rate varies as follows:

- Operational warehouse activities (2 operators) - 4.1 mSv/year;
- PMF operation (9 operators) - 0.6 mSv/year;
- PMF technical maintenance (2 operators) - 2.4 mSv/year.

Heat emissions

The heat emissions from the cooling system can be roughly calculated based on the need for cooling at 785 kW [9]. Based on the effective work time of 4000 h/year the heat emissions from the cooling system are approximately equal to 3000 MWh/year, and they are transferred by cooling water with flow 458400 m^3/year.

RAW generation

The secondary waste from PMF operation and maintenance can be divided in PMF operational waste and abrasive materials and components. The balance requires that secondary waste: dust, electrodes, bag filters and other waste (gloves, shoes, and foil) are recycled as incoming waste to the PMF. In other words, the radionuclides from this waste are finally immobilized in the plasma treatment mould. It is important to know what happens to the secondary waste which does not return as incoming to the PMF. This waste includes:

Waste water from the scrubber

Annual quantity of 400 m^3 with a total activity of 400 Bq conservatively accounts for < 10 m^3 evaporator concentrate. Even in case of cementing of the end product this quantity is negligible.

PTC refractory materials

The annual quantity is 4 tons. The specific activity of the most highly exposed lower elements with quantity of 2 t is with activity equal to that of the incoming waste, the lower elements with quantity of 2 t are with activity equal to 10 % of the activity of the incoming waste. Total average activity of this waste is calculated as 1.13E+9 Bq annually.

Soils and earth bowels

Soils

Non-radiation impacts

According to the PMF requirements the maximal limits of chemical releases should correspond to the current regulations, including the cases of possible emergencies. The IP analysis shows that PMF operation will comply with all the requirements of the Bulgarian and European legislation. Therefore, the PMF will not cause any impact on the soils during normal operation. Even in cases of possible impact on the soils, it is expected to be within the admissible limits. During the period of normal PMF operation negative non-radiation impacts on the soils in the KNPP 30-km area, including the Romanian part is not expected.

Radiation impacts

During the period of normal PMF operation negative radiation impacts on the soils in the KNPP 30-km area, including the Romanian part is not expected.

Earth bowels

Non-radiation impacts

Considering that the IP will be implemented on the second floor of the AB-2 existing building, non-radiation impact on the earth bowels during normal operation is not expected including in transboundary aspect.

Radiation impacts

The normal PMF operation is not expected to cause any radiation contamination of the earth bowels at KNPP and around it.

Landscape

Non-radiation impacts

Non-radiation impact on the landscapes at KNPP and around it during PMF operation is not expected. Non-radiation impact on the landscapes in neighboring Romania is not expected either.

Radiation impacts

Radiation impacts on the landscape components and the nature complexes in the KNPP 30-km area and in neighboring Romania are not expected either.

Flora

Non-radiation and radiation impact on the flora during PMF normal operation is not expected within the KNPP 30-km area and in neighboring Romania are not expected either.

Fauna

Negative impact on the fauna during PMF normal operation is not expected within the KNPP 30-km area and in neighboring Romania are not expected either.

Protected territories and protected areas

During the period of normal PMF operation negative impacts on the PT and PA are not expected including on Romanian territory.

Cultural heritage

When the normal technological regime of the PMF is observed, negative impacts on the cultural heritage in Kozloduy municipality and in the KNPP 30-km area are not expected including on Romanian territory.

During PMF decommissioning

The main assessment of the direct impacts is based on the descriptions in the PMF Decommissioning concept [14], the amounts of materials, their approximate estimation considering the flow of incoming waste, the decontamination measures during operation and maintenance.

Health risk

Non-radiation factors

During the period of PMF decommissioning transboundary impact by conventional physical factors is not expected.

Radiation factors

During the period of PMF decommissioning transboundary impact by radiation physical factors is not expected.

Socio-economic impact

Non-radiation impacts

Negative non-radiation impacts on the population in the Bulgarian part of the KNPP 30-km area in socio-economic aspect during PMF decommissioning are not expected.

Negative non-radiation impacts on the population and the economy in the Romanian part of the KNPP 30-km area in socio-economic aspect during PMF decommissioning are not expected either.

Radiation impacts

If the planned measures related to the safety of the personnel and the population and the preventing of contamination of the components of the environment are observed, the activities related to the Plan for PMF decommissioning would not lead to radiation contamination. Therefore, radiation impacts related to the socio-economic status of the population and the economy both in the Bulgarian and Romanian parts of the KNPP 30-km area should not be expected.

Emissions in the air

Non-radiation impacts

During the decommissioning period no conventional pollutants will be generated by the operation of the Plasma Melting Facility, because its activity will be terminated.

Non-controlled gas emissions of the welding works are expected to be generated by applying thermal cutting methods. These emissions will not impact the quality of the atmosphere air in the region and they are matter of significance only in view of the occupational hygiene.

Radiation impacts

During the decommissioning activities the ventilation system of AB-2 with HEPA filter will operate. Expected emissions are minor and negligibly low, therefore impact on KNPP site and neighboring territory including in transboundary aspect is not expected.

Emissions in the water

Non-radiation impacts

During the decommissioning process it is expected that the impact on the surfaces and waters will be reduced. It will have attenuation effect and will finally result positively in the indicators of chemical condition and total environmental condition of the water body into which the sewage waters from Kozloduy NPP are discharged, i.e. the Danube River. These impacts are direct, negative, temporary and reversible. They will disappear after completion of the decommissioning.

Radiation impacts

During the operation of the PMF no application of wet decontamination method will be applied. Some small quantities of low active water may be discharged from the cooling during the activities of mechanical cutting.

Another emission source of radionuclides into the water is the scrubber water with a concentration of radionuclides <1 Bq/l. These waters pursuant to the foreseen technology are discharged in the specialized sewage system of NPP and are treated by evaporation.

Therefore, during the decommissioning, no emissions are expected in the waters including in transboundary aspect.

Impacts from physical factors

Non-radiation impacts

The transport traffic across the settlements will not be increased and the unorganized noise emissions from it will not be increased either. The dismantling site will not be an organized source of noise, because the activities will be performed in the room. The dust impacts from the transport traffic will not be increased. Non-radiation impact in transboundary aspect is not expected.

Radiation impacts

The dose rate during the entire decommissioning process is 17 mSv. This is an average value and shows the range of this magnitude.

Waste generation

Table 11.5.7-1 below presents the quantities and types of materials from the material balance based on the data from ISAR [8].

Table 11.5.7-1 Quantities and types of materials during PMF decommissioning

Type of material	For free release[kg]	RAW [kg]
Metal materials	171097	32115
Concrete	148100	16400
Cables	3164	330
For pressing	1992	
Total	**324353**	**48845**

Additionally, secondary waste will be generated from the decommissioning activities, such as dust and ash from cleaning activities, metal particle from activity for cutting and technological waste (e.g.-safety clothes, plastic foil etc.)

Soils and earth bowels

Soils

Non-radiation impacts

The possible non-radiation impacts are expected to be related to the work hygiene only. Temporary emissions of gases from welding and from transport vehicles may be generated. Impacts on the soils and the lands around the plant, including Romanian territories, are not expected.

Radiation impacts

The emissions of radionuclides in the air and water during decommissioning are expected to be negligible; therefore, contamination of the soils at KNPP site and around it on Bulgarian and Romanian territory is not expected.

Earth bowels

Non-radiation impacts

Negative impact on earth bowels by non-radiation factors during decommissioning is not expected if the Program for decommissioning and the radiation protection procedures are strictly followed.

Radiation impacts

Impact on the geological environment and the earth bowels during decommissioning is not expected if the Program for decommissioning and the radiation protection procedures are strictly followed. The possibility for pollution of earth bowels in case of accidents is negligible, due to performing of the activities indoors, including in transboundary aspect.

Landscape

Non-radiation impacts

Negative impacts on the vertical and horizontal landscape structure during decommissioning are not expected. Negative impacts on the nature complexes from neighboring Romanian territories are not expected either.

