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MINISTRY OF SUSTAINABLE DEVELOPMENT AND TOURISM
ENVIRONMENTAL PROTECTION AGENCY

Environmental and Social Impact Assessment of Remediation of Five Contaminated Sites

WORLD BANK ESIA AND SAFEGUARD STUDIES
FOR CONTAMINATED INDUSTRIAL SITES REMEDIATION

COWI

COWI

ADDRESS COWI A/S
Parallelvej 2
2800 Kongens Lyngby
Denmark

TEL +45 56 40 00 00
FAX +45 56 40 99 99
WWW cowi.com

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APPENDICES

1 Executive Summary and Non-Technical Description

The Ministry of Sustainable Development and Tourism and the Environmental Protection Agency (EPA) of Montenegro are preparing the Industrial Waste Management and Clean-up Project (IWMCP) with the objectives to reduce the environmental and health risks posed by selected industrial waste disposal sites and to strengthen the local institutional capacity for regulation and management of industrial and hazardous waste. The project implementation is expected to be funded with financial support from the World Bank.

Component 1 of the IWMCP comprises investigation and subsequently remediation of five selected contaminated industrial sites. The following sites have been selected:

- Aluminium Plant Podgorica
- Steel Plan Nikšić
- Maljevac Thermal Power Plant Pljevlja
- Adriatic Shipyard Bijela
- Gradac flotation tailings pond.

The five sites are the most contaminated sites in Montenegro and are, except for Maljevac site, highly contaminated according to both national and international standard. The contaminated sites represent a risk for continues exposure of chemicals to both human and environment. The dominating pathways for spread of contaminants to environment or human is through windborne contaminated dust, leaking of chemicals to the groundwater, direct skin contact with contamination and, for Biejla, leakage of contaminants to the sea. The 0-alternative (doing noting) and the environmental baseline constitute a significant negative impact which needs to be addressed. The objective of the component 1 is to mitigate the negative impacts from the contamination. The component 1 includes

- Investigation with analyses of soil and groundwater with the purpose of detecting the type and amount of contaminants.

- Assessment of the risk and main pathways for the contaminants (soil, groundwater, surface water etc.).

- Preliminary design of the remediation.

The objective of the project is to mitigate the existing negative impacts from the contamination. The remediation will remove or limit the various pathways for spreading of contamination to humans and the environment and limit the future risk for exposure. The remediation will, in this way, have a significant positive impact on local populations and the environment.

Although the remediation project, by its nature, will have a significant positive impact on the environment, the implementation of the project needs to be planned carefully because the project is dealing with potential chemical substances with can be spread unintentionally if not handled correctly. Although the objective of the project is to ensure a significant positive impact on the environment, it is necessary to carry out an evaluation of the possible risks.

According to the World Bank Guidelines (OP 4.01), the remediation project requires an Environmental and Social Impact Assessment (ESIA), Environmental Management Plan (EMP) and at least two public consultations.

This report includes an independent assessment of environmental and social impacts of Component 1 – remediation of the five contaminated sites. The overall objectives of the independent ESIA study for the remediation of the five contaminated sites are:

- To identify and assess environment and social impacts, both adverse and beneficial, in the project's area of influence.

- To avoid, or where avoidance is not possible, minimize, mitigate, or compensate for adverse impacts on communities and the environment.

- To ensure that affected communities are appropriately engaged on issues that could potentially affect them.

- To ensure that the procedure of public consultation is carried out and documented according to the international (World Bank) requirements, so that the World Bank can approve the loan provision to Montenegro for implementation of the 2 Components of the Project.

The ESIA study and the investigation and design study by CDM / Hidroinzeniring is on a feasibility level. The remediations of the five contaminated sites are described in the preliminary design with an outline of the main principles for the remediation. The ESIA is prepared based on the preliminary design of the remediation and the level of detail in the ESIA accordingly.

In a later stage of the remediation project, an additional EIA following the Montenegrin guidelines and acceptable to the World Bank will be carried out based on the detailed design of the project. The EIA following the national Montenegrin

guideline and the World Bank EIA are nearly similar in context, however, the national EIA is carried out in the detailed design phase, whereas the World Bank ESIA is carried out in the feasibility/preliminary design phase of the project. In this preliminary phase of the remediation project many mitigation measures in the Environmental Management Plan and the monitoring in the Environmental Monitoring Plan can only be described in broad terms. In the EIA based on the detailed design, also the mitigating measures can be described in more detail. A detailed design of the remediation including an EIA following the national guideline is expected in 2013 before the construction can start.

The final selection of the sites to be remediated will depend on the funds available. At the moment, it is not known whether all or only the most serious contaminations will be remediated and whether the remediation will be carried out in prioritized order.

The environmental impact and recommendations are summarized in the following based on the interim report from the consortium CDM / Hidroinzeniring.

Gradac Tailing pond

The contamination at Gradac tailings pond is dominated by heavy metal located in the 3,900,000 tons of waste deposit west of the settlement Gradac. The area is uncovered and has no vegetation and the maximum and average concentrations of lead and arsenic in the soil exceed the threshold values. The investigation has indicated leaching of contaminants into the groundwater and potential risk to drinking and irrigation water cannot be excluded.

The current impact from the contaminated site at Gradac includes several negative impacts on the environment and on the social-economic environment. The three most significant environmental impacts are:

- Humans exposure to heavy contaminated dust particles.
- Impact on groundwater from percolating contaminated water.
- Impact on river water from contaminated drain water.

The objective of the remediation is to limit the negative impact by implementing various mitigating measures. The following remediation alternatives have been assessed for Gradac tailings pond:

Excavation: The contamination will be removed but the impact during implementation will be significant e.g. significant formation of dust from excavation, considerable transport through Gradac settlement and exposure of contamination to rain with increased leaking of contaminants. The costs involved in the excavation and re-deposition of all the material will be considerable in particular if no suitable hazardous landfill will be available in Montenegro. The option is therefore considered an alternative.

Minimizing erosion effects by securing measures: This proposed remediation includes creation of an artificial basin on top of the tailings material thereby eliminating any erosion at the surface of the tailings dump; however, it does not solve the problem of seepage water flowing through the material potentially

carrying heavy metals into the groundwater or river water. The option is therefore considered an alternative.

Preferred option:

Sustainable and long-term securing of the tailings dump. The selected remediation project at Gradac contaminated dump site includes:

- Geotechnical securing of the slopes
- Surface sealing
- Installation of a drainage system for melting water and precipitation
- Optional: re-cultivation of the top layer

The re-cultivation of the tailings surface will reduce the possible particle transport by wind erosion and further limit the uncontrolled spreading of contaminated material. In addition, the sealing of the surface and the installation of drainage systems for melting snow water and rainwater will limit the percolation through the waste body and minimize the leakage of contaminated water. This remediation is selected because it significantly limits both the impact from dust and the impact on river water and groundwater.

The remediation has a significant positive impact on the environment; however during the implementation of the remediation some minor short-term negative impacts might be expected including noise, increased traffic or dust related to the construction works during implementation of the remediation.

The environmental impacts before and after the project implementations are the following:

1 Air and dust – Existing significant negative impact with risk of exposure of humans and animals to contaminated dust and wind erosion of surface particles. The most frequently occurring wind direction is from northwest exposing the nearby settlement. Covering of the surface with a minimum of 30 cm uncontaminated soil will have a significant positive impact by preventing future spread of contaminated particles.

Soil – Existing negative impact with risk of exposure of humans and animals to contaminated soil by direct contact. Installation of a fence around the tailing pond will have a positive impact by preventing access to the site.

River water – Existing significant negative impact from risk of erosion of soil at the tailing pond slopes and landslide of contaminated soil. The slopes of the dams show significant soil erosion and instability cannot be excluded. Stabilization of the slopes with geotechnical measures will have a positive impact by preventing erosion of the soil and securing the slopes.

Groundwater – Existing adverse effects of contaminants of seepage water on groundwater. Sealing of the tailings pond can prevent percolation of rainwater through the waste body and will have a positive impact by limiting the risk of leaching.

Monitoring program for the remediation during the construction phases includes:

- River water: pH and heavy metals once a month
- Groundwater: pH and heavy metals once a month
- Air: Dust PM_{10} Daily visual inspection. Inside the construction site and outside in downstream wind direction

Monitoring program for the remediation during the operation phases includes:

- Control of drainage water quality: visual inspection, pH and heavy metals. Once a year
- Control for damage of top cover and efficiency of the drainage system: visual inspection. Once a year
- River water: pH and heavy metals. Once a year. 1 station upstream and 1 station downstream
- Groundwater: pH and heavy metals. Once a yea. Minimum 3 monitoring well at various locations surrounding the dumpsite.
- Soil: 20 surface soil samples from gardens in the village of Gradac Donji. Heavy metal. Once after completion of the remediation
- Control of leachate: heavy metal. Once a year. Installation of 3 monitoring wells inside the dumpsite

Nikšić Contaminated Site

The contamination at Nikšić is dominated by heavy metal located in the 600,000 m^3 waste deposit east of Nikšić. The area is uncovered and has no vegetation, and the maximum and average concentrations of lead and cadmium in the soil exceed the threshold values. 60-80% of the soil material consists of material with diameters less than 0.63 mm. This fraction can easily be spread by wind especially in the summer season.

The current impact from the dumpsite outside Nikšić includes several negative impacts on the environment and on the social-economic environment. The three most significant environmental impacts are:

- Direct human exposure to contaminated waste
- Human exposure to contaminated dust particles
- Impact on river water from contaminated drain water

The dumpsite does not pose an acute environmental risk. The Nikšić dumpsite consists of the old dumpsite D1 located south of the road towards the river and the new dumpsite D2 located north of the road.

The following remediation alternatives have been assessed:

1 Basic securing of the waste dumps D1 and D2 (alternative). The basic securing of the dumpsites includes fencing of the dumpsites, securing the slopes to avoid landslide into the river and spreading concrete or a similar material on surface to avoid dust. Although the least cost intensive, the basic securing with the spraying of concrete over the surface, will hamper the future usages and appear unaesthetic, and the option is therefore considered an alternative.

Complete closure of both waste dumps (alternative). The alternative is similar to basic securing but with extensive levelling and installation of a surface coverage layer. The alternative has a high cost and the area will not be available as a landfill after closure.

Preferred option:

Closure of dump site 1 and reconstruction of dump site 2. This selected remediation project at Nikšić contaminated dumpsites includes:

- Geotechnical securing of the slopes of D1
- Surface sealing and re-cultivation of D1
- Optional: re-cultivation of the top layer of dumpsite D1
- Reconstruction of dumpsite D2 into a regulated landfill

The geotechnical securing of the slopes of D1 requires extensive profiling of the waste material. The securing will prevent the embankment against erosion and landslides thereby protecting the nearby river.

The remediation has a significant positive impact on the environment; however during the implementation of the remediation some short-term minor negative impacts might be expected including noise, increased traffic or dust related to the construction works during implementation of the remediation.

The environmental impacts before and after the project implementations are the following:

1 Soil – Existing humans and animals exposure to contaminated soil by direct contact will be prevented by installation of a fence around the dumpsite. The mitigation measure will have a positive impact by preventing access to the site.

Dust – Humans and animals exposure to contaminated dust, wind erosion of surface particles. The negative impact is limited as the area is virtually uninhabited and impact on the Nikšić city is not expected. The old part of the dumpsite should be levelled, and both the dump and the slope should be covered by, at a minimum 30 cm, uncontaminated soil. The new part of the dumpsite is still in operation. Where possible, the dump should be levelled and reconstructed into a controlled landfill. The remediation has a positive impact by preventing future spread of contaminated dust particles.

River water – Existing risk of erosion of the slopes of the dump with potential transport of contaminated soil into the river pose a significant negative impact. Stabilization of the slopes with geotechnical measures like slope banking and covering with topsoil has a positive impact by preventing erosion of the slopes and eliminating the risk of waste sliding into the river.

Social impact - The remediation has a negative long-term impact for the waste collectors who will lose their source of income.

Monitoring program for the remediation during the construction phases includes:

- River water: pH and heavy metals once a month. 1 station upstream and 1 station
- Air: Dust and PM10 Daily visual inspection inside the construction site and outside in downstream wind direction

Monitoring program for the remediation during the operation phases includes:

- Control of drainage water quality: Visual inspection, pH, heavy metals, PAH, PCB and mineral oil once a year for the first 4 years
- Control of top cover and efficiency of the drainage system: Visual inspection
- River water: pH and heavy metals once a year in spring time for the first 4 years 1 station downstream

Bijela Remediation Project

The contamination at Bijela is dominated by heavy metal TBT, PAH and PCB located in the 60,000 tons of waste deposit inside the shipyard. The surface of the shipyard is highly contaminated with elevated levels of toxic metals. The area is uncovered and without vegetation; however the area is enclosed and only accessible for employed and inaccessible for animals. The waste is stored close to the sea and some waste is in direct contact with seawater.

The current impact from the dumpsite at Bijela Shipyard includes several negative impacts on the environment and on the social-economic environment. The three most significant environmental impacts are:

- Exposure to human from contaminated dust
- Direct exposure of human (employed at the shipyard) to contaminated waste
- Impact on sea water quality

The following remediation altenatives have been assessed:

2 Deposit of the waste material at a controlled landfill. At present, no landfill for hazardous waste is available in Montenegro although there are plans for establishing a hazardous waste facility. The option probably has a high cost and is considered an alternative.

3 Deposition of the waste in a local confined disposal site in the harbour of the shipyard (alternative). The alternative includes sorting of the entire solid waste material, groundwater remediation under the northern par of the shipyard sealing of the yard north and south, deposition of stabilized used grit into an artificial enclosure on both sides of the smaller jetty at the shipyard harbour. This option has a very high cost and the option is considered an alternative.

<u>Preferred option:</u>

4 The selected remediation project of the contaminated dump site at Bijela includes:

- Sorting of the entire present solid waste material and future generated masses.
- Excavation of contaminated backfill at shipyard North.
- Sealing of shipyard North and South.
- Excavation of sea-sediments at shipyard harbour.

The remediation has a significant positive impact on the environment; however during the implementation of the remediation some short-term minor negative impacts might be expected including noise, increased traffic or dust related to the construction works during implementation of the remediation.

The environmental impacts before and after the project implementations are the following:

1 Soil - Exposure of humans (especially employees) and animals to contaminated soil by direct contact (surface soil) pose a significant negative impact. The contaminated soil and material should be removed and the surface should be asphalted. This mitigation measure has a positive impact by preventing risk for direct human contact.

2 Dust - Exposure of humans and animals to contaminated dust, wind erosion of surface particles pose a significant negative impact. The remediation will have a positive impact with no future generation of polluted particle dust from the contamination (although dust might still be generated during the industrial activities at the shipyard).

3 Groundwater - The groundwater flow is expected to be towards the sea, and the groundwater is not used for drinking water. The contamination might spread to the sea with a significant negative impact on the seawater and sediment. Removal of the soil (the source of contamination) will have a positive impact on the environment, eliminating the risk for impact on the sea.

4 Seawater - Contaminated waste has partly been dumped on the sea floor next to the shipyard. The contaminated sediment has a long-term significant negative impact. The mitigation measure with removal of the sediment has a significant positive impact on the environment, eliminating the source for further contamination.

Monitoring program for the remediation during the construction phases includes:

› Dredging of sediment: Turbidity 2 times a day during dredging with monitoring of turbidity at 150 m downstream the dredging
› Air: Dust and PM10 Daily visual inspection inside the construction site and outside in downstream wind direction
› Soil: Control surrounding surface for contamination once. Samples at a distance of 200 m from the contaminated site

Monitoring program for the remediation during the operation phases includes:

› The remediation does not include a specific operational phase. Control of residual contamination in sea water and soil. Risk assessment of any residual contamination

Maljevac Ash Dumpsite Remediation and associated Sumane Ash Dump Development

The Maljevac Ash dumpsite is dominated by 8,000,000 tons of waste deposit. The area is uncovered and has no vegetation. No significant chemical contamination was found during the investigation by CDM, although Paleski Creek and its receiving waters Vezisnicu and Ceotina are affected by contaminated leachate and drainage water from the ash dump.

The current impact from the dumpsite at Maljevac Ash Dumpsite includes several negative impacts on the environment and on the social-economic environment. The three most significant environmental impacts are:

› Human exposure to dust particle
› Risk of dam failure
› Impact on river water.

› The following remediation alternatives have been assessed:

The remediation of Pljevlja Contaminated Site includes:

1 Stabilization of the dam and drainage wall. This alternative is basically similar to the preferred option with the addition of a “drainage wall” as called by CDM. This “drainage wall” consists of a series of wells constructed behind the existing dam covering the whole length of the dam. The objective of the drainage wall is to stabilize the upper part of the dam.

2 Construction of a secondary dam and continued ash deposition. This alternative includes construction of a secondary dam to be built at a distance of about 100-150 m from the exiting dam inside the dumping area. The secondary dam on top of the ash dump will be constructed in the ash deposit area with stone columns as piles. The area behind the new dam can be used for dumping of ashes, whereas no ashes can be dumped between the new dam the existing dam.

<u>Preferred options</u>

3 The selected option of Maljevac Ash Dumpsite is “Stabilizing embankment and monitoring of the dam status” which includes:

Redirection of Paleski Creek

Prevention of seepage formation

Sealing and re-cultivation the surface.

The remediation has a significant positive impact on the environment; however, during the implementation of the remediation some short-term minor negative impacts might be expected including noise, increased traffic or dust related to the

construction works during implementation of the remediation. Elektroprivreda Crne Gora (EPCG) is implementing a separate project in parallel with the aim to stabilize the dam.

The environmental impacts before and after the project implementations are as follows:

1 Dust – Exposure of humans and animals to dust particles from erosion of ashes. No significant contamination is expected; however, significant negative impact from the dust formation is expected. Small dust particles especially the small fraction $PM_{2.5}$ can pose a risk for human health. Positive impact by preventing future dust by ensuring that the surface of the dump is wet or covered.

2 Groundwater. The groundwater is slightly affected by leaches from the dumpsite with medium negative impact. The sealing and re-cultivation of the surface will have a positive impact due to limiting the seepage of water though the waste body.

3 Creek and river water. Paleski Creek and its receiving waters Vezisnicu and Ceotina are affected by contaminated leachate and drainage water from the ash dump. A by-pass should be built to direct the water from the Paleski creek around the dump. Positive impact as the relocation of Paleski creek will limit the impact from contaminated leachate

4 Risk of dam failure because of dam instability. The slopes of the dams are in risk of becoming unstable and currently constitute a significant potential negative impact. Stabilization of the slopes with geotechnical measures and water control will result in significant positive impact.

5 The remediation and closure of Maljevac Ash Dump will have a significant negative indirect impact on the development of the landfill in Sumane, because the closure of the Maljevac Ash dumpsite will increase the volume of ashes to be disposed at Sumane. Elektroprivreda Crne Gora (EPCG), is planning an extension of the ash dump at the Sumane site and will prepare the resettlement plan for the affected residence at the Sumane dumpsite. Implementation of a resettlement plan will compensate for the negative impact.

Monitoring program for the remediation during the construction phases includes:

- River water: pH and heavy metal once a month. 1 station upstream and 1 station downstream
- Groundwater: pH and heavy metal once a month from minimum 3 monitoring well
- Air: Dust and pm10 Daily visual inspection inside the construction site and outside in downstream wind direction

Monitoring program for the remediation during the operation phases includes:

- Control of water mass balance: Collection of data including precipitation for control of water mass balance every second month Installation of at least 3 inclinometers, 5 piezometers, 7 survey points and 1 Weather station
- Control of drainage water:pH and heavy metal every second month
- Control of surface soil: 20 surface soil samples analysed for heavy metals once at a distance of approximately 200 m from the construction

KAP Remediation Project

The contamination at KAP red mud ponds is dominated by fluorides, phenolic, heavy metal, PAH and PCB located in the 7,500,000 tons of waste deposit south of Podgorica. The maximum and average concentrations of Chromium, Nickel, cadmium, PAH, PCB and fluorides exceed the threshold values.

The current impact from the contaminated sites at KAP includes several negative impacts on the environment and on the social-economic environment. The three most significant environmental impacts are:

- Risk of impact on groundwater
- Exposure to human from contaminated dust
- Impact on river water

Currently, two separate remediation projects are investigated for the KAP-site. As part of the IWMCP, the company CDM has carried out a study for remediation of the "Red Mud Ponds" and as part of the "Lake Skadar-Shkoder Integrated Ecosystem Management Project" the company SWECO is engaged in the study of the remediation of the landfill inside the KAP-site. In a later phase, the two remediation projects will be combined.

The SWECO designed remediation of the solid waste at the eastern part of the dumpsite at KAP includes temporary re-disposal of the waste while a bottom liner and leachate collection is applied. After the bottom liner and leachate system is installed, the waste will be re-disposed back on the bottom liner and a final cover will be applied (described as option 3d in the reports from SWECO).

The final selection for the remediation of the red mud, which is the focus for this project, was not available during the preparation of this ESIA report; however, the options include capping of one or both of the red mud ponds. The three alternatives are as follows:

- Alternative 1 “Sealing of the waste disposal site”. This proposed remediation includes excavation of waste in sections with temporary storage and installing a bottom liner and leached system for permanent storage of the waste.

- Alternative 2 “Relocation of the solid waste on redesigned red mud basin A”. This proposed remediation includes providing a suitable cover for the ponds and relocation of the solid waste on the mud basin after installation of leached system.

- Alternative 3 “Sealing of the solid waste and groundwater treatment downstream”. This remediation includes sealing of the ponds and installation of monitoring wells downstream to control the contaminated plume.

The remediation has a significant positive impact on the environment; however, during the implementation of the remediation some short-term minor negative impacts might be expected including noise, increased traffic or dust related to the construction works during implementation of the remediation.

The environmental impacts before and after the project implementations are shown in the table below:

1 Air and dust - Exposure of humans and animals to contaminated dust - wind erosion of surface particles. The most frequently occurring wind direction is from north and northeast and the nearby small settlement can be affected. This current negative impact can be mitigated by covering the surface with plastic liner or mixing the top layer with lime, bentonite, cement or another material to create an impermeable layer. The mitigation measure will have a significant positive impact by preventing future spread of contaminated particles

2 Groundwater - Significant negative impact from the effects of contaminants in seepage water on groundwater. Groundwater analyses showed alkaline pH and elevated levels fluoride, cyanide, nitrate and mercury. Sealing of the ponds can prevent percolation of rainwater through the waste body and will have a significant positive impact by limiting the risk of leaching.

3 Cumulative impact - Heavy metal, PCB and PAH can accumulate in the sediment of the final receptor - Lake Skadar if the contamination is not remediated. The limiting of the percolation by covering the ponds will have a significant positive impact.

Monitoring program for the remediation of the red mud basins during the construction phases includes:

- River water: pH, heavy metals and fluoride once a month. 1 station upstream and 1 station downstream
- Air: Dust and PM10 daily visual inspection inside the construction site and outside in downstream wind direction
- Discharge water from drying of ponds: pH, heavy metals and fluoride once a month dependant on the discharge volume

Monitoring program for the remediation of the red mud basins during the operation phases includes:

- Control of drainage water quality: pH, heavy metals, fluoride PAH, PCB and mineral oil once a year for the first 4 years
- Control of top cover and efficiency of the drainage system: Visual inspection
- River water: pH and heavy metals once a year in spring time for the first 4 years
- 1 station downstream
- Groundwater: pH, heavy metals, fluoride PAH, PCB and mineral oil once a year for the first 4 years. 1 monitoring well upstream and 2 monitoring wells downstream
- Leachate: pH, heavy metals, fluoride, PAH, PCB and mineral oil 4 x year for the first 4 years

2 Objective of the Project and the ESIA Study

Background

The Ministry of Sustainable Development and Tourism and the Environmental Protection Agency (EPA) of Montenegro are preparing the Industrial Waste Management and Clean-up Project (IWMCP) with the objective to reduce the environmental and health risks posed by selected industrial waste disposal sites and to strengthen the local institutional capacity for regulation and management of industrial and hazardous waste.

Component 1 of the IWMCP comprises investigation and subsequently remediation of five selected contaminated industrial sites. The following sites have been selected:

- Aluminium Plant Podgorica
- Steel Plan Nikšić
- Thermal Power Plant Pljevlja
- Adriatic Shipyard Bijela
- Gradac flotation tailings pond.

Component 2 of the IWMCP comprises development of a national hazardous waste disposal facility. The objective is to develop a facility for reception and disposal of hazardous waste material from contaminated sites and from ongoing industries.

According to the World Bank Guidelines (OP 4.01), the remediation and the hazardous waste landfill project requires an Environmental and Social Impact Assessment (ESIA), Environmental Management Plan (EMP) and at least two public consultations.

This report includes an independent assessment of environment and social impacts from component 1 - the remediation of the five contaminated sites.

Objective of the ESIA-study

The overall objectives of the ESIA study for the remediation of the five contaminated sites are:

- To identify and assess environment and social impacts, both adverse and beneficial, in the project's area of influence
- To avoid, or where avoidance is not possible, minimize, mitigate, or compensate for adverse impacts on communities, and the environment
- To ensure that affected communities are appropriately engaged on issues that could potentially affect them
- To ensure that the procedure of public consultation is carried out and documented according to the international (World Bank) requirements, so that the World Bank could approve the loan provision to Montenegro for implementation of the 2 Components of the Project.

The ESIA study is an independent assessment of the impact on based on the site investigation and conceptual design of remediation prepared by the consortium CDM / Hidroinzeniring.

The ESIA study and the investigation and design study by CDM / Hidroinzeniring is on a feasibility level. In a later stage of the remediation project, additional environmental impact assessment will be included.

Background material for the ESIA study

The ESIA is an independent assessment of the remediation based on technical input from CDM, the consultant responsible for the site investigation and design of the remediation. The following technical background documents have been used:

- Interim Report. Site Investigations and Preparation Study for the Remediation of Industrial Waste Disposal Sites in Montenegro. CDM Hidroinzeniring. 03 June 2012.
- Other background material provided by the Ministry is listed in Appendix A.

The ESIA includes a summary of the findings presented in the interim report from CDM Hidroinzeniring. For detailed information on investigation and remediation please refer to the CDM Hidroinzeniring report.

The ESIA study and the investigation and design study by CDM / Hidroinzeniring is on a feasibility level. The remediations of the five contaminated sites are described in preliminary design with outline of the main principles for the remediation. The ESIA is prepared based on the preliminary design of the remediation and the level of detail in the ESIA is accordingly.

In a later stage of the remediation project, an additional EIA following the Montenegrin guidelines will be carried out based on the detail design of the project. The EIA following the national Montenegrin guideline and the World Bank EIA are nearly similar in context, however, the national EIA is carried out at the detail design phase whereas the World Bank ESIA is carried out in the

feasibility/preliminary design phase of the project. In this preliminary phase of the remediation project many mitigation measures in the Environmental Management Plan and monitoring in the Environmental Monitoring Plan can only be described in broad terms. In the EIA based on the detail design, also the mitigating measures can be described in more detail. A detail design of the remediation including an EIA following the national guideline is expected in 2013 before the construction can start.

3 Legislation and guidelines

Environmental Legislation in Montenegro

The framework of the environmental legislation of Montenegro is laid down in the *"Environmental Law of Montenegro"(published in Official Gazette of Montenegro 12/96).* This Law declares that Montenegro is envisaged as an Ecological State and that the authorities should work to upgrade the quality of human environments, reduce all factors that have a negative impact on human life and health and prevent any harmful effects on the human. The law also prescribes the polluter and user pays principles.

The *"Regulation on Environmental Impact Assessment of Montenegro" (Official Gazette of the Republic of Montenegro 14/97 and 80/05)* defines the activities subject to EIA, preliminary assessment procedures, public participation in decision- making, the procedures for the evaluation and verification of the EIA and the criteria for assessment reports. The law is fully harmonized with the EU directives regulating this area.

The *"Law on Waste Management in Montenegro" (Official Gazette of Montenegro, 80/05)* was adopted in 2005 and represents the legislative framework in the waste management sphere. In order to comply with the new European Union (EU) directive 2006/12/EC Waste Directive Montenegro introduced the *"Law on Amendments to the Law on Waste Management" (Official Gazette, number 73/08)* at the end of 2008. This law regulates waste management planning, classification of waste, defines the conditions for waste management, rights, obligations and legal responsibilities for waste operators, requirements and procedures for issuing permits, monitoring and other questions relevant for waste management. Several rulebooks and decrees have been introduced as a complement to the Law on Waste Management in Montenegro. These documents regulate specific topics of waste management.

In December 2011, a new "*Law on Waste Management in Montenegro"* was Implemented. The law describes the waste management including prevention or reduction of the amount of waste, reuse of waste collection, transport, processing and disposal facilities, monitoring of these procedures and subsequent maintenance of the landfill. In article 2 it is defined that the law is not applicable to land including contaminated sites. The section 4 describe the principles of the waste management including the polluters pay principle but also emphasizing the

sustainable development and prevention actions. Section 6 describe the various types of waste and that the type should be determined based on the hazardous properties and the characterization is described in section 7. In addition, the law requires manufactures to limit the amount of hazardous waste and specifies the responsibility of the waste producer.

