South Eastern European mining-related risks:

Identification and verification of “environmental hot spots”

Prepared as a part of the UNEP Vienna coordinated ADA project: “Improving regional cooperation for risk management from pollution hotspots as well as transboundary management of shared natural resources”

Updating of the ENVSEC desk assessment 2004 of security risks posed by mining – Reducing Environment & Security Risks from Mining in South Eastern Europe for:

Albania, Bosnia & Herzegovina, Macedonia, Montenegro and Serbia

DRAFT

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EXECUTIVE SUMMARY

This report presents the first results produced within the ADA (Austrian Development Agency, Vienna) project “Environment and Security in South Eastern Europe: Improving regional cooperation for risk management from pollution hotspots as well as the transboundary management of shared natural resources”. The execution of activities in 2006 and 2007 addresses two issues; mining and biodiversity. This document only addresses matters related to mining issues – namely activities to reduce trans-boundary environmental and human safety risks posed by sub-standard mining operations in the SEE region. In this regard, the activities carried out under the auspices of the ADA project build upon, make use of and strengthen a number of other ENVSEC activities that have been conducted in recent years. In particular the mining related work builds upon the ENVSEC desk assessment (DA) conducted in 2004 that examined environment and security risks posed by mining in South Eastern Europe.

This report provides analysis arising from 3 separate missions conducted in April and May 2006 to Albania, Bosnia & Herzegovina, Macedonia, Montenegro, and Serbia. During the missions data was collected that was to support the future selection of circa 5 sites of mining or minerals processing that can serve as pilot and/or demonstration sites within a ADA/UNEP regional programme of capacity building activities. The point of departure for the work was a candidate listing included in the DA. The focus of the work detailed herein has been to locate sites that combine as many “key parameters” as possible. While capacity building is important, the project is also driven by a desire to gain an up-to-date overview of the mining-related key environment problems in SEE and to contribute to tangible positive effects at sites in the medium term as well.

The key parameters mentioned above include: the presence of transboundary environment and health risks; the potential to demonstrate innovative, local and cost-efficient risk reduction and management measures; requiring skills in important capacity needs areas such as regional and local level tools for early warning, civil protection and conflict resolution and emergency response.

This assessment provides information (of varying detail) on more than 40 areas of mining and minerals activity in the target countries; some areas are comprised of many sites. In addition it presents more detailed case studies of 10 sites where somewhat more adequate information was already available.

This project work has been successful in a number of areas. Namely, this work has confirmed the hotspot status of many sites identified in the 2004 DA; it has allowed removal of a number of sites from priority listing; it has provided a relatively clear picture of national priorities in the target countries with regards to the subject of mining hotspots; and it has allowed the generation of a much more focused list of candidate sites. However, this analysis could not reach the point where definitive advice can be provided on “which” sites can and should be involved in the next stage of the UNEP/ADA works. Nor has the picture of capacity building needs become sufficiently clear in all sites and countries. In the penultimate section of this report, a tabular listing of 13 candidate areas (some areas with multiple sites) for further consideration is outlined. This further work must extract and specify the short list of circa 5 sites from this suite. The results of this past work indicate that visits to candidate locations will be crucial for the final prioritisation to be made.

Under the assumption that the required work to adequately delineate pilot and demonstration sites will be conducted in the near future, the concluding section of this report outlines the content and aims of capacity building workshops and a time line for action based on the information that is at hand.
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<tr>
<td>ADA</td>
<td>Austrian Development Agency</td>
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<td>ALB</td>
<td>Albania</td>
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<td>AMD</td>
<td>Acid mine drainage</td>
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<td>BIH</td>
<td>Bosnia and Herzegovina</td>
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<td>CEE</td>
<td>Central and Eastern Europe</td>
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<td>DA</td>
<td>Desk Assessment</td>
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<td>ENVSEC</td>
<td>Environment and Security Initiative</td>
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<td>EU</td>
<td>European Union</td>
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<td>FED</td>
<td>Federation (entity within BiH)</td>
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<td>GEF</td>
<td>Global Environment Facility</td>
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<td>ICPDR</td>
<td>International Commission for the Protection of the Danube River</td>
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<td>ISCC</td>
<td>Interim Secretariat for the Carpathian Convention</td>
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<td>MAK</td>
<td>Former Yugoslav Republic of Macedonia</td>
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<tr>
<td>MNE</td>
<td>Republic of Montenegro</td>
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<tr>
<td>NFP</td>
<td>National Focal Point</td>
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<tr>
<td>OSCE</td>
<td>Organization for Security and Cooperation in Europe</td>
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<tr>
<td>REC</td>
<td>Regional Environmental Centre for CEE</td>
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<tr>
<td>REReP</td>
<td>Regional Environmental Reconstruction Programme for SEE</td>
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<tr>
<td>RS</td>
<td>Republika Srpska (entity within BiH)</td>
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<tr>
<td>SEE</td>
<td>South Eastern Europe</td>
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<tr>
<td>SRB</td>
<td>Republic of Serbia</td>
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<tr>
<td>UNDP</td>
<td>United Nations Development Programme</td>
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<td>WB</td>
<td>World Bank</td>
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1 Background

1.1 ADA Mining missions

This report presents the first results produced within the ADA (Austrian Development Agency, Vienna) project

“Environment and Security in South Eastern Europe: Improving regional cooperation for risk management from pollution hotspots as well as the transboundary management of shared natural resources”.

The project implementation is lead by UNEP - Vienna Interim Secretariat of the Carpathian Convention (ISCC), and executed in cooperation with ENVSEC partners as well as their National Focal Points (NFP) in the following beneficiary countries and territories.

Albania, Bosnia & Herzegovina, Macedonia, Montenegro, and Serbia.

The objectives of the ADA project intervention refer to two environment issues:

- To reduce trans-boundary environmental and human safety risks posed by sub-standard mining operations in the SEE region.

- To encourage regional cooperation for transboundary mountain protected areas in SEE.

The execution of activities in 2006 and 2007 is coordinated by UNEP ISCC but is largely running parallel for the two issues; mining and biodiversity. This report only presents findings associated with the mining issue.

Project Purpose (related to mining)

This project executes activities with the following character:

- Targeted assessment of transboundary environment and health risks resulting from mining

- Development of policy and technical options suitable for the region and selection of demonstrations or pilot activities, in particular focusing on innovative, local and cost-efficient risk reduction and management measures

- Building of capacities to address problems at a regional and local level, including tools for early warning, civil protection and conflict resolution.

- Identification, delineation and cataloguing of mineral resource-related sites that pose substantial transboundary risk to the environment, public health and safety, and to the regional socio-political stability in SEE

- Provision of information on technical options required to support further work for transboundary risk and hazard reduction, identification of five hotspots requiring follow-up through risk mitigation as well as emergency measures.

- Increasing of local capacity for early warning, conflict resolution and emergency response, reaching international (EU) standards.

The activities carried out under the auspices of the ADA project build upon, make use of and strengthen a number of other ENVSEC activities that have been conducted in recent years. In
particular the mining related work builds upon the ENVSEC desk assessment conducted in 2004 that examined environment and security risks posed by mining in South Eastern Europe – *Reducing Environment & Security Risks from Mining in South Eastern Europe* [the DA]¹ As the compilation of the desk study was based almost exclusively upon secondary data sources (environmental reports, public access databases, web searches, and so forth) it was vital for the Inception Phase of the ADA project to conduct works to verify and update the gathered information in the target countries. Further primary data verification via personal and/or face to face interactions with relevant and qualified national actors was deemed necessary and appropriate. Therefore, short missions to the countries mentioned were conducted by the authors. These missions had objectives to:

- Inform governments, local experts and other interested institutions (e.g. ADA and UNDP offices) on the objectives, progress of ENVSEC and the new ADA project;
- Verify and update the desk assessment (DA) on mining hot spots through meetings with both governmental and independent experts;
- Assess the government interest and priorities in addressing the mining issues (upgrade current mining practises and policies, remediate environment impacts).

These missions were conducted as follows:

- 27-28 April 2006 Sarajevo (Bosnia and Hercegovina)
- 4-5 May 2006 Tirana (Albania)
- 9-15 May 2006 Podgorica (Montenegro), Belgrade (Serbia) and Skopje (Macedonia, including field trips).

This report combines the findings of earlier work(s) with new information and findings. References to earlier work, in particular the 2004 Desk Assessment, are made where appropriate.