Radiation impacts

PMF decommissioning is not related with radiation impacts on the landscape and negative impacts on its structure are not expected. Generated RAW during decommissioning and RAW management will be performed in accordance with the regulations; therefore, radiation impact on the landscape components is not expected.

Radiation impacts on the landscapes of neighboring Romania are not expected.

Flora

Potential adverse impacts on the flora during decommissioning activities related to the removal of existing components or systems, decontamination of components, as well as cutting and processing of large parts of equipment and treatment of RAW generated during decommissioning of nuclear facilities according to the regulations regarding the RAW management are not expected on KNPP site and adjacent territory as well as on Romanian territory.

Fauna

Potential adverse impacts on the fauna during decommissioning activities related to the removal of existing components or systems, decontamination of components, as well as cutting and processing of large parts of equipment and treatment of RAW generated during decommissioning of nuclear facilities according to the regulations regarding the RAW management are not expected on KNPP site and adjacent territory as well as on Romanian territory.

Protected territories and protected areas

Negative impacts on the PT and PA in KNPP nearby territories during treatment of RAW generated during decommissioning of nuclear facilities according to the

regulations regarding the RAW management are not expected on KNPP site and adjacent territory as well as on Romanian territory.

Cultural heritage

During the decommissioning activities related to the removal of the existing components or systems, decontamination of components such as cutting and processing of big parts of equipment potential impacts on the cultural and historical heritage are not expected on KNPP site and adjacent territory as well as on Romanian territory.

11.5.8 Cumulative effects in respect of the other projects fulfilled at Kozloduy NPP site

The PMF implementation is an important prerequisite for KNPP Units 1-4 decommissioning, as considered and justified in chapter 2 of the present EIAR.

Therefore, the PMF operation and the decommissioning activities are parallel processes, which will take place over a long period of time, and cumulative impacts are possible.

The most important cumulative impact is related with the radionuclide emissions in the air during PMF operation through the ventilation tube of AB-2 with total quantity of 6 MBq/a. This value is similar to the emissions from the decommissioning activities of KNPP Units 1-4, which are expected to be 20M Bq/a (information of the currently developed EIAR for KNPP Units 1-4 decommissioning).

The expected radionuclide emissions in the water during PMF operation are below 400Bq/year, which is negligibly low compared to the expected emissions from the KNPP Units 1-4 decommissioning activities, namely 120 MBq/year (without tritium).

The emissions of air pollutants and the heat emissions during PMF operation are impacts that are not similar to the decommissioning activities. The heat emissions are negligibly low compared to those from KNPP Units 5-6 operation.

Other important cumulative impacts with the decommissioning activities are the emissions from the transport activities.

Emissions into water

As stated in chapter 4 of this report, the emissions into water by the PMF are negligible and thus the assessment of cumulative effects with other projects is not necessary.

Emissions into air

The only point source for non-radioactive air pollutants is the PMF operation, thus the assessment of cumulative effects with other projects is not necessary (plane sources from transport activities are equal to the local emissions on the KNPP site).

It is extremely important to assess the cumulative effects by emissions of radionuclides into air.

The possible cumulative effects which have to be considered regarding the PMF are emissions of the following other projects on KNPP site:

- Operation of Units 5 + 6;
- Decommissioning of Units 1-4;
- PMF operation;
- Dry Spent Fuel Storage Facility (DSFSF) operation;
- Size Reduction and Decontamination Active Workshop (SRDW);

- And National Disposal Facility for Low and Intermediate Radioactive Waste (NDF).

These projects were assessed under the assumption that all of them are ongoing and the Wet Spent Fuel Storage Facility is empty and out of operation.

The DSFS and the NDF are not point sources for emission of radionuclides into air [51], [52]. According to EWN experience (EWN Environmental Impact Register, presented in chapter 11, attachment 9, Impact on the environment from the SRDW operation), the emissions of the SRDW are very low and considered as emission values of the Decommissioning activities.

During the calculation of the cumulative effect the releases in the air and water from the following activities are considered: KNPP Units 5-6 operation, Units 1-4 decommissioning and the emissions from the Plasma melting facility (PMF).

Input data

In table 11.5.8-1 and below the input data are given based on which the calculations are performed.

Table 11.5.8-1 Annual emissions of radionuclide in air

Emissions source	**Rare noble gases, Bq**	**^{131}I, Bq**	**Aerosols, Bq**	**Source (literature)**
Unit 5	5.5E+11	3.7E+06	4.5E+06	[52]
Unit 6	3.6E+10	7.7E+03	2.7E+05	[52]
Units 1-4			20E+06	[53]
PMF			6E+06	[2]

During normal operation of Units 5&6 KNPP, 2010, the actual emissions in the unbalanced water from EP-1 and EP-2, as per activity and nuclide distribution are:

- Nuclides (except ^{3}H): 289 MBq.
- Tritium (^{3}H): 22.7 TBq.

Mean annual values over the entire period of Units 1-4 decommissioning:

- Nuclides (except ^{3}H): 120 MBq.
- Tritium (^{3}H): 50 GBq.

Modelling of distribution of gaseous and liquid emissions into the environment are presented in the report “Analysis on the dose originating from gas aerosol and liquid releases to the environment from Units 5-6 operation, Units 1-4 decommissioning process and the emissions from the plasma melting facility (PMF) operation, incurred by the public within the 30-km monitored area surrounding Kozloduy NPP” [Chapter

11, Attachment 10]. For calculation of cumulative effect the following computer codes and models are used:

- Modelling programme code, based on the EU approved methodology CREAM (Consequences of Releases to the Environment Assessment Methodology) Radiation Protection 72 –Methodology for Assessing the Radiological Consequences of Routine Releases of Radionuclides to the Environment.
- To assess the public dose due to liquid discharges - program code DARR-CM, as adapted to the hydrology of the KNPP area and used for conservative evaluation of the dose exposure of a critical group of the public.
- To assess the public dose within the supervised area due to gas-aerosol discharges - program code LEDA-CM, Normal Operation Shield, as adapted to the geographical and meteorological characteristics of the KNPP area. The methodology considers both the external and the internal impact of the radioactive releases and estimates the annual individual effective dose, the annual individual dose equivalent, and the critical group dose, as well as the collective dose for the population, per age groups.

The modelling program codes used to estimate the individual and the collective effective doses to be incurred by the population from radioactive discharges to the environment have been verified and validated.

The results of the population dose calculation are presented in tables below.

Table 11.5.8-2 Individual effective doses from liquid and gaseous releases

Description of source	Max dose from gas-aerosol emissions, Sv/a	Max dose from liquid emissions, Sv/a	Max dose, Total, Sv/a
Operation Units 5&6 KNPP	$7.18.10^{-9}$ – $8.02.10^{-7}$	$3.22.10^{-7}$ – $6.00.10^{-7}$	*** $5.03.10^{-6}$
	$8.02.10^{-7}$	*** $4,23.10^{-6}$	
Operation Units 5&6 + Decommissioning Units 1-4	$7.33.10^{-9}$ - $8,04.10^{-7}$	$3.23.10^{-7}$ – $6.01.10^{-7}$	*** $5.04.10^{-6}$
	$8.04.10^{-7}$	*** $4.24.10^{-6}$	
Operation Units 5&6 + Decommissioning Units 1-4 +PMF	$7.36.10^{-9}$ – $8.05.10^{-7}$	$3.23.10^{-7}$ – $6.01.10^{-7}$	*** $5.05.10^{-6}$
	$8.05.10^{-7}$	*** $4.24.10^{-6}$	

****The dose estimates apply to critical groups of the population within the 40-km area around KNPP.*

Table 11.5.8-3 Collective effective dose for population in 40-km area around KNPP

Description of source	Collective dose from gas-aerosol emissions, manSv/a	Collective dose from liquid emissions, manSv/a	Collective dose, Total, manSv/a
Operation Units 5&6 KNPP	$1.47.10^{-2}$	$4.43.10^{-3}$	$1.91.10^{-2}$
Operation Units 5&6 + Decommissioning Units 1-4	$1.48.10^{-2}$	$4.44.10^{-3}$	$1.92.10^{-2}$
Operation Units 5&6 + Decommissioning Units 1-4 +PMF	$1.49.10^{-2}$	$4.44.10^{-3}$	$1.93.10^{-2}$

[1] The used software model allows estimations for a larger area range – 40-km, including the monitored 30- km area.