Other laws and regulations include:

"Law on Integrated Pollution Prevention Control, 2005" regulates environmental pollution prevention and control by issuing integrated permits for installations and activities that may have negative impacts on human health, the environment or material resources.

"*Law on Environmental Noise"* regulates noise emissions and their impacts and establishes measures to reduce the harmful effect of noise on human health.

A strategy for hazardous waste has been prepared within the *"Solid Waste Strategic Plan of Montenegro, 2004"*. The purpose of this strategy is to identify a hazardous waste management which does not represent barriers to the best economic and environmental management of hazardous waste, and identifies potential initiatives minimising these barriers. The strategic interim objective of the plan is to establish a controlled system of production, treatment and intermediary storage of hazardous waste. Storage facilities will also serve for the initial years as an intermediary storage for export of the hazardous waste to treatment facilities abroad.

European Environmental Legislation

The most important EU directives regarding environmental impact assessment and waste management are:

- *"Directive 85/337/EEC on the Assessment of the effects of certain public and private projects on the environment".* The directive requires member states of the EU to carry out assessments of the environmental impact of certain public and private projects before they are allowed to go ahead. The aim of the EIA process is to ensure that projects which are likely to have a significant effect on the environment are assessed in advance so that people are aware of what those effects are likely to be.

- *"Directive 97/11/EC amending Council Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment"*. The directive was adopted by the Council on 3 March 1997. The new Directive extends the scope of Directive 85/337/EEC in terms of the type of projects for which impact assessment is compulsory. It also widens the band of projects which are subject to individual review by the Member State concerned and the criteria for this are given in the Directive. It further specifies the information which developers must supply and provides for cooperation of Member States in the case of transboundary projects.

- *"ODPM Circular 2/99 Environmental Impact Assessment".* Important guidance on the interpretation of the EIA Regulations and on the procedure to be used.

- *"Directive 2006/12/EC of the European Parliament and of the Council of 5 April 2006 on Waste".* This directive is a framework directive on waste management in EU. It contains four annexes that list categories of waste, disposal and recovery operations, amendments to article 20 in the directive and correlation table.

- *"Council Directive 1999/31/EC of 26 April 1999 on the Landfill of Waste with Council decision of 19 December 2002".* This directive establishes criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of Annex II to Directive 1999/31/EC. The main aim of this Directive is to sharpen operational and technical requirements on landfills, to provide for measures, procedures and guidance to prevent or reduce negative effects on the environment such as surface water, groundwater, soil and air, and on the global environment including the greenhouse effect as well as any resulting risk to human health. Annexes of the directive prescribe general requirements for all classes of landfills, waste acceptance criteria and procedures, control and monitoring procedures in operation and after-care phases.

- *"Council Directive 91/689/EEC of 12 December 1991 on hazardous waste".* The object of this Directive is to approximate the laws on the controlled management of hazardous waste.

- *"Council Directive 94/31/EC of 27 June 1994 amending Directive 91/689/EEC on hazardous waste".*

- *"Council Directive 86/278/EEC of 12 June 1986"* The objective of this directive is the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture.

World Bank Policies and Guidelines

The objectives of the World Bank's environmental and social safeguard policies are to prevent and mitigate undue harm to people and their environment in the project development. These policies provide guidelines for Bank and borrower staffs in the identification, preparation, and implementation of programs and projects.

The main document describing the World Bank Policy for environmental impact assessment is *"Operational Policy/Bank Procedure (OP/BP) 4.01 Environmental Assessment".* The objective of the OP/BP 4.01 is to ensure the environmental and social soundness and sustainability of the investment project. In addition, the policy supports integration of environmental and social aspects of projects in the decision-making process.

The OP/BP 4.01 Environmental Assessment consists of seven basic elements:

Screening
Environmental assessment (EA) documentation
Public consultation
Disclosure
Review and approval of EA documentation
Conditionality in loan agreements

Arrangements for supervision, monitoring, and reporting

The OP/BP 4.01 Environmental Assessment includes the following three annexes:

- "Annex A: Definitions"
- "Annex B: Content of an Environmental Assessment Report for a Category A project". This annex describes the items which should be included the EIA.
- "Annex C: Environmental Management Plan". This annex includes the set of mitigation, monitoring and institutional measures to be taken during implementation and operation of he project

In addition, the World Bank safeguards include the following relevant policies:

- *"OP/BP 4.04 Natural Habitat".* The objective is to promote environmentally sustainable development by supporting the protection, conservation, maintenance and rehabilitation of natural habitats and their functions.
- *"OP/BP 4.09 Physical Cultural Resources".* The objective is to assist in preserving physical, cultural resources and avoiding their destruction or damage. The Cultural resources include archaeological, paleontological, historical, architectural, religious, aesthetic or other cultural significance.
- *"OP/BP 4.12 Involuntary Resettlement".* The objective is to avoid or minimize involuntary settlement and, where this is not feasible, to assist displaced persons in improving or at least restoring their livelihoods and standards of living in real terms relative to pre-displacement levels or to levels prevailing prior to the beginning of project implementation.
- *"OP/BP 4.37 Safety of Dams".* The objective is to ensure quality and safety in the design and construction of new dams and the rehabilitations of existing dams and in carrying out activities that may be affected by an existing dam.
- *OP/BP 7.05 Projects on International Waterways*" The objective is to ensure projects will neither affect the efficient utilization and protection of international waterways, nor adversely affect relations between the Bank and its Borrowers.

4 Description of the Project

The objective of the project for remediation of the industrial waste disposal site in Montenegro is to identify the most adequate remediation solutions to prevent further risks to the environment and the population from these sites.

Procedure and reason for the selection of the remediation opt

The five largest and most environmentally problematic dumpsites in Montenegro were chosen for characterization, evaluation and assessment to develop a site specific remediation strategy to ensure safe environment. The possible remediation options include:

- Complete removal of waste material and re-disposal or export
- Remodelling of the current disposal site with appropriate securing measures
- Chemical stabilization of contaminated materials
- Recycling of waste materials for new applications

As a first step, the company consortium CDM/Hidroinzeniring (CDM) has carried out additional investigation of the five sites. Based on the results, CDM carried out a risk assessment and prepared a preliminary design of the remediation with three alternatives. Based on the alternatives, EPA has selected the most feasible alternative for the remediation.

Description of the remediation

The description of the remediation has been reported by CDM in the Interim Report: "Site Investigations and Preparation Study for the Remediation of Industrial Waste Disposal Sites in Montenegro. CDM Hidroinzeniring. 03 June 2012". Subsequently, the EPA has informed COWI about the selected alternative which has to be used for the ESIA. Short description of each remediation can be found in the relevant chapters of this ESIA report.

Assessment of the overall sustainability of the project

The present disposal of industrial waste at the five contaminated sites in Montenegro is not sustainable in the sense that most solid hazardous waste is disposed at uncontrolled sites which carries potential risks for significant adverse impacts on environment and health. The waste has been disposed at dumpsites without membrane, fence or any significant protection measures. All this leads to a non-sustainable present situation in respect to spreading the contaminants to the environment with risks to human health and the environment.

The study by CDM has investigated the potential for establishing cost-effective remediation of the five most contaminated sites in Montenegro. The approach has included cost-benefit analysis.

The location of the five contaminated sites for remediation

The location for the five selected sites for remediation is shown in Figure 1.

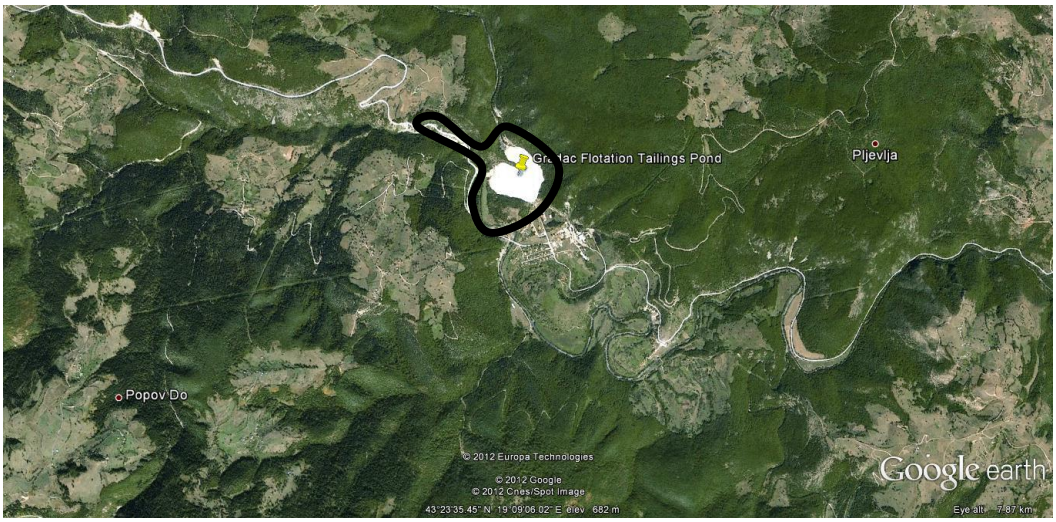
Figure 1 Location of the five sites

5 Gradac remediation project

Location

The contaminated site “Flotation Tailing dump site” originates from the activities of the lead and zinc „Suplja Stijena“ mine. It is located on the right bank of the river, 500 m downstream from the settlement Gradac Donji, and about 400 m from the flotation facilities. The site is about 30-40 km west of the city of Pljevlja, downstream of the Ćehotina River. The location is shown in Figure 2:

Figure 2 Location of Gradac Tailings Pond contaminated site and project area of impact



Impact assessment of the current situation and possible mitigation measures

The current impact from the contaminated site at Gradac is summarised in Table 1. In the present situation, the contaminated dump site has several negative impacts on the environment and on the social-economic environment. The objective of the remediation is to limit the negative impact by implementing various mitigating measures.

The remediation has a significant positive impact on the environment; however during the implementation of the remediation some short-term minor negative impacts might be expected including noise, increased traffic or dust related to the construction works during implementation of the remediation. The impact during the construction phase and the operational phase of the remediation is included in the Environmental Management Plan and Monitoring Plan in section 5.4.

Table 1 Summary of environmental and social impacts from the existing dump site and possible mitigating measures

Subject	Issue	Current impacts from dumpsite	Mitigation measures	Future impacts after remediation
1. Soil - Exposition of humans and animals to contaminated soil by direct contact	The area is uncovered and has no vegetation. The maximum and average concentrations of lead and arsenic in the soil exceed the threshold values.	Negative impact	Installation of a fence around the tailing pond.	Positive impact by preventing direct contact risk
2. Air and dust - Exposure of humans and animals to contaminated dust - wind erosion of surface particles	The floating sediments show size maximum of 75% for diameters smaller than 0.63 mm and such small particles can easily be spread by wind. The most frequently occurring wind direction is from northwest exposing the nearby settlement. Previous investigations did not show negative impacts on the settlement	Significant negative impact	Covering of the surface with a minimum of 30 cm uncontaminated soil	Significant positive impact by preventing future spread of contaminated particles
3. Drainage water - Exposure of humans and animals to contaminated surface or drainage water	The surface water on top of the dump site and the drainage water at the dam toe are slightly contaminated with heavy metals (cadmium, lead and zinc)	Minor negative significant	Installation of a fence to prevent uncontrolled access.	The mitigation measure has a positive impact preventing access to contaminated water
4. River water – erosion of soil at the tailing pond slopes	The slopes of the dams show significant soil erosion	Significant negative impact	Stabilization of the slopes with geotechnical measures	Positive impact by preventing erosion of the soil
5. River water - landslide of contaminated soil	Instability of the dams cannot be excluded. Large volumes of contaminated soil could slide down into the riverbed. Contaminated material will be spread and washed into the river which flows into Bosnia Herzegovina. This poses a risk for trans-border contamination from the existing dumpsite.	Significant negative impact	Slope stabilization by geotechnical measures is necessary.	Significant positive impact by securing the slope.
6. River water - Adverse effects of contaminated seepage water on the river water and inhabiting fauna	Current and previous analyses of river water do not indicate impact on the river water quality	Not significant impact	Monitoring of river water is recommended	Minor positive impact by limiting the risk of contamination of the river water
7. River water - Adverse effects of contaminated	According to CDM, the water quality of Ćehotina river can be categorized as	Not significant impact	Monitoring of drainage water from the tailing	Minor positive impact by limiting the risk of

Subject	Issue	Current impacts from dumpsite	Mitigation measures	Future impacts after remediation
seepage water on river water and human usability	satisfactory for the use as bathing water		ponds	contamination of the river water
8. Groundwater - Adverse effects of contaminants seepage water on groundwater	The investigation has indicated leaching of contaminants into the groundwater and potential risk of drinking and irrigation water cannot be excluded	Minor negative impact	Sealing of the tailing pond can prevent percolation of rainwater through the waste body	Positive impact by limiting the risk of leaching
9. Indirect impact	No indirect impacts is expected	-	-	-
10. Cumulative impact	No cumulative impact is expected	-	-	-
11. Transboundary impact	In case of dam failure the sediments might be spread by the river into neighbouring Bosnia Herzegovina	Significant negative impact	Stabilization of the slopes with geotechnical measures and water control	Significant positive impact
12. Social impact	The presence of a contaminated site gives the location a bad reputation	Minor negative impact	The remediation will have a positive impact on the local environment at Gradac Donji. Temporary, some residents may find short-term employment with the contractor responsible for the remediation.	Minor positive impact

5.1 Remediation Project for Gradac Contaminated Site

The remediation project at Gradac contaminated dump site includes:

- Geotechnical securing of the slopes
- Surface sealing
- Installation of a drainage system for melt water and precipitation
- Optional: re-cultivation of the top layer

The slopes will be secured in one of the two ways: 1) shaping the slopes with flotation material or 2) backfilling the erosion rills with material of smaller grain-size.

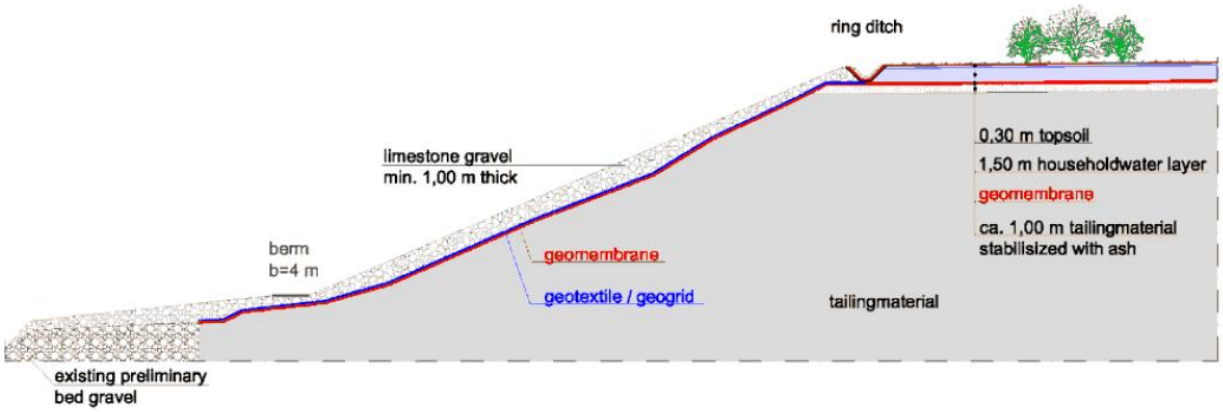
The surface of the waste body will be covered by approximately 1 m of material e.g. ashes from the Pljevlja site to improve the geotechnical stability. This is followed by a geomembrane and sealing layer e.g. plastic liner or bentonite layer. Finally, the surface will be covered by a layer of topsoil.

Water from the snow melt and rain will be collected in a planned ring channel system as shown in the figure below. The surface of the tailing pond will be sealed as described and this will prevent the melt and rainwater from infiltrating the waste body. The surface water from the waste body will drain into the ring channel system.

To further prevent infiltration, the top layer can be covered by vegetation and limestone can be added to reduce mobilization of the heavy metals. Heavy metals are usually mobile under low pH, but become immobile under high pH. Limestone will elevate the pH and the heavy metals will thereby become less mobile.

The remediation is illustrated in Figure 3.

Figure 3 *Illustration of the remediation at Gradac (Drawing prepared by CDM Consult)*



The advantages and disadvantages of the selected remediation are shown in Table 2.

Table 2 The advantages and disadvantages of the selected remediation

Remediation	Advantages	Disadvantages
Selected option Sustainable and long - term securing of the tailings dump	• Flotation material can stay on-site • No costs for disposal of the contaminated tailings material • Melt water and rain water will be led off in a controlled manner • Minimization of erosion effects (wind, heavy rain events) • Elimination of seepage water flowing through the tailings body • Continuous reduction of drainage water outflow at the dump foot until near cessation • Drying-out of the tailings material over the years • Lower costs for the additional construction measures compared to alternative 1 • Smooth an sound use of brown coal ash from the Thermal Power Plant Pljevlja (if applicable) • No additional costs for amendment material (if applicable) • Recultivation of the tailings pond surface and subsequent use is possible	• Costs for the construction measure • Proof must be provided for the stability of the existing dams and embankments • Further geotechnical investigation and planning necessary • Availability of suitable brown coal ash must be secured • Preliminary testing of the stabilizing properties of the chosen brown coal ash is necessary • Future monitoring necessary

5.2 Environmental Baseline

Description of the site and surroundings

The tailings pond site covers an area of 95,000 m^2 and is situated at 685 m above sea level. It is estimated that the site contains around 3,900,000 tons of tailing material consisting of small fragments that contain considerable amounts of heavy metals (0.24% lead; 0.70 % zinc; iron, copper etc).

The tailing pond is constructed with dams. One dam is located west – northwest of the pond. It is divided into two sections by a ridge and faces the river. Another dam is located to the east and faces the village. Each dam is 20-30 m high and both show serious surface erosion.

The tailing pond is visually divided into two sectors, which also demanded construction of two additional border dams. Occupied area is assigned as dump disposal extracted in the production process of lead and zinc. The height of disposed waste material is about 30 m.

Hydrology

The dump site is placed on the valley floor in an area where the river Ćehotina used to meander. The tailing dump site is constructed inside the meander and the river flow is redirected through the two new-built assigned tunnels through the mountain. The western and north-western slopes of the tailing are constructed as

artificial dams. The north-eastern and eastern borders are the slopes of the mountain Plana, while from the south the tailing is bordered by a natural mound. Between the Plana mountain slopes on eastern side and natural mound on the southern side, a valley has been formed and is enclosed by an artificial dam. The settlement Gradac Donji with buildings and infrastructure is located next to the eastern dam.

Climate

The climate is oceanic (Köppen climate classification: Cfb) with moderate continental climate features. The moderate mountain influence is reflected in the extremely low temperatures, making Pljevlja among the coldest municipalities in Montenegro. Pljevlja is the city with the highest number of cloud covered days in Montenegro and it is affected by fog about 200 days a year.

Cultural assets

There are no known monuments or cultural assets in close vicinity.

Flora, fauna and natural resources

The area around tailing dump site is dominated by forest vegetation. On the southern exposed slopes, oak forests appear while on the opposite, northern exposed slopes mixed beech-spruce forests predominate. Typical riparian vegetation appears along the banks of Ćehotina River. The entire area shows predominant characteristics of natural, non-modified landscape. Agro ecosystems are poorly represented, mainly as infields inside the settlement Gradac. Forest complexes are homogenous and cover large areas.

Biogeographically, the tailing dump site location belongs to the “Alpine biogeographical region”. Given the described characteristics of the area and the fact that it is predominantly hilly-mountainous and very sparsely populated, considerably high biodiversity is expected, both terrestrial and aquatic.

The entire Ćehotina river flow, riparian area and flows of tributaries are recognized as a significant area for establishing the Emerald ecological network in Montenegro, and the tailing dump site is thus situated inside the Emerald site. Approximately 10 km south-west of the site (air distance) there is another proposed Emerald network site – Regional Natural Park “Ljubišnja” which occupies part of the mountain area.

Previous investigations

The previous investigation of the Gradac contaminated sites includes inter alia:

1 Tailings Area Remediation Project for the " Šuplja Stijena" in Gradac near Pljevlja Book 1. Ascultation Design In English and Montenegrin

2 Rehabilitation Project of flotation tailings of the mine at Šuplja Stijena Gradac Pljevlja Book 2 vol. 1 Hidortechnicka main tailings remediation project hirografevinski general technical contributions

3 Tailings Area Remediation Project for the "Šuplja Stijena" mine in Gradac near Pljevlja, Book 3. Restoration of the Ore Flotation Plant with a view to Permanent Elimination of Detrimental Environmental Impacts (in English and Montenegrin)

The previous investigations include three reports prepared by the University of Belgrade describing the situation at the former Suplja Stijena mine and associated tailings area. The first report (Book 1) assesses the environmental risks caused by the fine grained tailings material deposited at the river bank. The study includes analyses of tailings material, drainage water, spring water and river water of the Ćehotina River.

As expected the soil analysis of drilling core and near surface samples from 2006 show high concentrations of zinc, lead and cadmium in the tailings material.

The scope of the second report (Book 2) is a geotechnical assessment of the slope stability of the tailings dump. This study includes a conceptual plan for geotechnical securing measures.

The third report (Book 3) of this series summarizes the production process of the flotation facility and records the remaining reagents (e.g. $Ca(OH)_2$, NaCN, $ZnSO_4$, and $CuSO_4$) left after closure in 2000. According to the research of CDM, the dumpsite is neither monitored nor maintained. The technical design of the tailings pond was never completed and there was no drainage system installed whatsoever. Heavy metals are washed out by rain and migrate into the groundwater and the river.

The tailing material amounts to 3,900,000 tons and has high concentrations of germanium, zinc, lead and cadmium (Book 1). The highest measured concentration is shown in Table 3.

Table 3 Highest concentration of contamination

Component	**Highest concentration in mg/kg**
Germanium	42.9
Zinc	9980
Lead	997
Cadmium	11.8

Additional investigation by CDM

The new investigation conducted by CDM includes additional drilling, leaching tests, sampling and analyses of soil, groundwater and surface water. The results of the investigation by CDM are shown in Table 4.

Table 4 Results from site investigation of tailing pond at Gradac

	Investigation	**Results**
Analyses of solid material	15 soil samples and 10 surface samples	Exceeding threshold limits Lead up to 9400 mg/kg Zinc up to-5000 mg/kg Arsenic up to 232 mg/kg Cadmium up to 17 mg/kg Mercury up to 3 mg/kg
Leaching test	Heavy metals and organic components	Highly acid geochemical conditions that support intense leaching of heavy metals
Surface water	1 water samples from the pond on top of the tailing pond	Exceeding threshold limits Cadmium 0.03 mg/l Zinc 11 mg/l Lead 0.27 mg/l
Drainage water	1 drain water sample from the west toe of the dam and 1 drain water sample from the northwest toe of the dam	Exceeding threshold limits Cadmium up to 0.4 mg/l Copper up to -0.6 mg/l Zinc up to -290 mg/l Nickel up to 0.8 mg/l Lead up to 0.25 mg/l
River water	1 river water sample downstream the tailing pond 1 river water sample upstream the tailing pond	Slightly elevated nitrite concentrations. No detection of elevated concentrations of heavy metals or organic components
Groundwater	1 groundwater sample from 17 m	Exceeding threshold limits Copper 0.67 mg/l Zinc 260 mg/l Nickel 0.83 mg/l Lead 2.33 mg/l Cyanides 0.053 mg/l

Characterization of the waste body

The results of the investigations show that the site is a potential source for contamination of the surrounding area. The contamination with heavy metals will be the main parameter for designing the remediation of the contaminated site. This type of contamination is generally relatively immobile. General characterization of the site based on available material is shown in Table 5.

Table 5 Preliminary characterization of the site in relation of remediation

Preliminary description	**Characterization**
Source volume	Very large volume (3,900,000 tons)
Source type	Dominated by heavy metals
Source strength	The concentrations of contaminants are low to medium but the large volume means a relatively high source strength
Hot spots	Not expected. Waste probably disposed relatively homogenously in the tailing pond
Sensitivity of surrounding area	High. Pristine area with high biodiversity and small residential area nearby. Full removal of the 3.9 million tons of waste is not feasible because full removal will have a very high environmental impact on the area with potential high spread of contaminants and have a very high cost.

5.3 Social-Economic baseline

Population data for Republic of Montenegro, Municipality Pljevlja and settlement Gradac, according to official preliminary data from Population Census in 2011, are given in Table 6.

Table 6 Population data for Republic of Montenegro, Municipality Pljevlja and settlement Gradac

	Total	Urban	Rural
Montenegro	625 266	401 462	223 804
Pljevlja	31 060	19 622	11 438
Gradac	295	-	-

Source: MONSTAT, Census of Population, Households and Dwellings in Montenegro, First results 2011.

The settlement of Gradac Donji is located south of the dumpsite with the school only a few meters from the southern dam. The residents were previously employed at the mine but are now mainly unemployed. No people are permanently living within the tailing pond. The nearest houses are seen in Table 7.

Table 7 Houses nearby the dump site

	Type	**Approximate distance to border of the dumpsite**
North west	Farmhouses	500
South	Village of Gradac Donji	25
West	Mountain area	-
East	Mountain area	-

Potential for employment

The potential for employment during the construction phase of the remediation may draw people to the area. On the positive side, there may be a temporary increase in economic activity and employment for the local community and local skills development.

The construction work related to the remediation can be tendered nationally or internationally according the WB procurement procedure. It is expected that national procedure will result in more input from companies located in Montenegro whereas the exchange of knowhow will be less.

5.4 Environmental and Social Management and Monitoring Plans

The purpose of the Environmental Management Plan (EMP) for the remediation is to ensure that all adverse environmental impacts are within the acceptable level. The EMP sets out to ensure that all aspects of the works comply with the relevant legislation, permit conditions and good practices, and that measures to mitigate the negative impacts identified in the ESIA are implemented. The EMP strives to implement appropriate environmental controls and monitoring procedures during construction.

The EMP and Monitoring plans are the basis for fulfilling the requirements under Montenegrin legislation. In a later phase, the Environmental Protection Agency will require all construction contractors to develop a detailed Construction Environmental Management Plan for their respective activities. The detailed CEMP should include detailed method statements, environmental control procedures and environmental compliance monitoring to be carried out during the construction works. The cost estimated is a rough assessment presented usually as less than and based on the following general principles:

- Mitigation measures usually included in good practices by the successful contractor is estimated to be minimal e.g. dust suppression by watering.
- Cost of visual inspection is estimated as minimal
- Installation of additional monitoring wells are estimated to less that 10,000 Euro each
- Chemical sampling, handling and analyse of soil or water are estimated to less than 500 Euro for a typical analyses including heavy metals and pH.
- Other cost estimate is given as best estimate

Table 8 Environmental and Social Management Plan

Phase	Issue	Mitigating Measures	Cost		Institutional Responsibility	
			Installation	**Operation**	**Installation**	**Operation**
Construction						
	Dust	Watering during dry periods, covering truck carrying soil during transportation. No work causing dust formation most be carried out during strong wind in the direction toward the settlement of Gradac.	To be included in the bid from the Contractor (minimal)	To be included in the bid from the Contractor (minimal)	Contractor supervised by EPA	Contractor supervised by EPA
	Handling of oil and fuel used for Contractor's vehicles and machinery	Oil and fuel should be stored in places with secondary containment. No drums must be placed directly on ground	As above	As above	As above	As above
	Traffic	Speed limits near small villages, road signs	As above	As above	As above	As above
	Work in contaminated tailing pond material	Use of Personal Protection Equipment, staff training The contractor shall prepare a health and safety plan before the implementation of the work. Special precautions for dust shall be taken including providing mask for workers and watering of the waste during dry seasons.	As above	As above	As above	As above
	Noise	The noise impact is related to the	As above	As above	As above	As above

Phase	Issue	Mitigating Measures	Cost		Institutional Responsibility	
			Installation	**Operation**	**Installation**	**Operation**
		use of machineries like bulldozer, waste compactor, vehicles for material transport; Limiting time for construction work suggestion: 07 – 20 h. Special restrictions to be implemented when working at the east site of the dumpsite near the school.				
	Construction waste	Any re-disposal of waste material from construction activities like levelling or excavation should be disposed internal on the dumpsite and only on areas already contaminated. Any new waste generated during the construction shall be disposed at controlled landfills.	As above	As above	As above	As above
	Social issue	Locals might gain temporary employment during the construction phase. The tender for the remediation work should include a clause that encourage employment of local people	To be included in the bid from the Contractor	To be included in the bid from the Contractor	As above	As above
	Training	The contractor shall set up a health and safety organization before the implementation of the work. The contractor shall also ensure that all relevant staff has been training in health and safety issue not at least	As above	As above	As above	As above

Phase	Issue	Mitigating Measures	Cost		Institutional Responsibility	
			Installation	**Operation**	**Installation**	**Operation**
		in relation to work in contaminated soil and use of personal protection equipment.				
Operation						
	Control of drainage water quality	Visual inspection and water sampling	-	5,000-10,000 Euro	Operator supervised by EPA	Operator supervised by EPA
	Control of leachate	Installation of 3 monitoring wells inside the dumpsite and water sampling	20,000-30,000 Euro	< 5,000Euro	As above	As above
	Control for damage of top cover and efficiency of the drainage system	Visual inspection	-	Minimal	As above	As above
	Control of surface soil in the village of Gradac Donji	20 surface soil samples from various garden risk assessment of residual contamination	5,000-10,000 Euro	-	As above	As above

Table 9 Environmental and social monitoring plan

Phase	Item	Parameter	Frequency	Location	Installation cost	Operation cost / year	Responsibility
Construction							
	River water	- pH - Heavy metals	Once a month	1 station upstream and 1 station downstream	<5,000 Euro	< 10,000 Euro	Contractor supervised by EPA
	Groundwater	- pH - Heavy metals	Once a month	Minimum 3 monitoring well at various locations. Existing well should be used if possible	< 30,000 Euro	< 15,000 Euro	Contractor supervised by EPA
	Air	- dust - PM_{10}	Daily visual inspection	Inside the construction site and outside in downstream wind direction	Minimal	Minimal	As above
Operation							
	Control of drainage water quality	-visual inspection - pH -Heavy metals	Once a year	Remedial system	-	<5,000 Euro	Operator supervised by EPA
	Control for damage of top cover and efficiency of the drainage system	- visual inspection	Once a year	Remedial system	-	<5,000 Euro	As above
	River water	- pH - Heavy metals	Once a year	1 station upstream and 1 station downstream	-	<4,000 Euro	As above
	Groundwater	- pH - Heavy metals	Once a year	Minimum 3 monitoring well at various locations surrounding the dumpsite.	-	< 5,000 Euro	As above

				Existing well should be used if possible			
	20 surface soil samples	- Heavy metal	Once after completion of the remediation	From gardens in the village of Gradac Donji	5,000-10,000 Euro	-	As above
	Control of leachate	- heavy metal	Once a year	Installation of 3 monitoring wells inside the dumpsite	15,000 EUR	< 5,000 Euro	As above

5.5 Alternatives

0-alternative

The 0-alternative means doing nothing. The current negative impacts from the contaminated tailings pond will continuously represent a risk of environmental and risk of human exposure.

