

# **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**

### **CHAPTER 8**

#### **EXPERTS CONCLUSION**

## CONTENTS

<b>8. Experts conclusion .....</b>	<b>1</b>
8.1 Atmospheric air .....	1
8.2 Harmful physical factors .....	2
8.3 Soils and earth bowels .....	4
8.4 Surface and ground waters .....	5
8.5 Flora .....	5
8.6 Fauna .....	6
8.7 Landscape .....	6
8.8 Protected areas and protected territories .....	7
8.9 Land use .....	7
8.10 Cultural heritage .....	8
8.11 Infrastructure .....	8
8.12 Health risk for the personnel and population .....	8
8.13 Social and socio-economic aspects .....	9
8.14 Summarizing conclusion .....	10

## 8. EXPERTS CONCLUSION

This chapter presents the summarized experts conclusion based on detailed description and analysis of the components and the factors of the environment and the main interactions between them, as well as the assessment of the expected impact on the environment and people as result of the implementation of the investment proposal “Installation and operation of a Facility for treatment and conditioning of radioactive waste with high volume reduction factor at Kozloduy Nuclear Power Plant”.

### 8.1 Atmospheric air

In the period of PMF operation, emissions containing harmful substances will be generated in both chambers – in the primary and in the secondary treatment chamber. Before their emission in the air, the off-gases will be purified through a system of purifying facilities, including HEPA filters. They latter have 99.97 % efficiency, and after the scrubber system the efficiency reaches 99.995 %. The purified off-gases will be discharged through one organized source of harmful substances emissions – 150 m ventilation stack.

In accordance with the PMF design the radioactivity containment will be provided by the equipment borders and the fences, as well as by the negative pressure in the system in respect to the building. Also, the fenced areas where the repair activities are performed are periodically cleaned, thus preventing the accumulation of radioactive contamination during the entire operational period. Furthermore, in order to prevent the accumulation of radioactive contamination and to facilitate maintenance the following activities are planned:

- Periodical clean-up of the respective components in the PMF with a special vacuum cleaner to prevent spreading of contamination. The vacuum cleaner is used to clean the PTC refractory concrete during repairs, the STC inside, the heat exchanger, the bag filters chamber, HEPA filters, ash collection chamber and so on, as well as of the surrounding areas during and after repairs.
- The last batch fed to the system before PMF shutdown should be with very low radioactivity or even with no radioactivity at all. Thus the remaining radioactivity in the different components will be reduced and actually washed away.

In the PMF decommissioning period the non-radiological pollutants from the PMF activity will be removed, since its activity will be ceased.

Non-organized short-term gas emissions are expected from welding when using thermal cutting methods. These emissions will not affect the air quality in the area, they are important in terms of work hygiene only.

During the decommissioning activities AB-2 ventilation system with HEPA filters will operate. Expected emissions are insignificant and negligibly low. Conclusions are made based on the assessment of the radioactivity of the metal surfaces – 64 MBq, and of the refractory materials – 3 GBq, provided by the Investor.

Air contamination during decommissioning of the Facility will not affect the air quality even in the closest settlements.

The cumulative effect is expected from non-radioactive air pollutants in terms of dust and PM, CO, SO<sub>2</sub>, HF, HCl and TOC as a result of increased transport vehicle traffic and the use of construction equipment at Kozloduy NPP site.

The cumulative effect is possible regarding radioactive aerosols during realization of this IP and the decommissioning activities of KNPP Units 1-4. The share of the PMF gaseous releases in the total gas flow rate through the ventilation stack is 0.09 % for 2011.

