Environmental and Social Impact Assessment of Remediation of Five Contaminated Sites

WORLD BANK ESIA AND SAFEGUARD STUDIES FOR CONTAMINATED INDUSTRIAL SITES REMEDIATION
Environmental and Social Impact Assessment of Remediation of Five Contaminated Sites

Executive Summary

WORLD BANK ESIA AND SAFEGUARD STUDIES
FOR CONTAMINATED INDUSTRIAL SITES REMEDIATION
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 continuous 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 tailing 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 year. Minimum 3 monitoring wells 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

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

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 inaccesssible 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 alternatives 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.

Preferred option:

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.

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.

Preferred options

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 through 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.

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
ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT OF NATIONAL HAZARDOUS WASTE DISPOSAL FACILITY

EXECUTIVE SUMMARY

WORLD BANK ESIA AND SAFEGUARD STUDY FOR NATIONAL WASTE DISPOSAL FACILITY
ENVIRONMENTAL AND SOCIAL IMPACT
NATIONAL HAZARDOUS WASTE DISPOSAL FACILITY

WORLD BANK ESIA AND SAFEGUARD STUDY FOR NATIONAL WASTE DISPOSAL FACILITY
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 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. The project implementation is expected to be funded with financial support from the World Bank (WB).

Component 2 of the IWMCP comprises establishment of a national hazardous waste disposal facility (HWF). The objective is to develop a facility for reception and safe disposal of hazardous waste material originating from contaminated sites and from ongoing industrial activities. A study for identification of sites suitable for establishment of the HWF is carried out by the consortium of the companies Ecorem and Hydroplan, hereafter just called Ecorem.

The present document is a generic framework ESIA prepared according to agreement with the EPA and the WB based on information available for the shortlisted sites in June 2012 at the stage of a very preliminary design of the facility. The ESIA was prepared following the WB guideline. During the next phase of the project implementation with more detailed design of the waste facility site, a more detailed EIA following the National legislation will be undertaken.

The differences between the WB guideline and national legislation are that the WB guideline requires two public consultations, whereas national legislation only requires one public consultation, social and economical issues are required by national legislation, but not to the same extent as by the WB guidelines. National legislation requires data on population and site development as part of chapter “Site description” and consideration of impacts to local inhabitants as part of chapter "Possible impacts", including possible migration for the above impact from the project. The ESIA which will be executed as part of the detail design will follow both the WB policies as well as the Montenegrin Legislation.

The current situation in Montenegro regarding hazardous waste handling cannot be considered as being sustainable due to a high potential risk of spreading of
contaminants and the impact on the environment and on human health. The establishment of the hazardous waste facility is proposed to ensure a safe and environmental-friendly way of hazardous waste storage with significantly lower risk of exposure compared to the present situation.

In the current situation, a significant risk of human exposure to hazardous waste cannot be excluded due to uncontrolled storage. After establishing the hazardous waste disposal site, the waste will be disposed under controlled conditions and the risk of human exposure is considerably reduced. The overall environmental impact after establishing the solid hazardous waste facility are described below:

› Air. The facility will practically eliminate the risk for evaporation and spread of contaminants to the air with a significant positive impact from the HWF.

› Soil. The waste will be disposed under controlled conditions and the facility will practically eliminate the risk of soil contamination. The facility will have a significant positive impact.

› Groundwater. The waste is disposed under controlled conditions and the facility will practically eliminate the risk of groundwater contamination resulting in significant positive impact from the HWF.

› Surface water. The waste is disposed under controlled conditions and the facility will practically eliminate the risk for impact on surface water. The HWF will have a significant positive impact on the environment.

› Health and safety. The facility will practically eliminate the risk for humans and only trained people will handle the chemicals. The HWF will have a significant positive impact.

Ecorem has prepared a long list of potential sites for location of a hazardous waste facility site. The following 10 locations were included in the long list:

› Bar area - Mozura Site
› Podgorica area – Regional Sanitary Landfill Meadows
› Podgorica area – Aluminium Plant KAP
› Nikšić area – Nikšić Steel Plant Landfill
› Nikšić area – Bauxite Mine
› Nikšić area – Budos Site
› Pljevlja area – Sumane Site
› Pljevlja area - Maljevac Ash and Slag Landfill
› Pljevlja area - Borvica Surface Mine
› Pljevlja area - Repetitor Site

Based on the long list and further evaluation of technical and environmental parameters, Ecorem has prepared a shortlist with three sites as potential locations for the hazardous waste disposal facility based on investigations completed in June 2012. The sites were evaluated and given a score depending on the setting, technical aspect, environmental impacts and social impacts. The shortlist includes
the KAP Aluminium Plant site, Nikšić Steel Plant Landfill site and Sumane Open Mine site.

By further evaluation, the Environmental Protection Agency has excluded the location in Pljevlja, due to site location in the far north of Montenegro and thus at great distance from the rest of the country and the producers of hazardous waste. This location would greatly increase the cost for use and transport. In addition, the site is sometimes very difficult accessible in wintertime because of snow and the site is situated in the direct vicinity of habitations and agricultural land. Hereafter, the Environmental Agency has limited the potential sites for hazardous waste facility to:

› Current landfill site of Steel Plant, Nikšić: score 77
› Brownfield site of KAP, Podgorica; score 75

The final selection for the location of the hazardous waste site has not yet been decided and additional evaluations of the potential sites will be carried out during the next phase of the project. The main advantages and disadvantages of the two sites are presented below.