A. Excavation

This alternative includes a complete excavation of the tailings material and re-disposal at another dump site either inland or abroad. The excavation of the dump will take several years and during the excavation, the material will be exposed to constantly changing weather conditions. The excavation and re-disposal is very costly and will require further geotechnical investigations and planning.

B. Minimizing the erosion effects

This alternative is a geotechnical securing measure which involved partial heightening of the dam to ensure protection against erosion. The alternative also includes constant water cover of the pond to prevent spread of contaminated dust particles but no measures for preventing leaches of water from the dump.

The most prevalent environmental impacts from the three alternatives are shown in Table 10.

Table 10 Environmental impacts from alternatives

Alternative	**Phases**	**Impact**
0-alternative		Significant negative impact for human and environmental exposure
A. Excavation	Construction phase	Significant negative impact on the local community due to heavy traffic Significant negative impact on the local community due to release of potentially contaminated dust particle during the excavation Significant negative impact due to risk of mobilizing the contamination during the excavation with potential for impact on surface water and groundwater
	Operation phase	Significant positive impact on the environment as the contamination is removed Significant positive impact as risk of dam collapse is eliminated

B. Minimizing the erosion effects	Construction phase	Positive impact on minimizing the risk of release of potentially contaminated dust particles The existing negative impact on surface water and groundwater will remain
	Operation phase	Significant positive impact as risk of dam collapse is eliminated

The advantages and disadvantages of the alternatives are shown in Table 11.

Table 11 The advantages and disadvantages of the alternatives

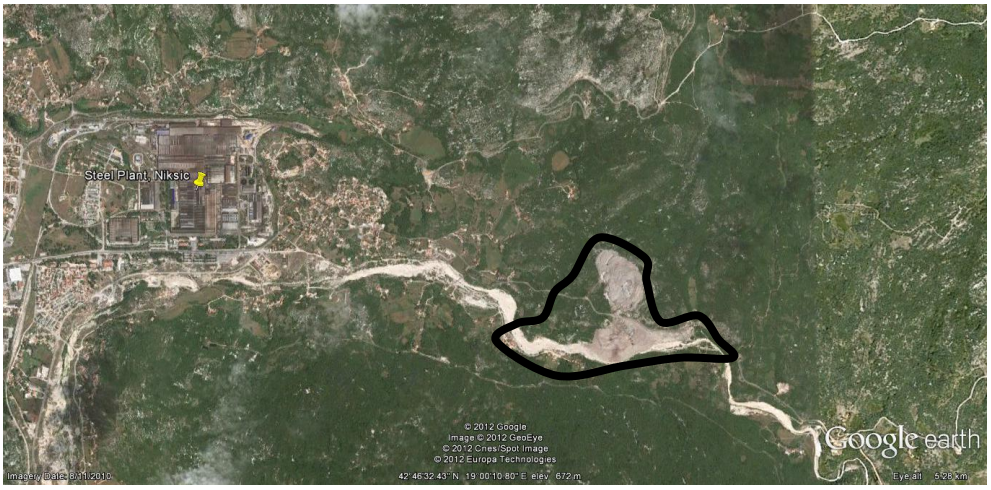
Alternative	**Advantages**	**Disadvantages**
A. Excavation	• Save alternative to stop the contaminant transport into the groundwater or Ćehotina River • Save alternative to stop abrasion and contaminant transport via wind erosion/ dust formation • Immediate improvement of the local environmental situation	• High investment costs for the construction measure • High costs for transport and disposal of the material • Unclear fate of the contaminated material after removal • Stability against collapse of the embankments must be proven • Further geotechnical investigation and planning necessary
B. Minimizing the erosion effects	• Flotation material can stay on-site • No costs for disposal of the contaminated tailings material • Minimization of wind erosion if a constant water coverage can be assured throughout the whole year and the surface does not fall dry, even partly • Lower costs for the additional construction measures compared to alternative 1	• Percolation of seepage water through the dump body will continue and transport dissolved contaminants into the groundwater and river • The melting water and rain water from the natural mountain ridge will continue to run down the north-western and northern slopes, maintaining erosion effects • With continued erosion activities the stability of the tailings dams will be affected • Costs for the construction measure • Contaminated seepage water can flow into the planned drainage channels at the bottom of the slopes and flows into the river untreated • Proof must be provided for the stability of the existing and planned dams at any filling level • Further geotechnical investigation and planning necessary • Future monitoring necessary

6 Nikšić Remediation Project

The location of the Nikšić Steel Factory dump site is about 3 km east of the factory in a natural valley on the edge of Gračanica River valley. The location of the Nikšić Steel Plant dumpsite is shown in Figure 4.

In addition, the Nikšić site is also considered a potential location for establishing a national hazardous waste facility as described in the concurrent study by Ecorem.

Figure 4 Location of Nikšić Steel Plant dumpsite and project area of influence



Impact assessment of the current situation and possible mitigation measures

The current impact from the dumpsite outside Nikšić is summarised in Table 12. In the present situation, the contaminated dump site has several negative impacts on the environment and on the social-economic environment. The objective of the remediation is to limit the negative impact by implementing various mitigating measures.

The remediation has a significant positive impact on the environment; however during the implementation of the remediation some short-term minor negative impacts might be expected including noise, increased traffic or dust related to the construction works during implementation of the remediation. The impact during the construction phase and the operational phase of the remediation is included in the Environmental Management Plan and Monitoring Plan in section 6.4.

Table 12 Summary of mitigation at Nikšić Steel Plant

Subject	Issue	Current impacts from dumpsite	Mitigation measures	Future impacts after remediation
1. Soil - Exposition of humans and animals to contaminated soil by direct contact (surface soil)	The area is uncovered and has no vegetation. The maximum and average concentrations of lead and cadmium in the soil exceed the threshold values.	Medium negative impact	Installation of a fence around the dumpsite	Positive impact by preventing direct contact risk
2. Dust - Exposure of humans and animals to contaminated dust, wind erosion of surface particles	The soil material contains 60-80% for diameters smaller than 0.63 mm. This fraction can easily be spread by wind especially in the summer season. Negative impact is limited as the area is virtually uninhabited. Impact on the Nikšić is not expected	Medium negative impact	The old part of the dumpsite should be levelled and both the dump and the slope should be covered by at a minimum 30 cm uncontaminated soil The new part of the dumpsite is still in operation. Where possible the dump should be levelled and reconstructed into a controlled landfill. Fly ashes should be wetted and covered by contaminated soil or waste.	Positive impact by preventing future spread of contaminated particles
3. River water – erosion of soil at the slopes of the dump	The slopes of the southern part show significant soil erosion with potential for transport of soil into the river	Significant negative impact	Stabilization of the slopes with geotechnical measures like slope banking and covering with topsoil	Positive impact by preventing erosion of the slope and eliminate the risk of waste sliding into the river
4. River water – landslide of contaminated soil	The risk for potential landslides along the dump slopes is considered to be low	Minor negative impact	None as the stabilization of the slopes in point 3 will prevent any significant soil transport.	Positive impact by preventing erosion of the slope and eliminate the risk of landslide into the river
6. Indirect impact	No indirect impacts is expected	Not significant impact	-	-
7. Cumulative impact	No cumulative impact is expected	Not significant impact	-	-
8. Transboundary impact	Nikšić is located more or less in the middle of Montenegro and no transboundary impacts are expected	Not significant impact	-	-
9. Social impact	The remediation has a negative long-term impact for the waste	Minor positive impact	The tender for the remediation work should include a	Short-term positive for the waste collectors.

Subject	Issue	Current impacts from dumpsite	Mitigation measures	Future impacts after remediation
	collectors who will lose their source of income. The remediation will have a positive short-term impact on the local employment at Rubeza or other local villages if some of the some residents can be employed by the contractor for the remediation.		clause that encourages the employment of locals particularly the waste collectors	

6.1 Remediation of Nikšić Contaminated Site

The Nikšić dumpsite consists of the old dumpsite D1 located south of the road towards the river and the new dumpsite D2 located north of the road. The remediation project at Nikšić contaminated dumpsites includes:

- Geotechnical securing of the slopes of D1
- Surface sealing and re-cultivation of D1
- Optional: re-cultivation of the top layer of dumpsite D1
- Reconstruction of dumpsite D2 into a regulated landfill

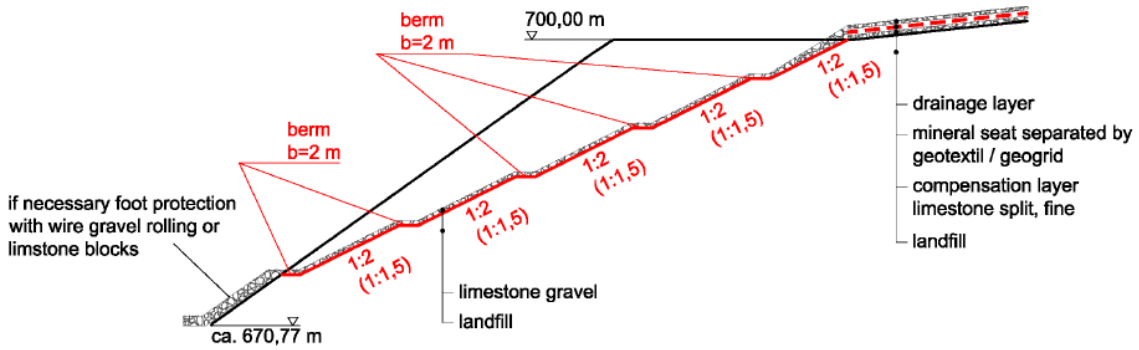
The geotechnical securing of the slopes of D1 requires extensive profiling of the waste material. The securing will prevent the embankment against erosion and landslides thereby protect the nearby river.

Applying a top layer will prevent direct human contact and give a protection against dust and spread of windborne contaminated particles. The sealing could consist of limestone layer underneath a drainage layer. These layers can be separated by a geomembrane.

The reconstruction of dumpsite D2 might include extensive soil work.

The remediation is illustrated in Figure 5.

Figure 5 *Illustration of the remediation at Nikšić dumpsite D1 (Drawing prepared by CDM Consult)*



The advantages and disadvantages of the selected remediation are shown in Table 13.

Table 13 *The advantages and disadvantages of the selected remediation*

Remediation	**Advantages**	**Disadvantages**
Selected option Closure of dump site 1 and reconstruction of the dump site 2	Pro dump 1: • Wind-carried transport eliminated • No landslides or deposition of contaminated material in the river Gracanica • Recultivation and usage of the area is possible, integration into the landscape Pro dump D2: • Transformation of an uncontrolled dumpsite into a regular-operated landfill. This provides a proper preparation for future closing and securing measures • Prevention of landslides at the slopes • Recultivation and usage of the area is possible • Cost-efficient creation of a regular-operated landfill for similar industrial waste.	• High costs for the construction measure • High transportation costs • Costs for covering and sealing material • Proof must be provided for the stability of the slopes at every stage of construction • Further geotechnical investigation and planning necessary

6.2 Environmental Baseline

Description of the site and surroundings

The dumpsite has been used since 1956. It is estimated that it contains around 2 million tons of waste generated in the production process at the Nikšić steelwork. The waste has been disposed without pre-separation and any kind of pre-treatment.

The dumpsite is divided into two separate parts. Since 1974 about 600,000 m^3 of all kinds of unsorted industrial waste from the steel plant have been deposited at the southern dumpsite. Because this older part of the dumpsite only had limited

capacity, a second northern dumpsite was opened in 2006 opposite the old dump site. It has an estimated capacity of 825,000 m^3.

The slope of the dump close to the river has been partially excavated; large amounts of material (at least some 1000 tons of slag) have been removed recently. The dumpsite covers an area of approximately 12.5 ha.

The main waste streams from Nikšić Steel Work consist of ash from the thermoelectric power facility (12,000 t/year) and sludge from the wastewater treatment plant as well as waste ash and slag from the moulding/foundry sands. This material contains heavy metals and PCB as well as other contaminants.

The dumpsite is located in the cast valley of Visinapolja surrounded by cast mountains (High Cast) consisting of Mesozoic limestone and dolomites. No specific classification of the geological layers succession has been available.

The area around the dumpsite is unpopulated or very sparsely populated. The village Rubeza is located about 1 km west of site. On the southern edge of the dumpsite across the Gračanica River there are a few houses, but it is not known whether they are permanently or temporarily inhabited or completely abandoned.

Flora, fauna and natural resources

The terrain is predominantly hilly-mountainous, with fairly deep Gračanica River valley. The entire area is characterized by relatively widespread and compact complexes of broad-leaved forest vegetation. Considering the character and homogeneity of the vegetation cover, it is expected that the area contains the floral and faunal elements that are common for the predominantly broad-leaved forest ecosystems of submediterranean with predominantly broad-leaved forests. There are no protected nature areas in the region.

Hydrology

The river Gračanica has its source in the mountains approximately 20 km southeast of Nikšić near Kuta. The river flows in a north western direction passing the dam lake Jezero Liverovici. After the lake, the river seems to drain away into cast underground until Nikšić, where it reappears and continues in a southern direction.

Climate

The climate of the Nikšić area has the characteristics of both Mediterranean climate and Continental climate. The average temperature for January is 1.3 °C (34.3 °F), while the average temperature in July is 21.1 °C (70.0 °F). Average humidity amounts to 68.6%. Nikšić receives 2,245 hours of sunshine per year, with hot and dry summers and rainy winters. On average, there are 19 days per year with snowfall.

Cultural assets

There are no known monuments or cultural assets in close vicinity. The Monument for the habitants of the village Dragovoljici who were killed in the First World War is about 2 km east of the site with no direct visibility.

Previously investigations

The previous investigations include inter alia:

1 Projektni Zadatak, Za Izradu Glavnog Gradjevinskog Projekta Deponije Konjev do 2 (Terms of Reference, The making of the Construction Project to Landfill, Konev 2)

2 Nikšić, short description of Nikšić landfill

The two dumpsites were investigated in 2006 and 2007. The result of the investigation showed a moderate to high contamination in mixed sampled with cadmium (Cd), Lead (Pb), Chrome (Cr), Nickel (Ni), Boron (B) Molybdenum (Mo) and Fluor (F). Elevated concentrations of PAH and PCB were detected in the southern part of the dumpsite and elevated concentrations of PAH were detected in the northern part of the dumpsite.

Additional investigation by CDM

The new investigation conducted by CDM includes additional drilling, leaching tests, sampling and analyses of soil, groundwater and surface water. The results of the investigation by CDM are shown in Table 14.

Table 14 Recent analysis by CDM

Analysis	Samples	Results
Analyses of solid material	2 surface samples and 7 soil samples from boreholes	Exceeding threshold limits Copper up to 3903 mg/kg Zinc up to 3170 mg/kg Chromium up to 2907 mg/kg Nickel up to 299 mg/kg Cadmium up to- 22 mg/kg Lead up to 2615 mg/kg PAH up to14.9 mg/kg PCB up to38 mg/kg Mineral oil - not significant
Leaching test	Heavy metals and organic components	Slightly acid to slightly basic geochemical conditions that support low leaching of heavy metals
Surface water	A sample from lake Jezero Liverovici	No elevated concentrations of inorganic or organic components
Groundwater	No groundwater in the deep monitoring wells	No analyses

The concentration of lead, cadmium, copper, chromium and nickel in the soil is especially high although the risk of leaching is only moderate.

Characterization of the waste body

The results of the investigations show that the site is a potential source for contamination of the surrounding area. The contamination with heavy metals will be the main parameter for designing the remediation of the contaminated site. Characterization of the waste body is shown in Table 15.

Table 15 Preliminary characterization of the site in relation to remediation

Preliminary description	Characterization
Source volume	Large volume (600,000 m^3 in the northern dumpsite and 825,000 m^3 in the southern dumpsite equal approximately 2,500,000 tons)

Source type	Dominated by heavy metals
Source strength	The concentrations of contaminants are low to medium but the large volume means a relatively high source strength
Hot spots	Cannot be excluded but will be more or less impossible to find due to the large volume
Sensitivity of surrounding area	Medium – natural area surrounding the dumpsite no residential area nearby

6.3 Social-Economic baseline

Demographic

Population data for Republic of Montenegro and Municipality Nikšić, according to official preliminary data from Population census in 2011, are given in the following table Table 16.

Table 16 Population data for Republic of Montenegro and Municipality Nikšić

	Total	Urban	Rural
Montenegro	625 266	401 462	223 804
Nikšić	72 824	57 278	15 546

Source: MONSTAT, Census of Population, Households and Dwellings in Montenegro, First results 2011.

The area in the vicinity of the dumpsite is unpopulated or very sparsely populated. The village Rubeza is located about 1 km west of site. Very few houses can be seen around the Nikšić dumpsite. The nearest houses, which might be abandoned, are shown in Table 17.

Table 17 Houses nearby the dump site

	Type	**Approximate distance to the border of the dumpsite**
North	Farmhouse	350
East	Farmhouse	460
West	Farmhouse	130
South	Farmhouse (might be abandoned)	130

Resettlement and change in natural resources

No people lives permanently inside the dumpsites; however, waste collectors have been observed at the dumpsite collecting scrap metal. The remediation of the dumpsite will include fencing and deter further access for waste collectors to the dumpsite.

Social analyses of waste collectors

COWI has carried out a social analysis of the waste collection at the Nikšić dumpsite.

The dumpsite is privately owned. At present, the landfill management does not deny waste collectors access to the dumpsite. However, the waste collectors are only allowed into the northern part as there are machines and trucks on the southern part of the landfill. There are 30 to 50 waste collectors with usually 15 collectors each day. The age of the waste collectors are between 20 to 60 years or older. The waste collectors include both men and women. They are mainly unemployed with no other income or retired persons with small pensions from previous work.

Only metal parts which originate from the steel work are collected. However the amount collected has been steadily decreasing because of decreasing steel production and because the factory has started to separate metal parts before deposition at the dumpsite. The landfill manager estimated that the daily income is around 5-10 Euro per person with 10 Euro being considered “a lucky day”.

Three waste collectors were willing to give information on the activity including an elderly couple around 60 years and an elderly woman.

The woman informed that waste collection was her only income and that she had been doing it for 20 years. Her family consists of 4 persons, however she was the only one with a regular income from waste collection. During hard times other family members will participate in the waste collection. She explained that her daily income was around 10 Euro; however she also needs to pay for transport to the companies buying the metal. She did not collect waste from other sites.

She lived in the nearby village of Rubeza about 1 km away. Today, around 20 people in Rubeza regularly carry out waste collection. Previously, more people were involved in waste collection. The people in Rubeza can observe when the trucks are coming from the steel work with new loads, and she has observed that the number of trucks has decreased and sometimes there are no trucks for a whole day. She informed that there were around 10 collectors present on the day of the interview.

The elderly couple also lived in Rubeza. The husband was retired from the steel and explained that he receive pension but the pension is very low. He did not specifying the size of the pension. The woman has never been employed and waste collecting was her only occupation work. She did not inform about a pension. They explained that they could not survive without the income from the waste collection. They are a family of 10 people including children who still go to school. They have an additional income from a small farm - especially vegetables. They estimated their daily income to 5 – 7 Euro, although there were days with income as low as 3 Euro.

Potential for employment

The potential for employment during the construction phase of the remediation may draw people to the area. On the positive side, there may be a temporary increase in economic activity and employment for the local community and development of local skills.

The construction work related to the remediation can be tendered nationally or internationally according the WB procurement procedures. It is expected that

national procedure will result in more input from companies located in Montenegro whereas the exchange of knowhow will be less.

6.4 Environmental Management and Monitoring Plans

The purpose of the Environmental Management Plan (EMP) for the remediation is to ensure that all adverse environmental impacts are within acceptable levels. The EMP sets out to ensure that all aspects of the works comply with the relevant legislation, permit conditions and good practices, and that measures to mitigate the negative impacts identified in the ESIA are implemented. The EMP strives to implement appropriate environmental controls and monitoring procedures during construction.

The EMP and Monitoring plans are the basis for fulfilling the requirements under Montenegrin legislation. In a later phase, the Environmental Protection Agency will require all construction contractors to develop a detailed Construction Environmental Management Plan for their respective activities. The detailed CEMP should include detailed method statements, environmental control procedures and environmental compliance monitoring to be carried out during the construction works. The cost estimated is a rough assessment presented usually as less than and based on the following general principles described in section 5.4.

The selected remedial option includes reconstruction of dumpsite D2 into a regulated landfill. The environmental and social management plan for the reconstructed landfill D2 is described in the report “Environmental and Social Impact Assessment of National Hazardous Waste Disposal Facility” and included in appendix C.

Table 18 Environmental and Social Management Plan

Phase	**Issue**	**Mitigating Measures**	**Cost**		**Institutional Responsibility**	
			Installation	**Operation**	**Installation**	**Operation**
Construction						
	Dust	Watering during dry periods, covering of trucks that carry soil	Should be included in the bid from the (minimal)	Should be included in the bid from the (minimal)	Contractor supervised by EPA	Contractor supervised by EPA
	Handling of oil and fuel used for contractor's vehicles and machinery	Oil and fuel should be stored in places with secondary containment. No drums should be placed directly on ground	As above	As above	As above	As above
	Traffic	Speed limits near small villages like Rubeza, road signs	As above	As above	As above	As above
	Work in contaminated material	Use of Personal Protection Equipment, staff training	As above	As above	As above	As above
	Noise	The noise impact is related to the use of machineries like bulldozer, waste compactor, vehicles for material transport; Limiting time for construction	As above	As above	As above	As above

		work suggestion: 07 – 20 h.				
	Construction waste	Any re-disposal of waste material from construction activities like levelling or excavation should be disposed internal on the dumpsite and only on areas already contaminated. Any new waste generated during the construction shall be disposed at controlled landfills.	As above	As above	As above	As above
	Social issue	The tender for the remediation work should include a clause that encourages employment of local people, preferably the waste collectors Other waste collectors might be given a compensation	Employment should be included in the bid from the Contractor	-	Compensation should be decided by World Bank	EPA
	Training	The contractor shall set up a health and safety organization before the implementation of the work. The contractor shall also ensure that	As above	As above	Contractor supervised by EPA	Contractor supervised by EPA

		all relevant staff has been training in health and safety issue not at least in relation to work in contaminated soil and use of personal protection equipment.				
Operation						
	Control of drainage water quality	Visual inspection and water sampling	-	5,000-10,000 Euro	Operator supervised by EPA	Operator supervised by EPA
	Control for damage of top cover and efficiency of the drainage system	Visual inspection	-	5,000 Euro	As above	As above
	Social issue	The waste pickers can be hired for work at the future landfill. The access to the landfill can be regulated and the waste pickers can be given personal protection equipment in order to support her living.				

Table 19 Environmental and social monitoring plan

Phase	Item	Parameter	Frequency	Location	Installation cost	Operation cost / year	Responsibility
Construction							
	River water	- pH - Heavy metals	Once a month	1 station upstream and 1 station downstream	<5,000 Euro	< 10,000 Euro	Contractor supervised by EPA
	Air	- dust - PM_{10}	Daily visual inspection	Inside the construction site and outside in downstream wind direction	Minimal	Minimal	Contractor supervised by EPA
Operation							
	Control of drainage water quality	Visual inspection - pH - heavy metals - PAH, PCB and mineral oil	Once a year for the first 4 years	Remedial system	-	<5,000 Euro	Operator supervised by EPA
	Control of top cover and efficiency of the drainage system	Visual inspection	-	Remedial system	Operator	< 5,000 Euro	Operator supervised by EPA
	River water	- pH - Heavy metals	Once a year in spring time for the first 4 years	1 station downstream		<2,000 Euro	Operator supervised by EPA

6.5 Alternatives

0-alternative

The 0-alternative means doing nothing. The current negative impacts from the contaminated dumpsite at Nikšić will continuously represent a risk of environmental and risk of human exposure.

A. Basic securing of both waste dumps

This alternative includes prevention of unauthorized and uncontrolled access of humans and animals to both waste dumps. The waste material contains heavy metals and partly organic contaminants which can be spread with contaminated dust particle and cause negative health effects. The alternative includes a fence around the landfill to prevent access, securing of the slope to prevent landslides of contaminated waste especially into the river and surface treatment to prevent spread of dust particle.

B. Complete closure of both waste dumps

This alternative is a closure and securing of both dumps involving extensive profiling and installation of a surface cover layer. The embankments will be secured in the same way as for the alternative 1.

The most prevalent environmental impacts from the three alternatives are shown in Table 20.

Table 20 Environmental impacts from alternatives

Alternative	**Phases**	**Impact**
0-alternative		Negative impact for human and environmental exposure will continue
A. Basic securing	Construction phase	Limited negative impact on the local community due to release of potentially contaminated dust particle during the levelling of the dumpsite Negative impact due to risk of mobilizing the contamination during the levelling with potential for impact on surface water and groundwater
	Operation phase	Positive impact on the environment as the contamination is less exposed thereby limiting the risk of spread Significant positive impact as risk of landslide into the river is eliminated
B. Complete closure of both waste dumps	Construction phase	Negative impact on the local community due to release of potentially contaminated dust particle during the levelling of the dumpsite
	Operation phase	Positive impact on the environment as the contamination is less exposed thereby limiting the risk of spread Significant positive impact as risk of landslide into the river is eliminated

The most suitable remediation has been selected based on the advantages and disadvantages of the alternatives as shown in Table 21.

Table 21 The advantages and disadvantages of the alternatives

Alternative	**Advantages**	**Disadvantages**
A. Basic securing	• Minimum alternative • Direct contact of humans and animals with the waste material eliminated • If the surface is to be treated the wind-carried transport will be eliminated	• Unaesthetic landscape • Recultivation and use of the area will be impossible • Entering the treated area will be impossible • Settling of the top layers due to decomposing or rotting processes within the loosely deposited waste material cannot be excluded • Continuous maintenance works are expected • Sustainability of the abrasion protection must be ensured by continuous control and possibly required repairing measures • Surveillance of the fencing and possible damage (e.g. by aging, animals, car accidents) must be ensured • Proof must be provided for the stability of the slopes at every stage of construction • In the case of dump site 2 it would require extensive additional levelling • Further geotechnical investigation and planning in the slope region necessary • Costs for securing of the slopes
B. Complete closure of both waste dumps	• Elimination of direct contact and material uptake by humans or animals • Wind-carried transport eliminated • No landslides or deposition of contaminated material in the river Gracanica • Recultivation and usage of the area is possible, integration into the landscape	• High costs for the construction measure • High transportation costs • Costs for covering and sealing material • Proof must be provided for the stability of the slopes at every stage of construction • Further geotechnical investigation and planning necessary

7 Bijela Remediation Project

Location

The Adriatic shipyard Bijela is situated in the Bijela settlement in Bokakotorska Bay along the road Herceg Novi – Risan. This is in the vicinity of the Kamenari settlement which has a ferry line across the bay. Bijela is extended along the coast in an elongated shape due to the expressed topography of the hinterland. The shipyard is located approximately 12 km from the international border to Croatia and approximately 12 km from the international waterway in the Adriatic Sea as shown in the Figure below.