### 1.2 Environment and security work and the “Mining Desk Assessment” 2004

The Environment and Security (ENVSEC) initiative was formed by three organizations – the United Nations Environment Programme (UNEP), the United Nations Development Programme (UNDP), and the Organization for Security and Co-operation in Europe (OSCE). In 2004, it was joined by NATO and recently by the REC² and the UNECE. The Initiative is aimed to provide a framework for dealing with environmental issues across borders and promoting peace and stability through environmental co-operation and sustainable development. The Initiative has initially focused on the three regions: Central Asia, the Caucasus and South Eastern Europe (SEE).

The Initiative is basically structured in three distinct but interlinked pillars, dealing with:
- Vulnerability assessment and monitoring.
- Capacity building and institutional development.
- Policy development and implementation.

After the launching of the Initiative at the Kiev "Environment for Europe" Ministerial Conference in May 2003, and preparation of the regional report on environment and security priorities in SEE, the EnvSec Partners, in consultations with the countries in the region, have developed the following priority fields of action:


² The Regional Environmental Center for Central and Eastern Europe (REC), see [www.rec.org](http://www.rec.org)
• Managing and reducing trans-boundary risks of hazardous activities.
• Management of trans-boundary natural resources.
• Cross-cutting issues (awareness, information, education, etc.)

**ENVSEC and mining issues**
The EnvSec Consultations in Kiev and in Skopje, September 2004, identified hazardous activities, including mining operations and associated processing activities, as posing potential risks of trans-boundary character in the region. This was confirmed as a main priority of the region at a ministerial-level meeting in Cluj-Napoca, Romania in May 2005. Within this field, the ADA/UNEP project contributes to the management of such trans-boundary risks, by providing deeper risk assessments for decision-makers, clearer identification and/or verification of potential “hot spots” and recommendations for priority measures of mitigation and risk management at the regional level. Moreover, the project will carry out capacity building in the field of tools for early warning and conflict resolution.

**Political and sectoral context**
National Governments are strongly represented in the ENVSEC process through partnerships with all three founding organizations. Ministries of Foreign Affairs and Ministries of the Environment have given their firm endorsement to the ENVSEC approach at the 5th Environment for Europe Conference in Kyiv, at the OSCE’s Economic Forum in Prague, at the OSCE Maastricht Ministerial Council and at other international and regional fora. Sub-regional consultation processes are taking place on a regular basis, e.g. the Cluj-Napoca Ministerial meeting on Mining in May 2005. Progress and tangible outputs of ENVSEC, including those produced with the support of the present project, will be presented to both local and international stakeholders regularly. In this regard, a major international launch to a wide international audience is planned at the 6th Environment for Europe Conference, to be organized in autumn 2007 in Belgrade within the ADA/UNEP project.

An assessment of the links between security and environment has been developed through a number of regional consultations with Governments and local stakeholders in each country, resulting in the 2003 report “Environment and Security: Transforming Risks into Cooperation: The Case of the Central Asia and South Eastern Europe”. Main environmental and human security priority areas were identified, such as: managing trans-boundary risks of hazardous activities as well as management of shared natural resources, rivers, lakes, mountains.

ENVSEC plans for South-Eastern Europe are regularly presented and discussed in the context of the REReP and other relevant fora such as the ICPDR, as well as in the context of UNEP’s cooperation with REC.

**Outline of the problem and local potentials**
The environmental legacies are well known. Badly operated or abandoned mining sites have already caused severe pollution, some with impacts across national boundaries, e.g. the Baia Borsa tailings spill (heavy metals) and the Baia Mare release in Romania (cyanide), the Sasa tailings spills in the Former Yugoslav Republic of Macedonia (heavy metals), and various releases at Majdanpek, Veliki Majdan in Serbia and Mojkovac in Montenegro. Water courses have been the principal vector of transboundary chronic and accidental pollution. Smelters near borders also contribute to transboundary air pollution. This pollution had and has serious impacts on human health and poses considerable risks in the future. Such incidents create additional political tensions at a time when peace and cooperation are on the top of the agenda. There is also economic damage as agricultural exports and tourism regularly suffer during the strong media exposure that accompanies such accidents. All these chronic problems - besides their direct environmental impacts - create a negative atmosphere for economic investments, actually badly needed in the region.
Characteristics of the (sector) environment and economic aspects

The countries proposed for this ADA/UNEP project have been directly or indirectly involved in the conflicts that escalated in the past ten and more years in the Balkan region. These war-torn nations, where tensions still exist, have been also subject to economic crises as a result of their isolation from the global economy and the impacts of the transition from socialist economic policies to free market economies.

Mining has a long tradition throughout the region, but after cessation of mining operations most sites were simply abandoned. This has been particularly serious in recent decades and thousands of old "abandoned" or "orphaned" sites are scattered throughout the region. In Bosnia & Herzegovina, Montenegro, Serbia, Albania, Macedonia and Kosovo alone ENVSEC identified over 180 separate operations, some with many individual sites of activity in the 2004 DA. Circa a third of these appeared to be of significant environmental and security concern, and nearly a fifth was deemed to be associated to potential transboundary risks.

Numerous metal processing facilities that were established in SEE in the second half of the 20th century are still operating but they are often uneconomic and there remains a great risk that they may be abandoned without proper rehabilitation. The safety and pollution hazards from these old sites are now of great concern and ongoing impacts are a reality. Resources needed for clean-up weigh heavily on the national development programmes, and the visible pollution leads to public opposition to existing and new mines, even if they secure or create jobs for local workers. As a result of a lack of investment capital and effective regulatory frameworks operational mines are generally operating at a sub-standard level – both from a technical efficiency point of view and from an environmental perspective. The transboundary environmental impacts associated with such sites may in some cases have negative impacts on political cooperation between countries, some of which have only recently emerged into an open conflict.

On the other hand, recent changes (since circa mid 2005) on the global market for mining products (ores, concentrated metals, semi-finished products) have resulted in an unprecedented re-direction of capital investments into the mining sector. Governments in SEE that are in the process of preparing and implementing the privatisation and closing of mines are confronted with the new perspective that mining is becoming more and more profitable. This appears to be providing a sound foundation to the opportunity to clean up a substantial number of mining sites as part of new and ongoing operations. As such, the re-opening of sites under modern industrial practises, as stipulated by the EU (BREF documents), could make urgently required mitigation and rehabilitation programmes much more feasible than was assumed a few years ago.

Target group, groups or people involved, partner(s)

Besides the ENVSEC national focal points (NFPs) in the countries (representatives from the Ministries of Environment and Foreign Affairs), partner agencies include UNDP, OSCE, GRID-Geneva, GRID Arendal, Carpathian Network of Protected Areas, WWF International, IUCN (including Belgrade Office for SEE), UNDP and OSCE country offices, and UNMIK.

Target Groups include regulators and administration, such as national Ministries of Environment or Mining and associated institutions, mining operators (both public and private), affected and/or involved communities, civil society organizations, academia and research institutions, as well as the media.

Other interventions

UNEP was heavily involved in the assessment of the environmental impacts of Baia Mare spill in 2000. A survey of current legacies in accession countries is given in the European Union (EU) report of the Joint Research Center (JRC) Enlargement Project PECOMINES, and by national
studies. PECOMINES and its partners such as the EnvSec Mining Desk Assessment, the EnvSec Tisza River Basin Assessment, and three Post Conflict Assessments have provided regional hot spot related data. Together, these reports highlight the presence of hundreds of seriously polluted mining sites in SEE that require attention and control.

A previous project carried out in 2004 by ADA on rehabilitation measures of a Romanian mining dam in Baia Borsa – Novat serves as a point of reference on how to achieve effective and fast risk reduction (here: safe water cycle) at (relatively) low level of investment (some EUR 300,000).

Figure 1  Overview of potential environmental hotspots in SEE
1.3 Scope, limitations and mission methodology

The scope of this assessment addresses mining industry activities in SEE countries. However, certain flexible boundaries have been placed upon the scope of works due to its relationship to the earlier DA. In the ENVSEC DA, extractive industry sites in the focus countries were catalogued and examined. This categorisation initially included ferrous metals, non ferrous metals, precious metals, and coal. Oil and gas sites were catalogued but further analysis was not performed, as this sector was deemed to fall outside the “minerals” industry. Further, for the work within the Desk Assessment, the initial “minerals” focus was intended for sites of mining and beneficiation (milling and metals concentration). In practice, this boundary setting proved to be unrealistic because of the commonality of vertically integrated operations (kombinats) in the region. As such, mining, milling, smelting, and even refining are often combined. However, while coal mining operations were catalogued, thermal power generation sites (and their ash dumps) were not. As a result, this ADA/UNEP assessment principally addresses mining sites, beneficiation sites or mining and beneficiation sites but in a number of instances, metal smelting sites are included as a result of the afore-mentioned relationships.