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<tr>
<th>Assessment of the location “Brownfield site at KAP”</th>
<th>Main advantages</th>
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<tr>
<td>› The site is centrally located in Montenegro and thus fairly closes to most producers of HW. It is very easily accessible by road and railroad and the land is partly privately and publicly owned.</td>
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<tr>
<td>› The available surface of 6 ha should be sufficient to accommodate the HW disposal facility. The land is also even and the stability of the subsoil is good.</td>
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<td>› The site is a brownfield with very low aesthetic value and requires remediation and the remediation works and the construction of a HW disposal facility could be combined.</td>
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<td>› The rather poor visibility from the closest settlements is an additional advantage.</td>
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<td>Main disadvantages</td>
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<td>› The site is close to agricultural land and is situated between water protection zones.</td>
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<th>Nikšić Steel Plant Dumpsite</th>
<th>Main advantages</th>
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<tr>
<td>› The former waste disposal site of the steel plant at Nikšić is centrally located in Montenegro and thus fairly close to most producers of hazardous waste. It also very good accessibility by road and railroad. The available surface in the northern part of the disposal area is 3 ha, which should be sufficient for the construction of the HW disposal facility.</td>
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The waste disposal from the steel plant is mainly composed of slag and present enough bearing capacity to construct a disposal facility on top.

Because the waste disposal needs to be remediated, the de-pollution and stabilization measures, such as extensive profiling, appropriate surface treatment, or the reconstruction of one of the dumpsites can be combined with the construction of a hazardous waste disposal facility, potentially through a Public Private Partnership (PPP). This could have a positive impact on the total project costs. The closest habitations are at a fair distance to the site, and the site is hardly visible from the road or inhabitat areas.

**Main disadvantage**

- The land is privately owned.

- The southern part of the steel plant waste disposal is situated on a steep slope and is directly alongside the River Gračanica. Incorporation of this southern part for construction and operation of a HW disposal facility is not recommended.

**The following alternatives are considered:**

- 0-alternative is “doing nothing” which means no establishing of a hazardous waste facility. The consequence is that hazardous waste will continuing to be stored and deposited in uncontrolled ways with extensive risks to the environment and to human health

- Export of all hazardous waste is an alternative to establishing a hazardous waste storage facility in Montenegro albeit at much higher costs and not cost effective. Furthermore, a facility for collection/transport of hazardous waste will still be needed. The hazardous waste would be repacked at this facility and transported out of Montenegro. The exported waste shall then be disposed/treated at an approved and licensed facility outside Montenegro. The cost for establishing deposit for the hazardous waste would be limited if the waste is exported whereas the cost for transport and fee for disposal/treatment at facility outside Montenegro would increase. The advantage of the central facility is the possibility of capacity building which will ensure correct handling of hazardous waste. Without a central collection facility the risk of incorrect handling of the hazardous waste will increase.

- For the location of a central facility, based on vulnerability maps of Montenegro, ten possible suitable locations were evaluated, out of which the locations of KAP and Nikšić are the most suitable.
The present document contains assessment of impacts during the HWF construction phase and during the HWF operation phase for the two options of the facility location. The environmental and social impacts from the construction phase will mainly be related to dust during soil works, to working with contaminated soil and/or waste and to increased traffic during the construction period. The impacts during the HWF operation phase will be relatively limited, provided that the landfill is constructed and operated according to EU standards. The landfill will receive and dispose of solid hazardous waste and thus should pose lower risks than a facility that receives liquid hazardous waste.

The most important mitigation measures during the construction phase of the hazardous waste facility include inter alia:

▶ Material supply and transport: Using approved and licensed borrow pits or buying material from licensed companies for production of stone fractions and clay. Material shall be wet or the trucks shall be covered.

▶ Dust: Watering during dry periods as a dust prevention.

▶ Handling of oil and fuel used for Contractor's vehicles and machinery: No oil products or drums containing chemicals must be placed directly on the ground, and for KAP, oil and fuel must be stored with secondary containment. The KAP site is located on sensitive groundwater resource and between groundwater protection zones.

▶ Traffic and traffic 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 less traffic. Also traffic passing through residential areas, particularly near schools and hospitals, should be avoided.

▶ Protection of soil groundwater and surface water: Storage areas for various materials shall be located away from surface water and, if necessary, the surface shall be covered to prevent leakage. Washing areas of concrete trucks and other equipment should not be placed on permeable soil and the water shall not be draining directly into the ground. Installation of a small temporary water treatment plant might be necessary.

▶ Waste collectors: Nikšić: There are 30 to 50 waste collectors with usually 15 collectors each day. The waste collectors shall be compensated. There are no waste collectors at KAP.

The most important mitigation measures during the operation phase of the hazardous waste facility include inter alia
Work safety with safety instructions and protective equipment (gloves, boots, working suits, masks).

Accident at location: Provide a sufficient quantity of water against fire, and provide other fire extinguishing agents and prepare emergency response plan.

Temporary storage of hazardous waste before final disposal with clear separation of various incoming waste. Any waste showing sign of leakage should be placed on separate section and all temporary stored waste shall be covered to prevent dust formation.

Accident during transport of chemicals to the site: The most direct route to the site shall be taken and transport of hazardous waste shall only be done by licensed companies. The licensed companies shall develop a respond plan in case of accidents.

Groundwater or river water: Leachate management system including leak detection system.

Noise: The operation will include a limited number of equipment including bulldozer, waste compactor, and vehicles for waste transport. Limiting operation hours on the landfill e.g. 07 – 20 h.

The most important mitigation measures during the closure phase of the hazardous waste facility include inter alia:

- The operator shall prepare a closure plan based on the knowledge of stored chemicals.
- A final cover system shall be installed for preventing leakage and erosion of the landfill cells.
- The permeability of the final cover must be less than the underlying liner system to prevent bath tube effect.
- Vegetation of the surface (not using plants with deep roots) to limit the percolation of rainwater.
- Access to the site should be prevented by a fence.
- Groundwater shall be monitored in downstream monitoring wells.