The shipyard is situated within the urban area of Bijela. The dumpsite is located inside the shipyard. The location of the shipyard is shown in Figure 6.

Figure 6 Location of Bijela Shipyard and possible main impact area

Impact assessment of the current situation and possible mitigation measures

The current impact from the dumpsite at Bijela Shipyard is summarised in Table 22. In the present situation, the contaminated dump site has several negative impacts on the environment and on the social-economic environment. The objective of the remediation is to limit the negative impact by implementing various mitigating measures including noise, increased traffic or dust related to the construction works during implementation of the remediation.

The remediation has a significant positive impact on the environment; however during the implementation of the remediation some short-term minor negative impacts might be expected. The impact during the construction phase and the operational phase of the remediation is included in the Environmental Management Plan and Monitoring Plan in section 7.4.

Table 22 The Environmental and Social Impact assessment

Subject	**Issue**	**Current impacts from dumpsite**	**Mitigation measures**	**Future impacts after remediation**
1. Soil - Exposition of humans and animals to contaminated soil by direct contact (surface soil)	The surface of the shipyard is highly contaminated with elevated levels of toxic metals. The area is uncovered and without vegetation and is enclosed and inaccessible for humans and animals	Significant negative impact	The contaminated soil and material should be removed and the surface should be asphalted.	Positive impact by preventing risk for direct human contact
2. Dust - Exposure of humans and animals to contaminated dust, wind erosion of surface particles	Wind dust transport is expected mainly during the summer season when the surface is dry and wind blow alternating from the	Significant negative impact	The contaminated soil and material should be removed and the surface should be asphalted.	Positive impact with no future contaminated dust from the dump site

Subject	Issue	Current impacts from dumpsite	Mitigation measures	Future impacts after remediation
	mountains or the sea. Residential area neighbouring the shipyard			
3. Groundwater	The groundwater flow is expected to be towards the sea. The groundwater is not used for drinking water. The contamination might spread to the sea	Negative significant	Contaminated soil should be removed and an oil-phase skimmer installed	Removal of the soil will have a positive impact on the environment elimination the risk for impact on the sea
4. Seawater	Contaminated waste has partly been dumped on the sea floor next to the shipyard. The contaminated sediment have a long term impact	Significant negative risk	The sediment should be removed	Removal of the sediment has a significant positive impact on the environment elimination the source for further contamination
5. Dredging	During dredging the fine sediment material might increase the turbidity of the water and result in spreading of contaminated particle.	Minor significant	Dredging must not be carried out during strong wind, high waves or current. The turbidity must not exceed 50 NTU at a distance of 150 m from the dredging.	Removal of the sediment has a significant positive impact on the environment elimination the source for further contamination
6. Indirect impact	No indirect impacts is expected	-	-	-
7. Cumulative impact	No cumulative impact is expected	-	-	-
8. Transboundary impact	The remediation might include exporting of the waste to controlled landfill in Italy or Germany.	Insignificant	Export of Hazardous Waste should be in accordance with the Basel Convention	-
9. Social impact	No significant impact	Insignificant	-	-
10. Cultural assets	The remediation might have a positive impact on the conception of the environment in Bijela.	Insignificant	-	-

7.1 Remediation of Bijela Contaminated Site

The remediation project of the contaminated dump site at Bijela includes:

- sorting of the entire present solid waste material and future generated masses;
- excavation of contaminated backfill at shipyard North;
- sealing of shipyard North and South;
- excavation of sea-sediments at shipyards harbour.

The waste material will be sorted, excavated and deposited at a controlled external landfill. Subsequently, the area will be sealed (asphalted). The sediment and the contaminated waste will be removed and transported an external landfill.

The advantages and disadvantages of the selected remediation are shown in Table 23.

Table 23 The advantages and disadvantages of the selected remediation

Remediation	**Advantages**	**Disadvantages**
Selected option Complete remediation measures and deposition of used grit and sediments at a landfill	• Elimination of direct contact and material uptake by humans • Save alternative to stop uncontrolled contaminant transport into harbour area • Save alternative to stop contaminant transport via wind erosion / dust formation • Elimination of contaminated leachate from backfill into groundwater • Save alternative to stop contaminated transport from sea-sediment to aquatic fauna • Immediate improvement of the local environmental situation	• Costs for transport and disposal of the material (wastes and excavated backfill) • Unclear fate of the contaminated material after removal • Possibly high exporting costs if deposition at a local landfill (Nikšić dump D2 or new landfill in MON) is not possible

7.2 Environmental Baseline

Description of the site and surroundings

The Bijela Shipyard was founded in 1927 and is currently the biggest shipyard of the southern Adriatic Sea. It covers a total area of 12 ha and consists of 2 pilled jetties (500 and 175 m long) and 2 floating docks (l/w 259/45 m and 184/27 m). The shipyard is equipped for repairing and reconstructing of ships and other vessels of all types and purposes of up to 120,000 DWT. The activities include removal of old paint, old hull coatings and rust by sandblasting and the application of new coatings and paintings.

Used blast grit from the Adriatic Shipyard has been piled on two dumps. These result in a mixture of different waste fractions (hazardous/non hazardous) that were dumped on the shipyard`s mostly unpaved surface. CDM has reported a volume of 60,000 t of spent waste blasting grit, 2,000 t of contaminated municipal waste, some hundred tons of steel scrap, several tons of construction waste, outdated oil

and sludge recovery equipment and some vessel dilapidated hulks. The surrounding area/soil is covered with blast grit, too. The volume of the dumps has previously been reported to be some 25,000 m³ and 50,000 tons respectively (ToR), however these figures are considered too high.

Flora, fauna and natural resources

The grit dump is placed in the part of the shipyard which is practically on the coast line. Part of the grit is packed in plastic bags near the coast, while the other part is located inside the shipyards court some dozen metres from the coast. The grit packed in plastic bags is planned for export in accordance with the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal rules. However, the dump on the coast still includes a huge amount of scattered grit mixed with other metal and plastic waste. Part of this grit is placed in the coastal water.

The contamination has a potential impact on the marine ecosystems or air quality because of airborne spread of grit. This is especially an issue as seasonal winds in the bay are quite common. In addition, the Bokakotorska Bay is one of the most important touristic destinations in Montenegro and the neighbouring Risansko-Kotorski Zaliv Bay is proposed as an Emerald Network site.

Cultural assets

Kotorski Zaliv Bay is a protected area by UNESCO as a part of World Natural and Cultural Heritage.

Climate

The area of the Bay of Kotor is characterized by a Mediterranean climate with dry and hot summers and warm winters. Herceg Novi has a specific microclimate, which is a result of southern exposition, proximity to the sea, limestone substratum and mountainous hinterland which prevents the breakthrough of cold air masses.

Herceg Novi has approximately 200 sunny days a year. In July and August there are approximately 11 sunny hours per day. Average annual temperature is 16.2 °C. The average daily temperature fluctuation is only 4 °C. Average temperature from May to September is about 25 °C, which provides a swimming season over 5 months long since the average summer sea temperature is rather high, between 22 °C - 26 °C.

The annual average precipitation is 1,930 mm. Relative air humidity is at its highest level, 80%, in the fall. Its lowest level, 63%, comes in the summer.

Previous investigations

Previous investigations of the contamination of Bijela Shipyards include inter alia:

1 Analiza I Karakterizagrija Grita 2008, Analysis and Characterization of Grit 2008

2 Brodogradiliste Bijela, Shipyard Bijela - Short description

3 Ceti Grit 20 Sep. 2011 I-III

4 Elaborat Zastite Zivotne, Sredine 1, (Environmental report 1)

The produced waste contains different potentially hazardous residues of the removed ship paint and coatings, which can contain biocidal heavy metals or organic components, TBT and PAHs. The blast grit material is mixed with other types of waste such as metal scrap, plastics, barrels, oil and other hydrocarbons. The slopes of the dumps have partially reached the beach of the Kotor Bay meaning that water and sediment is in direct contact with the waste.

Available analysis show elevated levels of TBT (tributyltin), arsenic, barium, copper, zinc, fluoride, chrome, tin, cobalt, nickel, lead, total polyaromatic hydrocarbons (PAH), total hydrocarbons and mercury (dry substance as well as leachate tests).

Minor contamination of the sediment was also identified, as well as in seashells, which serve as the major bio-indicator of this type of contamination. Such situation is a result of inadequate disposal of solid waste (waste grit, waste oils, grease and oily water, paint traces etc.) on site.

Investigations in the zone of the shipyard show that considerable quantities of grit resulting from sand-blasting as well as solid waste of hazardous origin and quality are deposited on the seabed.

Additional investigation by CDM

The new investigation conducted by CDM includes additional drilling, leaching test, sampling and analyses of soil, groundwater and surface water. The results of the investigation by CDM are shown in Table 24.

Table 24 Samples taken at the shipyard

	Investigation	**Results**
Analyses of surface soil	10 drillings to 0.5 m	Exceeding threshold limits: Arsenic up to 59 mg/kg Copper up to 2554 mg/kg Zinc up to 2265 mg/kg Chromium up to 5338 mg/kg Nickel up to 528 mg/kg Cadmium up to 9 mg/kg Lead up to 600 mg/kg Mercury up to 2.3 mg/kg PAH up to 117 mg/kg PCB up to 0.208 mg/kg
Analyses of deeper drillings	4 drillings to 10 m	Exceeding threshold limits Copper up to 1179 mg/kg Zinc up to 2201 mg/kg Chromium up to 3330 mg/kg Nickel up to 404 mg/kg Cadmium up to 44 mg/kg Lead up to 104 mg/kg TBT up to 5 mg/kg Mercury up to 3.6 mg/kg PAH up to 0.197 mg/kg PCB up to 0.208 mg/kg
Analyse of used grit	1 sample of used grit	Waste material Fe 284 mg/kg

	Investigation	Results
		Cr 14 100 mg/kg Cu 1166 mg/kg Ni 976 mg/kg Cd 25.5 mg/kg
Analyses of groundwater	4 samples with one from each of the 4 drillings	Low to very low concentration of heavy metals Exceeding threshold limits: TBT up to 0.00158 mg/kg PAH up to 5.90 mg/kg Total hydrocarbon up to 51 mg/kg Phenols 0.74 mg/kg BTEX up to 0.060 mg/kg CHC up to 0.062 mg/kg
Sea sediment	10 samples taken from 2.5 – 20 m bsl	Exceeding threshold limits: Copper 338 mg/kg Zinc 474 mg/kg Chromium 700 mg/kg Nickel 237 mg/kg Lead 161 mg/kg TBT 4.93 mg/kg Mercury 3.6 mg/kg PAH 17.61 mg/kg PCB 0.163 mg/kg
Leaching test		Neutral to slightly acidic conditions. Only one sample exceeded the threshold limits. In general moderate leaching
Sea water	2 samples	No indication of contamination except for 0.04 µg/l TBT which is above the EU standard of 0.0015 µg/l
Sea-shells	Sea shell from the bottom near the harbour of the ship-yard	No concentrations above the permitted limits.

Potential risk and design parameter

The results of the investigations show that the location is a potential source for contamination of the surrounding area. The potential source for contamination from the disposal of the waste grid includes TBT (tributyltin), arsenic, barium, copper, zinc, fluoride, chrome, tin, cobalt, nickel, lead, total polyaromatic hydrocarbons (PAH), total hydrocarbons and mercury (dry substance as well as leachate tests). These components are relatively immobile.

TBT will bind strongly to suspended material such as minute organic material or inorganic sediments. The extent of binding to bottom sediment will vary with location, organic content, particle size, and type of material. TBT is extremely toxic to molluscs; however TBT was not detected in the analyses of the sea-shells.

General characterization of the waste body

The results of the investigations show that the location is a potential source for contamination of the surrounding area. The potential source for contamination from the disposal of the waste grid includes TBT (tributyltin), arsenic, barium,

copper, zinc, fluoride, chrome, tin, cobalt, nickel, lead, total polyaromatic hydrocarbons (PAH), total hydrocarbons and mercury (dry substance as well as leachate tests). These components are relatively immobile. Characterization of the contaminated body is shown in Table 25.

Table 25 Characterization in relation to remediation

Preliminary description	**Characterization**
Source volume	Medium volume (60,000 t)
Source type	Dominated by heavy metal, TBT, PAH and PCB Mineral oil, PAH, phenols, BTEX and CHC was detected in the northern part of the shipyard.
Source strength	The concentrations of contaminants are low to medium but the location close to the coast means a relatively high source strength
Hot spots	Not expected
Sensitivity of surrounding area	Very high – dumpsite located at coastline and resident area nearby

7.3 Social-Economical baseline

Demographically Bijela is part of the Herceg Novi municipality which stretches from Prevlaka to the Verige Strait. An almost unbroken string of towns lie along this strip of coast, accommodating the municipality's 30,992 s) residents. These include Igalo, Herceg Novi, Baošići, Đenovići, Meljine and Bijela. Due to their proximity, Herceg Novi and Igalo are usually considered one town with a combined population of 14,462. Administratively, Herceg Novi's current population is 11,108.

Population data for Republic of Montenegro, Municipality Herceg Novi and settlement Bijela, according to official preliminary data from Population census in 2011, are given in Table 26.

Table 26 Population data for Republic of Montenegro, Municipality Herceg Novi and settlement Bijela

	Total	Urban	Rural
Montenegro	625 266	401 462	223 804
H. Novi	30 992	19 617	11 375
Bijela	3725	-	-

Source: MONSTAT, Census of Population, Households and Dwellings in Montenegro, First results 2011.

Bijela is a small town with approximately 3,700 inhabitants. The town is dominated by the shipyard which is the largest employer in the town.

The shipyard is located in the middle of the town surrounded by residential and commercial area.

Potential for employment

Potential for employment during the construction phase of the remediation; however the effect is considered limited due to the relatively limited scale of the remediation

The construction work related to the remediation can be tendered nationally or internationally according the WB procurement procedure. It is expected that national procedure will result in more input from companies located in Montenegro whereas the exchange of knowhow will be less.

7.4 Environmental Management and Monitoring Plans

The purpose of the Environmental Management Plan (EMP) for the remediation is to ensure that all adverse environmental impacts are within the acceptable level. The EMP sets out to ensure that all aspects of the works comply with the relevant legislation, permit conditions and good practice, and that measures to mitigate the negative impacts identified in the ESIA are implemented. The EMP strives to implement appropriate environmental controls and monitoring procedures during construction.

The EMP and Monitoring plans are the basis for fulfilling the requirements under Montenegrin legislation. In a later phase, the Environmental Protection Agency will require all construction contractors to develop a detailed Construction Environmental Management Plan for their respective activities. The detailed CEMP should include detailed method statements, environmental control procedures and environmental compliance monitoring to be carried out during the construction works. The cost estimated is a rough assessment presented usually as less than and based on the following general principles described in section 5.4.

Table 27 Environmental and Social Management Plan

			Cost		**Institutional Responsibility**	
Phase	**Issue**	**Mitigating Measures**	**Installation**	**Operation**	**Installation**	**Operation**
Construction						
	Dust	Dust control during excavation in dry periods and loading of waste material into big bags	Should be included in the bid from the Contractor (minimal)	Should be included in the bid from the Contractor (minimal)	Contractor supervised by EPA	Contractor supervised by EPA
	Handling of oil and fuel used for Contractor's vehicles and machinery	Oil and fuel should be in places with secondary containment. No drums must be placed directly on ground	As above	As above	As above	As above
	Work in contaminated material	Use of Personal Protection Equipment, staff training	As above	As above	As above	As above
	Dredging of sediment	Dredging must not take place during strong waves or current and not exceed the turbidity limits	As above	As above	As above	As above
	Noise	The noise impact is related to the use of machineries like bulldozer, dredgers, vehicles for waste transport; Limiting time for construction work suggestion: 07 – 20 h.	As above	As above	As above	As above

	Construction waste	Any new waste generated during the construction shall be disposed at controlled landfills.	As above	As above	As above	As above
	Social issue	No mitigation measures necessary	-	-	-	-
	Surrounding soil	Control surface soil samples at a distance of 200 m from the contaminated site	5,000-10,000 Euro	-	Contractor supervised by EPA	Contractor supervised by EPA
	Training	The contractor shall set up a health and safety organization before the implementation of the work. The contractor shall also ensure that all relevant staff has been training in health and safety issue not at least in relation to work in contaminated soil and use of personal protection equipment.	As above	As above	As above	As above
Operation						
	The remediation does not include a specific operational phase	Control of residual contamination in sea water and soil. Risk assessment of any residual contamination	3000 EUR	-	Final report from contactor to be approved by EPA	Final report from contactor to be approved by EPA

Table 28 Environmental and social monitoring plan

Phase	Item	Parameter	Frequency	Location	Installation cost	Operation cost	Responsibility
Construction					*Rough estimate*	*Rough estimate / year*	
	Dredging of sediment	Turbidity	2 times a day during dredging	Monitoring of turbidity at 150 m downstream the dredging	<1,000 Euro	-	Contractor supervised by EPA
	Air	- Dust - PM_{10}	Daily visual inspection	Inside the construction site and outside in downstream wind direction	Minimal	Minimal	Contractor
	Soil	Control surrounding surface for contamination	Once	Samples at a distance of 200 m from the contaminated site	3,000 Euro	-	Contractor supervised by EPA
Operation							
	The remediation does not include a specific operational phase	Control of residual contamination in sea water and soil. Risk assessment of any residual contamination	Once	At and around the site	15,000 Euro	-	Contractor appointed by EPA for control of residual contamination

7.5 Alternatives

0-alternative

The 0-alternative means doing nothing. The current negative impacts from the contaminated dumpsite at Bijela will continuously represent a risk of environmental and of human exposure.

A. Basic remediation and disposal at controlled landfill

This alternative includes the following: sorting of the entire present solid waste material and future generated masses, groundwater remediation under the northern part of shipyard, sealing of shipyard North and South, dredging of sea-sediments at the shipyards harbour. This alternative includes installation of an oil-skimming in the northern for removal of free oil phase from the groundwater but without excavation of the contaminated soil.

B. Basic remediation and deposition of stabilized used grit

This alternative includes: sorting of the entire present solid waste material, groundwater remediation under the northern part of the shipyard, sealing of shipyard North and South, deposition of stabilized used grit into an artificial enclosure on both sides of the smaller jetty at the shipyard. A confirmed enclosure will be constructed with a double sheet pile wall of concrete and the grit material will be deposed in the enclosure after stabilization with concrete. This alternative will require considerable investigation and the cost is expected to be high. In addition, the remediation might be effected in case of earthquake.

The most prevalent environmental impacts from the three alternatives are shown in Table 29.

Table 29 Environmental impacts from alternatives

Alternative	**Phases**	**Impact**
0-alternative		Negative impact for human and environmental exposure will continue
A. Basic remediation and deposition of used grit and sediments at a controlled landfill	Construction phase	Limited negative impact on the local community due to release of potentially contaminated dust particle during removal of the contamination Short-term negative impact on sea water quality during dredging of the sediment in the harbour of the shipyard
	Operation phase	Significant positive impact on the environment as the contact risk will be eliminated Significant long-term positive impact after removal of the contaminated sediment Significant positive impact on the sea water as the contaminated grit material is removed

B. Basic remediation measures and deposition of stabilized used grit into an artificial enclosure	Construction phase	Limited negative impact on the local community due to release of potentially contaminated dust particle during removal of the contamination Short-term limited negative impact on sea water during construction of the wall for the enclosure
	Operation phase	Positive impact on the environment as the contamination is enclosed and spread of contaminated is limited Risk of damage to the enclosure wall from earthquake

The most suitable remediation has been selected based on the advantages and disadvantages of the alternatives as shown in Table 30.

Table 30 Advantages and disadvantages of the alternatives

Alternative	**Advantages**	**Disadvantages**
A. Basic remediation and deposition of used grit and sediments at a controlled landfill	• Elimination of direct contact and material uptake by humans • Save alternative to stop uncontrolled contaminant transport into harbour area • Save alternative to stop contaminant transport via wind erosion/ dust formation • Minimization of contaminated leachate from backfill and capture of floating oil from groundwater • Excavation and disposal of contaminated backfill can be avoided • Save alternative to stop contaminated transport from sea-sediment to aquatic fauna • Immediate improvement of the local environmental situation	• Costs for transport and disposal of the material • Unclear fate of the contaminated material after removal • Possibly high exporting costs if deposition at a local landfill (Nikšić dump D2 or new landfill in Montenegro) is not possible
B. Basic remediation measures and deposition of stabilized used grit into an artificial enclosure	• Elimination of direct contact and material uptake by humans • Save alternative to stop contaminant transport via wind erosion/ dust formation • Save alternative to stop uncontrolled contaminant transport into harbour area • Deposition of the contaminated material at the site, no transportation costs • Stabilization of contaminated material in inert concrete mixture • Sealing of contaminated sea floor • Sealing of unsecured areas at the shipyard site (on-land) • Minimize of contaminated leachate from backfill and capture of floating oil from groundwater • Space gained for utilization by the shipyard (harbour area)	• High costs for the construction measure • Costs for sealing material/ concrete components • Costs for installation of the confined basin/ sheet pile walls • Further material testing necessary to find optimal mixing ratios • Further geotechnical investigation and planning necessary • Risk of higher costs in case of unknown geological subsoil (rocks?) at the basin • Risk of damage at the confining walls or stabilizing concrete by earthquake impact • Possible corrosion of the confining/ stabilizing materials by sea water • Regular monitoring of the sea water and groundwater quality

8 Maljevac Ash Dumpsite Remediation and Sumane Ash Dump Development

Maljevac Ash dumpsite - Thermal Power Plan Pljevlja

Ash and sludge generated in the process of the Thermal Power Plant in Pljevlja are disposed at the dumpsite Maljevac. The dumpsite is located approximately 4 km from the city, south-westward, along the road Pljevlja – Žabljak. The thermoelectric power plant „Pljevlja“ is located about 1 km (air distance) from the ash dump site, also in a south-westward direction. The dumpsite, the thermal power plant and the city of Pljevlja are located in the northern part of the Republic of Montenegro, in the geographical region of „mountainous Montenegro“.

The dumpsite is formed by damming the relatively broad and shallow valley of „Paleski potok“ stream, in the vicinity of village Zbljevo. Maljevac dumpsite is located as shown in Figure 7.

Figure 7 *Location of the Maljevac dumpsite near the Thermal Power Plant in Pljevlja and project area of influence*

The Sumane site earmarked for the Sumane Ash Dump development is abandoned lignite mine located in the south of Pljevelja TPP. The former open cast mine is some 15 m deep and has not been recultivated. The residual pit has been used for

disposal of construction debris and waste. Disposal of debris and waste seems to be ongoing on an irregular basis.

Impact assessment of the current situation and possible mitigation measures

The current impact from the contaminated site at Maljevac as well as Sumane residual pit is summarised in Table 31. In the present situation, the contaminated dump sites have several negative impacts on the environment and on the social-economic environment. The objective of the remediation is to limit the negative impact by implementing various mitigating measures.

The remediation has a significant positive impact on the environment; however during the implementation of the remediation some short-term minor negative impacts might be expected including noise, increased traffic or dust related to the construction works during implementation of the remediation. The impact under construction phase and under operational phase of the remediation is included in the Environmental Management Plan and Monitoring Plan in section 8.4.

Table 31 Summary of environmental impact mitigation measures

Subject	**Issue**	**Current impacts from dumpsite**	**Mitigation measures**	**Future impacts after remediation**
1. Dust - Exposition of humans and animals to contaminated soil by dust from erosion of ashes	The area is uncovered and has no vegetation. No significant contamination is expected.	Significant negative impact	The ash dump site should remain wet unless the dump becomes covered	Positive impact by preventing future dust considered that the dump are wet or covered
2. Exposure of groundwater	The groundwater is slightly affected by leaches from the dumpsite	Medium negative significant	To minimize water output from the drain, a by-pass from Paleski creek should be build	No changes
3. Impact on creek and rivers	Paleski creek and its receiving waters Vezisnicu and Ceotina are affected by contaminated leachate and drainage water from the ash dump.	Medium negative significant	A by-pass should be built to direct the water from the Paleski creek around the dump	Positive impact as the relocation of Paleski creek will limit the impact from contaminated leachate
4. Risk of dam failure because of dam instability	The slopes of the dams are in risk of becoming unstable	Significant negative impact	Stabilization of the slopes with geotechnical measures and water control	Significant positive impact
5. Risk of accident	The risk of failure of the dam is very high	Highly significant	EPCG will conduct a dam stabilisation project in parallel	Significant positive impact
6. Indirect impact	The remediation and closure of Maljevac Ash Dump, is linked to the Sumane Ash Dump development,	No significant negative impact	Elektroprivreda Crne Gora (EPCG), is planning an extension of the ash dump at the Sumane	Sumane ash dump development will have positive effects: Uncontrolled dumping of

	The Maljevac site remediation can´t be completed without Sumane site development, but the Sumane development is not caused or triggered by the Maljevac site remediation.		site and will prepare a resettlement plan if required for possibly affected residences at the Sumane dumpsite. New ash dump will be operated in line with best international practise. Water consumption will be reduced by factor 6 to 10, area in operation and dust emissions will be reduced	construction debris and waste will be stopped. Dust emissions will be stopped. Finally, the current open residual pit will be remediated when the ash dumping is finished.
7. Cumulative impact	Concentration of contaminants are very low and no indirect impacts are expected	Not significant	-	-
8. Transboundary impact	In case of dam failure the sediments might be spread by the river into neighbouring country Bosnia Herzegovina	Significant negative impact	Stabilization of the slopes with geotechnical measures and water control	Significant positive impact
9. Social impact	As for the indirect impact	Significant	As for the indirect impact	As for the indirect impact

8.1 Remediation of Pljevlja Maljevac Contaminated Site

The remediation of the Pljevlja Contaminated Site includes:

- Redirection of Paleski Creek
- Prevention of seepage formation
- Sealing and re-cultivation of the surface
- Treatment facility for drainage water
- Sumane Ash dump development (as associated investment)

The culvert channelling the Paleski Creek under the dump site is broken. It is therefore recommended that the creek water is redirected on the north side of the ash dump in an open channel.

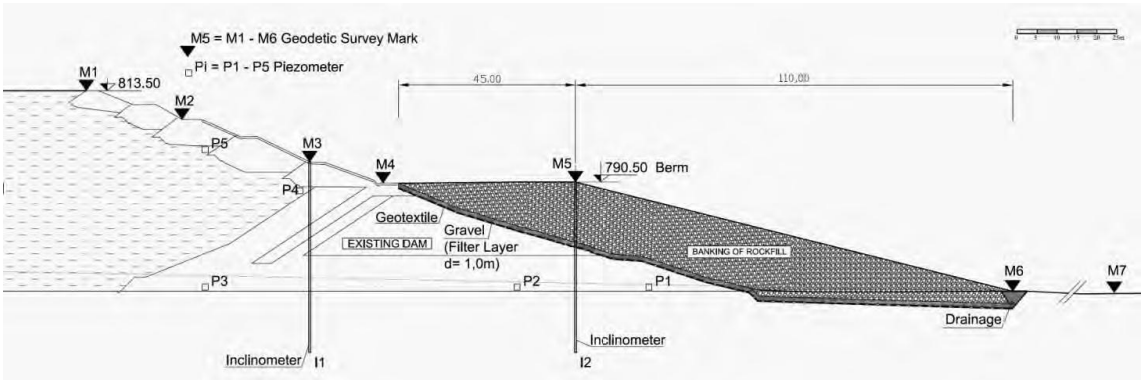
The prevention of seepage will be done by reshaping the areas into several sections with roof-like slopes and collecting the precipitated water in channels and discharged into constructed settling ponds.

Elektroprivreda Crne Gora (EPCG) is implementing a separate project in parallel with the aim to stabilize the dam. CDM has proposed a stabilization of the embankment composing of a stepwise removal of the eroded material and profiling. A geotexile can be placed on the side followed by 0.8 m drainage layer. On the airside a 15 m long and 2 m depth excavation can be carried out installed with a drainage layer to collect drainage water. Finally, a 15 m thick support structure can be constructed at the airside.

A treatment facility for the drainage water might be necessary depending on the actual quality of the drainage water.

The remediation is illustrated in Figure 8.

Figure 8 *Illustration of the remediation of the contaminated site at Pljevlja Maljevac ash dump including dam stability which is additional to the remediation and carried out in parallel (Drawing prepared by CDM Consult).*



As a prerequisite of the full site remediation, EPCG has to terminate ash disposal at Maljevac ash dump site. EPCG is planning to erect a new ash dump. The erection of the new dump is not part of the Maljevac site remediation project. Basically it is going to be implemented because the Maljevac dump capacity will be expired latest within the next two years of ongoing TPP operation. EPCG´s favorite solution is the construction and operation of a new ash dump ”Sumane”, which is located some 2.5 km from the TPP and would use an abandoned lignite mine for ash disposal. The ash will be delivered to the new dump by a hydraulic ash transport system. The new system would operate at an ash-water ratio around 1 to 1, such reducing water consumption and excess water[1], Any excess water and precipitation is going to be pumped back to the TPP and used for ash slurry transportation

Part of the dump preparation is the installation of a clay liner, plastic liner, drainage layer and drainage system following best international standards, see figure 8a .