The dose estimates obtained refer to the population of the Bulgarian side (72416 people, year 2007). Taking into account the population in the respective part of Romania – another 75 150 people, the collective effective dose for the entire area can be approximately doubled. These are data fully comparable with the practice adopted for PWRs worldwide.

The dose distribution map for the population within the 40-km area and as a function of the distance to the emission source are presented on fig. 11.5.8-1 and fig. 11.5.8-2.

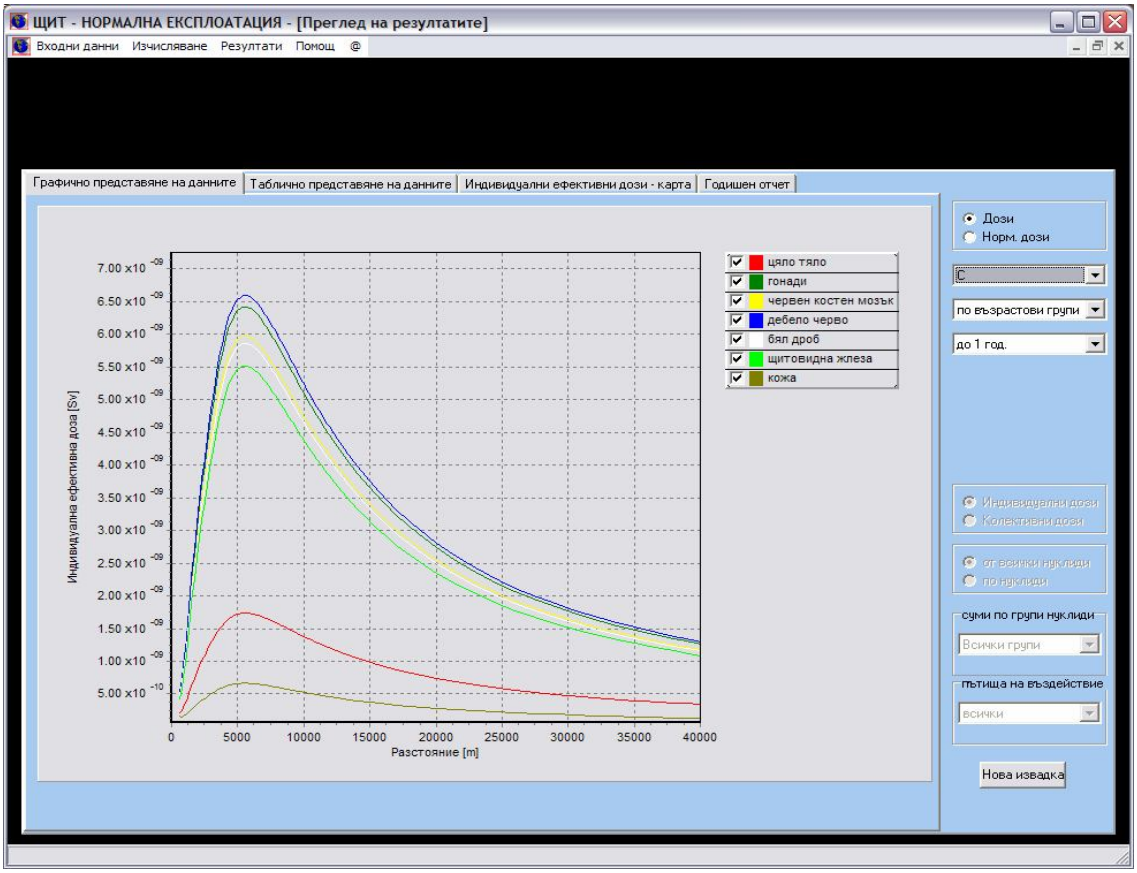

Fig. 11.5.8-1 Individual effective dose as function of the distance to the source

The maximum values of the individual effective dose were calculated within the 5-6 km Kozloduy NPP area.

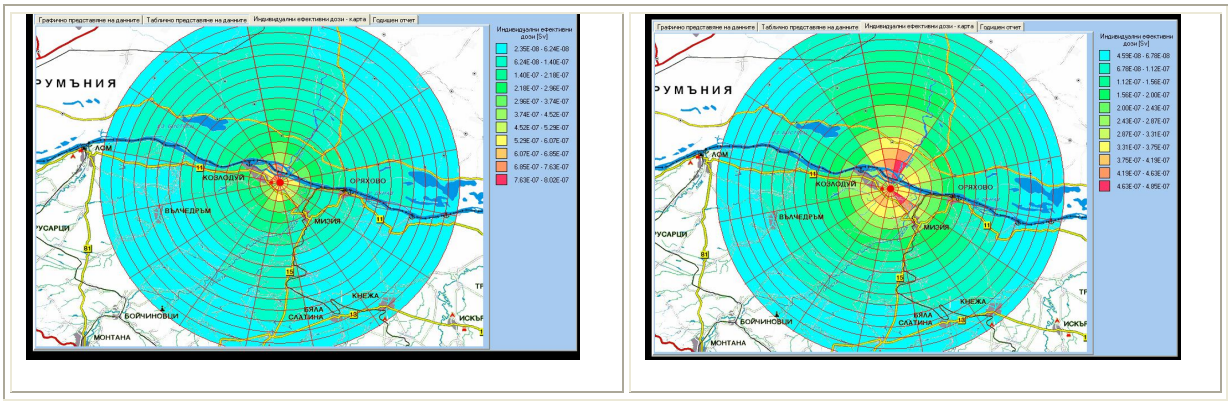

Fig. 11.5.8-2 Distribution of the individual effective dose from external exposure to RNGs, LLAs, ^{131}I + (^{3}H, ^{14}C) within the area of Kozloduy NPP, 2011

a) with meteorological data for 2011 b) with micro climate data for 2001–2011.

The calculation of the cumulative effect and the dose rates for the population performed by the EWN experts and presented in [57] confirm the obtained results.

Conclusions

Based on the performed analysis for population dose during normal operation Units 5&6 Kozloduy NPP, Decommissioning Units 1-4 KNPP and normal operation of the Plasma Melting Facility (Project 5c) the following conclusions can be made:

- The maximum annual effective dose per individual of the critical group of the population living within the 40-km area around KNPP, resulting from the liquid and gas-aerosol releases to the environment, was conservatively calculated at 5.05 μSv/a, which is a much lower value than the quota of 250 μSv/a for exposure from radioactive emissions from NPP (Ordinance on the Assuring of Safety of NPPs) and the norms determined for the population of 1 mSv/a (ONRZ-2012, Basic Norms for Radiation Protection).
- The additional dose that might be incurred is about 500 times lower than natural radiation background (2.33 mSv).
- The calculation of the cumulative effect added to the effect of KNPP normal operation, and due to emissions from the decommissioning of KNPP units 1-4, and the normal operation of the plasma melting facility (PMF), Project 5c) results in a negligible increase of the maximum individual and collective effective doses by 0.5 to 1 %.
- The maximum annual effective dose of the population within the 40-km area around KNPP, and due to aerosol emissions only, 6 MBq under normal operation of the plasma melting facility (PMF), was estimated at

$5{,}47.10^{-10}$ Sv/a, which is barely 0.01°% from the total exposure resulting from all activities on the KNPP site.