As far as was possible, the original assessment – and as such, this assessment – address both existing (operational or “under care and maintenance” sites) and historic sites. In practice, data availability (and indeed the availability of national experts with knowledge of sites) has precluded strong consideration of historic sites. A number of data collection methods have been applied in the conduct of this work. The generation of the DA was based almost entirely on secondary sources such as international minerals databases, governmental and intergovernmental reports (in particular an extensive suite of UNEP, UNECE, UNDP and World Bank publications), NGO materials and a range of internet-based material. Follow-up to the DA conducted during 2004 and 2005 involved a number of ENVSEC facilitated workshops where National representatives gave input, an ENVSEC mission to Kosovo, and a number of reference communications with a range of governmental actors. This mission has utilised a considerable number of personal/group interviews and meetings with key government and independent experts (a total of 30 meetings with groups or individuals are reported in this document). Follow-up work to the mission has required both written communications with informants and cross-referencing of verbal input with material from reports that have been made available.

In the earlier work discussed above, all minerals-related sites where meaningful data were found were examined. However, here only those where a serious environmental/health impact or environmental/health risk is reported are being examined in order to verify their importance (or otherwise) in terms of the magnitude of the environmental risk or harm. Information sources additional to those sourced for the Desk Assessment utilised in this work represent the full range mentioned above. Further, the 2006 mission work has sought to verify a number of key information sources utilised in earlier work.

In particular due to the considerable constraints upon both project budgets and available time for this work, this assessment is limited in a number of ways:

- only a limited number of informants could be met and briefly interviewed (usually 1-3 hours) per informant group and only a few informant groups per country (between 5 and 8 meetings per country);
- the overall time available for analysis and confirmation of preliminary findings is very short;
- during both the desk study in 2004 and the first project mission in spring 2006, there was no possibility to visit mining sites (except for two sites in Macedonia) and this activity is vital for data verification;

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3 Only peripherally related to the work covered by this report. The mining and environment situation in Kosovo will be reported upon at a later stage of this project.
• there are clearly vested interests held by some of the informants,
• a number of informants have limited mining or environmental expertise and/or site knowledge;
• in some cases it was observed that political issues and realities have, or may have influenced the nature of information conveyed;
• language barriers may have led to misunderstandings and misinterpretations.

The Mission Consultants have made various efforts to overcome these constraints, e.g. by cross-checking a considerable volume of site information with several experts as well as in meeting notes and the literature.
2 Analysis of environmental hotspots and risks related to mining in SEE

This chapter summarizes the information about mining sites in each of the assessed SEE countries available pursuant to the verification missions. The information provided here highlights the facts, views and opinions that underpin the short-list of a very limited number of sites of priority concern in each country. It is envisaged that this short list will be the subject of a more detailed check in the next phase of ADA and associated ENVSEC work. Such refinement will be aimed at drafting mitigation project concepts for selected sites.

It is clear that there are a number of transboundary environment risks associated with mining. This project will provide further detail to examples from the SEE region identified as “potential” in the DA and verify their status. Such transboundary risks do not encompass the full range of those found globally, however they provide an overview of many of the most pressing that mining nations and their neighbour’s experience. Discussions of capacity-building related needs to be dealt with are included in chapter 3 in this report.

In general, it can be stated that the types of mining and minerals processing operations shown in this report share a number of pathways, in which the surrounding environment and communities can be exposed to the harmful effects of pollutants associated with mining and minerals processing activities.

In the desk assessment a total of more than 180 major sites of resource extraction and downstream processing were identified in the region. In the SEE countries studied, the following number of sites or operations were documented in 2004 (see also the map below):

- Albania – circa 45 sites (at least 10 of concern),
- Bosnia and Herzegovina – circa 40 sites (at least 7 of concern),
- Kosovo (territory under UN interim administration) – circa 40 sites (at least 14 of concern),
- (Former Yugoslav Republic of) Macedonia – circa 20 sites (at least 10 of concern),
- Montenegro – circa 11 sites (at least 4 of concern)
- Serbia – circa 30 sites (more than 8 of concern)

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4 It should be noted, that a number of sites identified as being “of concern” in the DA were found to be of less importance during the conduct of the verification missions. The major reason for downgrading the “apparent importance” of sites is generally that transboundary pollution transmission pathways were not available, although in a number of cases, assumptions regarding the likelihood of pollution from sites were not correct.

5 The DA report only provides qualitative descriptions of sites that “appear” to be of high hazard, and “may” have significant probabilities of an environmentally damaging event associated with them. It has not been sought to ascertain the likelihood (probability and frequency) that pollution incidents may occur in any quantitative form; the likely harm (damage to people, property, or the biophysical, social, or cultural environment) or the consequences of an event or situation except in general terms.

6 Important limitations for the study were that details of current ownership and activity status for identified sites and assessment of the legal status of abandoned/orphaned mines, both in general and for specific sites, was not possible to undertake with the available information. This remains as an important area of work for all parties. Further, the sites identified from within the considerable information examined within the study generally only represent the larger “internationally visible” operations. Many smaller or older sites remain to be catalogued. Moreover, many of these “operational entities” contain multiple pollution sources.
The primary task of the project missions of spring 2006 was to verify and revise the priority site listings as well as to obtain additional information required to confirm their status and to assess their potential for short-listing.

### 2.1 Albanian Hotspots

From the late 1970s through 1990, Albania was a leading world producer and exporter of chromite. The principal commercial chromite deposits are in the massifs of the Midrita region in north-central and northern parts of the country. Copper ore also occurs in a number of areas throughout the country and was mined in underground operations. While the largest processing operations are located in northern Albania, significant copper mining and beneficiation activities have also taken place in the south-eastern portion of the country. Albania has also been subject to 25 years of oil and gas exploration in the south-western parts of the country.

The candidate hotspots in Albania as identified in the DA were principally associated with ferrochromium processing/smelting industries, chromite mining, and copper mining and processing industries. 11 minerals-related operations were listed as potential hotspots (national and trans-boundary risk hotspots) for Albania\(^7\) in that report.

In the mission conducted to support this analysis, operations based in 8 mining related areas have been discussed and brought forward by informants as being of prime importance. All of these were assessed in the DA, but a number have been deemed more important by the National actors than they were assessed to be at that time. Chromite related sites noted in the DA were generally given a lower priority by national actors and copper mining sites were given a higher priority. It was explained that waste disposal practices associated with copper mining in the country have led to serious problems in a number of areas.

While it was confirmed that mining and minerals related sites are among those of highest concern, it was stressed that there are also a number of other priority sites related to the oil and chemicals industry and hazardous waste disposal that have severe implications for environmental and health. Moreover, these sites are very high – or even at the absolute top of – national priorities for risk amelioration and remediation works.

Among listings of the highest priority environmental and health risk hotspots (9 listed in a UN report\(^8\) and 26 listed in a (Albanian) hazardous waste report from 2004\(^9\), the following mining, minerals and metals related operations or areas are included along with the number quoted to us from the Albanian report:\(^10\)

- (6) Elbasan ferrochromium, steel and nickel smelter complex
- (8) Rubik copper mining area
- (12) Pogradec chrome nickel crusher deposits/dump

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\(^7\) Note that transboundary means here “into the Adriatic Sea”, except for where the potential for effects to Lake Ohrid are concerned. As such, the Albanian work has a distinctly more national nature and the “transboundary” aspect of ENVSEC and ADA work is more focused on the challenges that Albania “shares” with its neighbours and a general need for reduction of health and environmental risks.


\(^9\) Details of this report were not received.