[1] Basically with an ash to waterratio of 1 : 1 no excess water is to be expected during standard operation. However, under certain operational states, i.e. start of ash disposal, stopping/interruption of ash disposal and reduced load of the TPP, the mixture is leaner in order to maintain sufficient flow velocity in the pipeline system. In addition, rinse water and precipitation occur.

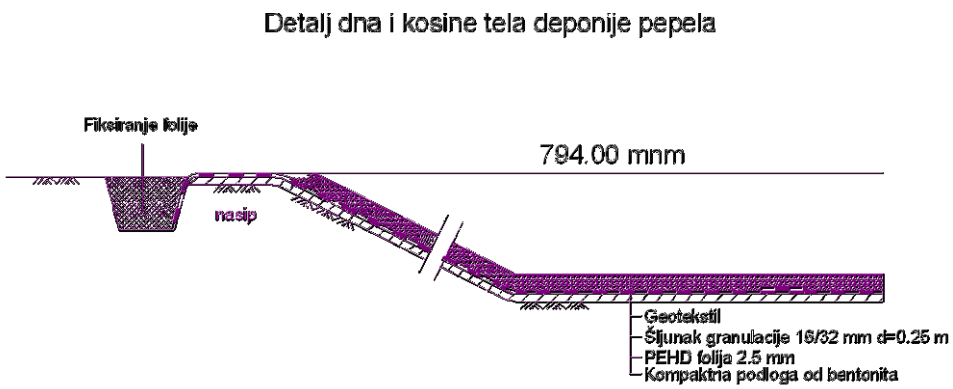


Figure 8a *Illustration of the Sumane Ash Dump base preparation (Drawing prepared byEPCG).*

After closure, the dump will be covered with a clay/bentonite liner, plastic liner, drainage layer and soil (see figure 8b). The new ash dump shall cover an area of ca. 420,000 m², ash dump capacity is 6,200,000 t.

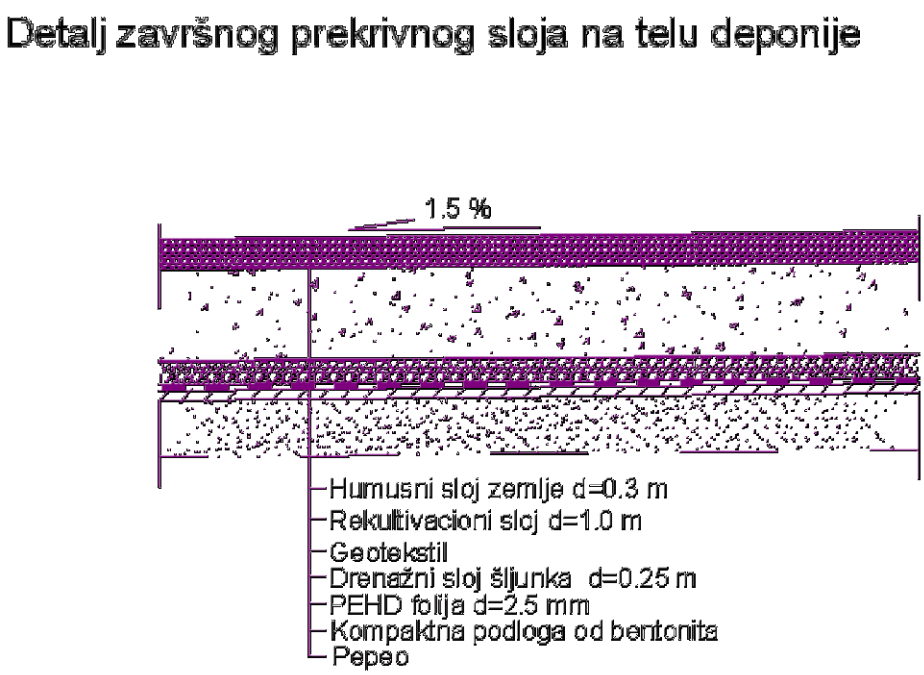


Figure 8b *Illustration of the final Sumane Ash Dump cover and recultivatio (drawing provided by EPCG)*

The advantages and disadvantages of the selected remediation are shown in Table 32.

Table 32 The advantages and disadvantages of the selected remediation

Remediation	Advantages	Disadvantages
Selected option Stabilizing embankment and monitoring of the dam status, cover of Maljevac Ash Dump surface, Sumane Ash Dump development	• Increased stability in the lower part of the dam • Risk of a dam collapse is lowered • Prevention of erosion at the lower dam area • Relatively low investment costs • Prevention of wind erosion of ash • Backfilling and remediation of Sumane abandoned lignite pit • Removal of waste from Sumane residual pit • Reduction of dust emissions at SUmane residual pits • Stop illegal waste dumping at Sumane site • Reduction of water demand	• No sustainable and long-term securing of the dam • Remaining local dam stability deficits • Continued uncontrolled drainage release from the dump site • Necessity for complete long-term monitoring of the dam structure • Long term costs for monitoring and consultancy activities

8.2 Environmental Baseline

Description of the site and surroundings

The Maljevac dam has been raised several times and has finally reached an elevation of about 80 to 100 metres. The riverbed at the valley floor has been channel by standard concrete tubes; however the tubes are leaking and thereby leading to contamination of the river. Instability of the earth dam has been reported and the safety of the dam is questionable.

The current disposal takes place in the form of water suspension (slurry). The slurry transport system has been designed for an ash/water ratio 1:10, but is currently operating at a 1:6 ratio. Excess water is fed back to the production process by pipes. Maljevac ash dump contains approximately 8,000,000 tons of ash (fly ash and bottom ash). It is composed of three separate parts, two of them are at the same level, while the third one is raised one level up by an additional dam. The third part is inactive now, since it reached the projected capacity.

The existing settlements in the vicinity of the dumpsite are village-type settlements. Small groups of houses and single houses are located on the fringes of the valley more or less within a distance from the dumpsite of 100-200 m. The infields and slopes of the neighbouring hills are mainly covered with orchards.

As already mentioned above, the Sumane site is an abandoned lignite mine located in the south of Pljevelja TPP and Maljevac Ash Dump. The former open cast mine has not been recultivated. The residual pit has been used for disposal of construction debris and waste. The ground of the residual pit consists of a clay

layer which has got reportedly a thickness of some 15 to 25 m. Small heaps of waste and debris are covering most of the pit area. Disposal of debris and waste originating from households seems to be on-going on an irregular basis.

The site is crossed by a tarmac road and surrounded by small groups of houses and single houses within a distance of some 200 to 500 m.

Flora, fauna and natural resources

The surrounding area shows patterns of typical cultural landscape. The soil strips near the northern, southern and south-eastern slopes of the landfill comprise numerous small plots. These plots are probably used for cultivation of crops and vegetables. The soil strips show relatively homogenous structures, without any forest vegetation. There are some shrub and forest vegetation in a small area along the eastern edge of the landfill, dominated by cultivated conifers (Maljevac hill).

Forests occupy the peaks of the hills. The natural vegetation fragments are most probably of ruderal-type, since it is the most common patterns in areas which are under strong androgen pressure. The same applies to faunal structure which is mainly composed of species with higher ecological resilience. These are the usual characteristics of semi-natural or artificial ecosystems like the agro-ecosystems.

Biogeographically, the landfill location is in range of an “Alpine biogeographical region”. That region includes the Dinaric Mountains in the western part of the Balkan Peninsula.

Hydrology

The entire Ćehotina River and the riparian area (the interface between land and river) are recognized as a significant area for establishing the Emerald ecological network in Montenegro. Development of ecologically significant areas is an on-going process throughout the Balkan region as a preparatory phase for the establishing of the NATURA 2000 ecological network in Europe. The dumpsite is very close to the one peripheral and minor part of the proposed Network site (few hundred meters - river Vezišnica flow near the power plant).

Climate

Climatically, the area is characterized by moderate continental climate features. The mountains have a strong influence in the climate reflected in the extremely low winter temperatures, making Pljevlja the coldest of municipalities in Montenegro. Pljevlja is the city with the highest frequency of clouds in Montenegro and about 200 days a year Pljevlja are affected by fog.

Previous investigation

The previous investigations related to Maljevac Ash Dump Site and Sumane site include:

1 Extract from “Eleborat procjene uticaja na životnu sredinu eksploatacije uglja na PK”Potrlica” year?

2 Ocjena current ecological situation in Pljevlja, and what has changed from the "historic session of the Legislature" 1991. year?

3 Extract from unknown document Introduction Exploitation of coal exploration in coal basin takes place at the location of PK "Potrlica" Ljuca in the PK-šumanskom "Sumani I".

4 Document with the heading “Open pit "Sumani I" is in the final stage of exploitation and the exploitation of the dynamics of production completion in 2010”.

5 Study Determination "0" State Emissions from Thermo-Power Plants Pljevlja and a number of analyses

6 Site visit report Euroaid, 17 June 2009

7 EPCG various monitoring reports of water analyses, Wisutech, Analyses of radio-nucleotides and other documents

8 Cadastral Map, design drawings and explanations provided by EPCG on the Sumane Ash Dump development

9 Contributions to the Geology of Northern Montenegro/Upper Lias in the environment of Pljevelja, L. Noeth

10 Several other minor documents with more or less relevance to the sites

Maljevac ash dump contains fly ash and bottom ash from the Thermal Power Plant. Fly ashes contain substantial amounts of silicon dioxide (SiO2) and calcium oxide (CaO) and increased content of metals, fluorine and boron, as compared to the maximum allowed concentrations. The heavy metals are expected to constitute the main contaminants of the dumpsite.

The MA radionuclide analyses of the ashes were carried out in 2009. The analyses did not indicate any significantly elevated level of the radionuclides: U-238, Ra-226, Pb-210, Ra-228 and Th-228. Although higher than the natural background, level the concentrations of the radionuclides are well below the international standards.

After the second public consultation, Ms. Dana Krezovic from Pljevlja has forwarded some comments to the projects. The comments are included in appendix D. The comments discuss various previous investigations of the ash from the Power Plant and the following was included in the comments:

„After request of Municipality Pljevlja in 2008., Center for Ecotoxicological Research (CETI), Podgorica, investigated character of the waste. On the basis of analyses, ash from filter of Thermal powerplant Pljevlja was characterized as hazardous waste (due to increased pH value of 13.69) and slag from Thermal powerplant Pljevlja as non-hazardous waste (Certificate on categorization no. 00-14-14269/1612/04/01, dated on 16/01/2009). Additionally, results of analyses showed in the report include toxic metals, whose concentration was below maximum allowed values: arsenic, barium, copper, zync, nickel, lead, chromium, cobalt and mercury. Gamma-spectrometric analysis showed activity of all analyzed radionuclides below maximum allowed values, in accordance with „Rule book on limits of radioactive contamination in environment and methods of decontamination“ (Off. gazette of SRJ, 9/99).”

In relation to the discussion of the ash being characterized as hazardous waste or not the comments also includes the following

"*Information on environmental conditions in Montenegro in 2004., and Plan on waste management in Montenegro for period 2008-2012 (Off. gazette of the State, 16/08) suggests that 280.000 tons of ash a year gets transported to ash and slag dumpsite Maljevac, which is not classified as hazardous waste in the EU list (ash and mud from the bottom and dust from furnaces are not classified as dangerous waste), but requires specific management. However, information on environmental conditions in Montenegro in 2009 classifies this waste as industrial dangerous waste, suggests that total transported quantity by that time was 7.500.000 tons of ash and slag to the dumpsite, and remediation of already accumulated waste became an issue*."

In accordance with suggestion from Ms. Dana Krezovic the population date in this ESIA report has been updated.

Additional investigation by CDM

The new investigation conducted by CDM includes additional drilling, leaching test, sampling and analyses of soil, groundwater and surface water. The results of the investigation by CDM are shown in Table 33.

Table 33 Results from site investigation of Maljevac ash dump site

	Investigation	**Results**
Analyses of solid material	15 drilling to 0.5 m b.s. and 2 drillings to 30 and 60 m b.s. respectively	5 samples from the surface of the dump did not show any elevated concentration of contaminants (heavy metals, PAH, PCB and hydrocarbon) From the deep drilling only one sample showed slightly elevated concentrations of zinc
Leaching test	pH, heavy metals and organic components	No significant leaching. Four samples from ashes show basic reaction and one strong acid reaction
Surface water	2 water samples from the pond on the surface	Highly basic and high conductivity
Groundwater	2 groundwater sample from 3 and 21 m b.s. respectively	Acid with relatively high conductivity. Otherwise no indication of contamination

Characterization of the contamination

The results of the investigations show that the site is a potential source for contamination of the surrounding area mainly by spreading of dust and the risk of dam failure. The potential source of contamination from the disposal site includes various heavy metals although found in very limited concentrations. Fluorine and boron, sometimes found in fly ash, were not found in significant concentrations. . Characterization of the site based on available material is shown in Table 34.

Table 34 Characterization of Maljevac Ash Dumpt site in relation to the remediation

Preliminary description	**Characterization**
Source volume	Very large volume (8,000,000 t)
Source type	Heavy metal
Source strength	The concentrations of contaminants are low
Hot spots	Not expected in the deposit
Sensitivity of surrounding area	Sensitive groundwater and surface water resources and resident areas and farmland nearby. Low biodiversity

8.3 Social-Economical Baseline

Demographic

Population data for Republic of Montenegro and Municipality Pljevlja, according to official preliminary data from Population census in 2011, are given in Table 35.

Table 35 Population data for Republic of Montenegro and Municipality Pljevlja

	Total	Urban	Rural
Montenegro	625 266	401 462	223 804
Pljevlja	31 060	19 622	11 438

Source: MONSTAT, Census of Population, Households and Dwellings in Montenegro, First results 2011.

The area in the vicinity of the dumpsite is relatively sparsely populated. Locally around the Maljevac dumpsite, only very few houses were observed or can be seen from aerial photos. The nearest houses are seen in Table 36.

Table 36 Buildings nearby the dump site

	Type	**Approximate distance to border of the dumpsite**
North	Farmhouse	120
North East	Farmhouse	60

Resettlement and change in natural resources

While the remediation and closure of the Maljevac Ash Dump will not cause the volume of ashes to be disposed at the Sumane site as the Maljevac dump capacity will be finished in any case shortly, the Sumani Ash Dump Development is an associated investment to the Project. The Power Plant Company, Elektroprivreda Crne Gora (EPCG) is planning an extension of the ash dump at the Sumane site because Maljevac dump will be expired very soon and has to be closed anyway. Most of the area is owned by EPCG, including a buffer zone surrounding the dump area. In addition, EPCG has options to acquire additional land. Under consideration of this additional land acquisition, the new ash dump is not expected to come closer than 300 m to houses within the next 7 years. However, the framework for the potential of resettlement which might be needed in connection with the establishment of the Sumane Ash Dump site o is included in appendix B.

8.4 Environment and Social Management and Monitoring Plan

The purpose of the Environmental Management Plan (EMP) for the remediation is to ensure that all adverse environmental impacts are within the acceptable level. The EMP sets out to ensure that all aspects of the works comply with the relevant legislation, permit conditions and good practice, and that measures to mitigate the negative impacts identified in the ESIA are implemented. The EMP strives to implement appropriate environmental controls and monitoring procedures during construction.

The EMP and Monitoring plans are the basis for fulfilling the requirements under Montenegrin legislation. In a later phase, the Environmental Protection Agency will require all construction contractors to develop a detailed Construction Environmental Management Plan for their respective activities. The detailed CEMP should include detailed method statements, environmental control procedures and environmental compliance monitoring to be carried out during the construction works. The cost estimated is a rough assessment presented usually as less than and based on the following general principles described in section 5.4.

Table 37 Environmental and Social Management Plan forMaljevac site remediation and Sumane Ash Dump development

Phase	**Issue**	**Mitigating Measures**	**Cost**		**Institutional Responsibility**	
			Installation	**Operation**	**Installation**	**Operation**
Construction	Dust	Watering during dry periods	Should be included in the bid from the Contractor	Should be included in the bid from the Contractor	Contractor supervised by EPA	Contractor supervised by EPA
	Handling of oil and fuel used for machines	Oil and fuel should be stored in places with secondary containment. No drums must be placed directly on the ground	As above	As above	As above	As above
	Traffic	Speed limits near small villages	Should be included in the bid from the Contractor	Competent Montenegrin authority	As above	As above
	Work in contaminated ashes	Use of Personal Protection Equipment	Should be included in the bid from the Contractor	Contractor	As above	As above
	Noise	The noise impact is related to the use of machineries like bulldozer, compactor, vehicles for material transport; Limiting time for construction work suggestion: 07 – 20 h.	Should be included in the bid from the Contractor	Contractor	As above	As above
	Waste	Any new waste generated during the construction as well as the waste dumped at Sumane residual pit shall	To be included in the bid from the Contractor	Contractor	As above	As above

Phase	Issue	Mitigating Measures	Cost		Institutional Responsibility	
			Installation	**Operation**	**Installation**	**Operation**
		be disposed at controlled landfills.				
	Sumane dumpsite preparation	In case any resettelemtn would be required, this will be done in accordance with OP4.12 of the World Bank.	The possible impacts on the nearby houses for the new Sumane ash dump site shall be determined when the detailed technical design is available from EPCG.	-	EPCG/EPA	EPCG/EPA
	Social issue	For the Sumane landfill construction, the Thermal Power Plant will develop a resettlement plan in line with OP412, in case resettlement would be required	-	-	The Power Plant Company, Elektroprivreda Crne Gora	The Power Plant Company, Elektroprivreda Crne Gora
	Training	The contractor shall set up a health and safety organization before the implementation of the work. The contractor shall also ensure that all relevant staff has been training in health and safety issue not at least in relation to work in contaminated soil and use of personal protection equipment.	Should be included in the bid from the Contractor	As above		
Operation	Dust emissions	Sumane Ash Dump surface covered by water or use of water spray system	To be included in contractors bid	20,000 – 30,000 Euro	Operator supervised by EPA	Operator supervised by EPA

Phase	Issue	Mitigating Measures	Cost		Institutional Responsibility	
			Installation	Operation	Installation	Operation
	Control of drainage water quality	Part of the remediation system	-	5,000 - 10,000 Euro	Operator supervised by EPA	Operator supervised by EPA
	Leachate	Control of leachate system	-	5,000 - 10,000 Euro	As above	As above

Table 38 Environmental and social monitoring plan

Phase	Item	Parameter	Frequency	Location	Installation cost	Operation cost/year	Responsibility
Construction							
	River water	- pH - Heavy metal	Once a month	1 station upstream and 1 station downstream	<10,000 Euro	<10,000 Euro	Contractor supervised by EPA
	Groundwater	- pH - Heavy metal	Once a month	Minimum 3 monitoring well	< 20,000 Euro	<10,000 Euro	As above
	Air	- dust - pm_{10}	Daily visual inspection	Inside the construction site and outside in downstream wind direction	Minimal	Minimal	As above
Operation							
	Control of water mass balance	Collection of data including precipitation for control of water mass balance	Every second month	At least: 3 inclinometers 5 piezometers 7 survey points 1	< 20,000 Euro	< 5,000 Euro	Operator supervised by EPA

Phase	Item	Parameter	Frequency	Location	Installation cost	Operation cost/year	Responsibility
				Weather station			
	Control of drainage water	- pH - Heavy metal	Every second month	-	< 4,000 Euro		As above
	Control of surface soil	20 surface soil samples analysed for heavy metals	Once	At a distance of approximately 200 m from the construction site	5,000 – 10,000 Euro	-	As above

8.5 Alternatives

0-alternative

The 0-alternative means doing nothing. The current negative impacts from the contaminated site and the risk of dam collapse will continuously represent a risk for the environment and for humans.

A. Stabilization of the dam and drainage wall

This alternative is basically similar to the preferred option with the addition of a "drainage wall" as called by CDM. This "drainage wall" consists of a series of wells constructed behind the existing dam covering the whole length of the dam. The objective of the drainage wall is to stabilize the upper part of the dam.

B. Construction of a secondary dam and continued ash deposition

This alternative includes construction of a secondary dam to be built at a distance of about 100-150 m from the exiting dam inside the dumping area. The secondary dam on top of the ash dump will be constructed in the ash deposit area with stone columns as piles. The area behind the new dam can be used for dumping of ashes, whereas no ashes can be dumped between the new dam the existing dam.

The most prevalent environmental impacts from the three alternatives are shown in Table 39.

Table 39 Environmental impacts from alternatives

Alternative	**Phases**	**Impact**
0-alternative		Significant negative impact on people especially related to the potential collapse of the dam
A. Stabilization of the dam and drainage wall	Construction phase	Limited negative impact on the local community due to heavy traffic
	Operation phase	Significant positive impact as the risk of dam collapse is eliminated
B. Construction of a secondary dam and continued ash deposition	Construction phase	Positive impact on minimizing the risk of release of potentially contaminated dust particles
	Operation phase	Significant positive impact as risk of dam collapse is eliminate Negative impact from the continued use of the sites for dumping will continue for some years

The most suitable remediation has been selected based on the advantages and disadvantages of the alternatives as shown in Table 40.

Table 40 The advantages and disadvantages of the alternatives

Alternative	**Advantages**	**Disadvantages**
A. Stabilization of the dam and drainage wall	• Water pressure will be held off to a large extend from the dam structure along the total height • Dam stability is secured to a large extend and long term • Controlled and complete draining of the dumping material • Prevention of wind erosion of ash	• Higher investment costs compared to alternative 1 • No extension of the dumping capacities
B. Construction of a secondary dam and continued ash deposition	• Additional securing for the primary dam • Reduction of seepage • Extension of ash pond capacity • Reduction of dust formation	-

9 KAP Remediation Project

9.1 Physical and Environmental Baseline

Location

The Kombinat Aluminijuma Podgorica (KAP) is located approximately 10 km south of Podgorica, the capital of Montenegro. The plant is situated between two rivers – Morača River and Cijevna River immediately south of the River Morača, approximately 15 km upstream of the Lake Skadar. The location of KAP and its dumpsite is shown in Figure 9.

Figure 9 Location of Kombinat Aluminijuma Podgorica and project area of influence

Remediation projects at KAP-site

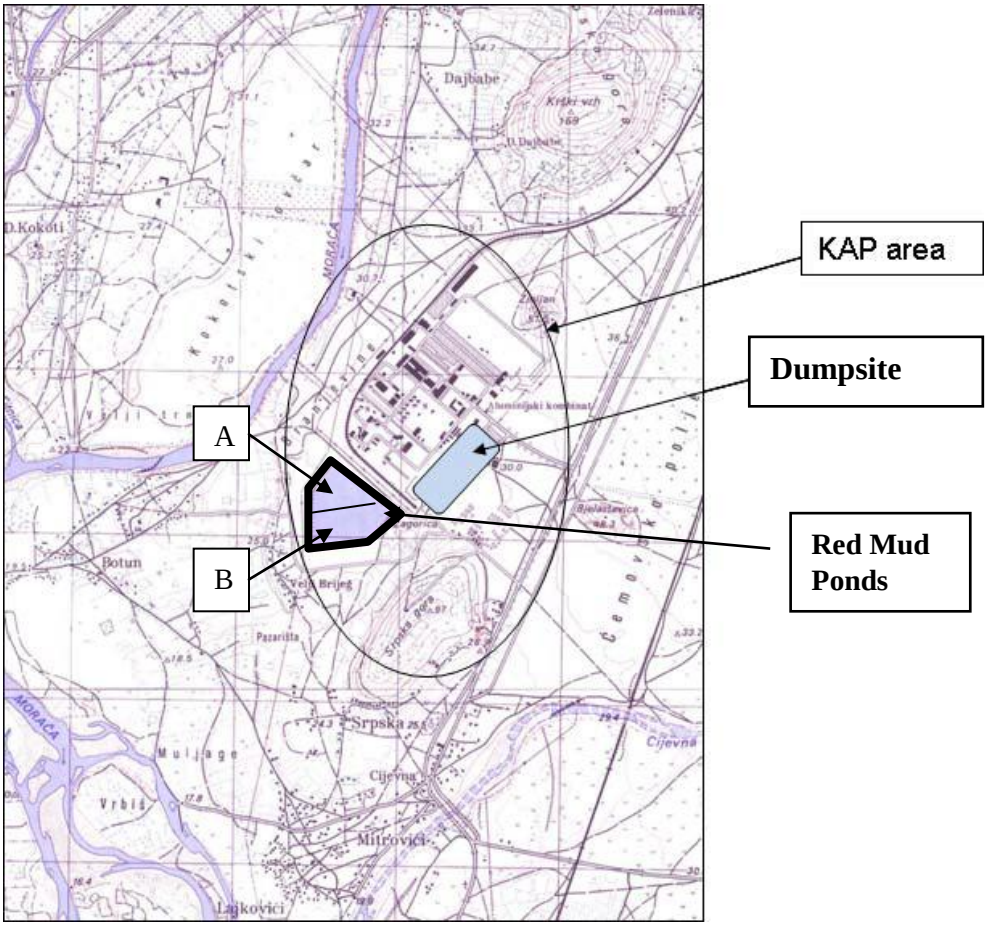
Currently, two separate remediation projects are investigated for the KAP-site. As part of the IWMCP, the company CDM has carried out a study for remediation of the "Red Mud Ponds" and as part of the "Lake Skadar-Shkoder Integrated Ecosystem Management Project", the company SWECO is engaged for the study

of the remediation of the solid waste dumpsite inside the KAP-site. The location of the red mud ponds and the solid waste dumpsite is shown in Figure 10.

The first phase of the proposed IWMCP will be to do a detailed design as the current studies are on feasibility study level and these will further refine the ESIAs. In a later phase, the two remediation projects will be combined and be finances by GEF/WB. This ESIA is focusing on the remediation of the Red Mud Ponds and a separate EIA will be prepared concurrently with the remediation of the KAP dumpsite. The final selection of the remediation of the red mud and the solid waste has not been taken at the moment of the preparation of this ESIA. For this reason, the Environmental Management Plan and the Monitoring Plan is prepared as generic plans and will be updated later based on the selected remediation.

In addition, the KAP site is also considered as a potential location for establishing a national hazardous waste facility as described in Ecorem's concurrent study.

Figure 10 *Location of the "Red Mud Ponds" and the "Dumpsite"(modified drawing prepared by SWECO).*



CDM has presented three different scenarios for remediation of the red mud basin. At the time of the preparation of this ESIA, no preferred scenario has been selected. SWECO has presented 4 different main scenarios for remediation of the dumpsite. Based on further evaluation it has been preliminary decided that the remediation of the solid waste dumpsite will included temporary re-disposal of the

waste, installation of bottom liner and leaked collection system underneath the dumpsite, re-disposal of the waste on the bottom liner and installation of a cover.

The red mud ponds are also shown in Figure 11.

Figure 11 Red mud Pond A and B

Impact assessment of the current situation and possible mitigation measures

The current impact from the contaminated sites at KAP is summarised in Table 41. In the present situation, the contaminated dump site has several negative impacts on the environment and on the social-economic environment. The objective of the remediation is to limit the negative impact by implementing various mitigating measures.

The remediation has a significant positive impact on the environment; however during the implementation of the remediation some short-term minor negative impacts might be expected including noise, increased traffic or dust related to the construction works during implementation of the remediation. The impact during the construction phase and the operational phase of the remediation is described in the Environmental Management Plan and Monitoring Plan in section 9.5.