- The maximal individual effective dose for the population in the 60-km area from the KNPP releases in 2010 compared to the 2010 state, including all projects at KNPP site, is the same (see table 11.5.8-3). This means that the cumulative effect is negligible.
- The results from the modeling analyses and the EWN experience [57] show that the exposure of the population is very low and is comparable to the natural radiation background. Therefore, the impact from PMF operation is negligible.
- The comparisons of the collective effective dose values for the population around KNPP with the respective data for many other nuclear power plants with PWRs (WWERs) reactor type proved comparable with the practice worldwide.

11.5.9 Measures for mitigation and minimization of the adverse impact on the environment

11.5.9.1 Measures for mitigation and minimization of the adverse impact on the environment indicated by the Designer

Table 11.5.9.1-1 Plan for implementation of the measures indicated by the Designer

No	Description of the measure	Period/Phase	Result
1.	Implementation of the first barrier in the PMF to prevent the release of radioactive contamination into the room air, where the new treatment facility will be located, is the installation itself (feeder, plasma furnace, secondary combustion chamber and flue gas system). The physical boundary of the process flow will be confined within different enclosures, mechanical equipment, confinements and vessels.	Design Commissioning Operation	Occupational health and safety Protection of the occupational and public health Environmental protection
2.	Implementation of the second barrier consisting in the equipment that houses radioactive waste is under a controlled under-pressure by means of the extraction fans. Under-pressure conditions will be imposed in all operating conditions. Furthermore, all the existing gases will be routed to the KNPP ventilation stack- 2 (VS-2) of AB-2 through different filtering and cleaning stages (existing and new).	Design Commissioning Operation	Occupational health and safety Environmental protection
3.	Implementation of the third barrier to an unlikely hypothetical radioactive release of the PMF - the building itself where sub-atmospheric conditions are required during operating conditions. Even though the building is not a leak tight confinement building, the	Design Commissioning Operation	Occupational health and safety by minimization of the residual contamination in the internals of the equipment, reducing the risk of spread of contamination and the operator dose.

No	Description of the measure	Period/Phase	Result
	existing ventilation system guarantees sub-atmospheric conditions from the external area and the suctioning of possible indoor contamination through HEPA filters before being released through the ventilation stack - 2 to the environment.		Protection of the occupational and public health Environmental protection
4.	Technological measure, consisting in a stable matrix of the cold slag constitutes an inherent barrier to radionuclide dispersion from RAW. Once cooled down in the Slag Collection Chamber (SCC), the RAW material becomes a solid metallic-like matrix. This solid material serves as an intrinsic physical barrier against dispersion of radionuclide from the RAW.	Design Commissioning Operation	Occupational health and safety Protection of the occupational and public health Environmental protection
5.	Establishing of Instruction for periodical cleaning where maintenance activities are carried out, preventing the accumulation of contamination along the entire operation stage.	Design Commissioning Operation	Occupational health and safety Protection of the occupational and public health Environmental protection
6.	The periodical cleaning of the respective components inside the PMF to be carried out by special adapted vacuum cleaner aiming to minimize the spread of contamination. It will be used to clean the refractory concrete of the PTC when repaired, the insides of the STC, the boiler, the bag house, the HEPA-filters, confinement of ash collection chamber, etc. and also the surroundings during and after	Commissioning Operation	Occupational health and safety Protection of the occupational health

No	Description of the measure	Period/Phase	Result
	maintenance activities.		
7.	Before a planned shutdown of the PMF, the last waste batch fed to the system can be very low contaminated. By this procedure the residual radiation into the different components is reduced and in fact is "flushed out" and decontaminated.	Operation	These activities will minimize the residual contamination in the internals of the equipment, reducing the risk of spread of contamination and the personnel doses.
8.	In any case, for manholes or covers, which have to be opened for maintenance or inspection and are considered critical in terms of potential spread of contamination, temporary confinements should be mounted consisting of aluminum frames and plastic foils to be installed (e.g. on top of PTC for refractory replacement).	Construction Operation	Occupational health and safety by minimization of the residual contamination in the internals of the equipment, reducing the risk of spread of contamination and the operator doses.
9.	Maintenance or inspection at confinements is normally executed with extra protective clothing and wearing of masks in order to protect operators or maintenance people from contamination. The suspected contaminated plastic foils from maintenance activities can be treated in the PMF.	Operation	Occupational health and safety by minimization of the residual contamination in the internals of the equipment, reducing the risk of spread of contamination and the operator doses.
10.	The operators and the radiation protection agent to perform regularly control on the contamination around the plant equipment to detect occurring contamination at an early stage. Thoroughly cleaning is prevented the spread of contamination due to immediate decontamination work.	Operation	Occupational health and safety by minimization of the residual contamination in the internals of the equipment, reducing the risk of spread of contamination and the operator doses.
11.	Efficient performance of the programs required by the standards in force in relation to	Design, Operation Decommissioning	Protection of the human health and of the environment

No	Description of the measure	Period/Phase	Result
	Radiological Protection.		
12.	Maintain and update of the above mentioned documents, which are directly related with the provision of radiation protection at the respective facility.	Design, Operation Decommissioning	Protection of the human health and of the environment
13.	The off gas treatment system to achieve emission values under the below listed thresholds: Total dust – 1 mg/m^3; CO-5 mg/m^3; TOC- 1mg/m^3; HCl – 1 mg/m^3; HF-1 mg/m^3; SO_2-5 mg/m^3; NOx – 100 mg/m^3; Heavy metals: Sum of Cd and Tl – 0.005 mg/m^3; Hg-0.005 mg/m^3; Sum of Sb, As, Pb, Cr, Cu, Mn, Ni, V, Sn- 0.05 mg/m^3; Dioxins and Furans - 0.01 ng/Nm^3.	Design, Operation	Protection of the atmospheric air, the soils, the vegetation and the human health against pollution
14.	Introduction of Continuous Emissions Monitoring (CEM) of the off-gas emissions.	Design, Operation	Protection of the atmospheric air, the soils, the vegetation and the human health against pollution.
15.	The wastewater discharge system of the facility to be insulated in order to prevent potential interaction with the groundwater.	Design, Operation	Protection of the surface and groundwater against contamination.
16.	Observance of the best practices in the technological process and maintenance in normal operational conditions of the PMF.	Design, Operation	Protection of the human health and of the environment.

11.5.9.2 Measures for mitigation and minimization of the adverse impact on the environment indicated by the EIA experts – authors of the EIAR

The measures given in table 11.5.9.2-1 encompass all phases of the Investment Proposal implementation and are compliant with the provisions of Appendix 2a to art.14 (1), item 5 of the EIA Regulation (title amended SG3/2006) prom. SG 25/2003, amended SG 3/2006, SG80/2009, SG29/2010, last amended SG 94/30.11.2012, effective 30.11.2012. The measures are in compliance with the regulatory frame concerning RAW including the Regulation on radiation protection during activity with sources of ionizing radiation (SIR).