The performed “Analysis on the dose originating from gas aerosol and liquid releases to the environment from the Units 1-4 decommissioning process and the emissions from the plasma melting facility (PMF) operation (Project 5c), incurred by the public within the 30-km monitored area surrounding Kozloduy NPP” allows to make the following conclusions:

1. The maximum annual effective dose per individual of the critical group of the population living within the 40-km area around KNPP, which includes the 30-km monitored area, resulting from the liquid and gas-aerosol releases to the environment, was conservatively calculated at 5.05  $\mu\text{Sv/a}$ , which is a much lower value than the quota of 250  $\mu\text{Sv/a}$  for exposure from radioactive emissions from NPP (Ordinance on the Ensuring of Safety of NPPs) and the norm determined for the population of 1 mSv/a (ONRZ-2012, Basic Norms for Radiation Protection).
2. The additional dose that might be incurred is about 500 times lower than natural radiation background (2.33 mSv).
3. 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 %.
4. The maximum annual effective dose of the population within the 40-km area around KNPP, due to aerosol emissions only, 6 MBq under normal operation of the plasma melting facility (PMF), was estimated at  $5.47 \cdot 10^{-10}$  Sv/a, which is barely 0.01% from the total exposure resulting from all activities on the KNPP site.

## 8.2 Harmful physical factors

### Ionizing radiation

Based on the analysis of the radiation status of the environment and the presented information, the impact of the ionizing radiation from the activities in the period of IP implementation on the radiation  $\gamma$ -background can be estimated as insignificant under the following conditions:

- Keeping the zones with their control limits and admissible values of  $\gamma$ -radiation, as well as their control values and admissible limits on the outside walls of rooms containing radiation;

- Keeping the limits on the  $\gamma$ -radiation in and around the newly created buffer zones and temporary storage areas, as well as the capacity limits of the RAW storage facilities;
- Provision of adequate biological protection of the activated equipment, of RAW treatment and RAW transportation;
- Keeping the limit values for emissions of radioactive substances in waste waters and the ground atmosphere layer outside of the reactor site and in the regulated zones for radiation monitoring.

It can be concluded that there will be no impact on the radiation  $\gamma$ -background during the PMF operation and decommissioning activities, including dismantling. Emissions of gaseous RAW during PMF operation and decommissioning are limited to the permitted levels for aerosols, and therefore have negligible impact.

### **Noise**

The shredder is expected to be the main source of noise. Measurements of the noise levels during operation are planned. The normative limit noise levels will be observed. It is possible that additional measures for noise insulation and personal protective equipment against noise will be required. No considerable additional impact from noise load is expected at KNPP site, since the PMF will be installed in a separate building (AB-2). The impact will be local.

Drilling and cutting tools and equipment will be used in dismantling, which may generate excessive noise levels depending on their type. Adopted preventive measures must be applied systematically.

### **Vibrations**

Expected vibrations are typical for the object, with negligible impact on the personnel at KNPP site, temporary and limited in action.

### **Microclimate**

PTC and STC will be coated on the outside with refractory and insulation materials, they will be remotely operated and the operators will be at a distance. Nevertheless, it is necessary to detect infrared radiation from the facilities. It is one of the main microclimate components and has the ability to penetrate deeply in tissues, heating them up. Together with the other microclimate components, infrared radiation leads to heat exhaustion and thermal overheating, and it may cause heatstroke and sunstroke as well. The workers in maintenance and repair may also be exposed to excessive levels of infrared radiation.

### **Toxic gases**

Non-radioactive air pollutants are released under the same conditions as the radioactive ones. Declared values of concentrations of dust, CO, SO<sub>2</sub>, HF, HCl and TOC are below the admissible limits and they are not expected to have any unfavorable health effect.

## **Work in shifts and night-time work**

Work in shifts and night-time work may lead to sleep and nervous system disorders, disturbances in the diurnal rhythm of many body systems. Night-time work leads to increase of the digestive system diseases.

Cumulative effect is not expected.

After the end of PMF operation and decommissioning activities a sharp decrease of all impacts on the environment by ionizing and non-ionizing radiation, noise and vibrations is expected.

## **8.3 Soils and earth bowels**

During PMF construction impacts to soils, earth bowels and geological foundation are not expected, because the PMF is proposed to be located within AB-2, in Room BK301 at level +6.30 m and in Room BK039/3 at level +0.0 0m.

The requirements to PMF operation (ToR, item 3.4 – Operational conditions) determine that maximal limits of chemical releases should correspond to the acting legal documents, including possible emergency situations. The IP analysis shows that during PMF operation all the requirements of the Bulgarian and European legislation will be observed, meaning that there will be no impact on soils during normal PMF operation. Even in case of possible impact on soil, it is expected to be within the admissible limits.

