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COMPLEX EXPLORATION OPERATIONS FOR THE PURPOSE OF MONITORING THE INFLUENCE OF THE FLYING AND BOTTOM ASH DEPOT SREDNJE KOSTOLAČKO OSTRVO ON THE ENVIRONMENT

Abstract

Based on the request by the Department of Environment Preservation, an order was given for the investment-technical documentation for implementation the remediation measures and to encompass the entire area of the flying and bottom ash depot on the location Srednje Kostolačko ostrvo. In order to define the project criterion for protection the ash depot, with the purpose of conducting the measures of remediation, it was necessary to make the Geotechnical Exploration Project. The Project is aimed to determine the exploration operations which will define the geological, engineering-geological and hydrogeological terrain characteristics. The designed exploration operations encompassed the field explorations and appropriate laboratory tests. The obtained results would enable to review the impact of the flying and bottom ash depot on the environment, and also to secure the relevant basis for further mining, construction, technological and all other projects at the locations in question.

Keywords: *exploration operations, ash depot, environmental impact*

1 INTRODUCTION

The ash depot of SKO is in the final exploitation stage and is going to be shut down in succession, one cassette at a time. The size of the flying and bottom ash depot of SKO and its geometry, upon cessation of operations, opens up the new possible usages for this area. The potential construction location requires permanent landscaping of this area which would ecologically be completely justified and acceptable. The problem of the SKO depot is made harder by its location between the Danube and the river Mlava, the impact of fluctuation of the surface and underground water levels, settlement proximity, climatic and meteorological factors, archeological culture monuments, etc.

The flying and bottom ash depot is located in the so-called Srednje Kostolačko

ostrvo. From the north side, the depot is bordered by the defensive mound of the Danube, and from the east by a ridge mound placed in parallel with the regulated water flow of the river Mlava. On the south side, the depot is bordered by the tailing dump "Kipa Dunavac" and a ridge mound along the right bank of the Dunavac immediately next to the settlement Stari Kostolac, and on the west side, the depot is bordered by a the new brim channel of the cooling water, flowing into the river Danube.

In order to define the project criterion for the ash depot protection, it is necessary to conduct a series of geotechnical explorations to determine the geological-geotechnical, hydrogeological, geochemical, chemical, technological, pedological and other conditions at the actual location.

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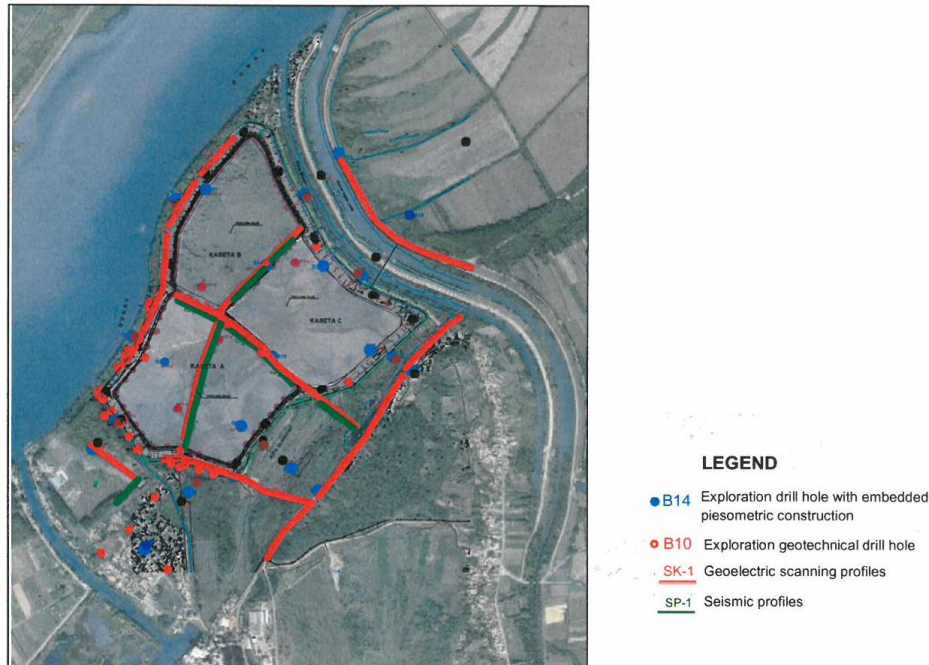


Figure 1 Position of the SKO flying and bottom ash depot and the schedule of exploration operations

2 CONCEPT AND RESEARCH METHODOLOGY

Types of exploration to be realized:

- Collection and analysis of all available data for the given location,
- Geodetic operations,
- Field exploration operations (geotechnical explorations in situ, hydrogeological explorations in situ, geophysical explorations, exploratory drilling with additional operations, mapping of the ash depot of immediate surround terrain, core of the exploration drill sites and exploration trenches, core and soil sampling, monitoring well construction),
- Laboratory testing (physical-mechanical, geochemical, water chemistry, pedology, etc.),

- Development the geotechnical and geochemical paper on the results of conducted exploration.