Table 41 Summary of environmental impact and mitigation measures

Subject	Issue	Current impacts from dumpsite	Mitigation measures	Future impacts after remediation
1. Soil - Exposition of humans and animals to contaminated soil by direct contact	The area is uncovered and has no vegetation. The maximum and average concentrations of Chromium, Nickel, cadmium, PAH, PCB and fluorides exceed the threshold values.	Limited negative impact (due to the industrial nature of the site)	Handling of red mud should be in accordance with the safety regulations prepared by the company	Limited positive impact as the access to the site is already restricted
2. Air and dust - Exposure of humans and animals to contaminated dust - wind erosion of surface particles	The most frequently occurring wind direction is from the north and northeast and the nearby small settlement can be affected	Negative impact	Covering of the surface with plastic liner or mixing the top layer with lime, bentonite, cement or other material to create an impermeable layer	Significant positive impact by preventing future spread of contaminated particles
3. Drainage water - Exposure of humans and animals to contaminated surface or drainage water	The surface water shows high alkaline pH and fluorides	Minor negative impact significant	Warning signs should be put up	The mitigation measure has a positive impact
4. Groundwater - Adverse effects of contaminants seepage water on groundwater	Groundwater analyses showed alkaline pH and elevated fluoride, cyanide, nitrate and mercury	Significant negative impact	Sealing of the ponds can prevent percolation of rainwater through the waste body	Significant positive impact by limiting the risk of leaching
5 Indirect impact	No indirect impact	-	-	-
6. Cumulative impact	Heavy metal, PCB and PAH can accumulate in the sediment of the final receptor - Lake Skadar	Potential impact if contamination continues	Limiting the percolation by covering the ponds	Significant positive impact
7. Transboundary impact	The final receptor for the groundwater and river water from the KAP site is the Lake Skadar which is actually the border between Montenegro and Albania	Significant negative impact	Remediation that limits the potential risk of spread of contaminants through groundwater or river	Significant positive impact
8. Social impact	KAP site is located in an industrial area and with strict assess control	-	-	-

9.2 Remediation Project for KAP Red Mud Pond

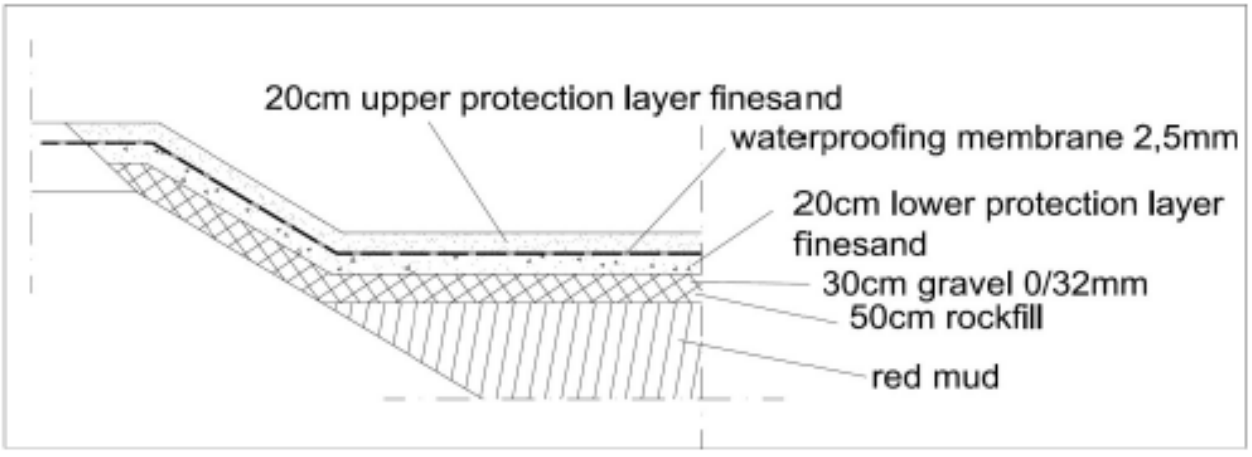
The final selection for the remediation of the red mud site was not available during the preparation of this ESIA-report. The various proposed types of remediation of the red mud are described in Table 42.

Table 42 The 3 alternative remediations for the Red Mud as suggested by CDM

	Alternative 1	**Alternative 2**	**Alternative 3**
Objective	A sealing liner on top of the whole area to prevent percolating water though the red mud.	Conditioning of the red mud material on-site.	Close down of the red mud ponds and solid waste and groundwater treatment downstream the KAP site.
Method	Each pond is portioned into 100x100 m sections. Each portion should then be dried and after drying equipped with a top including a sealing plastic layer	Instead of a plastic liner, the upper layer of the ponds will be mixed with lime, bentonite, cement or other materials to create an impermeable layer.	Installation of monitoring wells downstream to control the contaminated plume.
Options	1a The wall between the two ponds will be elevated by 2 m making it possible to expand the capacity for red mod deposit in pond A. 1b The pond A might be used for future "hazardous waste facility site" 1c. Installation of top layer on pond B only	1 Both pond A and pond B will be sealed 2 Only pond B will be sealed	-

The alternative 1 with a sealing liner on top of the whole area is illustrated in Figure 12.

Figure 12 Illustration of alternative 1 for remediation of red mud (drawing prepared by CDM).



The advantages and disadvantages of the alternatives are shown in Table 43.

Table 43 The advantages and disadvantages of the various alternatives

Alternative	Advantages	Disadvantages
Alternative 1a and 1b	• Prevention of seepage formation • Prevention of wind erosion of red mud particles • Improvement of the optical appearance • Continued utilization for red mud deposition • Increase of deposition capacity In addition for 1b: • Combined solution for liquid and solid waste from the production process	•high investment costs
Alternative 1c	• Prevention of seepage formation in non-lined basin B • Prevents wind erosion of red mud particles • Improvement of the optical appearance of basin A • Continued utilization of basin B for red mud deposition	• Basin A will not be remediated • Seepage from basin A can still leak into the underground • Probably no final solution to prevent groundwater contamination
Alternative 2a and 2b	• Prevention of seepage formation • Prevents wind erosion of red mud particles	• Closing down of the disposal pond • Preliminary testing of suitable conditioning materials necessary In addition for 2b • Red mud in basin A remains untreated • Probably no final solution to prevent groundwater contamination
Alternative 3	• Low initial investment costs • Stepwise approach to identify dimension of groundwater contamination • Improvement of the drinking water quality • Additionally treatment of contamination originating from other sources	• The source of contaminants is not treated • Further geochemical surveys are necessary to locate the contaminant plume • Costs of groundwater treatment plant depend on level of contamination and hydrological conditions

9.3 Remediation Project for KAP Solid Waste Dumpsite

The final selection for the remediation of the solid waste dumpsite was not available during the preparation of this ESIA-report. The various proposed types of remediation of the solid waste are described by CDM is shown in Table 44

Table 44 The 3 alternative remediations for the solid waste sites in combination with the remediation of the red mud ponds as suggested by CDM

	Alternative 1	**Alternative 2**	**Alternative 3**
Objective	Sealing of the waste disposal site	Relocation of the solid waste on redesigned red mud basin A	Sealing of the solid waste and groundwater treatment downstream
Method	Excavation of waste in sections with temporary storage and installing a bottom liner and leached system for permanent storage of the waste	If the red mud basin is provided with suitable cover, the solid waste could be relocated on the mud basin after installation of leached system.	Installation of monitoring wells downstream to control the contaminated plume.

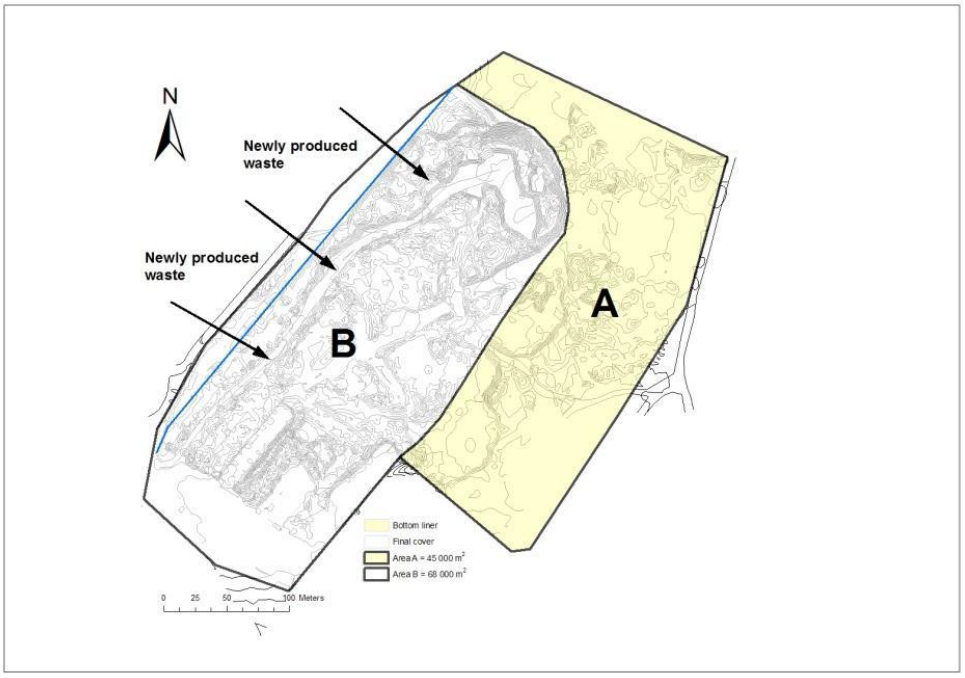
Concurrently, SWECO has developed a remediation plan for the solid waste dumpsite.

This proposal for remediation includes that the waste in the eastern part (ca. 4.5 ha) of the dumpsite is excavated, moved and placed on top of the waste on the western side of the dumpsite. On the eastern part a bottom liner and leachate collection is applied. All the waste from the western part is then re-disposed on the eastern part on the bottom liner and a final cover is applied.

Thereafter, a bottom liner and leachate collection system is constructed on the western part and connected to the liner in the eastern part to create a bottom liner over the whole dumpsite area. The western part is then available for disposal of new waste, c. 6.8 ha, which would last for more than 40 years with a disposal height of c.10 m and an annual disposal volume of c. 7 000 m^3.

In practice, the preparation of the bottom liner would be performed in stages. No new land area is occupied, and newly produced waste may deposited on the site. The principle of this scenario and the sequence of the removal of the waste, installation of the bottom liner and the application of the final cover is shown in the Figure 13.

Figure 13 Remediation of solid waste dumpsite at KAP (drawing prepared by SWECO)



9.4 Environmental baseline

Description of the site and surroundings

Activities at the site were started in 1969. The main reason for the development of the aluminium industry in Montenegro was the availability of adequate reserves of quality bauxite and resources (hydropower coal mines) for electricity generation.

About 7.5 million tons of red mud are accumulated at two disposal sites adjacent to the KAP Plant. Red mud is a waste product which is produced during the bauxite ore processing where crushed bauxite particles are placed in a hot sodium hydroxide solution. The solid stage of mud is treated as a non-hazardous waste, while the liquid stage of mud is treated as hazardous waste because of the high concentration of NaOH. After extraction of the alumina from the bauxite ore, the material is treated in an electrolytic cell in which a large amount of fluoride components are used.

The first disposal pond "A" is a basin with a surface area of 170,000 m² and a bottom layer that contains about 3.5 million tons of red mud. The second disposal pond "B" is a basin with a surface area of 220,000 m², which doesn't have any bottom layer. It contains about 4 million tons of red mud and is no longer being filled up. The ponds are equipped with a water-spraying system, which prevent dust rising when the wind is blowing.

The Bayer process alumina plant was shut down in June 2009. When refining activities were ongoing, it was reported that the red mud production was approximately 1 million m³/year comprising approximately 270,000 tons of solids.

Flora, fauna and natural resources

The surrounding area shows signs of a typical, cultural landscape. The area is considerably human-modified. A few houses are situated near the western slope of

the dumpsite as part of the neighbouring village of Botun. Nearly all soil is used for agricultural purposes, i.e. most likely for crop and vegetable cultivation. There is little forest vegetation except for some individual trees and tree lines among the cultivated fields.

According to the space characteristics of the vicinity of the dumpsite, poor and degraded plant communities are to be expected. Similar situation could be expected for the animal communities as well, which are most probably composed of species with higher ecological resilience (mainly rodents and possible some birds). These species are common for semi natural and artificial ecosystems like agro-ecosystems.

Numerous birds can be seen on the water surface, which are mainly water birds. Considering that there are no conditions for feeding or nesting on the dumpsite, it could be supposed that birds use the water surface just as a temporary resting place.

There are no protected natural areas in close vicinity of the KAP site; however, 10 km south-southwest of the site the “Skadarsko Jezero” National Park is situated. Negative impacts on the water quality and the lake ecosystems cannot be excluded considering that the Skadar Lake is located downstream of the KAP site. Contaminated groundwater can potentially have an impact as the groundwater flows directly to the lake and also if it enters the river which flows to the lake.

Hydrogeology

The KAP plant is built on glaciofluvial sediments of the Zeta valley. The area of the valley is 484 ha. The direction of the groundwater flow in the area varies throughout the year depending on the water level in the river Morača but is generally from the north-northwest toward south-southeast. The flow in the river varies from a minimum of 5.5 m3/second to 900 m^3/second with an average of 132 m^3/second. The depth from the surface to the groundwater ranges from about 17 meters in the summer period to about 13 meters during high water periods. Studies indicated that in the south-eastern part of the KAP site, the thickness of the glaciofluvial sediments are significantly reduced with the smallest thickness in the area from the foothill zone of the red mud dump up to the Srpska hill.

Climate

Podgorica has a modified Mediterranean climate with hot, dry summers and cool winters. Although the city is only some 50 km from the Adriatic Sea, an arm of the Mediterranean and the proximity of the Dinaric Alps to the north alter its climate. The mean annual rainfall is 1,600 mm. The temperature exceeds 25 °C about 135 days each year and the median daily temperature is 16.4 °C. The number of rainy days is about 120, and those with a strong wind around 60 days. An occasional strong northerly wind influences the climate in the winter, with a wind-chill effect lowering the perceived temperature by a few degrees.

Previous investigations

Previous investigations of the KAP site include:

1 Studija, Utvrđivanje "0" Stanja Emisija IZ KAP-a, Knjiga. 1, (Study Determination "0" State Emissions from KAP, Book. 1)

2 Studija, Utvrđivanje "0" Stanja Emisija IZ KAP-a, Knjiga. 2, (Study Determination "0" State Emissions from KAP, Book 2)

3 Site Investigation Report, KAP Montenegro Assignment number 1989320000, SWECO.

4 Best Practical Environmental Options Report, SWECO, May 2012

Previous investigation of soil samples from twelve different locations in the Zeta plain from 1998-2004 showed varied concentrations of heavy metals, PAHs and PCBs. The results of the monitoring of soil from locations 500 m and 1000 m north, east and west of the Electrolytic section of KAP, as well as from the Srpska location, south of the plant (both cultivated and non-cultivated land), show elevated concentrations of fluorides, PAH's, PCB's and metals such as chromium and nickel. The measured levels do not meet the requirements given in the guidelines.

Previous groundwater investigation has shown a significant decrease in contamination concentrations over the years from 1990 to 2004, which is likely due to the remediation that was carried out and to the high permeability of the soil and the dilution by rainfall. Monitoring wells around the aluminium oxide plant showed mostly elevated pH. All showed elevated concentrations of PAHs, PCBs, phenolic compounds and metals. The twelve new wells that were drilled in 2004 showed that the groundwater south of the red mud pond has a high pH and is contaminated by phenolic compounds, fluorides, metals, PAH's, mineral oil and ammonia.

Analysis of metals in the river water of the Morača River, Crnojevica River and in the Shkoder Lake in 1981 showed low concentrations of metals.

In 2007, some 600 tons of PCB oils and PCB-contaminated soil were stored in drums at the dedicated PCB storage area, situated directly north of the administration building and south of the main transmission station. This spill is not part of the remediation plan prepared by CDM.

During previous audits and site visits potentially asbestos-containing material has been visually identified in the form of corrugated cement roofing/cladding and is potentially present in insulation material at some production locations. In 2010, the KAP management reported that 70,000 m² would be removed from the Pot room roofs due to damage and leakage. Removed asbestos cement sheeting has been transported to the northern section of the solid waste dumpsite. The total quantity of asbestos containing materials stored in this location was unknown by KAP Management in 2010.

Additional investigation by CDM

The new investigation conducted by CDM includes additional drilling, sampling and analyses of soil, groundwater and surface water. The results of the investigation by CDM are shown in Table 45.

Table 45 Results from site investigation of the KAP site

Red Mud Pond	**Investigation**	**Results**
Analyses of solid material	3 drillings to 30 m 4 drillings to 0.5 m for pond sampling 10 drillings at pond dam	Soil samples from 30 m drillings exceeding threshold limits: Arsenic up to 75 mg/kg Chromium up to 83 mg/kg Nickel up to 79 mg/kg PAH up to 2.66 mg/kg PCB up to 0.17 mg/kg

	3 drillings to 30 m at potential landfill site 10 drilling to 0.5 m at potential landfill site and test of asbestoses	Surface soil samples exceeding threshold limits: Chromium 143 mg/kg Nickel 90 mg/kg Lead 65 mg/kg Fluoride 905 mg/kg Cadmium 8 mg/kg PAH 14.4 mg/kg PCB 0.09 mg/kg No indication of asbestoses
Leaching test	26 soil samples	Alkaline conditions for all deep drilling and in 4 surface samples This clearly indicates the influence of NaOH.
Surface water from ponds	2 water samples	Exceeding threshold limits pH between 8.2 -10.0 Fluoride 3.2mg/l Cyanide 0.0053 mg/l
Groundwater	4 groundwater sample from newly installed wells 10 groundwater samples from existing wells	pH between 9.3 -11.6 High electrical conductivity Concentration exceeding threshold limits: Nitrite 1.4 mg/l Mercury 0.006 mg/l Fluoride 108 mg/l Cyanide 0.3 mg/l

Characterization of the waste body

The results of the previous investigations show that the location is a potential source for contamination of the surrounding area. The potential source for contamination from the disposal of the red mud is the heavy metal. Other types of waste include fluorides, phenolic, heavy metal, PAH and PCB. It is unknown to which extent these components are found in the red mud. Preliminary characterization of the site based on available material is shown in Table 46.

Table 46 Preliminary characterization in relation to remediation

Preliminary description	**Characterization**
Source volume	Very large volume (estimates from 3,500,000 to 7,500,000 t)
Source type	The concentrations of contaminants in the red mud are low with relatively limited elevation of heavy metals, however contamination from other parts of the aluminium production process includes fluorides, phenolic, heavy metal, PAH and PCB
Source strength	Relatively low from the red mud itself; however investigation downstream the red mud basins has shown contamination with fluorides, phenolic, heavy metal, PAH and PCB
Hot spots	Not expected in the red mud basin
Sensitivity of surrounding area	Sensitive groundwater and surface water resources and resident areas and farmland nearby.

	Low biodiversity

9.5 Social and Economical Baseline

Demographic

Population data for Republic of Montenegro and Municipality Podgorica, according to official preliminary data from Population census in 2011, are given in the following Table 47.

Table 47 Population data for Republic of Montenegro and Municipality Podgorica

	Total	Urban	Rural
Montenegro	625 266	401 462	223 804
Podgorica	187 085	156 169	30 916

Source: MONSTAT, Census of Population, Households and Dwellings in Montenegro, First results 2011.

The closed area surrounding the KAP site is dominated by industrial properties and agricultural land with a few settlements south and southeast of the site. The nearest permanent residences are found south of the site at a distance of approximately 200-500 meters. The residences consist mainly of small housings.

Potential for employment

The potential for employment during the construction phase of the remediation may draw people to the area. On the positive side, there may be a temporary increase in economic activities and employment for the local community and local skills development.

The construction work related to the remediation can be tendered nationally or internationally according the WB procurement procedure. It is expected that national procedure will result in more input from companies located in Montenegro whereas the exchange of knowhow will be less.

9.6 Environmental Management and Monitoring Plans for the remediation

Various alternatives for remediation have been proposed by CDM; however, at the time of preparing this report, no final selection of the preferred remediation has been taken. The Environmental and Social Management Plan and Monitoring Plan in Table 48 and Table 49 are therefore prepared as general framework plans for the remediation of the red mud basins. The Environmental and Social Management Plan and Monitoring Plan in Table 50 and Table 51are prepared as general framework plans for the remediation of the solid waste dumpsite.

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Table 48 Environmental and Social Management Plan for remediation of red mud basins

Phase	Issue	Mitigating Measures	Cost		Institutional Responsibility	
			Installation	**Operation**	**Installation**	**Operation**
Construction						
	Dust	Watering during dry periods, cover trucks carrying soil during transportation	Should be included in the bid from the Contractor (minimal)	Should be included in the bid from the Contractor (minimal)	Contractor supervised by EPA	Contractor supervised by EPA
	Handling of oil and fuel used for contractor's vehicles and machinery	Oil and fuel should be stored in places with secondary containment. No drums must be placed directly on ground	as above	as above	as above	as above
	Traffic	Speed limits inside the KAP-site	as above	as above	as above	as above
	Work in contaminated material	Use of Personal Protection Equipment, staff training	as above	as above	as above	as above
	Noise	The noise impact is related to the use of machineries like bulldozer, compactor, vehicles for waste transport; Limiting time for construction work should follow the general regulations for the Aluminium Plant	as above	as above	as above	as above

Phase	Issue	Mitigating Measures	Cost		Institutional Responsibility	
			Installation	**Operation**	**Installation**	**Operation**
	Construction waste	Any re-disposal of waste materials from construction activities like levelling or excavation should be disposed internal on the dumpsite and only on areas already contaminated. Any new waste generated during the construction shall be disposed at controlled landfills.	as above	as above	as above	as above
	Social issue	Locals might gain temporary employment during the construction phase. The tender for the remediation work should include a clause that encourage employment of local people	Should be included in the bid from the Contractor	Should be included in the bid from the Contractor	EPA	EPA
	Training	The contractor shall set up a health and safety organization before the implementation of the work. The contractor shall also ensure that	As above	As above	Contractor supervised by EPA	Contractor supervised by EPA

Phase	Issue	Mitigating Measures	Cost		Institutional Responsibility	
			Installation	**Operation**	**Installation**	**Operation**
		all relevant staff has been training in health and safety issue not at least in relation to work in contaminated soil and use of personal protection equipment.				
Operation						
	Control of drainage water quality	Maintenance – ensure free drainage	Installation of sampling points – relatively low cost	< 10,000 Euro	Operator supervised by EPA	Operator supervised by EPA
	Control for damage of top cover and efficiency of the drainage system	Maintenance – ensure complete coverage	Visual inspection	< 5,000 Euro	as above	as above
	Groundwater	Access to monitoring wells	Monitoring wells already exist	< 10,000 Euro	as above	as above
	Control of leachate	Installation of 6 monitoring wells inside the dumpsite	30,000 Euro	< 10,000 Euro	as above	as above

Table 49 Environmental and social monitoring plan for remediation of red mud basins

Phase	Item	Parameter	Frequency	Location	Installation cost	Operation cost / year	Responsibility
Construction							
	River water	- pH - Heavy metals -Fluoride	Once a month	1 station upstream and 1 station downstream	<5,000 Euro	< 8,000 Euro	Contractor supervised by EPA
	Air	- dust - PM_{10}	Daily visual inspection	Inside the construction site and outside in downstream wind direction	Minimal	Minimal	as above
	Discharge water from drying of ponds	- pH - Heavy metals -Fluoride	Once a month dependant on the discharge volume	Discharge point	-	< 10,000 Euro	
Operation							
	Control of drainage water quality	- pH - heavy metals - PAH, PCB and mineral oil - Fluoride	Once a year for the first 4 years	At the remediation	-	< 10,000 Euro	Operator supervised by EPA
	Control of top cover and efficiency of the drainage system	Visual inspection	-	At the remediation	-	< 5,000 Euro	as above
	River water	- pH - Heavy metals	Once a year in spring time for the first 4	1 station downstream	-	< 5,000 Euro	as above

Phase	Item	Parameter	Frequency	Location	Installation cost	Operation cost / year	Responsibility
			years				
	Groundwater	- pH - heavy metals - PAH, PCB and mineral oil - Fluoride	Once a year for the first 4 years	1 monitoring well upstream and 2 monitoring wells downstream	Monitoring wells probably exist	< 10,000 Euro	as above
	Leachate	- pH - heavy metals - PAH, PCB and mineral oil - Fluoride	4 x year for the first 4 years	6 monitoring wells inside the dump site area. Not to be installed if the dumpsite is installed with bottom membrane	< 60,000 Euro	< 20,000 Euro	as above

Table 50 Environmental and Social Management Plan for remediation of solid waste dumpsite

Phase	Issue	Mitigating Measures	Cost		Institutional Responsibility	
			Installation	**Operation**	**Installation**	**Operation**
Construction						
	Dust	Watering during dry periods	Should be included in the bid from the Contractor (minimal)	Should be included in the bid from the Contractor (minimal)	Contractor supervised by EPA	Contractor supervised by EPA
	Handling of oil and fuel used for contractor's vehicles and machinery	Oil and fuel should be stored in places with secondary containment. No drums must be placed directly on ground	as above	as above	as above	as above
	Traffic	Speed limits inside the KAP-site	as above	as above	as above	as above
	Work in contaminated material	Use of Personal Protection Equipment, staff training	as above	as above	as above	as above
	Noise	Limiting time for construction work should follow the general regulations for the Aluminium Plant	as above	as above	as above	as above
	Construction waste	The re-disposal of the solid waste materials should be carried out only on surface with	as above	as above	as above	as above

Phase	Issue	Mitigating Measures	Cost		Institutional Responsibility	
			Installation	**Operation**	**Installation**	**Operation**
		concrete of asphalt				
	Social issue	Locals might gain temporary employment during the construction phase. The tender for the remediation work should include a clause that encourage employment of local people	Should be included in the bid from the Contractor	Should be included in the bid from the Contractor	EPA	EPA
	Training	The contractor shall set up a health and safety organization before the implementation of the work. The contractor shall also ensure that all relevant staff has been training in health and safety issue not at least in relation to work in contaminated soil and use of personal protection equipment.	As above	As above	Contractor supervised by EPA	Contractor supervised by EPA
Operation						
	Control of drainage	Maintenance – ensure	Installation of	< 10,000 Euro	Operator supervised by	Operator supervised by

Phase	Issue	Mitigating Measures	Cost		Institutional Responsibility	
			Installation	**Operation**	**Installation**	**Operation**
	water quality	free drainage	sampling points – relatively low cost		EPA	EPA
	Control for damage of top cover and efficiency of the drainage system	Maintenance – ensure complete coverage	Visual inspection	< 5,000 Euro	as above	as above
	Groundwater	Access to monitoring wells	Monitoring wells already exist	< 10,000 Euro	as above	as above
	Control of leachate	Installation of 6 monitoring wells inside the dumpsite	30,000 Euro	< 10,000 Euro	as above	as above

Table 51 Environmental and social monitoring plan for remediation of solid waste dumpsite

Phase	Item	Parameter	Frequency	Location	Installation cost	Operation cost / year	Responsibility
Construction							
	River water (if possible to be combined with monitoring of red mud basins)	- pH - Heavy metals -Fluoride	Once a month	1 station upstream and 1 station downstream	<5,000 Euro	< 8,000 Euro	Contractor supervised by EPA
	Air	- dust - PM_{10}	Daily visual inspection	Inside the construction site and outside in downstream wind direction	Minimal	Minimal	as above
Operation							
	Control of drainage water quality	- pH - heavy metals - PAH, PCB and mineral oil - Fluoride	Once a year for the first 4 years	At the remediation	-	< 10,000 Euro	Operator supervised by EPA
	Control of top cover and efficiency of the drainage system	Visual inspection	-	At the remediation	-	< 5,000 Euro	as above
	River water (to be combined with monitoring of red mud basins)	- pH - Heavy metals	Once a year in spring time for the first 4 years	1 station downstream	-	< 5,000 Euro	as above

Phase	Item	Parameter	Frequency	Location	Installation cost	Operation cost / year	Responsibility
	Groundwater(to be combined with monitoring of red mud basins)	- pH - heavy metals - PAH, PCB and mineral oil - Fluoride	Once a year for the first 4 years	1 monitoring well upstream and 2 monitoring wells downstream	Monitoring wells probably exist	< 10,000 Euro	as above

10 Public consultation

The first public consultation for the project was carried out in the period 09/04/2012 to 11/04/2012. The description of the first public consultation is attached in appendix D.

The second public consultation was carried out in the period 09/07/2012 to 12/07/2012. The description of the second public consultation is attached in appendix E. Short descriptions from each public consultation are as follows:

Bijela, remediation of the contamination at the Shipyard, 09/07/2012, 11:00

- A participant said that the report offered two options, the cheapest one and the most expensive. However, he proposed to build a pre-treatment facility for hazardous waste, and thus decrease amount of waste that would be disposed in a hazardous waste facility. He said he knew of such technologies, and these are used worldwide.
- A representative from the inspectorate of environment said that the Shipyard would not be allowed to continue with their current sandblasting practices after remediation; they will not be allowed to generate dangerous waste without proper solution for its disposal.
- Several citizens said that the conclusion from the public consultation should be that citizens of Bijela want waste grit to be removed as soon as possible, and as far away from Bijela as possible.

Podgorica, remediation of the red mud ponds at KAP,10/07/2012, 12:00

- The director of the Alumina factory KAP and professor at University of Montenegro said that combination of options 3 and 1 b would be the most efficient and cheapest solution.
- A participant said that none of the options considered reuse of red mud; he mentioned a study that offers possibilities to use red mud as construction material. The answer was that such solutions are possible from a technical

point of view, but not recommended, as it is not fully clear whether the solutions are safe in the long term.

Nikšić, remediation of the steel work landfill, 11/07/2012, 09:00

- The potential for contamination of the groundwater was discussed. It was explained that the investigation includes three drillings of 30 m depth, one in riverbed and two in waste, with sampling for each meter of depth; total of 90 samples, and about 30 samples were analyzed in laboratory. However, several participants expressed that the groundwater has not been investigated properly.

Several participants ask why the discussion regarding National Hazardous Waste Facility was separated from the discussion regarding the remediation of the landfill.**Pljevlja, remediation of the ash dump site, 12/07/2012, 12:00**

- A representative from Pljevlja Municipality took the word. He said that DMIL had skipped some important facts from the Study, and for abut 10 minutes he read part from the report. During the reading, he showed an aerial photo of the ash dumpsite made in 2010, and claimed that the present situation is much worse, since additional quantities of ashes had been disposed in the meantime.