\(^10\) It is not believed that these numbers indicate an official ranking but they have been included in this report for reference.
(14) Rehova copper mines
(15) Kurbnesh copper mines
(16) Kalimash/Kukes copper mines and smelter

Other important sites not related to the mining sector include:  

(3) & (13) Oil at Ballsh, Kucova, Patos-Marinza: These sites of severe oil pollution at locations of onshore oil and gas extraction were highlighted as the absolute priority sites by government, UNDP and other experts. At the Patos-Marinza oil field, surface and groundwater is being severely contaminated by oil from wells, pumps, pipelines and pre-treatment facilities and sulphurous gas and hydrocarbon emissions are emitted to the atmosphere. At the Ballsh refinery around 20,000 tpa of the refinery’s oil are (were) lost into the surrounding environment. Wastewater containing oil impurities is being discharged into a channel, contaminating the Gjanica River, and probably affecting the local water supply. The refinery also emits toxic pollutants into the atmosphere.

(10) Plastic (pvc) waste at Lushnja – no details available.

(1) Hg contamination associated with ChlorAlkali production at Vlora. A site of a former chlorine alkali and PVC factory is situated 5 kilometres from the city of Vlora. Reportedly 5-6 hectares of former factory grounds have contaminate soil, with mercury to a depth of 1.0-1.5 metres below ground level.

(4) Lindane and Chrome 6 (Cr⁶⁺) at Porto Romano (Durres) - Several square kilometres of land are severely contaminated by hazardous chemicals and residues from a former chemical plant, a waste dump and an abandoned chemical storage site.

(2) As pollution from the fertiliser production at Fier city. The site of a former nitrate fertiliser plant reportedly has approximately 850m³ of arsenate and arsenide solution require proper disposal. Soil and most likely groundwater are contaminated with high levels of arsenic. The groundwater feeds the river that supplies local drinking-water wells. Untreated wastewater is being discharged into the same river.

(5) Uncontrolled hazardous waste site at Shara near Tirana – 100 x 860 m; not meeting environmental standards; no further details received.

(7) Fertiliser (phosphate) production at Lac. A stockpile of residues is potentially leaking arsenic and copper into the groundwater and contaminating local drinking water sources. About 30,000 tonnes of iron-rich residues from the production process remain deposited on the factory grounds. The dumpsite was built without previous preparation of the soil, a protective liner underneath, or a drainage system to prevent leachage.

(9) Paper plant at Lexha – no details received.

Discussions with government actors indicated that hot spot rehabilitation related to health impacts are a government objective. “Unofficially”, the priority of environmental and health hazards and risks in the country are generally determined by three factors ranked in the following order:

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Where possible additional details have been added from the REC report DEVELOPING A PRIORITY ENVIRONMENTAL INVESTMENT PROGRAMME FOR SOUTH EASTERN EUROPE, ANNEX 3: FULL LIST OF HOTSPOTS

An industrial chemical process based on the electrolysis of sodium chloride for the production of sodium hydroxide and chlorine.
1. Risks to the population

2. Risks to tourism

3. Risks to biodiversity

The Mining Institute (to be transformed into an Agency under the Ministry for Economy) reviews the EIAs that are needed for every mining permit. The Ministry also decides about all sites to be closed (ca. 10-20/year), based on a proposal by the Institute, which then also supervises the closure works.

This was also reflected in the communication with Albanian informants – in general meeting discussions focused on sites that are polluting riverine waters and thus affecting downstream abstracting communities and agriculture. This factor is also instrumental to metals smelting wastes and copper tailings waste being accorded high priority.

Pursuant to interviews and discussions held in Albania and cross referencing with information in the Desk Assessment, it is judged that the most important mining and metals processing sites, operations or areas\(^\text{13}\) are the following.

- **Elbasan smelter complex** that represents the most serious metals industry related hot spot in the country leaving behind an accumulation of some 35 years of metallurgical wastes. Wastes (about 1.5-2.0 millions tons of ferronickel slags and ferrochromium wastes) from smelting activities contaminate soil and groundwater with heavy metals (chromium, nickel and manganese). Water in the Shkumbini River is contaminated by heavy metals and phenolics from this dump.

- **Rreshen**, which is a major centre for copper mining, with 7 or more mining and copper ore concentrator operations located on both arms of the Mati-Fani river system and contributing to a suite of environmental problems. Informants indicate that all tailings dumps are located on or in the river(s). As a result of the nature of the ores (arsenopyrites) significant concentrations of arsenic are among the heavy metals in effluents polluting agricultural irrigation waters. Tailings apparently contain around 0.8% copper and as such should represent an economic resource suitable for reprocessing and safe disposal. In addition to the tailings issues, the Lac copper smelter is located in an area adjacent to this area (and is presumably where copper from these mines was smelted) and it was also indicated that there are environmental issues associated with this site.

- **Kurbnesh**, that has was described as a “very large disaster area”, discharging into Fani and Mati Rivers. Again the site(s) involved tailings from copper concentrators that have been dumped directly adjacent to, or in river beds. Kurbnesh was described by one informant as second to Rreshen in seriousness among the copper tailings sites.

- **Greater Rubic and Reps area** that again involves copper tails, which have been dumped adjacent to or in the Fani River. The Rubic site or sites appear close to the Rreshen mining on maps and are located on the Fani, which enters the Mati River downstream of Rubiku. The Reps site or sites (including Gurch, Lajo, Spac, and Thurr mines) are further upstream on a Mati tributary. Note: Further investigation into the mining operations in the Reps area are warranted. USGS database information indicates that the cumulative production of mines in that area (circa 350kt per year) makes this area one of the highest production zones in the country.

\(^{13}\) Some of the “hot spots” are clearly sites – Elbasan smelter complex and its waste dump for example – other “sites” clearly comprise of a number of operational sites or waste dumps potentially spread over a large geographical area. Informants were unable to provide more than indications of the actual locality, extent and volumes of hazardous material involved with such areas.
• **Fushe Arrez area** that hosts the largest copper mining and beneficiation complex in the country, which produced and concentrated more than 320 000 Mt/yr of copper ore when operating at full capacity. Again arsenic contamination of surface and ground waters is an issue due to Arsenopyrite deposits and the location of residue stockpile(s) near the bank of the Fani River. On the positive side for this site it was reported that very rich copper grades are (still) present at the site (circa 4% Cu, 2% Zn, 4g/t Au and up to 40g/t Ag providing indications that ongoing mining activity is likely in the medium to long term and possibly providing opportunities for remediation works.

• **Pogradec** where ferronickel crusher deposits (nickeliferous iron ore) have been dumped near Lake Ohrid. These (reportedly) commercial-grade materials are presumably from the mines near Pogradec (the principal mines were at Prrenjas, Guri i Kuq, and Bitinska). Plans have reportedly been developed for their removal and processing (presumably at Elbasan) but the status remains unclear.

• **Rehove village** where copper mining waste has again been dumped in a number of locations by a river (the Osum that enters Albania from Greece). One informant described this site as a "disaster area" with "burnt grass" however, little other data was available. In Rehove there are apparently ongoing Au and Cu operations with rich concentrations indicated (4% Cu and 4g/t Au).

• **Kalimash/Kukes/Gjejan area**, which is a copper mining area including mines, concentrator(s) and a smelter. Again, the ores contains Arsenopyrite and are generating significant As pollution to waters on the middle Drini river. Informants indicated that the Gjejan area may be the most serious pollution site.

Other sites highlighted in the DA that were not included among priorities during this mission include:

• the **Burrel Ferrochrome Smelter**, a site that was not mentioned or reacted to by informants; and

• Chromite mines such as those at **Bater, Bulquize, Kalimash** and others; sites that have been downgraded for two reasons. Firstly informants indicate that effluents from these sites are of far less concern than from copper sites in Albania. Secondly as some of them, the Bulquize dumps in particular, are of economic interest and the distinct possibility exists that they may be reprocessed.
Figure 2  Hotspot areas in Albania
Table 2-1. Albanian sites of priority concern