Engineering-geological Exploration Operations

In order to determine the geotechnical terrain model and to define the geotechnical conditions as well as permanent solutions for the slope stability at the whole depot area, a detailed engineering-geological exploration is required, as well as a complex geo-mechanical exploration of the present lithological factors which encompasses the following:

- Making the engineering-geological field map,

- Conducting the exploration drilling with core sampling and the following geotechnical and geochemical operations,
- Construction and engineering-geological mapping of exploration pits,
- Detailed engineering-geological core mapping,
- Sampling from exploration drill and exploration holes for laboratory, physical mechanical and geo-mechanical testing,
- Penetration test SPT,
- Static penetration test CPT,
- Water permeability test,
- Laboratory parameter testing the physical-mechanical soil characteristics.
- Laboratory chemical and geochemical soil and water testing.

Pedological Tests

In order to completely define the surfaces of degraded land due to erosion, as well as chemical pollution, the indicators and sub indicators were defined as factors for this type of pollution. Based on this, the degree of land endangerment was defined through the chemical pollution, i.e. based on the values of pollutants and concentration values of dangerous and harmful substances (As, Ba, Cd, Cu, Zn, Pb, Mn, Ni) which could indicate a serious land contamination. As an indicator of degradation the endangerment of the land by alkalization will also be displayed through (active and substitution acidity), electric conductivity and as a fertility indicator the content of organic matter.

Geophysical Exploration

In order to obtain the engineering-geological data of the field for closing, sanitation and reclamation of the flying and bottom ash depot "Srednje Kostolačko ostrvo" in Kostolac, aside from the geomechanical and laboratory testing, it is necessary to conduct the geophysical tests. Geophysical test

will be conducted in the form of refraction-seismic tests and geoelectrical tests.

The task of the refraction-seismic and geoelectrical tests consists out of:

- determination the depths and speeds of spreading elastic longitudinal (V_p) and transverse waves (V_s) in certain lithological environments,
- determination the thickness (D) of surface complex,
- determination the spatial setting and depth positioning of individual lithological factors,
- determination the value of specific electrical resistance ρ_p and ρ in **ohm** of certain lithological factors for the requirements of facility grounding design.

Refraction-seismic tests are based on determining the value of expansion speed of elastic longitudinal (V_p) and transverse waves (V_s) in different lithological environments.

Geoelectric tests will be conducted applying the method of specific electric resistance in the variant of geoelectric scanning. Through this methodology of geophysical tests and field reconnaissance on a wider area, the data on thickness the individual lithological factors and determination of compromised zones due to the underground water circulation would be obtained.

The purpose of these geophysical - (seismic and geoelectrical) testing is to determine the depths and speeds of elastic longitudinal (V_p) and transverse wave (V_s) spreading in the specific lithological environments, determination the spatial setting and depth of grounding the individual lithological factors.

Geochemical Tests

For the purpose of realization the Geotechnical paper of remediation and facility construction in the area of flying and bottom ash depot "Srednje Kostolačko ostrvo", with the project of geotechnical

explorations among others, the geochemical and hydrochemical exploration of the immediate depot area are designed.

Sampling locations are designed by the project, and the precise sampling micro locations will also be defined by the project. In case of unpredicted circumstances, changes and choosing the new locations for sampling will be defined in accordance with the project designer.

In the set of these explorations, the following operations are designed:

- Sampling of soil for the geomechanical parameter testing,
- Sampling of underground water for quality control,
- Sampling of surface water for quality control.

CONCLUSION

Geotechnical explorations and results of these explorations will be the input data for the stability analysis of slopes of the existing depot as well for necessary geostatic stability and funding of the facilities of renewable energy sources, most likely the solar plant that can be built in the area of this ash depot.

The range and type of designed geotechnical exploration is planned so that it

will secure the adequate base for making the previous Feasibility Study with the idea solution of construction a solar plant in the Srednje Kostolačko ostrvo.

The range and type of planned geochemical explorations should provide a sufficiently reliable base for remediation measures and protection of this area (ground and water).

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