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| **Environmental Management Plan****Reconstruction Substations 110/35 kV/kV Aleksinac****PE Electric Power Industry of Serbia****The Floods Emergency Recovery Project****January, 2016** |

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### **INTRODUCTION**

This investment is a part of the Floods Emergency Recovery Project (FERP), which has been signed between the Government of Serbia and the World Bank (WB) on 09. October 2014.

The FERP focuses on delivering support to the priority sectors that were affected by the floods, as identified in the Recovery Needs Assessment (RNA). This includes support to the energy and agriculture sectors, and flood protection. The needs in the housing sector, which was also one of the hardest hit, have been addressed by the government through other donor support mechanisms, notably from the EU and the UN. The project would: (i) help close the financing gap and ensure continued provision of electricity services, particularly during the first winter following the floods; (ii) provide direct financial support to farmers in affected areas at a time when the fiscal accounts are under severe stress and may be unable to deliver the needed support; and (iii) help improve resilience to disasters by financing investments in critical flood prevention infrastructure.

**The Project Development Objective (PDO)** is to: (i) help restore power system capability to reliably meet domestic demand; (ii) protect livelihoods of farmers in flood affected areas; (iii) protect people and assets from floods; and (iv) improve the Borrower’s capacity to respond effectively to disasters.

### **INSTITUTIONAL AND IMPLEMENTATION ARRANGEMENTS**

The project will be implemented over three years with a proposed closing date of December 31, 2017. Institutional arrangements and responsibilities of the different institutions are outlined below.

The Office for Reconstruction will be responsible for overseeing the overall project implementation. Project management functions and day to day operations will be the responsibility of EPS, the Directorate for Agrarian Payments (DAP) (with the support of Treasury), and the Project Implementation Unit (PIU) established under DWM (see Figure 1 below).

The project consists of four components: (1) Energy Sector Support; (2) Agricultural Sector Support; (3) Flood Protection; and (4) Contingent Emergency Response.

### **COMPONENT 1: ENERGY SECTOR SUPPORT (EUR 157.11 MILLION)**

The objective of this component is help restore power system capability to reliably meet domestic demand through power purchases, improved reliability of the distribution system and energy conservation measures, and help the restoration of strategic energy assets.

1. *Subcomponent 1A: Support for electricity purchases (EUR 119.82 million*). Subcomponent 1A will support electricity purchases by EPS to improve power availability and avert an impending energy crisis particularly over the first winter heating season following the floods. The project would support power purchases made under commercial practices under multi-monthly, monthly, and weekly contracts. Retroactive financing for power import contracts from June 2014 to the signing of the Loan Agreement will also be considered carrying ex-post facto review for eligibility.
2. *Subcomponent 1B: Urgent restoration of the distribution network and load management* (*EUR 14.29 million*). Subcomponent 1B will support the provision of: (i) metering devices for the flood affected areas; (ii) mobile substations; (iii) energy-efficient light bulbs, technical assistance, and other goods to support load management activities.
3. *Subcomponent 1C: Dewatering of the Tamnava West Field Mine (EUR 23 million).* Subcomponent 1C will support the first critical step to put the Tamnava West Field Mine in the Kolubara mining basin back into operation and help avoid significant health hazards associated with the flooded mine, including the potential pollution of ground water, an increase in water-borne diseases, as well as threats to surrounding flora and fauna that would emerge as a result of stagnant water in the mine pit. Subsequent activities related to mine recovery and coal mining equipment rehabilitation will be undertaken by EPS and are outside the scope of this project.