<table>
<thead>
<tr>
<th>Site or area name</th>
<th>Activity</th>
<th>General description of likely hazards/risks and pollution pathways</th>
<th>Confirming informants</th>
<th>Ref # in DA site records</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Elbasan</strong></td>
<td>Ferrochromium smelting Steel smelting Nickel smelting (steel, coke, pig iron, and nickel)</td>
<td>In general, smelting activities of this kind generate pollution via emission of Ni, Cr, Fe, Cu and Zn and total ferrochrome dust to atmosphere. Environmental concerns also include depositional soil contamination, waste/sludge dumps and process chemical pollution. These pollution vectors can (do) also contribute to surface and groundwater pollution. Specifically for this site, there are large quantities (about 1.5-2.0 millions tons) of stored ferronickel slags and ferrochromium wastes. The metallurgical complex in Elbasan closed in 1990, although there is still a scrap smelter working with obsolete equipment and technologies. Wastes from metallurgical operation contaminate soil and groundwater with heavy metals (chromium, nickel and manganese). Water in the Shkumbini River is also contaminated by heavy metals and phenol.</td>
<td>S. Guri – 4/5/2006 D. Shkupi 4/5/2006 MoEFWA &amp; ITNPM* 5/5/2006</td>
<td>D27 D28</td>
</tr>
<tr>
<td><strong>Rubic &amp; Rreshen copper mining area</strong></td>
<td>Multiple sites of copper mining, beneficiation and primary smelting</td>
<td>Copper concentrates were smelted at the Lac and the Rubic pyrometallurgical primary smelters. In general, copper smelting activities of this kind generate pollution via emission of Cu – Cu/Fe compounds; sulfides, sulfates, oxides, chlorides; fluorides of arsenic, antimony, cadmium, lead, mercury, and zinc dust to atmosphere. Environmental concerns also include depositional soil contamination, waste/sludge dumps and process chemical pollution. Solid waste slag is a prime contaminant output, and in addition wastewaters typically contain dissolved and suspended solids of Cu, Cd, Pb, Zn, As, Hg as well as residues from mould release agents (lime or aluminum oxides), fluoride may</td>
<td>S. Guri – 4/5/2006 D. Shkupi 4/5/2006 MoEFWA &amp; ITNPM 5/5/2006</td>
<td>D24 /Rreshen) D27 (Lac)</td>
</tr>
</tbody>
</table>
also be present, effluents often exhibit low pH.

In general, **copper ore mining and beneficiation** produces waste rock and tailings waste. Effluents that can be expected include ARD/AMD from mine workings and waste heaps. Effluent will typically contain metals/pollution such as sulfate, copper, zinc, and cadmium depending on the ore.

Specifically for this site, these ores have been reported to contain high concentrations of arsenic, a factor that compounds downstream water and groundwater concerns. Particulates from waste heaps as dust will also be a local issue. Issues such as the long-term geotechnical stability of the impoundment, the chemical stability of the tailings, long-term surface and groundwater management are likely to be of concern.

Primary pollution pathways for tailings is directly by river transport. Essentially all copper tailings in Albania are reportedly dumped adjacent to or in river beds. Aquifers below rivers will also be affected.

<table>
<thead>
<tr>
<th>Kurbnesh copper mining area</th>
<th>Multiple sites of copper mining &amp; beneficiation</th>
<th>Primary pollution pathways for tailings are directly by river transport. See comments above regarding concerns for pollution from copper mining and beneficiation sites.</th>
<th>S. Guri – 4/5/2006 MoEFWA &amp; ITNPM 5/5/2006</th>
<th>D21</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kukes Copper Smelter (also known as Gjegjan smelter)</td>
<td>Copper Smelting &amp; electrowinning site Also copper ore mining and beneficiation</td>
<td>Copper concentrates were smelted at the Gjegjan (Kukes) pyrometallurgical primary smelter in the far north-eastern part of the country. See comments above for copper smelting activities of this type. Specifically for this site, the presence of electrowinning operations indicate that that wastewater effluents to the environment will have included spent electrolytic baths, slimes recovery, spent acid from hydrometallurgy processes and sludges from wastewater treatment processes.</td>
<td>S. Guri – 4/5/2006 MoEFWA &amp; ITNPM 5/5/2006</td>
<td>D21 D26 D14 +D19(Gjegjan) D20(Nikoliq, Pus, Golaj)</td>
</tr>
<tr>
<td><strong>Kukes &amp; Kalimash mining areas</strong></td>
<td>See comments above regarding general concerns for pollution from these mining and beneficiation sites.</td>
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<tr>
<td>----------------------------------</td>
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<tr>
<td><strong>Rehove area</strong></td>
<td>Copper concentrates were smelted at the Rehove Mine and beneficiation plant in south-eastern Albania. Impacts for smelting as above listing for Kukes. Primary pollution pathways for tailings is directly by river transport in the Osum River. See comments above regarding concerns for pollution from copper mining and beneficiation sites.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fushe-Arrez copper mining area</strong></td>
<td>Fushe Arrez, the largest copper mining and beneficiation complex in the country, produced and concentrated more than 320 000 Mt/yr of copper ore. Arsenic contamination of surface and ground waters likely due to Arsenopyrite deposits. Residue stockpile is near the bank of the Fani River. See comments above regarding concerns for pollution from copper mining and beneficiation sites.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


*This group of informants included Sajmir Hoxha, Senior Advisor MoEFWA - NFP ENVSEC, Adil Neziraj (Director General of Geological Survey), Cerciz Dyrmishi, Dep. Dir. Gen. Geol. Survey), Kristo Rodi (Director of Regulatory Directorate at Min.Econ.), Martin Cukalla (Director of Institute of Mining Technology ITNPM) and Prof. Jani Bakalbash (Dir. Mining Dept. ITNPM).
2.2 Bosnia and Herzegovina Hotspots

Before the dissolution of the Federal Republic of Yugoslavia and the subsequent civil war, Bosnia and Herzegovina was a major centre for metallurgical industries in the former Yugoslavia. At that time the country’s total output of steel in Zenica was more than 2 Mtpa. By the end of 1999, production was being maintained at approximately half this capacity.

The country was also a major producer of bauxite, alumina, and aluminium. Bauxite was mined in Vlasenica, Jajce, Bosanska Krupa, and a range of other sites located in the North West part of the country. Alumina refineries are located at Birac-Zvornik and Mostar. The production of other nonferrous metals included only relatively minor amounts of lead and zinc ore mined and milled at Srebrenica (Sase mine) in Republika Srpska (RS) and at Olovo and Vares in the Federation of Bosnian Moslems and Croatians (FBC).

Both brown coal and lignite are mined in the country. In the FBC, the Middle Bosnia and the Tuzla coal mines supply (supplied) the Kakanj and the Tuzla powerplants with more than 80% of their total coal production. In RS, the lignite surface mine at Gacko and the brown coal surface mine at Ugljevik were fully integrated with the Gacjo and Ugljevik powerplants respectively. Despite the general disruption of the economy in the post conflict years, according to informants, the majority of pre-war mines now operate on at least a part-time basis, examples being: Milice, Vares, Srebrenica, bauxite mine(s) in RS, and coal mine(s) in Tuzla.

In the past, Bosnia and Herzegovina has also been a major producer of asbestos. Asbestos and asbestos cement are reportedly mined, milled and produced in the Bosnian Petrovo Selo area.

The candidate hotspots in Bosnia and Herzegovina as identified in the DA were principally associated with aluminium, ferroalloy processing/smelting, manganese mining and processing, and iron/steel smelting. 7 minerals-related operations were listed as potential hotspots (national and trans-boundary risk hotspots) for Bosnia and Herzegovina in that report.

In the mission conducted to support this analysis, operations based in several mining related operations have been discussed and brought forward by informants as being of prime importance. The majority of these were assessed in the DA, but a number have been deemed more important by the national actors than they were assessed to be at that time.

Four sites noted in the DA were deemed to be of lower priority by national actors and 1 mining site was given a higher priority, namely the Vares lead and zinc mining operations. A number of new sites were mentioned for which the authors did not have previous data. While it was confirmed that a number of mining and minerals related sites are of great concern, it appears that national priorities for risk amelioration and remediation works are yet to be elucidated. In this regard, while the mission succeeded in interviewing a suite of knowledgeable national actors, contact with all key “accountable for mining” parties desirable for a full picture of the national view was not achieved. For example, the Federation’s Ministry for Industry, Mining and Energy is located in Mostar and for the RS, responsibility lies with the Ministry of Energy in Banja Luka. Neither of these offices could be visited in the time available. Further, it was apparent that a lack of

14 In the Vares area there are operations for the mining of lead and zinc and the mining of iron ore. Only the iron ore operations were identified, catalogued and analysed.

15 An important WB report is still to be obtained in this regard. “Environmental Protection Assessment of Industrial, Medical and other Hazardous Wastes in BiH” report # TR-5024.01), but the key contact, Ms Vesna Francic was currently unavailable. A written request for information was left with WBG staff and the matter has been followed up. No information has been received at the time of writing.
(environmental) ministry resources allied with the institutional instability and complexity in BiH has contributed to a lack of clarity with regards to environmental and health risks associated with the extractive industries.