- A participant who said she lived in the village of Zbljevo asked if the team of presenters were aware that Ministry Sekulic had visited the dam several days earlier. She asked about the status of expropriation, since this issue has been open for 30 years.

- A participant said that Chief Ecology Inspector of Montenegro in 2006 had issued decision to close the ash dumpsite; however, Power Plant had continued to use it. He asked why EPA had not reacted to such a violation of law.

- A participant went up to the presenters, and showed results from CETI from 2008, where ash and slug are described as dangerous waste. Therefore, remediation project must treat ash and slug as dangerous waste.

- Other participant express that the laboratory CETI could not be trusted and independent verifications of the results should be included.

Gradac, remediation of the tailing ponds, 12/07/2012, 15:30

- CDM emphasized that some results of analyses were dramatic; for example, concentrations of lead; arsenic and cadmium were, respectively, 600, 12 and 8 times above allowed limits. She recommended to EPA Montenegro and World Bank that Gradac should be top priority for remediation between 5 locations.

- A participant said that in his opinion, funds would not be used for Gradac. It had been promised many times, but the issue had not been solved. In his opinion, the best solution was to resettle all inhabitants younger than 50 years to another location.

Appendix A Background material

The background documents were received from EPA and include inter alia the following:

1 Analiza I Karakterizagrija Grita 2008, Analysis and Characterization of Grit 2008

2 Brodogradiliste Bijela, Shipyard Bijela - Short description

3 Ceti Grit 20 Sep. 2011 I-III

4 Elaborat Zastite Zivotne, Sredine 1, (Environmental report 1)

5 Studija, Utvrđivanje "0" Stanja Emisija IZ KAP-a, Knjiga. 1, (Study Determination "0" State Emissions from KAP, Book. 1)

6 Studija, Utvrđivanje "0" Stanja Emisija IZ KAP-a, Knjiga. 2, (Study Determination "0" State Emissions from KAP, Book 2)

7 Site Investigation Report, KAP Montenegro Assignment number 1989320000, SWECO.

8 Projektni Zadatak, Za Izradu Glavnog Gradjevinskog Projekta Deponije Konjev do 2 (Terms of Reference, The making of the Construction Project to Landfill, Konev 2)

9 Nikšić, short description of Nikšić landfill

10 Tailings Area Remediation Project for the "šuplja stijena" in Gradac near Pljevlja Book 1. Ascultation Design In English and Montenegrin

11 Rehabilitation Project of flotation tailings of the mine at Suplja Stjena Gradac Pljevlja Book 2 vol. 1 hidortechnicka main tailings remediation project hirografevinski general technical contributions

12 Tailings Area Remediation Project for the "Šuplja Stijena" Mine in Gradac near Pljevlja, Book 3. Restoration of the Ore Flotation Plant with a view to Permanent Elimination of Detrimental Environmental Impacts (in English and Montenegrin)

13 Eloborat. Projektni Zadatak az Izradu Glavnog Gradjevinskog Deponija Konjev do 2

14 Extract from “Eleborat procjene uticaja na životnu sredinu eksploatacije uglja na PK”Potrlica” year?.

15 1. Ocjena current ecological situation in Pljevlja, and what has changed from the "historic session of the Legislature" 1991. year?

16 Extract from unknown document Introduction Exploitation of coal exploration in coal basin takes place at the location of PK "Potrlica" Ljuca in the PK-šumanskom "Sumani I".

17 Document with the heading “Open pit "Sumani I" is in the final stage of exploitation and the exploitation of the dynamics of production completion in 2010”.

18 Study Determination "0" State Emissions from Thermo-Power Plants Pljevlja and a number of analyses

19 Site visit report Euroaid, 17 June 2009

20 EPCG various monitoring reports of water analyses, Wisutech, Analyses of radio-nucleotides and other documents

21 Several other minor documents with more or less relevance to the sites

Appendix B Environmental and Social Management Plan and Monitoring Plan for National Hazardous Waste Facility located at D2

Environmental Management Plan

			Cost		Institutional Responsibility		Comments
Phase	Issue	Mitigating Measures	Install	Operate	Install	Operate	
Construction phase	Material supply	Using existing borrow pits or buying material from licensed companies for production of stone fractions and clay	The work related to control of license and obtaining a copy for record is estimated to 800 eur. Must be included in the bid from the Contractor	N/A	Contractor	Ministry of Sustainable Development and Tourism/Environmental Agency shall appoint an independent consultant for supervision	The Ministry of Sustainable Development and Tourism/Environmental Agency shall signed a contract for supervisory of the construction work The specific requirements shall be specified in the bid documents and Special Specifications.
	Material transport	Material shall be wet or the trucks shall be covered	-	An environmental supervisor shall be responsible for controlling material transport Estimated cost 4000 eur/Months during construction period Must be included in the bid from the Contractor	Contractor	Same as above	
	Dust	Watering during dry periods	Installation of water system for dust suppression.	An environmental supervisor shall be responsible for	Contractor	Same as above	

			Cost		Institutional Responsibility		Comments
Phase	Issue	Mitigating Measures	Install	Operate	Install	Operate	
			Rough estimate 10,000 eur. Dust monitor pm_{10} approximately 300 eur.	controlling dust. Covered by the estimated 4000 Eur/month for an environmental supervisor Must be included in the bid from the Contractor			
	Handling of oil and fuel used for Contractor's vehicles and machinery	The KAP-site is located on sensitive groundwater resource. For KAP and Nikšić: No oil products or drums containing chemicals must be placed directly on ground.	Cost of secondary compartments for deposits of oil and chemicals are estimated to 3000 Eur. Storage facilities must be included in the bid from the Contractor	An environmental supervisor shall be responsible for controlling correct storage of oil and drums. Covered by the estimated 4000 Eur /month for an environmental supervisor Must be included in the bid from the Contractor	Contractor	Same as above	
	Traffic	Traffic	N/A Must be included	N/A Must be included	Contractor	Same as above	

			Cost		Institutional Responsibility		Comments
Phase	Issue	Mitigating Measures	Install	Operate	Install	Operate	
		management plan. The route net near KAP is well developed and heavy traffic in this area is common. In Nikšić the traffic might pass thought the outskirt of Nikšić city. Transportation through urban areas during rush hours should be avoided or directed to the roads with lighter traffic. Traffic passing through residential areas, particularly near schools and hospitals, should be avoided. When construction activities must disrupt traffic, i.e. conveyor road crossings, proper signs must be put	in the bid from the Contractor	in the bid from the Contractor			

			Cost		Institutional Responsibility		Comments
Phase	Issue	Mitigating Measures	Install	Operate	Install	Operate	
		up, as well as alternative route signs.					
	Work in contaminated soil/waste	Use of Personal Protection Equipment Health and safety plan Staff training	Cost of personal protection equipment is estimated to 200 eur per person. With 10 persons working in contaminated environment the cost will be 2000 eur. Staff training 2000 eur. Must be included in the bid from the Contractor	An environmental supervisor shall be responsible for controlling correct work environment. Covered by the estimated 4000 eur /month for an environmental supervisor Must be included in the bid from the Contractor	Contractor	Same as above	
	Noise	The construction shall be limited to daylight working hours (not between 8 p.m. and 7 a.m.) equipment	Noise monitor approximately 300 eur + training in use 500 eur. Must be included in the bid from the Contractor	An environmental supervisor shall be responsible for controlling of noise level during construction. Covered by the	Contractor	Same as above	

			Cost		Institutional Responsibility		Comments
Phase	Issue	Mitigating Measures	Install	Operate	Install	Operate	
		operating with noise mufflers; notification of work to local residents; appropriate equipment maintenance		estimated 4000 Eur/month for an environmental supervisor Must be included in the bid from the Contractor			
	Work health and safety	Appropriate lighting and well defined safety signs on the construction site Health and safety plan	Minimum Must be included in the bid from the Contractor	Minimum Must be included in the bid from the Contractor	Contractor	Same as above	
	Protection of soil groundwater and surface water	Storage areas for various materials shall be located away from surface water and, if necessary, be covered to prevent leachate. Washing areas of concrete trucks and other equipment shall not be placed on permeable soil and	Installation of a small temporary water treatment plant might be necessary Estimated cost for a small portable water treatment plan is estimated to 10,000 eur.	N/A	Contractor	Same as above	

			Cost		Institutional Responsibility		Comments
Phase	Issue	Mitigating Measures	Install	Operate	Install	Operate	
		the water shall not be draining directly into the ground					
	Waste collectors	Nikšić: There are 30 to 50 waste collectors with usually 15 collectors each day The waste collectors shall be compensation	To be decided	-	EPA/WB	EPA/WB	
Operation phase							
	Site management	Good operational procedure	N/A The cost will be estimated in detail the next phase of the project	The cost for an environmental health and safety organization is preliminary estimated to 28,000 eur/year The cost will be estimated in detail in the next phase of the project	Operator	Ministry of Sustainable Development and Tourism/Environmental Agency	The management of the hazardous waste site facility shall be in compliance with the rules set by the Law on Waste Management of Montenegro and EU directives 99/31/EC, and Directive 94/62/EEC
	Work safety	Safety instructions and protective	Yearly cost for personal safety	As above	Operator	Ministry of Sustainable	

			Cost		Institutional Responsibility		Comments
Phase	Issue	Mitigating Measures	Install	Operate	Install	Operate	
		equipment (gloves, boots, working suits, masks)	equipment is estimated to 8,000 eur/year The cost will be estimated in detail in the next phase of the project			Development and Tourism/Environmental Agency	
	Accident at location	Provide a sufficient quantity of water against fire and other fire extinguishing agents. Prepare emergency response plan	Minimum The cost will be estimated in the next phase of the project	As above	Operator	Ministry of Sustainable Development and Tourism/Environmental Agency	
	Accident during transport of chemicals to the site	The most directly route to the site shall be taken Transport of hazardous waste shall only be done by licensed companies. The licensed companies shall develop a respond plan in case of accidents	N/A The cost will be estimated in the next phase of the project	As above	Operator	Ministry of Sustainable Development and Tourism/Environmental Agency	

			Cost		Institutional Responsibility		Comments
Phase	Issue	Mitigating Measures	Install	Operate	Install	Operate	
	Groundwater or river water	Leachate management system including leak detection system	Installation of leak detection system is estimated by Ecorem to 20,000 eur. Installation of a permanent waste water treatment system is estimated by Ecorem to 450,000 eur.	As above	Operator	Ministry of Sustainable Development and Tourism/Environmental Agency	
	Noise	The operation will include limited equipment including bulldozer, waste compactor, and vehicles for waste transport. Limiting operation hours of landfill e.g. 07 – 20 h.	Equipment - noise monitor estimated 300 eur.	As above	Operator	Ministry of Sustainable Development and Tourism/Environmental Agency	
	Air	Inspection for smell and control of dust	Minimum	As above	Operator	Operator	

Monitoring Plan						Cost		Responsibility	
Phase	What	Where	How	When	Why	Install	Operate	Install	Operate
Construction phase									
Material supply	Official approval or operating license	Borrow pit	Inspection	Prior to work	-	The work related to control of license and obtaining a copy for record is estimated to 800 eur.	-	Contractor	Supervisor appointed by EPA
Material transport	Control of dust from transport	Along the route	Inspection	Daily visual inspection during transport	Prevention of dust	-	An environmental supervisor shall be responsible for control. Covered by the estimated 4000 eur/month for an environmental supervisor	Contractor	Supervisor appointed by EPA
Dust	Dust from construction works	Construction site	Inspection PM_{10} monitor	Daily inspection during active construction	Prevention of dust	Installation of water system for dust suppression. Rough estimate 10,000 eur.	As above	Contractor	Supervisor appointed by EPA

						Dust monitor pm_{10} approximately 300 eur.			
Handling of oil and fuel used for Contractor's vehicles and machinery	Oil and fuel from contractors machinery	Construction site / camp	Inspection and if necessary soil and groundwater sampling	In case spill is observed	Prevention of soil and groundwater contamination	Cost of secondary compartments for deposits of oil and chemicals are estimated to 3000 Eur.	As above	Contractor	Supervisor appointed by EPA
Traffic	Control of routes according to the traffic management plan	Main roads to the construction site	Inspection	Unannounced during active construction 2-4 times a Month	Prevent negative impact on residential areas	-	As above	Contractor	Supervisor appointed by EPA
Work in contaminated soil/waste	Control for use of personal protection equipment	Construction site	Inspection	Unannounced during active construction at least once a week	Prevention of human exposure to contaminant through direct contact or dust	Cost of personal protection equipment is estimated to 200 eur per person. With 10 persons working in contaminated environment the cost will be 2000 eur. Staff training 2000 eur.	As above	Contractor	Supervisor appointed by EPA

Noise	Noise from construction works	Construction site	Inspection and monitoring with noise meter	Unannounced during active construction	Prevention of noise	Noise monitor approximately 300 eur + training in use 500 eur. to be paid by the contractor	As above	Contractor	Supervisor appointed by EPA
Work health and safety	Safe working environment	Construction site and along the transport roads	Inspection	Unannounced during active construction and transport least ones a week	Prevention of accidents	-	As above	Contractor	Supervisor appointed by EPA
Protection of soil and groundwater	Contamination of soil, groundwater and surface water	At or in the vicinity of the construction site	Surface water 1 station upstream and 1 station downstream the HWF site	Groundwater monitoring once a month River water monitoring once a month	Prevention of negative impact on soil and water environment	-	KAP: Rough estimate 20.000 eur with monthly sampling and analyses of 3 groundwater samples and 2 river samples Nikšić: Rough estimates 10.000 eur for surface water sampling and analyses.	Contractor	Supervisor appointed by EPA
Waste collectors	Nikšić: There are 30 to 50 waste collectors with usually 15 collectors each	People living nearby	Compensation	Prior to work	Compensation for lost income	-	-	Ministry of Sustainable Development and Tourism/Environmental	-

	day							Agency	
Operation phase									
Site management	Site management Plan	Facility including transportation to and from	Covering handling of waste inside the facility as well as transport	Continuously from start of operation	Ensuring best practices	-	The cost for a environmental health and safety organization is preliminary estimated to 28,000 eur/year	Operator	Operator
Work safety	Risk of exposure to hazardous waste	Facility including transportation to and from	Health and safety plan	Continuously from start of operation least once a week	Prevention of work related accidents	Yearly cost for personal safety equipment is estimated to 8,000 eur/year	Same as above	Operator	Operator
Accident at location	Risk of exposure to hazardous waste	Facility	Emergency plan as part of the health and safety plan	Continuously from start of operation	Prevention of spread of chemicals	-	Same as above	Operator	Operator
Accident during transport of chemicals to the site	Risk of exposure to hazardous waste	Transportation to and from the site	Emergency plan as part of the health and safety plan	Continuously from start of operation	Prevention of spread of chemicals	-	Same as above	Operator	Operator
Groundwater or surface water	Impact on surrounding environment	In the vicinity of the site	Surface water 1 station upstream and 1 station downstream	Continuously from start of operation with control ones a year	Ensuring optimal operation and controlling for unexpected	Nikšić: No need for groundwater monitoring.	Nikšić: Rough estimates 10.000 eur. for surface water sampling and	Operator	Operator

			the HWF site		spread from the site		analyses.		
Noise	Noise	Surrounding area and work environment at the site	Inspection and noise meter	Continuously from start of operation	Ensuring optimal operation	Noise monitor approximately 300 eur + training in use 500 eur. to be paid by the operator	As for site management	Operator	Operator
Air	Smell or spread of contaminants	Surrounding area and work environment at the site	Inspection and if necessary air sampling	Daily In case of indication of impact on air, air samples shall be taken Analyses for SO2, CO, NOx, and PM10	Ensuring optimal operation	Portable air sampler and monitor approximately 10,000 eur.	As above	Operator	Operator

Appendix C First public consultation

Appendix D Second public consultation

Minutes, second public consultation - ASY Bijela, 09/07/2012, 11:00

Public consultation held in room of Cultural Centre, Bijela.

Total of 27 participants attended the consultation, including representatives of EPA Montenegro, plus 4 representatives of COWI and CDM who conducted the event.

Name	Abbr.	Company	Contact data
Lars Bo Christensen	LBCH	COWI	
Dragan Milic	DMIL	COWI	
Vuko Strugar	VSTR	COWI	
Birgitt Alger	BIAL	CDM	
Danilo Kujovic		EPA Montenegro	danilo.kujovic@epa.org.me
Nikola Raičević		EPA Montenegro	nikola.raicevic@epa.org.me
Monika Figaj	MFIG	EPA Montenegro	monika.figaj@epa.org.me
Vesna Zarubica	VZAR	Directorate for inspection	vesna.zarubica@epa.org.me
Dejan Filipović		Directorate for inspection – Environmental inspection	dejan.filipovic@epa.org.me
Svetozar Radovic		Adriatic Marinas d.o.o.	sradovic@portomontenegro.com
Vasilije Jaukovic		Adriatic Marinas d.o.o.	vjaukovic@portomontenegro.com
Bozidar Vucinic	BVUC	Eko Montenegro Nikšić	eko.montenegro@gmail.com
Željko Odža		Citizen	nečitko
Bukilica Nenad		Citizen	-
Đuro Pesikan	DJPE	ASY Bijela	067/342-151
Petar Tušup		ASY Bijela	p.tusup@asybijela.com
Jasminka Zloković	JZLO	ASY Bijela	j.zlokovic@asybijela.com
Uroš Zloković		CTU	uroszlo@t-com.me
Nenad Vitomirovic	NVIT	Green Project Group	president@greenprojectgroup.org
Ljubo Vulović		Bijela	069/052-710
Vojo Lubarda	VLUB	President of administrative unit Bijela	067/506-001
Vojin Knežević	VKNE	Jeopardized citizen	vojinknezevic@yahoo.com

Mićo Krivokapić		Jeopardized citizen	-
Risto Pavlović		Deputy Director of JP "Čistoća" (municipal cleaning service), H. Novi	069/051-796
Mandić Jovan		D.o.o. Ardura, direktor	-
Serović Damjan		Citizen	-
Vujović Saša	SAVU	Municipality H. Novi	-
Jokić Sofija		Municipality H. Novi	067/800-548
Danijela Vlaović		Municipality H. Novi	069/551-764
Sonja Matijević		Deputy Director of JP "Čistoća" (municipal cleaning service), H. Novi	069/382-473
Zorica Mijajlović		JP "Čistoća" (municipal cleaning service), H. Novi – accounting department	069/381-474

DMIL opened the public consultation, greeted the participants and presented IWMCP. After presentation, he invited participants for discussion.

BVUC asked to compare properties of solid municipal waste and waste grit. Waste grit is not flammable, is not explosive, is not radioactive, and is not biodegradable. Municipal waste is biodegradable, thus explosive and flammable, due to generation of landfill gases. Therefore, he concluded that waste grit was easier to manage.

BIAL explained that waste grit contained remnants of paint, as well as TBT, which is carcinogenic and highly dangerous. In addition, it contains heavy metals; thus, grit is dangerous waste, and to claim the opposite would be to lye to the people.

BVUC agreed with the data. However, he asked if there was a more clever solution than exporting the grit, since it is too expensive. None of offered alternatives was good. National hazardous waste facility (NHWF) still does not exist. If it is implemented in Nikšić, it will take time to move the grit there. Bags (the grit was packed in) will be destroyed in a year. Therefore, we need a quick, efficient and cheap solution. Grit needs to be separated from water, from soil and from exposure to human and animals; it does not need to be separated from air, since it is packed in bags. The question is, how to do it. There are numerous locations in municipalities like Kotor and Nikšić , where specific landfill for grit can be built, with waterproof bottom lining and watertight cover, without degassing wells, and burial of grit for good. Waiting for NHWF is just waste of time.

BIAL said that such an alternative was considered; she listed advantages and disadvantages of all alternatives. Two approaches were investigated: waiting for NHWF, or finding a solution for grit only. On the basis of those investigations, the best option was selected.

BVUC did not agree with the statement. Waiting for NHWF is not acceptable, and only someone who does not wish good to Montenegro can propose such an option. He said there was no law that prohibits construction of more than one HWF; therefore, there was no obstacle to build another HWF, specific for grit only.

VZAR repeated that grit was a dangerous waste without any doubt (it contains remnants of paints and oil coatings that were banned); bags that grit was packed in have limited lifetime, and "Adriatic Marinas" showed interest in buying part of ASY Bijela; for all those reasons, process of remediation must be as quick as possible. She wanted to know how were calculated the quantities of soil beneath the grit.

Before DMIL could reply to the question, VKNE and VLUB took the word.

VKNE said that he had looked into two strategic documents: Strategic Master Plan and Development Plan to 2025, and this hot spot was not included in those documents. However, he understood from presentation that hot spot will continue to exist, which was not fair. (Comment by VSTR: by "hot spot", he meant not only landfill of waste grit, but entire Shipyard and its operating processes). Prices of real estate in vicinity of ASY Bijela are half of the price in other parts of Kotor bay. He lived in vicinity of ASY Bijela, and he was forced to always keep the windows on his house closed because of dust.

VLUB tried to speak; however, DMIL kindly asked to wait for previous two questions to be answered, otherwise questions might be lost.

BIAL answered question of VZAR: sampling drills were made in various parts of ASY Bijela, and depth of the contaminated soil was established; then land profiles were drawn, and quantity of soil to be removed calculated using those data. The calculation was very conservative to ensure that all contaminated soil was included.

VKNE asked how the area was calculated, since he lived about 200 m from ASY Bijela, and there is always a lot of dust in his house.

DMIL asked him if the dust originates from landfill where the grit was disposed, or from ongoing sandblasting processes in Shipyard.

VKNE replied that dust had been generated in ongoing sandblasting processes.

DMIL explained that sampling drills covered only area inside ASY Bijela, since scope of project was to remediate waste grit landfill, and not operating processes inside Shipyard.

VKNE asked if Government had plans to remove hot spot once grit was removed?

VZAR said that the Shipyard would not be allowed to continue with their current sandblasting practices after remediation; they will not be allowed to generate dangerous waste without proper solution for its disposal.

DJPE said that Shipyard itself was not identified as hot spot, but only landfill of waste grit.

VZAR generally agreed, but she said that the grit originated from the Shipyard.

BVUC repeated his proposal for third alternative: constructing hazardous waste facility dedicated to grit. He claimed it was faster and cheaper.

VLUB in the meantime tried to speak again, but since he did not want to wait for question already asked to be answered, he left the room. Another citizen said it was unacceptable and he also left the room.

BIAL said that solutions allowed by EU include complete solutions for dangerous waste, nevertheless of quantity, so constructing a landfill dedicated to grit only would be very expensive.

BVUC was not satisfied with such an answer, so he also left the room. As he was leaving, he said that option to export grit was chosen to allow someone to get the money.

SAVU asked who and when will take the decision for the remediation option, and will it be based on economic or environmental data.

DMIL explained that EPA Montenegro proposes the option, and then the Steering Committee decides if it will be accepted. He did not know when it would happen.

A citizen asked when the Study will be completed.

DMIL said it depended on other four locations, but should be expected soon.

MFIG confirmed what DMIL said earlier, that the Steering Committee would take the decision, and explained that the SC consisted of representatives of EPA, MoSDT and Government.

The citizen said that they are interested in solving the issue as soon as possible, and they hoped that the Study had a higher quality. They want existing waste to be removed, and not to accumulate new waste any longer. There is no space in Bijela to build sarcophagus over the grit, since it is on the coast, and land is valuable.

DMIL agreed with him, but emphasized that procedures should be respected, and sometimes they take a lot of time.

SAVU asked if there was a danger for project to be forgotten, since Government did not have obligation to take the decision.

JZLO said that experts should be left to do their job.

SAVU asked when the issue would be considered by SC.

DMIL said that team who conducted public consultation did not have approach to that level.

NVIT said that report offered two options, the cheapest one and the most expensive one. However, he proposed to build a pre-treatment facility for hazardous waste, and thus decrease amount of waste that would be disposed in a hazardous waste facility. He said he was aware of such technologies, and they were used worldwide.

BIAL said that such an option would be very expensive. Pre-treatment facilities are build only where there is a huge amount of waste; but amount of waste disposed off in Bijela was too small for such a facility to be viable. In addition, composition of waste must be taken into consideration as well, and presence of TBT in grit in ASY Bijela would only aggravate such a process.

NVIT repeated that in his opinion, such an option would be cheaper than chosen one.

BIAL said that everyone was entitled to his own opinion, but in her opinion, it would not be cheaper, but much more expensive.

NVIT proposed his company to estimate that cost, free of charge.

BIAL agreed with the offer, and said they were free to use CDM Interim report for that purpose.

No further questions were asked. Several citizens said that the conclusion from public consultation should be that citizens of Bijela wanted waste grit to be removed as soon as possible, and as far away from Bijela as possible.

DMIL closed the public consultation, and thanked to all visitors for their participation and input.

Minutes, second public consultation - Aluminium Plant (KAP), Podgorica, 10/07/2012, 12:00

Public consultation held in conference room of hotel "Ramada", Podgorica.

Total of 23 people attended consultation, in addition to representatives of EPA Montenegro and KAP, and 4 representatives of COWI and CDM who conducted consultation.

Participants:

Name	Abbr.	Company	Contact data
Lars Bo Christensen	LBCH	COWI	
Dragan Milic	DMIL	COWI	
Vuko Strugar	VSTR	COWI	
Birgitt Alger	BIAL	CDM Smith	
Denis Stjepan Vedrina	DENV	Hidroplan	
Vladimir Filipovic	VLAF	Ecorem	
Vladan Dragutinović	VDRA	EPA Montenegro	vladan.dragutinovic@epa.org.me
Almina Bučan	VDRA	EPA Montenegro	almina.bucan@epa.org.me
Danilo Kujović	DKUJ	EPA Montenegro	danilo.kujovic@epa.org.me
Ivana Bubanja		EPA Montenegro	ivana.bubanja@epa.org.me
Danka Maksimović		EPA Montenegro	danka.maksimović@epa.org.me
Zoran Amidžić		EPA Montenegro	zoran.amidzic@epa.org.me
Dragan Asanović	DASA	EPA Montenegro	dragan.asanovic@epa.org.me
Boro Miljanić		Eko Centar d.o.o. Nikšić	069/541-137
S. Putnik			
Aleksandar Duborija		Institute for technical research	067/528-258
Natasa Kovacevic	NKOV	NVO "Green Home"	natasa.kovacevic@greenhome.co.me
Jovana Janjušević	JJAN	NVO "Green Home"	jovana.janjusevic@greenhome.co.me
Rajko Vasiljević	RVAS	KAP	rajko.vasiljevic@kap.me
Marjana Kaluđerović		KAP	marjana.kaludjerovic@kap.me

Dušan Laković	DULA	KAP	dusan.lakovic@kap.me
Vukosav Žulović		KAP	vuko.zulovic@kap.me
Tatjana Miranović		Municipality Podgorica	miranovic.tanja@gmail.com
Milka Šćepović		Municipality Podgorica	milkascepovic@t-com.me
Milanka Baljevic	MIBA	Local municipality Golubovci	milankab@t-com.me
Veselinka Vukčević		Municipality Podgorica	v.vukcevic@pggrad.co.me
Lazarela Kalezic	LKAL	Municipality Podgorica	lkalezic@pggrad.co.me

DMIL opened the public consultation, greeted the participants and presented IWMCP (Industrial Waste Management and Clean-up Project), component A - remediation of five contaminated sites, in specific remediation of the red mud basins in KAP.

After presentation, he invited participants for discussion.

RVAS, director of Alumina factory inside KAP and professor at University of Montenegro, said that red mud basins were indeed a huge issue; he said his opinion about alternative solutions in another meeting with WB. At the time, the only issue was dust, since factory was not in operation. He shortly reviewed offered alternatives, and concluded that elevation of the walls allows KAP to operate for 2 or 3 more years, and in his opinion, it was not acceptable. He proposed that the solution must include closure of basins, since they are not suitable for further use, and new investor must solve the issue of filtration and disposal of red mud from the beginning, rather than allowing him to use basins for 2 to 3 years. In fact, options 2 and 3 explicitly state that fact, while option 1 does not.

DMIL and DENV again explained offered alternatives, stating that issue needed urgent solution, in accordance with national plans for Hazardous Waste management.

RVAS accepted their explanation. He said that from his experience, red mud had been stabilized; that meant, below the dept of 12 to 13 m, there was an impermeable solid red mud which maybe made the instalment of bottom liner unnecessary. There was leakage, but with leachate waters, and not red mud, and it could be remediated.

DMIL explained that this scenario had been described in option 3, and gave additional description, emphasizing disadvantage of that option, which is required extensive monitoring of groundwater.

RVAS agreed, and said that combination of options 3 and 1 b would be the most efficient and cheapest solution.

BIAL agreed with RVAS and supported his opinion.

DMIL said that obviously such a combination had been considered, but final decision had not yet been taken; Steering Committee will base their decision on the basis of all studies and comments from public consultations, and propose an option to be approved by Government.

BIAL explained that monitoring of groundwater, required for option 3, would be beneficial for Montenegro, since groundwater were an important resource, so their monitoring was useful, as she had shortly noticed in the Study.

VLAF asked if hydrologic risk assessment and model of groundwater flow had been prepared. If not, he proposed to do it.