Negative non-radiation impact on soils in the 30-km area around KNPP, including Romanian territory, is not expected during normal PMF operation. Therefore, no measures for prevention, reduction or compensation of negative impact on soils are required, since no such impact is expected.

During PMF normal operation impacts by non-radiation factors on the earth bowels is not expected.

Normal PMF operation is not expected to lead to radiation contamination of the soils in KNPP area and close to it. Therefore, Normal PMF operation is not expected to lead to radiation contamination of the earth bowels at KNPP site and the adjacent territories.

For the earth bowels only the accidents that could occur outdoors are relevant. Impact on the earth bowels could be expected during earthquakes and the following damages. There is no probability for damage of buildings and pollution of the earth bowels. However, it is possible that some cracks may occur on the asphalt layer covering the polluted ground. In such case, immediate measures should be undertaken for restoration of the cover layer.

Impacts will only be local and temporary, until the emergencies are contained, and by taking adequate procedure actions the trans-boundary impact and negative effect on the earth bowels of the neighboring Romanian territory will be avoided.

The expected emissions of radionuclides in the air and the water during decommissioning are estimated as insignificant and negligibly low; therefore, contamination of the soils at KNPP site and near it on Bulgarian and Romanian

territory is not expected. Impact on the geological environment and the earth bowels during decommissioning of the facility is not expected, if the Decommissioning program and the Radiation protection procedures are observed. The probability of contamination of the earth bowels as result of accidents is insignificant due to the fact that the activities will be performed indoors.

Cumulative effect is not expected.

## **8.4 Surface and ground waters**

PMF is designed to use industrial and potable water from the existing sources in compliance with the issued permits for water use. The PMF cooling system functions through “closed circuits” – the heat energy is transferred by heat exchangers to the existing “open circuits” of the KNPP cooling system. Therefore, water consumption is limited to the possible leaks in the “closed systems” and is expected to be not more than 2 m<sup>3</sup> per year.

It can be concluded that the quantities of used industrial and potable water are within the allowed limits.

Based on the designed PMF technology, generated waste waters (around 2510 m<sup>3</sup> per year) include the technological water for the scrubber and the facility cooling water. The chemical pollution of these waters is expected to be insignificant.

In accordance with the designed technology, the process of released liquid RAW is managed so that the volume of the release does not exceed 100 l/h. The scrubber water is gathered in a scrubber tank, which will also receive the cleaning waters from the 200 l drums, and then the water undergoes evaporation in the scrubber module.

Considering the treatment of blow-down water from the scrubber and the water from the cooling unit in the system for waste water purification of KNPP, it can be determined that the released activity in the Danube River is much lower than 400°Bq/year, or negligibly small.

Cumulative effect is negligible regarding sewage water quantity.

The impact on the surface and ground waters is expected to be reduced in the decommissioning process. This impact will be fading away and eventually will result in the indicators of the chemical state and general ecological status of the water body where waste waters are discharged from KNPP into the Danube River.

## **8.5 Flora**

RAW transferring may have a potential impact on the flora if there are deviations from KNPP standards in the physical and radiation characteristics of the containers, which will enter the PMF. Therefore, it is recommended that the radiation characteristics of the containers are measured before their transportation to the PMF.

During normal technological mode of PMF operation, negative impact on the flora on KNPP site and around it is not expected.

Cumulative effect is not expected.



Potential impacts on the flora in some risk situations are possible during decommissioning activities, related to removal of existing components or systems, decontamination of components, as well as cutting and processing of large parts of equipment. Special measures, other than keeping the best decommissioning practices, for prevention, reduction or compensation of negative impact on the flora during decommissioning are not recommended.

## **8.6 Fauna**

During normal technological mode of PMF operation, based on the design solutions for purification of the flue gases through a system of cleaning facilities, as well as directing of the waste waters in the existing sewage system, and considering the applied preventive and monitoring activities at KNPP, negative impact on the fauna on KNPP site and around it is not expected.

Cumulative effect is not expected.

Potential impacts on the fauna, such as chasing away of animals because of increased human presence, are possible during decommissioning activities, related to removal of existing components or systems, decontamination of components, as well as cutting and processing of large parts of equipment. Special measures, other than keeping the best decommissioning practices, for prevention, reduction or compensation of negative impact on the fauna during decommissioning are not recommended.