Table 11.5.9.2-1 Plan for implementation of the measures indicated by the EIA experts - authors of the EIAR

No	Description of the measure	Period/Phase	Result
1.	Establishment, maintenance and regular update of Instructions for radiation protection of the facility; Internal emergency plan for the facility, including measures for fire, explosion and accident protection.	Design Operation Decommissioning	Provide radiation protection for the respective facility. Protection of the human health and the environmental components
2.	Establishment, maintenance and regular update of Internal regulations and/or procedures for receiving, storage, return and accounting of sources of ionizing radiation at the facility.	Design Operation Decommissioning	Provide radiation protection for the respective facility. Protection of the human health and the environmental components
3.	Establishment, maintenance and regular update of Internal rules and procedures for collection, sorting, processing, handing over, storage and accounting of the generated radioactive waste at the facility.	Design Operation Decommissioning and closure	Occupational health and safety
4.	Establishment, maintenance and regular update of Internal regulations and/or procedures for using individual means of radiation protection of the personnel and for maintaining of personal hygiene from the point of view of radiation safety.	Design Operation Decommissioning and closure	Occupational health and safety

No	Description of the measure	Period/Phase	Result
5.	Establishment, maintenance and regular update of Internal regulations and/or procedures for radiation control at the facility and for individual occupational dose control of the personnel and program for radiation control in the radiation protected area and the monitored area around the facility.	Design Operation Decommissioning and closure	Protection of the human health and the environmental components
6.	Establishment, maintenance and regular update of Orders, appointing the persons responsible for the radiation protection at the facility; the persons responsible for receiving, handling, storing, accounting and controlling the sources of ionizing radiation at the facility; the persons responsible for notification in case of incidents and accidents with sources of ionizing radiation; the executives and the radiation protection operators at the facility, as well as the persons, authorized to work with sources of ionizing radiation at the facility.	Operation Decommissioning and closure	Protection of the human health and the environmental components
7.	Establishment, maintenance and regular update of Internal regulations and procedures for the way of giving the right for individual work with sources of ionizing radiation, holding of initial, routine current and periodical training and checks of the knowledge and skills of the personnel.	Operation Decommissioning and closure	Protection of the human health and the environmental components
8.	Establishment, maintenance and regular update of Job	Operation Decommissioning and closure	Protection of the human health and the environmental

No	Description of the measure	Period/Phase	Result
	descriptions of the personnel in their sections, related to activities with sources of ionizing radiation.		components
9.	Establishment, maintenance and regular update of Rules for authorization and provision of radiation protection of outside teams summoned for the liquidation and limitation of the consequences of an accident that has occurred at the facility.	Operation Decommissioning and closure	Environmental and human health protection
10.	Classification of the work places and of the radiological areas in the PMF, strict control on the personnel access in there.	Operation Decommissioning and closure	Minimization of the occupational health risk
11.	Performance of regular individual dosimetric control of the PMF operational staff and of the maintenance staff in compliance with Regulation 32/7.11.2005.	Operation Decommissioning and closure	Minimization of the occupational health risk
12.	Performance of regular radiation control of the ambient air in the PMF premises and facilities.	Operation Decommissioning and closure	Minimization of the occupational health risk
13.	To wear protective cloths and gloves in the PMF controlled areas.	Operation Decommissioning and closure	Minimization of the occupational health risk
14.	When work is performed in areas with probability of air active contamination or not captured surface contamination the use of protective means for the respiratory system is imperative.	Operation Decommissioning and closure	Minimization of the occupational health risk
15.	During the outages for cleaning, prophylactic, calibration, decontamination or repair of the PMF – to wear protective cloths and breathing mask.	Operation Decommissioning and closure	Minimization of the occupational health risk

No	Description of the measure	Period/Phase	Result
16.	Monitoring of the occupational health of the operation and maintenance staff in accordance with the national statutory requirements and KNPP rules.	Operation Decommissioning and closure	Minimization of the occupational health risk
17.	Execution of all medical prophylactic measures, prescribed by KNPP for the staff working in area class A.	Operation Decommissioning and closure	Minimization of the occupational health risk
18.	Optimization of the facility operation and special attention to $DeNO_X$ system operation, respective observation of the NOx releases.	Operation	Mitigation of the NOx average daily emissions on a value of less than 100 mg/m^3
19.	At the outlet of the off-gas cleaning system Continuous Emissions Monitoring (CEM) equipment will be installed to verify that all exit gases are within the proper ranges. That means off-gas effluents will be measured before the exhaust point to assure that the limits and recommendation of the EC document are fulfilled.	Design Construction Operation	Minimization of the public health risk. Environmental protection
20.	Continuation of the Continuous Emissions Monitoring (CEM) of the active releases through the ventilation stack of AB-2.	Operation	Minimization of the public health risk.
21.	Update of the Emergency Preparedness Plan with the incorporation of the PMF facility.	Operation Decommissioning and closure	Minimization of the public health risk.
22.	Prevention activities related to the public disclosure for the occurrence of incidents and accidents.	Operation Decommissioning and closure	Minimization of the public health risk
23.	Maintenance and continuous update of all operational documentation – instruction, ordinances, reports, etc.	Operation	Optimum operating conditions to avoid accidents or malfunction and

No	Description of the measure	Period/Phase	Result
			releases of emissions in the atmosphere
24.	Maintenance of the components of the off-gas cleaning system in good condition for reaching the best effect of its functioning.	Design Construction Operation Decommissioning and closure	Minimization of the public health risk Environmental protection
25.	To guarantee that during normal operation, expected operational states and DBA in the facility, the dose limits established in art. 9, items 1 and 2, as well as 3 – for the period after closure of the facility, will not be exceeded, according to the Regulation for safety during RAW management. Sensors should be installed to provide on-line control of the gamma radiation background.	Design Operation Decommissioning and closure	Minimization of the occupational health risk Environmental protection
26.	Program for in-house radiological monitoring should be developed and observed, as a part of the general Program for radiological monitoring of the plant site.	Design Construction Operation Decommissioning and closure	Minimization of the occupational health risk Environmental protection
27.	All chamber interfaces to be flanged sealing surfaces to prevent leaks in or out of the furnace. The system to operate under negative pressure to prevent leakage into the cell.	Design Construction Operation	Surface and ground water protection against contamination
28.	In order to prevent the spillage of hazardous liquids spillway trays (containments) to be placed below the tanks. In case of spillage the liquid to be retained in the spillway tray until treatment by the proper means according to its radioactivity status.	Design Construction Operation	Surface and ground water protection against contamination Minimization of the consequences in case of accidents
29.	Reconstruction or construction of drainage. All the drains will be collected in a vessel to be processed properly afterwards in	Design Construction Operation	Surface and ground water protection against contamination

No	Description of the measure	Period/Phase	Result
	accordance with their radioactivity.		Minimizations of the consequences in case of accidents
30.	Introduction of special operation instructions aiming the strict observation of the PMF process mode.	Operation	Continuous control on the whole facility functioning to prevent leaks
31.	Regular control and appropriate maintenance of the active drainage pipeline in order to prevent potential leakages and radioactive contamination.	Operation	Surface and ground water protection against radioactive contamination
32.	Establishment of soils monitoring plan – 6 and 12 months upon commissioning of the PMF. Definition of the radionuclide content in the layer 0-2 cm, 2-5 cm and 5-10 cm.	Design Operation	Soils and biodiversity protection
33.	Regular monitoring in accordance with KNPP plan for soil monitoring in the 36 monitoring stations.	Operation	Soils protection
34.	Observance of the best practices in decommissioning of such facilities.	Decommissioning	Biodiversity protection
35.	Continue with the established at KNPP practice for management of the hazardous chemical substances incorporating the substances necessary for the PMF operation.	Construction Operation	Environmentally friendly waste management and minimization of the health risk
36.	Handing over the non-radioactive waste to companies holding the license under art. 12 of the WMA on contractual basis.	Operation	Environmentally friendly waste management and minimization of the health risk
37.	Update of the KNPP Waste Management Program and approval by RIEW.	Operation	Environmentally friendly waste management and minimization of the health risk
38.	Elaboration of RAW management procedures in dependence of the type, mode of generation and further	Operation Decommissioning and closure	Environmentally friendly waste management and minimization of the

No	Description of the measure	Period/Phase	Result
	treatment.		health risk
39.	Maintenance of the accounting documents and waste flow tracking data base (part of DEMANS) on the incoming quantities, quantities of temporary storied and treated wastes on the PMF territory as well as the wastes handed over for further treatment.	Operation Decommissioning and closure	Environmentally friendly waste management and minimization of the health risk
40.	Elaboration of a Design project for PMF decommissioning. Part of this project shall be the procedures for waste activity determination in view of further treatment.	Decommissioning and closure	Environmentally friendly waste management and minimization of the health risk
41.	Ban on use of materials containing priority substances in the building of structures, engineering facilities, etc., when contact with groundwater is made or could occur.	Design Construction	Drinking water protection
42.	Control over compliance with the conditions of permits for water use.	Construction Operation	Drinking water protection, regulation of water abstractions
43.	Control over compliance with the conditions of permits for discharges of wastewater generated.	Construction Operation	Protection of surface and groundwater against pollution.
44.	Control over compliance with prohibitions against direct discharge of water containing hazardous and noxious substances in the protection zones of groundwater.	Construction Operation	Drinking water protection
45.	Optimizing water use for industrial purposes by introducing rotations.	Construction Operation	Protection of the water resources
46.	Control on prohibitions on disposal of priority substances that can lead to an indirect discharge into groundwater.	Construction Operation	Protection of groundwater against pollution.