BIAL replied it had not been done. It was not scope of this project, and required a different approach, so with existing data it was not possible to do it. However, she agreed it would be useful to have such a model, if WB was ready to finance it. Conclusions in CDM's Study had been based on spot analyses.

VLAF repeated that it should be done, since priority is to protect the groundwater.

DULA said that none of the options considered reuse of red mud; he mentioned a Study that offered possibilities to use red mud as construction material.

DMIL, BIAL and DENV explained that such a solutions are feasible from technical point of view, but not recommended, since it was not fully clear whether such a solutions would be safe in long term. In addition, profitability was uncertain, since it depended on amount of waste and market demand.

JJAN said that the Government of Montenegro had taken obligation to protect environment before KAP was sold. She asked, if option 1b was chosen and basins continued to be in use, would it strengthen private companies, since this way of remediation included investing in private companies, but in the same time allow them to continue generation of hazardous waste.

DMIL explained that clearance of ownership issues was not scope of this project, but only technical solution to the issue of existing waste.

DASA explained that project was in preliminary phase, and none of the options had been definitely chosen.

JJAN said that preliminary report, published in April, recommended an option to be chosen.

DASA said that it was only recommendation, but final decision had not yet been taken. He was certain that option 1a would not be selected.

Since there were no more questions or comments, DMIL thanked to all participants, closed the consultation about remediation of red mud basins at KAP, and informed that the public consultation for NHWF would follow.

Minutes, second public consultation – remediation of landfill of Steel Factory, Nikšić 11/07/2012, 09:00

Public consultation held in City Hall of Municipality Nikšić.

Total of 26 people attended the consultation, including 3 representatives of EPA Montenegro, and 4 representatives of COWI and CDM who conducted consultation.

Participants:

Name	Abbr.	Company	Contact data
Lars Bo Christensen	LBCH	COWI	
Dragan Milic	DMIL	COWI	
Vuko Strugar	VSTR	COWI	
Birgitt Alger	BIAL	CDM Smith	
Denis Stjepan Vedrina	DENV	Hidroplan	
Vladimir Filipovic	VLAF	Ecorem	
Vera Mirković	VMIR	Municipality Nikšić	mirkovicvera@yahoo.com
Sanela Ljuca		World Bank	sljuca@worldbank.org
Božidar Vučinić	BVUC	Eko Montenegro Nikšić	eko.montenegro@gmail.com
Zdravko Filipović		Neksan Nikšić	
Ivanka Nikolić - Mrkić		Neksan Nikšić	040.247-067
Nataša Bakić	NBAK	Municipality Nikšić	bakicnatasa@yahoo.com
Miodrag Karadžić		NGO "Association of young ecologists" Nikšić	ayen-ben@t-com.me
Dobrislav Bajović		Expert in environmental protection	bajone@t-com.me
Emilija Kovačina	EMIK	"Scena 083" Nikšić	069/348-846
Vladan Dragutinović	VDRA	EPA Montenegro	vladan.dragutinovic@epa.org.me
Danilo Kujović	DKUJ	EPA Montenegro	danilo.kujovic@epa.org.me
Dragan Asanović	DASA	EPA Montenegro	dragan.asanovic@epa.org.me
Boro Miljanić		Eko Centar d.o.o. Nikšić	069/541-137
S. Putnik			

Dragomir Vojinović	DVOJ		vojinovicd@t-com.me
Arsenije Lalatović	ALAL	Political party "PZP"	pzpnk@hotmail.com
Svetlana Mandić		Daily "Vijesti"	069/499-810
Anka Perović - Radović		Radio Montenegro	069/042-810
Ivana Jovović		Daily "Dnevne novine"	ivana.jovovic2006@gmail.com
Ratko Perošević		Daily "Pobjeda"	pobjedank@t-com.me

DMIL opened the public consultation, greeted the participants and presented IWMCP (Industrial Waste Management and Clean-up Project), component A - remediation of five contaminated sites, in specific red mud basins in KAP.

After presentation, he invited participants for discussion.

BVUC asked why the presentations for remediation of 5 sites and for NHWF were separated.

DMIL explained that those were two separate components of the project, and it was not known whether they would be developed simultaneously, so they needed to be discussed separately.

EMIK said that several years ago investigations showed level of contamination 200.000 times above allowed limits, so no new landfills should be built in Nikšić.

DMIL replied that topic of current discussion was remediation of existing landfill, and not construction of a new one.

EMIK asked if further disposal could be prohibited.

DMIL replied that scope of project was not further operation of steel factory.

BVUC asked both components to be unified.

DMIL explained again that project consisted of two separate components, for reasons he had already explained earlier.

EMIK said that most of the pollution spreads through the air, which caused 80% of persons with cancer in Montenegro to be found in Nikšić. Water pollution was also significant.

DMIL explained that the purpose of remediation was exactly to prevent further contamination.

EMIK said that trucks and bulldozers will generate a lot of dust.

DMIL explained that dust would be suppressed during construction phase.

EMIK said that final outcome would be construction of another landfill. She stated she did not believe anything, since one solution was presented, and different solution would be implemented.

VMIR asked, if decision was not to build NHWF in Nikšić, would option 2 be selected in that case and would financial means be provided.

DMIL confirmed her opinion; remediation would take place if NHWF would not be built in Nikšić.

VMIR emphasized that the landfill was privately owned.

BVUC was continually interrupting the consultation, insisting to unify discussion for two components.

BIAL explained that option 2 is cheaper than option 3. Both options include closure of landfill D1 (beside river), while solution for D2 is different, but in both cases eliminates pollution.

VLAF asked where Steel factory would dispose off the waste if the landfills were closed.

DMIL repeated that scope of project was not further operation of Steel factory, but remediation of its historical waste.

BVUC repeated his question, asked in public consultation in Bijela, whether any law restricts building of several landfills, so to build landfill dedicated to grit.

VSTR explained that question had been answered in Bijela, but he did not hear it, since he had left the public consultation. Law does not restrict number of HWF, but building of a landfill for a small quantity of specific waste is not financially sustainable.

DVOJ understood that remediation will take place only on surface. However, region is rich in groundwater, so surface protection is not enough.

BIAL explained that contamination was not found in the lake; river Gracanica was dry at the time, but soil samples were taken from depth of 30 m, and no pollution was found.

DVOJ asked what about waters at 100 m depth.

BIAL said that if there was no pollution at 30 m depth, in her opinion there should not be pollution in larger depths. Soil samples and samples from the riverbed had also been taken, and no pollution was found.

DVUJ said that lake was situated upstream of landfill, so that was reason for clean samples.

NBAK said that investigations should have been carried out during rainy season, too.

BIAL agreed with her.

BVUC asked about material of riverbed where sample was taken from.

BIAL said it was gravel limestone, as described in the Study. She explained that they made three drillings of 30 m depth, one in riverbed and two in waste, and took a sample for each meter of depth; total of 90 samples, and about 30 samples were analyzed in laboratory.

DVOJ repeated that surface protection was not enough, since level of ground waters could rise, and catch the pollution.

DMIL explained that analyses showed there was no infiltration of pollution into groundwater. He repeated that the project was only in preliminary phase, and exact technical solution was not finally selected.

DVOJ said that in his opinion, number of drillings was not enough.

BIAL partially agreed with him, more drillings would have been welcome. However, approach must be feasible, and balance between cost and needs must be found.

DVOJ said that many children in Nikšić suffered from bronchitis, and many people suffered from cancer, so he wanted issues to be solved at any cost.

BIAL explained that proposed solution for remediation was not something new; it had been applied worldwide, and it guarantees with high probability that landfill will not cause further pollution.

DVOJ asked if she would propose the same solution if they had more money at their disposal.

BIAL confirmed that she would have chosen the same solution, since it was very efficient, and would spend rest of money for other issues.

Since there were no more questions or comments, DMIL thanked to all participants, closed the consultation about remediation of red mud basins at KAP, and informed them that public consultation for NHWF would follow.

Minutes, second public consultation – remediation of ash dumpsite at Thermal Power Plant Pljevlja, 12/07/2012, 12:00

Public consultation held in city hall of Municipality Pljevlja.

Total of 22 people attended consultation, in addition to 3 representatives of EPA Montenegro and 4 representatives of COWI and CDM who conducted consultation.

Participants:

Name	Abbr.	Company	Contact data
Lars Bo Christensen	LBCH	COWI	
Dragan Milic	DMIL	COWI	
Vuko Strugar	VSTR	COWI	
Birgitt Alger	BIAL	CDM Smith	
Vladan Dragutinović	VDRA	EPA Montenegro	vladan.dragutinovic@epa.org.me
Almina Bučan	VDRA	EPA Montenegro	almina.bucan@epa.org.me
Zoran Amidžić		EPA Montenegro	zoran.amidzic@epa.org.me
Dana Krezović	DKRE	Municipality Pljevlja	dana.krezovic@hotmail.com
Veselin Paldrmić	VPAL	Municipality Pljevlja	vuckovic.vladanpv@gmail.com
Vladan Vučković	VVUC	JP "Čistoća" (municipal cleaning service)	
Milivoje Stanimirović		JP "Čistoća" (municipal cleaning service)	
Milutin Kečina			
Vinka Gogić		RTV Pljevlja	067/606-797
Milan Radović		Journalist, retired	
Olgica Otašević	OOTA	JP "Čistoća" (municipal cleaning service)	067/613-257

Bogdan Kečina		JP “Čistoća” (municipal cleaning service)	069/868-210
Petar Džerić			068/698-205
Alma Sadović		Journalist, "Pobjeda"	068/503-416
Vladislav Bojović	VLAB	Municipality Pljevlja	069/887-556
Milivoje Irić			iricmlv@gmail.com
Milenka Pejović		Inhabitant of Zbljevo	068/823-556
Milka Terzić		[unreadable]	067/397-019
Zagorka Kalović	ZAKA		vivavita@t-com.me
Vaso Knežević		Municipality Pljevlja	vasoknezevic@yahoo.com
Ismeta Džamić	ISMD	NGO "Citizen initiative"	052/322-156
Smail Huseinbegović		Retiree	068/748-681

DMIL opened the public consultation, greeted the participants and presented IWMCP (Industrial Waste Management and Clean-up Project), component A - remediation of five contaminated sites, in specific ash dumpsite at Thermal Power Plant Pljevlja.

When DMIL mentioned dust, a citizen from public asked if dust analysis had been made.

DMIL replied that dust has not been analyzed.

VVUC then asked why the presenters come at all. Several citizens supported him.

DMIL asked them to allow him to complete the presentation, and after that they could ask anything that is unclear.

After the presentation, he invited participants for discussion.

VPAL took the word. He said that DMIL had skipped some important facts from the Study, and read part from the report, which lasted about 10 minutes. During reading, he showed an aerial photo of the ash dumpsite made in 2010, and claimed that the present situation is much worse, since additional quantities of ashes had been disposed in the meantime. He expected Chapter 27 of negotiations with EU, related to environmental protection, would improve environmental situation in Montenegro.

DMIL asked him if all the data he read were included in the report.

VPAL confirmed that.

DMIL explained that the Study and ESIA Report had been distributed and available for 17 days before public consultation; aim of presentation was not to read the report, but to briefly summarize it, and then answer questions of public, and give additional details. He emphasized that EPCG was conducting a project on dam stabilization in parallel.

VDRA gave additional details on dam stabilization: owner of the project is EPCG, budget is 7 to 9 M EUR, and project should commence in August; after its completion, the dam will be stabilized.

A lady, who said she was inhabitant of Zbljevo, asked if the team of presenters were aware that Ministry Sekulic had visited the dam several days earlier. She asked about the status of expropriation, since it had been open for 30 years.

DMIL explained the scope of the project was to solve the existing issues, in order to eliminate future pollution. During construction of remediation works, there may be potentially negative impacts, but after remediation, there will be no negative impacts.

The lady said that there was decision from 1977 for EPCG , containing 13 requirements, and citizens would not give it up.

VVUC said that at the time, criminal charges were processed against inhabitants of Zbljevo. He said inhabitants would not allow any works on site to commence without solving legal issues first. He submitted a letter after first public consultation, and he asked what happened with the letter. He asked why remediation was required, when all results of analyses were good.

DMIL said that his letter was included in ESIA report, therefore forwarded to Client for further consideration. He asked VVUC for explanation whether he wanted to say that inhabitants would resist if remediation works started.

The answer from the citizens was not clear, since several people were talking in the same time.

The lady said that their requests were expropriation and dam stabilization.

DMIL said that he understood citizens asked for all legal questions to be cleared before remediation.

BIAL explained some details of the Study. She said 15 samples of the dust had been taken, and increased content of Arsenic was detected in one of them; other pollutants were below quality limits. However, dust is pollution itself, due to size of the particles, which allows them to enter respiratory system, so one of the options includes sealing of the dumpsite. Leachate waters had been analyzed, too, and increased content of Arsenic and increased pH had been detected.

VVUC asked about heavy metals.

BIAL replied they had not been detected.

VVUC said he had analyses with different results from ones presented in the Study, and he proposed supervision. He asked about level of mercury.

BIAL said that mercury level had been below quality limits.

VVUC and several citizens expressed their doubts about accuracy of analyses, and repeated request for supervision.

A citizen said that Chief Ecology Inspector of Montenegro in 2006 had issued decision to close the ash dumpsite; however, Power Plant had continued to use it. He asked why EPA had not reacted to such a violation of law.

ZAKA, professor of biology and member of NGO "Viva Vita" mentioned that mortality from cancer in Pljevlja and ratio of children diseases are high. However, such a reports had been kept as secret, so citizens did not believe anyone. She said Chapter 6.3 of CDM's Study was inadequate.

Citizen repeated his question to EPA, about violation of decision from 2006.

BIAL said that results presented in the Study were valid, and there was no any manipulation.

DMIL said that the purpose of the Study was to identify main issues to be solved.

VVUC said people already knew what the issues were, people just want them to be solved. He repeated again that results should be subject to supervision, outside of Montenegro, in presence of representative of citizens.

A Citizen approached the desk of presenters, and showed results from CETI from 2008, where ash and slug are described as dangerous waste. Therefore, remediation project must treat ash and slug as dangerous waste.

BIAL said that she should have a look at the documents first.

Citizen said that CETI seemed to issue various documents for various needs.

OOTA said that translator should have been present, so to translate complete discussion, and that the Study should have performed its own investigations, rather than using previous ones. She said that project anticipated closure of dumpsite, while other parallel project of EPCG anticipated dam stabilization and usage for 2.5 years; she wanted to know which of those two possibilities would happen. They had numerous public consultations earlier, but nothing had been solved, so it was understandable why citizens were nervous. She asked how the sealing of dumpsite would be done.

DMIL said that the translation was adequate, and the presence of people from abroad is to give detailed explanations when needed, so there was no need to translate entire discussion.

BIAL explained that all options include dumpsite sealing. At the current level of the project, the details of the sealing has not been described only the general requirements for cover.

OOTA asked about water layer in current ash dumpsite.

VDRA said that maintenance of water layer was responsibility of Power Plant, and violations could be reported to ecological inspection.

Citizen said that they had reported to various inspections, but they refuse the responsibility and direct them to another inspection.

OOTA asked to inform inspection from this public consultation.

ISMD said that people were not well informed about public consultation.

VSTR explained her that announcement was published 17 days in advance in two newspapers and on local radio and TV. In addition, SMS and e-mails were sent to all stakeholders and all participants of first public consultation, which is much more than actually required by the law, so comment of ISMD could not be justified.

A citizen said that the ash dumpsite should be equipped with water pumps with level sensors, so to automatically maintain water layer. He recommended to establish a vegetation belt ("green belt") around the dumpsite.

DMIL explained that green belt around dumpsite is not required for remediation purposes, while vegetation on dumpsite itself was optional, it would help, but was not absolutely necessary. The vegetation on the dumpsite would be defined in a later phase of project.

VLAB, councillor in local parliament, apologized for unpleasant atmosphere, but it was caused by sensitivity of the project, due to activity of those who had not been taking appropriate measures against contamination. He had asked after first public consultation to invite Director of EPA Montenegro and Minister of MoSDT to participate in second public consultation, so he wanted to know what happened to that request. He said that team of presenters should not come to public consultation at all, since they cannot give answers to question from public. He also asked to translate entire discussion.

DMIL said that his request was included in MoM, as appendix to ESIA Report, and send to Client, EPA Montenegro. He repeated that only question relevant for project were translated, when additional explanations were needed, and there was no need to translate complete discussion.

VLAB said he had an impression that problems are blurred. EPA delegated the team for public consultations, but team cannot answer all questions. Therefore, he appealed to EPA to finally solve the issue with Power Plant, which had lasted for 30 years. He asked if MoSDT supported proposed solution and if EPCG agreed with that. He informed that Parliament of Municipality Pljevlja on 8. June 2012 asked local Government to sign memorandum with Power Plant and Coal mine; requests from memorandum are mainly related to environmental issues. He asked if completion of the project could be expected by the end of 2012.

VDRA explained that project was in preliminary phase. Loan from WB should be expected in January 2013. Disposal of ash at current dumpsite, Maljevac, should stop in 2014, since extension of new site, Sumane, should be completed by that time.

VLAB asked why Government would take the loan, since generator of waste had the obligation to remediate its own waste. In his opinion, EPCG was the one to take the loan, not Government on the expense of the citizens.

VDRA explained that Government had the obligation to remediate historical pollutions, while waste generated in the future would be responsibility of generator.

Since there were no more questions or comments, DMIL thanked to all participants and closed the consultation.

Minutes, second public consultation – remediation of tailing pond at Gradac, Municipality Pljevlja, 12/07/2012, 15:30

Public consultation held in room of Municipal administrative unit in Gradac.

Total of 6 people attended consultation, in addition to 3 representatives of EPA Montenegro and 4 representatives of COWI and CDM who conducted the consultation.

Participants:

Name	Abbr.	Company	Contact data
Lars Bo Christensen	LBCH	COWI	
Dragan Milic	DMIL	COWI	
Vuko Strugar	VSTR	COWI	
Birgitt Alger	BIAL	CDM Smith	
Vladan Dragutinović	VDRA	EPA Montenegro	vladan.dragutinovic@epa.org.me
Almina Bučan	VDRA	EPA Montenegro	almina.bucan@epa.org.me
Zoran Amidžić		EPA Montenegro	zoran.amidzic@epa.org.me
Dana Krezović	DKRE	Municipality Pljevlja	dana.krezovic@hotmail.com
Z. Dragaš			
[unreadable]			
[unreadable]			
Slobodan Cvetanović			
[unreadable]			

DMIL opened the public consultation, greeted the participants and presented IWMCP (Industrial Waste Management and Clean-up Project), component A - remediation of five contaminated sites, in specific tailing pond at Gradac.

After presentation, he invited participants for discussion.

BIAL emphasized that some results of analyses were dramatic; for example, concentrations of lead, arsenic and cadmium were, respectively, 600, 12 and 8

times above allowed limits. She recommended to EPA Montenegro and World Bank that Gradac should be top priority for remediation between 5 locations.

DMIL explained the further procedure for this project.

Citizen said that in his opinion, funds would not be used for Gradac. It had been promised many times, but issue had not been solved. In his opinion, the best solution was to resettle all inhabitants younger than 50 years to another location.

DMIL and BIAL explained that several options had been considered, and the most suitable one would be selected. Resettlement of citizens was not an option, since it would not eliminate further pollution of environment, especially river Cehotina.

A citizen expressed his unsatisfaction with work of both local and republic Government. He stated that ownership of waste had not been cleared.

DMIL and VDRA explained that the ownership was not an issue, since project was related to historical waste, and government had the obligation to solve those issues. They explained further procedure.

Citizen showed through the window, to the piles of slag deposited at the slopes of the hill; he said that rains kept flushing those piles, and dirty waters covered town streets. He asked if remediation of any of 5 locations had started.

VDRA replied that decision of WB was expected in November 2012, and after that, projects will start in accordance with national legislation; so, none of the remediations are started at the time.

Several citizens repeated their unsatisfaction with work of Government, since problems had not been solved.

BIAL said that conditions were indeed terrible, so immediate temporary action should be taken; for example, tailing pond should be covered with layer of soil 5 cm thick, to prevent further spread of dust, especially because of children.

Citizen said that if Government or mine owner took care about people, they could find solution to solve the problem, at least temporary. He said not only the dust was problem, but also odours from the pond.

BIAL explained that odour originates fro cyanides present in the slag.

Since there were no more questions or comments, DMIL thanked to all participants and closed the consultation.

Comments received from Ms. Dana Krezovic of Municipality Pljevlja in a mail dated 18/07/2012:

CERTAIN SUGGESTIONS
Chapter "Previous investigations. List might have included project of dam sanation and ash and slag dumpsite recultivation in Thermal powerplant Pljevlja.
Please have a look, check and use the following suggestions, if it can help you:

- Study „Integral Environmental Protection in Municipality Pljevlja", Podgorica 1997, Volume I, Chapter 2.7: Radioactive contamination and environmental impact of radioactivity in Pljevlja. Author based his Study on „Report on preliminary investigations of impact of Thermal powerplant Pljevlja to radioactive contamination in working and living environment", made in October 1988, by Department for Mathematics and Physics, part of ex-University „Veljko Vlahovic" *(note by Vuko Strugar: today known as University of Montenegro)*, and researchers were Ph. D. Perko Vukotić, Ph. D. Slobodan Jovanović, Ph. D. Labud Vukčević and B. Sc. in Physics, Stanko Dapčević.

The Report and the Study aimed to evaluate radioactive contamination in environment in Pljevlja, caused by operation of Thermal powerplant. These researches included determination of uranium, thorium and potassium in samples from surface coal pit "Borovica", and samples of slag, of ash from filter, of water from dumpsite and of water from river Vezišnica. Results of those analyses suggested:

- Content of uranium in coal was on clark level, while that of thorium and potassium was even lower, indicating that analyzed coal had not naturally contained radioactive elements.
- Content in the slag was higher, as expected, due to burnout of organic components.
- Concentrations of uranium, thorium and potassium in samples of ash from filter were, respectively, about 4, 7 and 10 times higher than in coal.
- Concentrations of uranium and thorium in samples of ash from dumpsite were, respectively, about 3 and 2 times higher than in coal. Concentration of potassium was on clark level.
- Concentrations of U, Th and K in samples of water from dumpsite are higher than in river Vezišnica. The difference is higher for Th and K.
- Results are several hundreds times higher than usual for water ambience.

Furthermore, the Study suggests that all researches were informative only, so results cannot be considered as representative, due to limited number of samples. Having in mind results mentioned above, authors of "Report on preliminary investigations of impact of Thermal powerplant Pljevlja to radioactive contamination in working and living environment" concluded: „Ultimately, research showed that Thermal powerplant Pljevlja, according to concentrations of natural radionuclides in coal and ash, and having in mind efficiency of filtration system in powerplant, does not contribute to environmental contamination more

than other thermal powerplants in country, or more than average in well developed countries throughout the world". *(Note by Vuko Strugar: part „other thermal powerplants in country" reffers to ex-Yugoslavia, not to Montenegro, as in 1988 it still existed; there are no other thermal powerplants in Montenegro)*.
Center for Ecotoxicological Research (CETI), Podgorica, has been conducting „Program of systematic investigations of content of radionuclides in environment in Montenegro" since 1999., and analysis of content of radionuclides in samples of ash and slag from dumpsite „Maljevac" and soil in vicinity of ash and slag from dumpsite „Maljevac" of Thermal powerplant Pljevlja, since 2005.
In 2008 and 2009, as well as last several years, research of content of radionuclides in close vicinity of Thermal powerplant Pljevlja has been conducted, using samples of water from river Vezišnica, composite samples from ash dumpsite "Maljevac" and soil samples from 4 spots surrounding powerplant. Results showed that in 2005 periodical increase of content of natural radionuclides in river Vezišnica was observed, while in 2006., 2007., 2008. and 2009., no increase was observed for any of the analyzed radionuclides. Threshold values were set according to values for drinking water, so content of radionuclides in these samples can be considered as far from critical. Results showed that content of radionuclides in ash from dumpsite was below maximum values of known content of radionuclides in soil in Montenegro (MENEKO Projekt), with exception of content of ^{40}K, which is above the maximum value obtained in MENEKO Project. However, increased content of ^{40}K in ash samples was not concern. In addition, when interpreting these results, state of the material must be taken into consideration. Namely, ash in the dumpsite can be easily spread by wind in the surrounding area, if it is uncovered and unwatered, thus representing and additional issue. Soil samples from close vicinity of ash dumpsite „Maljevac" were taken for analysis of content of radionuclides in soil, in particular samples from uncultivated grassy soil, and from cultivated land, total of 4 samples. The definite conclusion could be taken that content of radionuclides in soil in vicinity of ash dumpsite „Maljevac" is significantly lower than known maximum values of content of radionuclides in soil in Montenegro (MENEKO Project).

Center for Ecotoxicological Research (CETI), Podgorica, has been analysing quality and contamination level of soil since 1999, as part of Program of analysis of pollutants in soil, on entire area of Montenegro, therefore in Municipality Pljevlja, too. Results of analyses of soil quality in vicinity of ash and slag dumpsite showed concentrations of boron, nickel and arsenic above maximum allowed limits; concentration of nickel in 2009 was three times higher than in 2008, while that of arsenic was in similar level.
Expert sources suggest arsenic to cause cancer in respiratory system, skin and other organs, while nickel was identified as cause of cancer in nasal and sine system and lungs.
In order to evaluate safety of land for agricultural purposes, sampling of soil and vegetation was done in 2002., in several locations in villages Komini and Vidra, in vicinity of thermal powerplant and ash dumpsite Maljevac. Content of toxic metals in analyzed samples was below law limits (Off. gazette of the State, 18/97).

Increased content of PAH was found in samples of hay, but refering to thresholds set for soil, since „Rule book on maximum content of pollutants and ingredients in kettle food" (Off. gazette of SFRJ, 2/90) does not set normatives for vegetation. Expert sources suggest that PAH may cause cancer when entered into human body.

After request of Municipality Pljevlja in 2008., Center for Ecotoxicological Research (CETI), Podgorica, investigated character of the waste. On the basis of analyses, ash from filter of Thermal powerplant Pljevlja was characterized as hazardous waste (due to increased pH value of 13.69) and slag from Thermal powerplant Pljevlja as non-hazardous waste (Certificate on categorization no. 00-14-14269/1612/04/01, dated on 16/01/2009). Additionally, results of analyses showed in the report include toxic metals, whose concentration was below maximum allowed values: arsenic, barium, copper, zync, nickel, lead, chromium, cobalt and mercury. Gamma-spectrometric analysis showed activity of all analyzed radionuclides below maximum allowed values, in accordance with „Rule book on limits of radioactive contamination in environment and methods of decontamination“ (Off. gazette of SRJ, 9/99).

Information on environmental conditions in Montenegro in 2004., and Plan on waste management in Montenegro for period 2008-2012 (Off. gazette of the State, 16/08) suggests that 280.000 tons of ash a year gets transported to ash and slag dumpsite Maljevac, which is not classified as hazardous waste in the EU list (ash and mud from the bottom and dust from furnaces are not classified as dangerous waste), but requires specific management. However, Information on environmental conditions in Montenegro in 2009. classifies this waste as industrial dangerous waste, suggests that total transported quantity by that time was 7.500.000 tons of ash and slag to the dumpsite, and remediation of already accumulated waste became an issue.

Appendix E COWI Registration

ERHVERVSSTYRELSEN

OFFICIAL CERTIFICATE

In its capacity as the competent authority pursuant to European Parliament and Council Directive 2004/18/EC of 31 March 2004 on the coordination of procedures for the award of public works contracts, public supply contracts and public service contracts and European Parliament and Council Directive 2004/17/EC of 31 March 2004 coordinating the procurement procedures of entities operating in the water, energy, transport and postal services sectors (Utilities Procurement Directive)

the Danish Commerce and Companies Agency
(Erhvervsstyrelsen)

hereby declares, certifies and confirms

that

COWI A/S

which has its registered office at Parallelvej 2, 2800 Kgs.Lyngby, is a Danish business established and existing according to Danish law and registered in the Central Business Register under CVR No. 44623528,

and that

pursuant to the above Council Directives 2004/18/EC and 2004/17/EC the following information applies to COWI A/S

----the business is not undergoing bankruptcy proceedings, restructuring proceedings, liquidation procedures or procedures to obtain a compulsory arrangement with its creditors, has not suspended payments, has not closed down its activities and is not in similar circumstances, no petition has been filed against the business for bankruptcy proceedings, restructuring proceedings, liquidation procedures, procedures to obtain a compulsory arrangement with its creditors, suspension of payments or any similar procedures

----the business has not, by any enforceable sentence pursuant to Danish law, been convicted of any punishable offence which might lead to any doubts about the professional integrity of the business/company and has not, by any enforceable sentence pursuant to Danish law, been convicted of any punishable offence falling within Article 45(1) of the Public Procurement Directive

----the business has met its obligations pursuant to Danish legislation to pay contributions to social security plans

----the business has met its obligations pursuant to Danish law to pay taxes and duties

Copenhagen, 16-04-2012

Pia Bøgh Jensen
Senior Clerk

ERHVERVSSTYRELSEN