## **8.7 Landscape**

Impact on the vertical and horizontal landscape structure during IP operation is not expected, because PMF will operate in a closed room on the territory of KNPP. Landscape components are not expected to be contaminated with pollutant emissions. Control of the radiation characteristics of the gas emissions after the extraction fans of the flue gas system and at the discharge piping of the PMF extraction system will be performed. Non-radioactive emissions are controlled by a System for continuous monitoring of the emissions.

As PMF will operate in a closed room in the NPP controlled area, the PMF operational period is not related to radiation contamination of the landscape. Subject to the requirements in TOR, contamination with liquid RAW is not expected either, since they will not be generated continuously, and the emissions will correspond to the legal requirements. Circle of substances in the landscape will not be changed. Socio-economic functions of the landscape of the territory of the plant and in its vicinity will remain the same.

The Program for radiation protection will be applied in cases of emergencies.

Radiation impacts on the landscape components are not expected during PMF operation.

Radiation impacts on the nature complexes in the 30 km area around KNPP, as well as in the neighboring Romanian territories, are not expected.

Cumulative effect is not expected.



Negative impacts on the vertical and horizontal landscape structure during decommissioning are not expected. The entire PMF equipment will be dismantled and removed. These activities will be performed in accordance with previously prepared Concept and Plan for PMF decommissioning.

Impacts on the landscape components during PMF shutdown stage are not expected. Radiation impacts on the nature complexes in the neighboring Romanian territories are not expected.

No measures for prevention, reduction or compensation of negative impact on soils are required.

## **8.8 Protected areas and protected territories**

RAW transportation may have a potential impact on the PA and PT if there are deviations from KNPP standards in the physical and radiation characteristics of the containers which will enter the PMF. Therefore, it is recommended that the radiation characteristics of the containers are measured before their transportation to the PMF.

Negative impact on the PA and PT during normal PMF operation is not expected.

Negative impact on the PA and PT is not expected during normal functioning of the cycle of pouring the mould into forms, transportation and weight measurement of the processed drums and determining the characteristics of the final product; the technological process results in a well-conditioned product that does not contain liquids, organic materials or radioactive contamination from outside sources.

Potential indirect impacts on parts of the PA and PT in some risk situations are possible during decommissioning activities, related to removal of existing components or systems, decontamination of components, as well as cutting and processing of large parts of equipment. These impacts are very unlikely to occur and at this stage it is sufficient that they are accounted for in the KNPP Emergency plan for actions in potential emergencies during PMF operation.

Special measures, other than keeping the best decommissioning practices, for prevention, reduction or compensation of negative impact on the PA and PT during decommissioning are not recommended.

Cumulative effect is not expected.

## **8.9 Land use**

The lands in the monitored 30-km area around KNPP are mostly agricultural. The investment proposal “Installation and operation of a Facility for treatment and conditioning of radioactive waste with high volume reduction factor at Kozloduy NPP” requires use of the existing KNPP site only. Free release of territories for agricultural or forest use is not expected. Therefore, impact of non-radiation and radiation factors on the land use during IP implementation is not expected, expropriation of agricultural land is not expected either.

Cumulative effect is not expected.

## **8.10 Cultural heritage**

Harmful impacts on the cultural heritage are not expected, because the investment proposal “Installation and operation of a Facility for treatment and conditioning of radioactive waste with high volume reduction factor at Kozloduy NPP” requires use of the existing KNPP site only, where no cultural monuments or archeological sites have been identified.

Potential impacts on the cultural heritage are not possible during decommissioning activities, related to removal of existing components or systems, decontamination of components, as well as cutting and processing of large parts of equipment.

Special measures, other than keeping the best decommissioning practices, for prevention, reduction or compensation of negative impact on the cultural heritage during decommissioning are not recommended.

Cumulative effect is not expected.

## **8.11 Infrastructure**

The IP implementation will not have a negative effect on the infrastructure of the municipality or the region. According to the design, new infrastructure (roads and others) will not be constructed, because the existing one will be used.