Considering that the critical period for the EPS power system is behind us (2014/2015 winter season is over), installation of energy saving lamps is no longer necessary (sub-component 1B (iii)), which was also evident at the time when the credit arrangement was prepared. A load management study was foreseen under this component. EPS already has an energy efficiency study, which is a strategic document not including the procurement of energy saving lamps. For this reason, EPS proposes that the said funds may be utilized for other purposes. EPS is planning to use EUR 1.5 million to procure cabinets including electronic electricity meters instead of the planned EUR 4.1 million for the sub-component 1B (iii) with the aim to separate the distribution network from the public lighting installations. Furthermore, the remaining EUR 2.6 million could be reallocated for equipment purchase under the rehabilitation project for 5 out of 54 most critical substations 110/35 kV/kV recently taken over by EPS from EMS.

Energy Sector Support will be the responsibility of EPS. General management and support functions are assigned to its Head Office in Belgrade. EPS has designated a small team of staff (project implementation team) for the implementation of the proposed project to work under the Head of Strategy and Investment Department of EPS. The project implementation team’s main function is to prepare the Project Operations Manual (POM), coordinate with other corporate departments to ensure effective implementation of procurement, contracting, contract administration, disbursement, financial management, accounting, and reporting. This team is responsible for the submission of Financial Management Reports to the Bank. The project accounts will be maintained by the Finance Department of EPS.

### **RECONSTRUCTION SUBSTATIONS 110/35 kV/kV ALEKSINAC 1**

### **FACILITY DESCRIPTION**

SS 110/35 kV Aleksinac has been in operation with installed unit of 20 MVA since 1975, and with additional 31.5 MVA since 1980. 110 KV and 35 KV facilities are mounted outdoors. This SS supplies areas of Aleksinac and Soko Banja with their surroundings. Around 204 million kWh was delivered through this SS during 2014 (with power factor which varies in the range of 0.89-0.96 per month), around 209 million kWh was delivered a year before, while in 2012 around 216 million kWh was delivered. It should be pointed out that SS 110/35 kV Aleksinac supplies consumption area which is geographically isolated from other SS 110/35 kV and for which there is no alternative supply in case of problems in operation of this facility.

In the SS itself, three 110 kV power lines meet, one of them, toward SS 35/10 kV Soko Banja, operating under the voltage of 35 kV (others come from SS Krusevac 1, through EVP Djunis, and from SS Nis 1). 110 kV switching substation is outside, air insulated, with two power lines and two transforming fields and classic “H” scheme. When 35 kV is concerned, eight SS 35/10 kV are supplied from this SS: Katun, Konfekcija, Rupe, Zelezara, Jama Morava, Hladnjaca Aleksinac, Separacija and Soko Banja, and one SS 35/6 kV RTB is supplied through five 35 kV busbar connections. 35 kV switching substation is outside, air insulated with one system of main and reserve busbars and nine 35 kV bays (five outlet bays, two transforming bays and one measuring bay and one coupling bay). Maximum load on 35 kV side was recorded in December 2014, when it amounted to 46.8 MW and 12.2 MVAr, representing load of 47 MW and 16.9 MVAr on 110 kV side, i.e. around 50 MVA, which means that SS was loaded 97 % compared to installed capacity (slightly higher - 99 % is load of the unit 31.5 MVA due to its electrical characteristics). SS 110/35 kV Aleksinac has only one reserve 35 kV connection which goes toward SS 110/35 kV Nis 1 through power line supplying SS 35/10 kV Katun and Toponica and is 28.1 km long. This power line is relatively old and only partly reconstructed (around 6.2 km of the line is Al/č 95 mm2, the rest of them is Cu 35 mm2), therefore it may provide stand-by supply only for SS 35/10 kV Katun. In case of failure of one of transformers, in the high load operation, reductions are inevitable.

### **ROLE OF THE FACILITY IN ELECTRICITY MARKET**

Present role, as well as the future role, of this facility is the same: it accounts for a place of connection of transmission and distribution systems and its purpose is distribution of electric energy in Aleksinac municipality (through supply of mentioned SS 35/10 kV and SS 35/6 kV). Thus, this SS enables electricity supply of more than 51500 inhabitants of Aleksinac municipality. From direction of this SS a stand-by supply of SS 35/10kV Toponica, with the main supply from direction of SS 110/35 kV Nis 1, is provided.