No	Description of the measure	Period/Phase	Result
47.	Control of industrial areas for industrial and hazardous waste.	Construction Operation	Protection of surface and groundwater against pollution.
48.	Compliance with the Regulation for the assessment of environmental impact during construction and technologies those are likely to affect the quantity and / or quality of drinking water.	Construction Operation	Drinking water protection
49.	Construction waste will be managed in accordance with the Regulation on management of construction waste and use of recycled building materials (prom. SG 89/13.11.2012)	Construction Operation	Environmentally friendly waste management
50.	Implementation of the WML requirements for separate collection of packaging waste, according to art. 33, par. 4 from WML.	Construction Operation	Environmentally friendly waste management
51.	Ferrous and non-ferrous metals to be submitted for further treatment to companies holding a permit under Art. 67 WML.	Construction Operation	Environmentally friendly waste management
52.	Updating the record books for the waste in accordance with Ordinance 2/2013 on the procedures and forms for providing information on waste management activities and procedures for the conduct of public records (prom. SG 10 from 05.02.2013).	Construction Operation Decommissioning	Environmentally friendly waste management
53.	In case of shortage of capacity of existing warehouses for temporary storage of waste to build a site for temporary storage of waste prior to their submission for utilization, including recycling.	Construction Operation Decommissioning	Environmentally friendly waste management
54.	Establish procedures for the management of radioactive waste, depending on the type, method of generation and	Operation Decommissioning and closure	Environmentally friendly waste management and minimization of the

No	Description of the measure	Period/Phase	Result
	subsequent treatment.		health risk
55.	Maintenance of the accounting documents and waste flow tracking data base (part of DEMANS) on the incoming quantities, quantities of temporary storied and treated wastes on the PMF territory as well as the wastes handed over for further treatment.	Operation Decommissioning and closure	Environmentally friendly waste management and minimization of the health risk
56.	Elaboration of a Design project for PMF decommissioning and closure. Part of this project shall be the procedures for waste activity determination in view of further treatment.	Decommissioning and closure	Environmentally friendly waste management and minimization of the health risk

11.5.10 Requirements of the Romanian Ministry of Environment and Forest

In the tables below the requirements, their fulfillment in the respective EIA Report chapter and comments are listed.

A. Environmental aspects to be assessed in the EIAR for the PMF (Romanian requirements)

Table 11.5.10-1 Requirements of the Romanian Ministry of Environment and Forest

Aspect	Chapter of the EIAR	Comment
1. The types of solid waste to be treated in PMF, the volume, the flows that generated them and the radiological characteristics; please specify if in the PMF there will be treated only Bulgarian waste or third parties waste as well?	Chapter 1, section 1.2	Only Bulgarian RAW will be treated there. The processed RAW shall be in one of the three forms stored on site: non-compacted, pre-compacted and super - compacted.
2. The predicted life time of the PMF installation, the dismantling time of installation and the way of treating the waste which result from dismantling the installation.	Chapter 1, section 1.2	The predicted life time is at least 40 years without replacement of its main components for the first 20 years.
3. The legal limits for the radioactive effluents which are discharged in environment (surface/underground waters, in air; etc, and the monitoring method of these effluents).	Chapter 1, section 1.2 Chapters 4.1 and 4.3	Liquid and gaseous radioactive waste is managed as per the provisions of the Regulation on radioactive waste management safety. The Investment proposal provides for a system for continuous monitoring of gaseous effluents before transmitting them to the ventilation tube of AB-2.
4. Specify the annual processing capacity considering that from mathematical calculations result a value which is different from the capacity of 250 tons/year mentioned in the Notification.	Chapter 1, section 1.2	The annual capacity is commensurate to 40 weeks of operation/year (4000h/year). The nominal capacity is 65kg/h including the time for slag pouring.

5. During the treatment process you are using other substances as well, (e.g. ammonium, nitrogen), please, specify the storage capacity of such substances on the facility site.	Chapter 1.2	Nitrogen - 120m^3/h; supplied from 10m^3 receiver (10 bars pressure); Ammonia – 14kg/h maximum consumption; the nominal annual consumption is expected to be 28 000 kg/year; supplied from a tank of a volume of 0.5°m^3
6. We kindly request the following data related to the water used in technological process: a). Complete information about cooling water e.g.: the source of cooling water, the cycle provided (closed/opened), the way of discharging, the temperatures characteristics and other pollution indicators if the cooling water will be discharged in surface water; b). Complete information about the characteristics of the water used in the process as a wastewater e.g.: the source of supply (potable water/surface water/technological water with special treatment etc), the place of discharge, the values of the pollution indicators expressed in concentration-mg/I and total annual loading -kg/y of pollutant. c) The operating way of the PMF installation (continuously or discontinuously) considering the different data mentioned (nominal flow of 0.625 m/h leads to 15 cm/day and 5475 cm^3/year of water consumption), while the water consumption mentioned in the Notification is 2500 cm/year.	Chapter 1.2 Chapter 1.2 Chapter 1.2	The water consumption is related to the above mentioned operation time of 4000 h/year
7. Considering the existing natural protected areas ROSCI0045 Coridorul Jiului and ROSPA0023 Confluenta Jiu	Chapter 3, 4, 11.5 and CAR	

Dunare please specify the sensitive areas which could be affected by the pollution.		
8. Please specify the European legislation that regulates the radioactive waste treatment and which will be used in the project.		EIA Directive, Bulgarian Regulations [4], [5] and [33] conforming to EU legislation; Directive 2011/70/EURATOM [50], the transposition date for the Member States is August 2013, but the first proposal was issued 2007.
9. Please specify if the PMF is an incineration plant considering the definition of the incineration plant (equipment or technical unit fixed or mobile designed for thermal treatment of the waste with or without recovering the heat; thermal treatment means incineration by oxidation or other thermal treatment procedure e.g. pyrolysis, gasification or plasma processes.	Chapter 1, section 1.2	The burnable waste is treated with a pyrolysis process in a plasma arc in the Primary treatment chamber and the incineration of the pyrolysis products in Secondary treatment chamber is made. Not unburnable waste is processed by melting in a plasma arc.
10. Explain why under the chapter "Results" (pag.7) and chapter "Additional Information/ Comments"(pag.10) of the Notification it is mentioned the Directive nr.76/2000/CE for waste incineration, considering that in this Directive, under art. 2, the radioactive wastes are excluded	Section 11.3	
11. Please specify what "almost fully" means, within the statement from the chapter "Results"(page. 8) "*the rest amount of the radioactivity together with the fly ash from the flue gas are caught almost fully in the .filter,* What is the percentage of radioactivity released?	Chapter 4	The assumed radioactivity of incoming waste per year is 1.34E+11 Bq, the annual emission of radioactivity is 6E+6 Bq [1]; thus 0.0045 % of the incoming radioactivity are released.