Also relevant to the governing bodies in the country, it was reported that while IPPC rules are to be in place from 2008 on, they are not yet being taken seriously in BiH, by industry in particular. Mining waters – a significant problem in the country – are not specifically addressed in any legislation and as such the existing legal framework neglects acid mine waters and pollution from historical and closed mines. Informants underlined further that a regulation on land rehabilitation after mine closure is not applied and that mine water management is largely non-existent. Further, there is no clear indication of mines’ impact on environment, as there is no systematic monitoring of surface and ground waters.

Also of importance in BiH was the presence of local actors who appear to have the skills and international networks in place to facilitate work on a number of the issues associated with priority sites. Informants in the Hydro-Engineering Institute Sarajevo (HEIS) in particular have been involved in the EU ERMITE programme (mine waters research 2003 see http://www.minewater.net/ermite/) and have links into the EU funded PIRAMID programme for Passive In situ mine water remediation see: http://www.piramid.org/. Such capacity may form a useful basis for work in the country.

Pursuant to interviews and discussions held in Bosnia & Herzegovina and cross referencing with information in the DA, it is judged that the most important mining and metals processing sites, operations or areas, are those listed in the following descriptive section. It should be noted that the first two sites mentioned here received the clearest endorsement as priority sites from informants during the mission.

- **Vares**, a historical centre of iron ore mining and iron smelting, and lead/zinc mining and concentration, where a range of mining legacies with serious environmental implications exist. In particular, there significant concern with tailings dam monitoring and stability. As an example, informants indicated that cracks are present in the Veovaca Pb-Zn tailings dam. Due to lack of funds and the conflict in BiH (1992-1995), mining activity ceased and mines have been left without rehabilitation or closure measures. Upon cessation of mining activities, the Smreka mine pit filled with water and is now an artificial lake (circa 3 Mm³) that is used in summer for recreation by local people (over 10,000 inhabitants) who already use the lake as a swimming centre. Moreover, agricultural activities (including agriculture and animal husbandry and fish breeding) are presently carried out on contaminated land and in contaminated waters. There has reportedly been no study about health impacts. Despite these challenges, Vares has been presented as an “open-air museum” with socio-economic development potential far beyond just mine-remediation activities due to its inherent socio-industrial “assets”. Moreover, the community is described as being very developed, with the Catholic church acting as a powerful catalyst for activity. In addition to mining legacy sites, the municipality hosts/has several natural and historical or religious monuments (including the monastery Kraljevo Sutjeska - the historic crowning place of kings) that constitute a basis for economic and tourist activities. Vares is close to Sarajevo (50 km north). Potentially important for remediation activities for PbZn wastes is that when operational, the extracted ore produced concentrates representing only 77% of the lead and 68% of the zinc present in the ore. Both these figures are low in international terms and as such lead and zinc not recovered must therefore be present in the waste indicating the possibility of an economic resource.

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16 BiH sections of reports available in this programme indicates that there are some 20-30 important abandoned mining sites in the country (see ERMITE map of contaminated sites).
17 A list of local activities agreed here is given in the COOR Action Plan 2003
- **Srebrenica**, a site of lead/zinc mining and concentration where and beneficiation mill where some 90% of the communal area has reportedly been mined or affected by mining in the past. According to informants, there are currently some 120 locations where contaminated mine waters exit to the surface and flow into local waterways. Pollution apparently ranges from iron contamination to the full suite of heavy metals that can be associated with lead/zinc ores and AMD. Polluted water run into Krivaja river which soon after flows into the Drina river at the Serbian border. Previous acute accidents are associated with the area - a tailing dam reportedly failed in the 1970s causing transboundary pollution. On the social and community side, informants indicated that the community is apparently tired of external actors “benefiting from their misery”. Despite this however, a letter of intent for cooperation is available from the mayor (via ZK).\(^{19}\) This site was also previously a health spa centre where treatments were based upon the metallic waters (Fe treatments). In the past, the rehabilitation of lead and zinc mining operations was high reportedly high on the RS’s reconstruction and development agenda,\(^{20}\) however the current desires at a jurisdictional level regarding restarting of activities versus permanent closure was not revealed in this mission.

- **Jajce**, is the site of a ferroalloy smelter with associated air, soil and water pollution problems. A high risk waste pond is also reported. Very limited data is available for this site at the present time although it has consistently been reported as an environmental and health risk concern – both in interviews in this mission and in previous “hot spot” studies conducted in the region.\(^{21}\)

- **Mostar**, a site where both alumina refining and aluminium smelting take place and where downstream processing industries also made the city of circa 125 000 the centre of aluminium fabrication and aircraft industries for the country. Primary environmental concerns indicated by informants for the Mostar aluminium facilities are related to the toxicity of leachates (high pH of 12+ and contaminants) and a flooded mine pit. Informants further related that rehabilitation works for the site may be being funded by German donors. There are apparently two separate sites at Mostar. More details were not made available to the mission.

Further, the interviews and discussions held in Bosnia & Herzegovina have introduced a number of additional sites for consideration or further study. These are listed in the following descriptive section.

- **Doboj** coal mine on Bosna river (50 km west of Tuzla) reportedly has a number of water issues. This site was reportedly purchased by a UK electricity company. Further details have not been received.

- **Stanari lignite mine**, a resource that has been exploited since 1946 and that had a serious accident in 2005. Reportedly mine tailings were washed away into river Ukrina. In 2006, a new dam is being built and revegetated.

- **Gradsko** lignite coal mine and power plant was named as having significant environmental issues but further details have not been received.

- **An unnamed mine** located between Tuzla and Bijeljina that the ministerial informant from RS indicated could be a significant issue.

Other sites highlighted in the DA that were not included among priorities during this mission include:

\(^{19}\) This was presented, and is held by Zvjezdan Karadzin of the Tuzla Mining Institute.


\(^{21}\) See for example, the 2003 REC report: Developing a Priority Environmental Investment Programme for South Eastern Europe, Annex 3: Full List of Hotspots.
• Petrovo-Selo and Ilici Asbestos mines - sites that no informants had opinions upon other than to note that they had ceased operations long ago;22

• the Buzim FBC Manganese Energoinvest mine and concentrator, a site that was not mentioned or reacted to by informants; and

• Zenica Steel plant due to it being taken over by international interests – i.e. apparently being started up by Mittal Steel;23 informants appear to believe that environmental issues associated with the plant would become less serious if ownership is transferred.

• Birac Zvornick, a site of alumina refining and aluminium smelting secondary to Mostar. Informants indicated low levels of concern regarding this site but some queries regarding the structural soundness of red mud storage(s), leachate problems and one of the bauxite mines that supply the operation remain.

22 It is noted however that concern remains in the minds of the authors with regards to such sites. Experience suggests that just because a site has ceased operations a long time ago does not necessarily indicate that hazards have been removed. Concerns with hazards such as airborne asbestos cannot be ruled out on the evidence presented to date. Moreover, this site is portrayed as a serious issue in the 2003, REC assessment report Developing a Priority Environmental Investment Programme For South Eastern Europe, Annex 3: Full List of Hotspots.