**REASONS FOR RECONSTRUCTION**

Bearing in mind that the role of this facility in distribution system has not been changing, the main reason for its reconstruction is to create possibility of connecting 110 kV line toward SS 110/35 kV Soko Banja within 110 kV facility, as well as deterioration of equipment in SS. Facilities 110 kV and 35 kV in this SS are outside. Transformers have been in operation since 1975 (20 MVA unit) and since 1980 (31.5 MVA unit), thus, they are at the end of their lifetime. Both transforming units operate over the year and particularly during winter period under conditions of overcurrent, which results in growth of operating temperatures of transformers. Most of the transformer parameters reflecting operational condition of transformers are satisfying and in accordance with total operational period. On the basis of resistance measurements results from 2010 (20 MVA unit) and 2008 (31.5 MVA unit), an increase of 110 kV windings resistance is registered in certain phases, probably as result of loose couplings/connections in voltage regulator under load of the said phases and/or at the junction of winding terminals and inlet (conductor) insulator.

### **DESCRIPTION OF TYPES AND MAXIMUM EXPECTED QUANTITIES OF HAZARDOUS SUBSTANCES**

In SS Aleksinac, hazardous substances are present:

* in technical and technological equipment,
* as waste.

Total quantity of hazardous substances that may be discovered at the location for any reason is given in Table 1.

| **NAME** | **PROCESS POINT** | **MASS BALANCE****(tons)** |
| --- | --- | --- |
| **Generic, chemical and other****and****chemical substances formula** | **Raw material** | **Intermediate product** | **Byproduct** | **Final product** | **Waste** | **Transport****Turnover** | **Storage** | **Max. daily** | **Middle monthly** | **Total annual** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** |
| **Transformer oil** | **X** |  |  |  |  |  |  | **43.78** |  | **43.78** |
| **Sulfuric acid** | **X** |  |  |  |  |  |  | **0.265**  |  | **0.265**  |

Table 1. Quantity of hazardous substances at the location (Form III)

### **MATERIAL BALANCE OF HAZARDOUS SUBSTANCES IN TECHNOLOGICAL EQUIPMENT**

In technical and technological equipment, the following hazardous substances are present:

* Transformer oil,
* Sulfuric acid.

Transformer oil is present in transformers (T) and in high-voltage (HV) equipment (circuit breakers and current measuring transformers).

### Sulfuric acid is present in rechargeable batteries (ACCU).

Description of separate and total quantities of oil and sulfuric acid within technical and technological equipment is given in Table 2.

|  |  |  |  |
| --- | --- | --- | --- |
| **Device-equipment** | **Type of hazardous substance** | **Quantity in device** | **Total quantity** |
| **Т-1** | **Transformer oil** | **19.0 t** | **41.5 t** |
| **Т-2** | **Transformer oil** | **22.5 t** |
| **HV equipment** | **Transformer oil** | **2.28 t** | **2.28 t** |
| **ACCU-batteries** | **Accu H2SО4** |  **0.265 t** |  **0.265 t** |

Table 2. Types and quantities of hazardous substances in technical and technological equipment

### **MASS BALANCES OF HAZARDOUS SUBSTANCES AS WASTE**

The quantity of oily wastewaters from oil pit depends on the atmospheric impact i.e. the quantity of precipitation. Dimensions of oil sump are: 6.00 m x 3.50 m, so the quantity of these waters is estimated according to the following formula:

Q = q . F. s. j. n [l/s]

where: q-is quantity of rain, [l/sha]; F- catchment area, [ha]; s-outflow coefficient; ј-precipitation reduction coefficient; n-outflow delay coefficient.