12. We kindly request to assess the radiological impact on environment and human health within a radius of 30 km from the PMF installation, considering the importance of this issue in taking the decisions, and also considering that population on the Romanian territory in area of influence of the PMF is around 23 communities.	Chapters 3 and 4	Additional modeling for cumulative impact has been done, presented in chapter 11, attachment 10 of EIAR, the conclusions from which are the basis for the estimates presented in EIAR chapters 3 and 4.
13. Please include in the EIA Report an analysis of dispersion of all types of pollutants emitted within a radius of 30 km around the plant, considering all possible impacts on environmental and human health of the pollution resulted from the treatment process.	Chapter 4	Additional modeling for cumulative impact has been done, presented in chapter 11, attachment 10 of EIAR, the conclusions from which are the basis for the estimates presented in EIAR chapters 3 and 4.
14. Please assess the cumulative impact (radioactive and non-radioactive) of all 3 projects developed in Kozloduy area (PMF, dismantling of NPP and the nuclear deposit) because of a likely cumulative transboundary impact on Romania: a) Considering the dismantling period of time -2011 -2035 mentioned in the Notification for the project "Dismantling of Units 1-4 of Kozloduy NPP" please present a timetable of the development of all 3 projects, specifying the construction period of time, the normal operation period of time, the dismantling period and recovery of the site period. We are very much interested what the cumulative impact of all 3 projects is in the overlapping periods.	Chapters 4.1.8 and 11.5	Additional modeling for cumulative impact has been done, presented in chapter 11, attachment 10 of EIAR, the conclusions from which are the basis for the estimates presented in EIAR chapters 3 and 4.

b) Specify in detail the sources of pollution, an estimation of the radioactive and non-radioactive emissions; the impact on environmental and human health in Romania, the legal requests for monitoring of the pollution, the constructive and management measures proposed in order to reduce the Cumulative impact of pollution on environment and human health in Romania. c) Specify the additional measures to be implemented in case of identification of a cumulative and synergistic effect.	Chapter 4.1.5, 4.3, 4.4, 4.5, 11.5 Chapter 6.3 Chapter 6 Chapter 6	

B. Assessment of sensitive environmental aspects related to the Plasma technology

Table 11.5.10-2 Assessment of sensitive environmental aspects related to the Plasma technology

Aspect	Chapter of the EIAR	Comment
1. The problem of radioactivity concentration in the resulted slag is claimed attention and special treatment on how the waste slag will be conditioned so that packages can be interim stored in a safe manner on-site KNPP, including specifying how the conditioning of such packages will be done in order to meet the wastes acceptance criteria, WAC, associated to the Low and Intermediate level Wastes Final Repository which is expected to be built nearby Kozloduy NPP site.	Chapter 1, 2 and 11.3	The main advantage of the PMF process is the immobilization of radioactivity in the slag. Conditioning (besides packaging) for final storage is not necessary. See [20] (experience from the ZWILAG Plasma Facility)
2. The problem of qualitative and quantitative emission limits authorized for	Chapter 11.3	The emission limits of non - radioactive air pollutants are given in the appropriate EU

chemicals: further details are needed regarding the alignment of Bulgarian regulations associated to emission limits allowed for toxic and hazardous chemicals (as stated by the Bulgarian side in the notification), in terms qualitatively and quantitatively, with European legislation and regulatory requirements equivalent in Romania.		Directive and the transposed Bulgarian Ordinance [48].
3. The problem of accident and hazard analyses: a special attention has to be pay to risk analysis (e.g. HAZOP) and chose of postulated accident (design basis accident) that have to quantify all possible scenarios associated with fire and explosion hazard, with nearby human activities, including the associated common cause events (e.g. earthquake, flooding), given that the PMF installation processes metallic materials melt at high temperatures, which might change the risk level from radioactive hazard to industrial hazard or both, in some accident conditions, which can significantly affect the environment over considerable distances.	Chapter 4.1.3	These types of accidents are assessed and analyzed in the Intermediate Safety Analysis Report. This report is reviewed and approved by Bulgarian Nuclear Regulatory Agency (BNRA).
4. The problem of technical specifications for operation and degradation management measures: it must be rigorously and systematically address a set of technical specifications related to operation of that objective, including the development of specific programs for aging management for relevant systems, structures and components, taking into	Chapter 1.2	This documentation is part of the Licensing Package that must be submitted to the Bulgarian Nuclear Regulatory Agency (BNRA) and approved by them before issuing the License for operation. The aging processes are considered in the facility design.

account the terms source, the characteristics of the technological process, the extended lifetime of the PMF installation, the ultimate heat sink, the safety design criteria and the possible negative environmental impact on large areas, in case of failures or accidents resulting from the neglect of these issues.		
5. From the point of view of the environmental impact, incineration of radioactive waste is regarded as a method with a higher environmental impact than other volume reducing methods (such as super-compaction, for example.), because it can lead to emission of radioactive and non-radioactive pollutants. Therefore, we kindly request the future documentation to detail the characteristics of the waste to be incinerated, in terms of volume: source and level of activity.	Chapter 1, section 1.2	
6. The future technical documentation should also include a facility conceptual decommissioning plan, including the management of radioactive waste generated during this activity.	Chapter 1, section 1.2	A Conceptual Decommissioning Plan is included in the Safety Analysis Report.
7. *"Construction is planned to start in January and to finish in August 2013*". Taking into account the long period of time which is necessary in general to get all the agreements and permits for a new nuclear facility and keeping in mind that plasma melting is a relatively new technology, please let us know if the mentioned terms are fix or they can be changed.		The planned terms for the commissioning of the facility correspond to the plans for intensive decommissioning activities at Units 1-4 and the respective need to vacate storage spaces (changes are possible).

8. The Environmental Impact Assessment Report which will be sent to Romanian Ministry of Environment: and Forests should include the potential radiological and non-radiological releases, for all the facility operating conditions.	Chapter 4	
9. We kindly ask you to mention the foreseen PMF lifetime and how it was correlated with the decommissioning plan of the 4 Units of KNPP.	Chapter 4	It is expected that the dismantling of Units 1-4 and operation of the PMF are overlapping for the duration of the dismantling period.

C. Information on water in the technological process (Letter 3674/01.10.2012)

Table 11.5.9-3 Requirements of the Romanian Ministry of Environment and Forests

Aspect	EIAR chapter	Comment
1. At the point 3.8.2, it is necessary that the obtained monitoring data to be included in the EIA and compared with previous similar data, both national and JDS 2 data base for the radiation and non-radiation indicators.	Chapter 3.2.	EIAR chapter 3.2 is based on a comparison of the performed analyses of the input data received for the past three years – of radiation and non-radiation indicators. JDS 2 database is available only for 2007. For EIA it is more suitable to use data for a larger time interval regarding an area close to the IP – Danube river close to KNPP site.
2. At the point 3.8.2.1., it cannot be told that only the mentioned indicators offers information about chemical pollution; there is a much longer list of chemical substances and compounds that assess chemical characterization at EU level; Maybe it can be told that these indicators are mostly used for revealing possible	Chapter 3.2 (description of the indicators). Chapter 1.2.4, 4.3 and 4.1.2 (data on all used substances).	The text according item 3.8.2.1 of ToR, and according to EIAR confirms that the referred indicators are namely "The key indicators used for the assessment of the chemical status of surface waters ..." Information on all substances included in the process is presented in items 1.2.2.4, 4.3.6, 4.1.2.11 and 8.4 from

Aspect	EIAR chapter	Comment
accidental pollution of waters. It is normally that, besides these general indicators, to be analyzed and quantified all substances mentioned in chapter 1.2.2, as well as the assessment of possible presence and concentrations in waters. Furthermore, besides the national norms from table 3.8.2.1.1., the obtained data should be compared at least with ICPDR norms for Danube, for having a homogenous view of the approach.		EIAR. It is necessary to consider that the dust and ashes in the flue gases (including heavy metals and metal oxides) will be captured by the bag filter and the HEPA filter, which excludes the possibility for release of such contamination in the waste waters.
3. In a similar way, as for point 2., the quality of Ogosta River must be analyzed, as well as the quality of other rivers in the vicinity of the project area. All data must be present as they are, both comparison with previous status and ICPDR norms must be mentioned also. Similar for other rivers in the discussed area, as Iskar, etc. All presented data must be assessed back to back with European laws for protection of population and environment, mainly (in this case) norms for ecological and chemical status of waters (according to Directive 2000/60/EC) and norms for different water uses.	Chapter 3.2.	The waste waters from the industrial sources around KNPP are discharged only in the Danube River. Therefore, control of the pollution indicators is performed on this river only. As a base for comparison of the indicators, in EIAR item 3.2 there is information regarding the water quality of the Ogosta river.
4. The chemical indicators mentioned in table 3.8.2.1.1. are, in present, part of assessment of ecological status. In this respect, the ecological status, as well as the prediction of reaching or not the "good status" within Directive 2000/60/EC must	Chapter 3.2 and 4.1.2	Chapter 3.2 and 4.1.2. The ecological status is assessed according to the requirements of Directive 2010/75/EC effective 07.01.2011, which represents the current requirements regarding the limits of the industrial emissions (integrated pollution