23 Ispat Group of India/Mittal Steel Company Ltd., signed a letter of agreement in July to purchase controlling shares in B-H Steel (Metal Bulletin, 2004, LNM initials agreement for Bosnia’s BH steel. Metal Bulletin, no. 8851, July 19, p. 7.). LNM’s formal acquisition, which was completed in August, gave LNM 51% of B-H Steel’s shares. The acquisition agreement called for LNM to increase the share capital in B-H Steel by $80 million and to invest in a capital expenditure program during a 10-year period, which would be valued at no less than $135 million. Kuwait Consulting & Investment and the Government of Bosnia and Herzegovina were to retain 41% and 8% of the shares of B-H Steel stock, respectively (LNM Holdings N.V., 2004b).
Table 2-2. BiH sites of priority concern

<table>
<thead>
<tr>
<th>Site or area name</th>
<th>Activity</th>
<th>General description of likely hazards/risks and pollution pathways</th>
<th>Confirming informants</th>
<th>Ref # in DA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Srebrenica</td>
<td>Pb-Zn mine and beneficiation mill.</td>
<td>In general, lead-zinc mining and beneficiation leads to concerns with geotechnically unstable tailings wastes that can generate ARD/AMD with a pH 3 containing sulphates, Pb, Zn, Cu, Fe, Zn, Cd. In addition particulates pollution as blown dust and mine water effluents can be an issue. Specifically for this site, it is reported that there are more than 120 locations where mine waters (contaminated to various degrees) are flowing to the surface and entering local waterways.</td>
<td>T. Kupusovic / S. Mizic 27/4/2006 Z. Karadzin 27/4/2006</td>
<td>E34 E35</td>
</tr>
</tbody>
</table>
| Vares             | Pb-Zn mining & beneficiation Also iron ore mining & pig iron smelting | General environmental concerns for lead-zinc mining and beneficiation apply as for Srebrenica above. In general, iron ore mines generate concerns with geotechnically unstable tailings wastes and mines where ores have high sulphur content involve significant potential for ARD/AMD from both mine workings and waste heaps. Environmental concerns associated with this include: pH of 3 or lower and contamination with sulphate, Cu, Fe, Pb, Zn, and Cd depending on the contents of the ore. In general, iron smelting activities of this kind generate pollution via emission of furnace particulate emissions, slag, volatile materials released during coking incl. by-products ammonia, benzol, xylene, toluene, tar, pitch and tar acids Specifically for this area, the following details are relevant:  
  • The Smreka iron-ore mine pit is water-filled and used for recreation. Water quality has not been determined.  
  • A geochemical investigation in the area of the Vares (Pb/Zn) mine shows high... | T. Kupusovic / S. Mizic 27/4/2006 | Pb/Zn sites not listed in DA Fe mine & smelter listed at E31 & E40 |

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24 Although barite (barium sulphate) contains a “heavy metal” (barium), it is not considered to be a toxic chemical by most governments because of its extreme insolubility.
levels of heavy metal contamination of surface and groundwaters and AMD effluents containing Pb, Zn are generated by tailing dams (these reportedly generate barite deposits)
- Cracks are reported in the Veovaca tailing dam!
- Unrehabilitated mines also pollute Bosna river.
- Local soils are chronically contaminated with metals (Mn, Cu, Zn, & Cd) which is also blown as dust and associated health risks exist for surrounding rural settlements. There is also high radiation. A report on soils in Vares and Olovo is available at [http://www.etos.co.yu/mibor/projects/mine_water/page01.html](http://www.etos.co.yu/mibor/projects/mine_water/page01.html)

<table>
<thead>
<tr>
<th>Location</th>
<th>Process</th>
<th>Description</th>
<th>Authors</th>
<th>Date</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jajce smelter</td>
<td>Ferroy-alloy smelting</td>
<td>In general, smelting activities of this kind generate pollution via emission of Ni, Cr, Fe, Cu and Zn and total ferrochrome dust to atmosphere. Environmental concerns also include depositional soil contamination, waste/slag dumps and process chemical pollution. These pollution vectors can (do) also contribute to surface and groundwater pollution.</td>
<td>V. Topalovic</td>
<td>27/4/2006</td>
<td>E29 E30</td>
</tr>
<tr>
<td>Mostar Refinery &amp; Smelter</td>
<td>Alumina refining Aluminium smelting</td>
<td>In general, environmental concerns for alumina refineries and smelters include uncontained and unprotected wastes, residues and chemicals, particularly red mud wastes and spent pot linings (SPL) etc. from smelting operations. Red mud dams often generated very high pH leachates (circa pH 12) and the geotechnical stability of red mud storage can be an issue. There is often an acute risk of groundwater and surface water pollution from associated with SPL wastes.</td>
<td>M. Weiner</td>
<td>28/4/2006</td>
<td>to be confirmed.</td>
</tr>
<tr>
<td>Possibly Birac Zvornik /</td>
<td>Alumina refining Aluminium smelting</td>
<td>As for Mostar. In addition, the Vlasenica bauxite mine is likely to affect the Drinica river to some extent (enters Drina river reservoir).</td>
<td></td>
<td></td>
<td>E4</td>
</tr>
</tbody>
</table>
Figure 3 Hotspot areas in BiH

- Jajce
- Mostar & Zvornik (Al)
- Srebrenica (Pb-Zn)
- Vares & Olovo (Fe, Pb-Zn)
2.3 Former Yugoslav Republic of Macedonia Hotspots

The Former Yugoslav Republic (FYR) of Macedonia hosts deposits containing economic grades of copper, iron, lead, precious metals such as silver and gold, and zinc. In second half of the 20th century, an extensive processing and fabricating infrastructure was established that allowed the production of not only these metals and their alloys, but also such ferroalloys as ferrochromium, ferromanganese, and ferronickel, and aluminium. While not covering all operations in the country, a brief précis of major operations is included here for background.

**Copper mining:** Bucim mine is the country’s only producer of copper ore with capacity to produce circa 4 Mt/yr of ore, 50 000 t/yr concentrates, 8 000 t/yr copper cathode, and 3 000 t/yr copper alloys.

**Lead and zinc production:** The country’s smelter and refinery for the production of lead, zinc and associated metals is located in Veles (MHK Zletovo-Veles). Historically, about 45% of the feedstock came from domestic lead and zinc mines (Sasa-Kamenica, Zletovo-Probitip, and Toranica-Kriva Planca). The zinc refinery had a production capacity of 14 000 t/yr and the lead refinery one of 40 000t/yr.

**Ferroalloys:** Macedonia operated two ferroalloy plants at Tetovo and Kavadarci. The Tetovo plant was established in 1952 to produce mainly such chromite-related products as ferrochromium, ferro-silicochromium, and sodium dichromate. The plant at Kavadarci commenced operation in 1982 with an installed capacity of about 12 000 t/yr utilising nickel or feedstock from the Rzanovo Mine. This plant is still operational and has been modernised.

The candidate hotspots in FYR of Macedonia as identified in the DA were associated with a broad suite of metals activity and spanned: lead and zinc mining, beneficiation, smelting and refining; ferrochromium smelting; chromite mining and beneficiation; copper mining and beneficiation; and ferronickel and antimony mining, beneficiation and smelting. 10 minerals related operations were listed as potential hotspots (both national and/or transboundary risk hotspots) in the FYR of Macedonia in that report.

In the 2006 mission conducted to support this analysis, operations based in 9 mining and metals related sites have been discussed and brought forward by informants as being of prime importance and two of the DA sites were not indicated to be problematical or of priority. The primary point of departure for discussions in this regard was the listing for the highest priority environmental and health risk hotspots listed by the EU 2001 National CARDS Programme under Component 1: Preparation of a National Waste Management Plan: Study E Contaminated Industrial Sites. This report was finalised in the autumn of 2005 and addresses the evaluation of the methods and involved costs of the rehabilitation and/or temporary solutions for the various heavily polluted industrial sites in Macedonia. All of the sites brought forward by informants were assessed in the DA (except for 2 thermal power plants and their associated coal/lignite mines) but there are some minor changes to the priorities

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25 A document labelled EU results from chemical analysis for the hot spots in the Republic of Macedonia was provided to the mission and formed a basis for most discussions with informants.

26 Note that while extensive, this report has not covered all sites. Moreover, there are a number of significant limitations to the data and criteria that has been utilised to rank the priority of the sites. This said, this document appears to represent the point of departure for an official programme of rehabilitation and as such appears to carry considerable weight. On the other hand, and as shall be developed in this discussion, many of the priorities appear to match both the DA and the observations and impressions gained from this mission.
listed in the DA. These changes in priority essentially reflect the differing foci of studies (i.e. DA work focused more on transboundary issues and less on national issues).

While it was confirmed that mining and minerals related sites are among those of highest concern, again it was confirmed that there are also a number of other priority sites related to other sectors that have significant implications for environmental and health. This said, mining and metals related sites appear to account for 8 of the top 10 priority sites in the country. As such mining issues are (or should be) very high in national priorities for risk amelioration and remediation works.

Pursuant to analysis of samples from the sites, the CARDS programme document provides a ranking of the sites that is shown below.\textsuperscript{27} Mining and metals related sites discussed and included as priorities in the DA are marked with an asterisk\textsuperscript{*}.