Cumulative effect is not expected.

## **8.12 Health risk for the personnel and population**

All activities during the construction, operation and decommissioning of the PMF correspond to the requirements for healthy and safe work conditions and protection of human health. Each year prophylactic examinations of the personnel are performed following a determined schedule by KNPP “Labor medicine” department. Observing the PMF commissioning and decommissioning instructions and the systematic application of the ALARA principle minimize the specific risk of occupational dose for the personnel.

During the assembly activities some work groups will be exposed to general and local vibrations, metal aerosols, infrared and ultraviolet radiation (welding). There are effective means for personal and collective protection and their use will minimize the unfavorable health effect, which will be local and of short duration.

As for the health risk for the population resulting from the IP implementation, it is close to zero, because the hazardous radioactive materials, as well as the construction works producing conventional harmful impact, will remain within the plant site; therefore, measures for reducing the harmful impact on the population health during IP implementation are not necessary. This is confirmed by the results of the “Analysis on the dose originating from gas aerosol and liquid releases to the environment from the Units 1-4 decommissioning process and the emissions from the plasma melting facility (PMF, Project 5c) operation, incurred by the public within the 30-km supervised area surrounding Kozloduy NPP”.

Considering the above information and by observing all measures during installation, operation and decommissioning of the PMF, it can be concluded that the IP implementation will not produce a negative impact on the state of the environment and will not harm the health of KNPP personnel and the population in the 30-km area around it.

Cumulative effect is not expected.

### **8.13 Social and socio-economic aspects**

From socio-economic point of view, the possible impacts on the population and the economy of the investigated territory during normal operation of PMF would be positive in some aspects.

Using part of the released qualified personnel that has participated in the operation of Units 1-4 and the gained experience and knowledge will be applied in the treatment and conditioning of RAW. Also, the application of the best technologies in regard to the PMF will bring social security and confidence to the PMF and KNPP personnel and the population of the territory around the plant.

The PMF operational and decommissioning activities will require opening of new job positions for highly qualified personnel leading to higher employment rate.

Observing the technological standards and safety rules at the PMF site and in the plant area during operation will guarantee the elimination of negative impacts on the population in the 30-km area around KNPP.

The above information leads to the conclusion that negative non-radiation impacts on the population on Romanian territory in regard to the socio-economic aspects are not expected. The positive cumulative effect is expected because of the increase of the employment rate.

Measures for prevention, reduction or compensation of negative impact are not required.

During PMF decommissioning negative non-radiation impacts on the population on Bulgarian territory in regard to the socio-economic aspects are not expected.

Negative non-radiation impacts on the population and economy in the 30-km area of KNPP on Romanian territory in regard to the socio-economic aspects are not expected.

On the condition that all planned measures and activities related to the safety of the personnel and population and to preventing the contamination of the environment are closely observed, the activities in the Plan for PMF decommissioning will not lead to radiation contamination. Therefore, radiation impact related to the socio-economic status of the population and the economy in the KNPP 30-km area on both Bulgarian and Romanian territory is not expected.

## 8.14 Summarizing conclusion

Based on the expert conclusions it can be summarized that the impacts from the Investment Proposal implementation on the environment and the human health are very low, considering the following:

- The radiological impacts are reduced to much lower levels by consistent application of the ALARA (As low as reasonably achievable) principle, which has been successfully applied to all previous activities at KNPP site.
- The non-radiological impacts from the PMF construction, operation and decommissioning activities, such as the generation of non-radioactive waste and emissions of harmful substances in the atmosphere as a result of transport activities, are assessed as very low and of local importance, as well as limited in time.

Most of the impacts are expected to be very low but could be further reduced by application of the proposed measures for minimization, mitigation and avoidance of the harmful impacts.

**Based on the analysis and assessment of the investment proposal “Installation and operation of a Facility for treatment and conditioning of radioactive waste with high volume reduction factor at Kozloduy NPP”, the performed studies, investigations and consultations, as well as the estimated impact of the object on the components of the environment, the authors of this EIAR recommend to the MEW Supreme Council of Environmental Experts to prescribe the execution of the measures and recommendations in the Report and to APPROVE the implementation of the KNPP investment proposal.**