For q= 120 [l/sha], oil bath surface F [ha], s=0.008 , ј=0.006; n=1, calculated quantity of water that originates from atmospheric impact from 1 oil bath is:

Q= 0.00001727 [l/s]

Solid oily waste originates from residue from oil pit after its cleaning. It is estimated according to expert and practical experience that it amounts to around 5% out of total quantity of oily waters that are produced during the year.

|  |  |
| --- | --- |
| **Type of hazardous substance** | **Quantity, [kg/year]** |
| **Oily water and oil emulsion** | **5,667** |
| **Solid oily waste** | **283** |

Table 3. Estimated types and quantities of hazardous waste produced during the year

The quantity of wastewater coming from sanitary equipment is defined according to the specified number of consumers. They go into the sewer system of the city.

|  |  |  |
| --- | --- | --- |
| **Consumer** | **Number of consumers** | **Total consumption, [l/s]** |
| **WC** | **2** | **0.14** |
| **Washstand** | **2** | **0.04** |
| **Shower** | **1** | **0.07** |
|  | **TOTAL** | **0.25** |

Table 4. Estimated types of sanitary waters

### **TECHNICAL AND TECHNOLOGICAL SPECIFICS OF STORAGE AND WORK WITH HAZARDOUS SUBSTANCES**

**А) Oil for transformers and high-voltage equipment**

There is significant amount of transformer oil of mineral origin in SS "Petrovac" and in terms of environmental impact it is the only important one.

Characteristics of transformer oil in terms of environmental impacts are provided in Table 5.

|  |
| --- |
| According to the European Agreement concerning the International Carriage of Dangerous Goods by Roads, ADR code |
|  | Class andserial number | WHC – I (low danger to water) |
|  | Substance ID number  | 54106 |
|  | Danger label  | GGVS/ADR, ADNR/AND,, GGVE/RID, UN, IATA/DGR, GGV See/IMDG |
| **1.** | Numerical substance symbol(According to the list of hazardous substances of the United Nations or UN number) | RL 67/548/EWG, RL 88/379/EWG |
| **2** | Description:Mineral oil inhibited by 2,6-Di-tert-butyl-p-cresol BHT |  |
| **3.**  | Physical and chemical characteristics |  |
|  |  | Concentration in % | 100 |
|  |  | State of aggregation (physical condition description) | liquid |
|  |  | Ignition point (оC) | 143 °C |
|  |  | Explosion limit % (zap) | 0.6-6.5 |
|  |  | Decomposition due to high temperature (оC) | above 360 |
| **4.** | (ECO) Toxicological characteristics |
|  |  | Toxic  | X |
|  |  | Flammable liquids | X |
| **5.** | Point of hazardous substance in the process |
|  |  | Raw material | X |
| **6.** | Mass and volume balances (in kg, t, l, m3) |
|  |  | Total annual | 43.78 t |

Table 5. Form II- Characteristics of transformer oil

**B) Battery acid**

For battery charging 75% sulfuric acid is used.

***Features:*** according to JUS Z.CO 005/79 degree of toxicity is 3; degree of flammability 0; degree of reactivity 1;

***Maximum allowed concentration***: according to JUS Z.BО.001/71 maximum allowed concentrations in air of the working environment is 1mg/m3.

***Flammability and explosiveness:*** Sulfuric acid and its vapors are not flammable.

***Fire danger:*** Sulfuric acid does not burn or support combustion, but concentrated acid can cause ignition of many substances, for example: wood, paper, cotton and other combustible substances.

***Environmental protection:*** Waste water containing sulfuric acid must be neutralized prior to discharging into the public sewer system or in the receiving watercourses.

### **IDENTIFICATION OF THE SOURCES OF DANGER**

Based on the analysis of technical documentation and accident events on this SS in the last 5 years and examining the condition of SS on the site, data about the possible failure of SS system components are obtained, which would result in endangering the environment with hazardous substances.