Aspect	EIAR chapter	Comment
be included also in the EIA.		prevention and control) for the waste incineration facilities. It is necessary to consider that all waste waters generated by the PMF will be processed in the Controlled area by evaporation. The vapor condensate can be reused, and only the excess condensate will be released in the Danube river. Due to that the impact on the water quality will be very insignificant (chapter 4.1.2 of EIAR).
5. The chapter 3.8.2.2 must offer also data about the analyzed indicators, measured values and comparison with previous status, using both national (if exist), IAEA norms and ICPDR data.	Chapter 3.2	EIAR presents data regarding the analyzed indicators in item 3.2.
6. All the other remarks referring to surface waters from the previous document must be taken into account in detailed description in the EIA study.	See above tables 11.5.9-1 and 11.5.9-2	All remarks by Romania presented to the moment are reviewed in detail and reflected in the ToR and EIAR. Chapter 11.5 of EIAR is developed especially to consider the issues brought up by Romania.
7. The last, but not the least, is to present the cumulative impact of all activities developed or under preparation for future development in the mentioned area, taking into account that this project is not the only one and all the other projects use water and discharge waters in the same river. Even each project states that the discharged waters are not significant in comparison with Danube flow and indicators load, the cumulative discharges could	Chapter 4.1.10 and 11.5 (and this document).	All cumulative impacts resulting from the activities in this region are considered in items 4.1.10 and 11.5 of EIAR.

Aspect	EIAR chapter	Comment
lead to significant impact.		
8. Concerning groundwater, text explanations are confusing without references to maps with boreholes situation and flow direction and to the hydro geological cross-sections. We consider that schematic maps and cross-sections should be included in order to better assess and understand the impact.	Chapter 3.2	References to maps with the location of the drilling samplers and the flow direction, as well as to the hydrogeological profiles are presented in item 3.2 of EIAR.
9. Data on the groundwater abstractions and discharges on the studied groundwater is missing. We consider this data very important, taking into account the strong relationship between the chemical and quantitative status of groundwater and the mention (page 59) that the aquitard between the Quaternary aquifer and the Pliocene aquifer bellow is imperfect.	Chapter 3.2 and 4.1.2.4	Data on the groundwater abstractions and discharges are presented in item 4.1.2.4 of EIAR. Impact on the chemical state of the ground water is not expected, as direct or indirect discharge of waste water into ground water bodies is not planned. The water abstraction from ground water bodies is minimal compared to the quantity used by KNPP.
10. Subchapter 3.8.3.2 should be considerably detailed taking into account the pollution by tritium already occurred. Finding and removal of the sources of the pollution and other measures to improve groundwater quality should be provided. Also the natural radioactivity of groundwater should be proved by tests previous to the Kozloduy Power Plant construction.	Chapter 3.2	Tritium is generated in the reactor area, as result of the division in the nuclear fuel. During the operation of this facility tritium will not be generated, and there will be no increase of tritium in the environment. Nevertheless, for information purposes, in EIAR item 3.2 data regarding the tritium contamination status is presented.
11. Referring to air pollution, a simulation about the diffuse pollution from rain water and run-off water must be also presented (models, predictions, dispersion wave) both for		The level of air contamination will be below the admissible limit according to EU norms. The modeling of maximal ground concentrations performed in chapter 11, Attachment 10

Aspect	EIAR chapter	Comment
radiation and non - radiation indicators.		shows that due to the low values the possible impact on the quality of rain waters is negligibly low (insignificant).

D. Considering the existing natural protected areas ROSCI 0045 Coridorul Jiului and ROSPA 0023 Confluenta Jiu Dunare , we consider necessary to include also the following issues (Letter No. 3674/01.10.2012)

Table 11.5.10-4 Requirements of the Romanian Ministry of Environment and Forests

Aspect	EIAR chapter	Comment
1. The impact of the project on species of flora and wild fauna located inside or outside of the natural protected areas, but in the project areas, on the both banks of River Dunarea.	Chapter 4.1.4, 4.1.5 and 11.5 (this document).	Analysis of the possible impacts within the project territory on the objects from Natura 2000 on Romanian and Bulgarian territory are presented in items 4.1.4, 4.1.5 and 11.5 of EIAR.
2. The cumulative impact with other projects developed on the proposed site or in the neighbourhood which could damage the natural capital from both states.	Chapter 4.1.4, 4.1.5 and 11.5.	Analysis of the possible impacts within the project territory on the objects from Natura 2000 on Romanian and Bulgarian territory are presented in items 4.1.4, 4.1.5 and 11.5 of EIAR.
3. Measures for mitigation the impact of the project on the biodiversity and also provide dates about the residual impact after their implementation.	Chapters 6, 8 and 11.5.	The mitigation measures regarding the biological diversity are reviewed in items 8.8 and 11.5 of EIAR.
4. **In general terms and in the available/provided documentation, the position of the Bulgarian can be considered acceptable.** However, there are issues that require a greater degree of detail, even at this phase level of the project. These issues should at least be considered and should be confirmed that they will be treated or highlighted in the future environmental impact report and that it will impose a	Chapter 4.1.3, 4.1.8.8.	The list of determined initiating events, and the analysis of the possible impacts resulting from accidents is presented in item 4.1.3, 4.1.8.8 and 4.4.3 of EIAR.

structure targets or be specified in the ToR. The following topics require a breakdown by the Bulgarian side**:** **1. Attachment 7, B.3.** Considering the Bulgarian response: "A detailed accident and risk analysis is completed in the Safety Analysis Report document. This document is an integral part of the project documentation which is subject to regulator's approval. It is impossible to build the PMF without the approval of this document", we would still like the ToR to contain at least the postulated initiating events list, including the identification of the maximum credible accident in terms of frequency and radiological consequences. Our request has its justification in the fact that the accident analysis will be part of a licensing documentation (SAR) at which the Romanian side has no access as a tool to demonstrate the suitability of radiological / industrial safety for this project. This requirement is minimal and should not be negotiable.		
2. Attachment 7, B.4. Considering the Bulgarian response: „The aging processes are considered in the facility design. The possible negative impacts shall be assessed in the EIA Report", we believe that it is necessary to confirm that the document referenced as Technical Specifications (known as the Limiting		The description of the licensing process is included in the SEP (Stakeholder Engagement Plan), chapter 5 and the NTS. In the Intermediate Safety Analysis Report – the document needed for the approval by the nuclear regulator, there is an item (Equipment aging

Conditions for Operation) will be issued based on which the whole operating process of the mentioned facility should be performed. Our request has its justification in the fact that developing such a licensing process support document will provide an additional guarantee that the safety limits, the operation and design features and administrative controls are defined, identified and evaluated, in liaison with the demonstration of the radiological safety, objectives, principles requirements and best operating practices.		management), which considers the planned measures during the design, operation and maintenance, measures to avoid accidents due to the change in materials resulting from aging. Some of the preventive measures are included in the requirements to: the materials for construction of the PMF equipment; the production process of the PMF elements; the operational conditions, etc. Also, regarding aging, the feedback from the accumulated operational experience will be properly considered. During PMF repair outage the equipment will be checked for deviations from the normal state, damages, corrosion, etc. During the elaboration of the Technical Specification (developed at the facility commissioning stage) all the limitations and requirements resulting from the design stage will be considered, including those regarding aging management.