**Fault tree and accidents development schemes**

Based on analyzed sources of danger on SS "Aleksinac", the following failures with accidents development schemes and impact on the environment are systematized, and are presented in the following schemes:

Oil leakage

**Destruction of Т**

Fracture of armature, pipes, damage of covering

Mechanical explosion of Т

Fire in T

Oil bath

Soil

Shock wave

Soil contamination

Demolition, burning, injuries

Thermal radiation

Products

Air pollution

Protective box

Hazardous waste

Oil pit

Figure 1. Scheme of accident development at transformer destruction

**Destruction of HV equipment**

Oil leakage

Soil

Soil contamination

Figure 2. Scheme of accident development at HV failure or loss of sealing properties of equipment connections

**Destruction of oil pit**

Oil leakage

Soil

Soil contamination

Figure 3. Scheme of accident development during leaks or overflow of oil pit and/or bath

**Failure in ACCU battery**

Damage of ACCU covering

H2 cloud

Fire in SS

Leakage H2SO4

Floor of ACCU ba.

Shock wave

Demolition, burning, injuries

Thermal radiation

Products

Air pollution

The room of ACCU battery

Protective pit

Hazardous waste

Explosion

Organic substancess

Figure 4. Scheme of accident development at failure of some element in ACCU battery

### **DESCRIOPTION OF WORKS AND MAIN IMPACTS**

Preliminary Design with Feasibility Study is elaborated by Elektroistok inzenjering d.o.o. and Elektrotehnicki institute Nikola Tesla A.D. According to mentioned documents proposed works include:

1. Leveling plateau.
2. Construction of trails and new cable channels.
3. Adaptation/rehabilitation of existing command building.
4. Construction of a new 35 kV facility.
5. The demolition and removal of the old existing 35 kV facility.
6. Replacement of the complete fence and reconstruction of existing drainage channel around the rim of the plateau. (See Annex 1).

All the land on which the building is located is owned by EPS Distribucija. By the Contract No. 8772 dated 11.09.2014, the Republic of Serbia has provided real estate for management and use by the Government Conclusion 05 No.: 46-9323/2013 dated November 1st, 2013. All activities regarding reconstruction will be performed within the fenced area of SS and further expansion outside the existing, fenced lot, is not foreseen. There are no private persons that are related to this land.

The environmental impacts during execution of civil works will be limited to the ones which are common to all construction activities - air, dust and noise pollution, vibrations and local soil and possibly groundwater disturbance. The negative impacts will be felt only temporarily (during the works execution) and their impacts will be limited. However, application of good engineering practices and proper site and contract control will contribute to minimize or avoid negative impacts altogether.

HAZARDOUS WASTE

The waste is presently stored in electrical equipment according to Table 2. The waste will be removed according to management plan which will be delivered by contractor and approved by EPS representatives. Plan of all works (removal, transport and waste disposal) must be in accordance with all current relevant international and Serbian legislatives. Contractor is obligated to remove and dispose/deliver/store all equipment at the EPS warehouse in Aleksinac, according to the plan and internal EPS Distribucija procedures related to ISO 14001 standard.

In order to avoid, prevent or mitigate the potential occupational and community health and safety risks, potential environmental impacts on air quality, underground waters, noise disturbance, waste generation and management, the good demolition/construction practice implementing several mitigation measures is proposed within the following Environmental Mitigation/Monitoring Plan- EMP. (Annex 2)

The main responsibility for implementation of EMP related measures lays on the Contractor/Subcontractor, who needs to take into the account and applies on daily basis all proposed preventive and mitigation measures. The Site Supervisor needs to perform the supervision on the practical implementation of the mitigation measures by the Contractor/Sub-contractor, and issue corrective instructions and/or orders, if necessary.

The Project Implementation Unit will also coordinate the overall working plan related to construction schedules, implementation progress and implementation of proposed measures for avoidance and/or minimization of environmental, health and safety risks.

### **OVERVIEW OF SS ALEKSINAC**



Picture 1. Transformers overview



Picture 2. Building and electrical facility overview

### **Annex 1**

### **Annex 2**