\textbf{High environmental risk:}
1. OHIS A.D (organic chemical industry) at Skopje
2. Sasa (lead and zinc mine) at Macedonian Kamenica\textsuperscript{*}
3. MHK Zletovo (lead and zinc smelter) at Veles\textsuperscript{*}
4. Bucim copper mine at Radovis\textsuperscript{*}

\textbf{Medium environmental risk:}
5. Zletovo mine (lead and zinc mine) at Probistip\textsuperscript{*}
6. Lojane (former chromium, arsenic, antimony mine) at Kumanovo\textsuperscript{*}
7. Silmak ferro-silicon plant (former HEK Jugochrom) at Jegunovce\textsuperscript{*}
8. Toranica (lead and zinc mine) at Kriva Palanka\textsuperscript{*}
9. Makstil (iron & steel plant) at Skopje

\textbf{Low environmental risk:}
10. REK Bitola (Thermal power plant and lignite mine) at Bitola
11. MHK Zletovo (fertiliser factory) at Veles
12. OKTA Rafinerija AD (oil refinery) at Skopje
13. REK Oslomej - ESM (Thermal power plant and coal mine) at Kicevo
14. Tane Caleski (metal surface treatment) at Kicevo
15. Feni Industry (ferro-nickel smelter) at Kavadrci\textsuperscript{*}
16. Godel tannery at Skopje

Indications from the May 2006 mission are that EU-funded rehabilitation and/or risk amelioration feasibility studies on these sites are being (have been) commenced in the summer of 2006 and results could be available in spring 2007.

Also relevant to the involvement of the governing bodies in the country and the legitimacy of the work in this mission, the mission was informed that the government has – as the first in SEE – established a national coordination body for ENVSEC in February 2006. This body comprises 14 member institutions including international organisations, NGOs, expert institutions, donor organisations, the EU, 2 ENVSEC partners, the private sector, and government, and has produced a draft work programme. Further, the government’s pollution reduction programmes endorsed or launched by the government are supported by municipalities and it was reported that environment education and awareness are developing. On the downside, there is still no Environment Protection Agency initiated to deal with many practical aspects of environment management. Significant challenges listed by informants include a lack of government staff and unclear responsibilities associated with the decentralisation process.

\textsuperscript{27} Albeit this ranking appears to be based upon a very limited set of soil and/or water samples.
Of central importance to the status of sites and thus their potential for ongoing operation and rehabilitation or closure, is the privatisation process. When visiting the Ministry of economy, the mission was informed of the recently complete, current and/or ongoing privatisation process for a number of sites (notably Sasa, Zletovo-Probistip, Taranica and Bucim mines as well as the Veles smelter) while it was stated that environment obligations are part of the tender conditions this was not confirmed by other experts and in general it appears that (as is relatively standard) environmental legacies existing at sites will remain the responsibility of the state. Informants also indicated concerns that the privatisation process may not be substantially improving environmental performance in a number of cases.

Again of importance in Macedonia is the presence of some local actors who appear to have skills and important links to industrial actors who operate in the country. The mission was supplied with details of a number of environmental studies, monitoring work and engineered interventions that indicate that there is a base of environmental engineering skills that can be built upon.

As such, and pursuant to interviews and discussions held in the Republic of Macedonia and cross referencing with information in the Desk Assessment and recent study reports obtained during the conduct of the mission, it is judged that the most important mining and metals processing sites, operations or areas, are those listed in the following descriptive section.

- **Bucim copper mine.** This site located at Radovis in eastern Macedonia is the country’s only major copper mine. It is consistently listed as a major environmental problem for the country with pollution related risks encompassing: heavy metals contamination in water and soil, particulate emissions to air, and (the possibility of) stability concerns in tailings impoundments. As one of the high profile sites in Macedonia, and due to the fact that the site has been visited by this mission, it is possible to provide a detailed description of the Bucim Mine and its environmental concerns. These are included in Box 1 (Annex A).

- **Sasa (lead and zinc mine) at Macedonian Kamenica.** The Sasa lead/zinc mine is located approximately 10 km to the north of the small town of Makedonska Kamenica, in a relatively remote location some 5 km to the west of the Bulgarian border. The mine was opened in 1963 and during the 1990s ore production levels at Sasa were approximately 0.5Mtpa. No ore has been mined since March 2003. The site has a number of significant environmental issue including: atmospheric dust emissions, mine and tailings dam discharges to surface waters, and a tailings landfill that has no environmental safeguards with respect to the lining of its base; the treatment of wastewater discharged from its base; or dust emission controls under windy conditions. In addition, a culvert under the tailings dam failed in 2003 leading to a catastrophic release of tailings. More detailed information regarding the site is included in Box 2 (Annex A).

- **Lojane (former chromium, arsenic, antimony mine) at Kumanovo.** The Lojane Chromium and Antimony Mine was active in the period 1923 till 1979, and antimony and chromium ores were extracted and processed during this time. The mine site, including the remains of the beneficiation plant and the residual waste dump is located north of Kumanovo, near the border with Serbia and Kosovo. Due its position near the border, the mine was in the one of the crisis areas that were most affected by the 2001 ethnic conflict. The site has a number of serious environmental issues related to soil and water pollution and residual hazardous wastes. It is

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28 This final item represents an unresolved concern of the mission consultants related to the position of the Polnica township directly down-valley of the tailings dam. Stability concerns were NOT raised by informants during the visit. It is hoped that this concern can be resolved in the near future.

29 These site notes have been generated after interviews with Mr. Dejan Mirakovski, environmental consultant to the mine and a half day site tour hosted by the Mine Director (Vasyl Borutskyy), the Deputy General Manager (Nikolajco Nikolov) and the Chief engineer (Zivko Gocev). The pit, the processing plant, the tailings dam and the effluent flow sites were viewed during the visit.
currently the subject of a UNDP and ENVSEC site assessment and remediation plans are under development. More detailed information regarding the site is included in Box 4 (Annex A).

- **Zletovo mine (lead and zinc mine) at Probistip/Dobrevo.** Zletovo mine was initially opened in 1947, to provide lead and zinc concentrates for the Veles smelter. The current Zletovo lead/zinc mine is located close to Dobrevo village, approximately 3 km to the north-east of the town of Probistip and 7 km north-west of Zletovo village. The ore processing facility is to the west of Probistip, with the tailings landfill a further 3 km to the south-west of this town. While operations were close in 2001 it is anticipated that they will be re-opened in the near future. The sites associated with this mine have a number of serious environmental concerns associated with them. Not least that heavily contaminated mine waters are discharged into agricultural lands extensive contamination occurs by cadmium, lead and zinc in crops irrigated by river waters below the Zletovo mine and other nearby mines. The ore is processed at the Probistip concentration plant where the tailings storage facility is known to be prone to failure. Notably, in 1975, the tailings dam at Zletovo failed and the lagoon discharged, flooding the downstream villages and agricultural land. The tailings landfill has no environmental safeguards with respect to the lining of its base; the treatment of wastewater discharged from its base; nor dust emission controls under windy conditions; the tailings pond is another very significant risk site. A more detailed description of the mine its environmental concerns are included in Box 3 (Annex A).

- **Zletovo smelter (lead and zinc) at Veles.** The Veles smelter is located on the north-western outskirts of the town of Veles (population of circa 60 000). The main smelter operations were initially opened in 1972-3, an ion exchange cadmium plant was opened in 1979 and other minor processing operations were added in the 1980s. In the 1990s, production levels were approximately 65 000 tonnes zinc, 35 000 tonnes lead and 125 000 tonnes of sulphuric acid by-product. Since 1993, the only part of the plant that has been maintained has been the zinc furnace. It is clear that the emissions from the smelter are contributing to regional atmospheric pollution, but the precise extent of this is as yet uncertain. The River Vardar flows in a south-easterly direction some 0.75km to the east of the smelter and the slag landfill and is affected by effluents from these sites. Extensive impacts on local soils and community health has also been recorded. More detailed information regarding the site is included in Box 6 (Annex A).

- **Toranica (lead and zinc mine) at Kriva Palanka.** The Toranica mine is located approximately 18 km south-east of the town of Kriva Palanka and 2 km west of the Bulgarian border. The mine started commercial production in 1987 and for Macedonia was considered to be a relatively new lead/ zinc facility. At its peak it accounted for approx. 20% of the total Macedonian lead and zinc production. There are a number of environmental concerns associated with the site: In particular, there is extensive metal contamination (by cadmium, lead and zinc) in the river waters downstream of the mine and the tailings impoundment has no environmental safeguards with respect to the lining of its base; the treatment of wastewater discharged from its base; or dust emission controls under windy conditions. A more detailed description of the mine and its environmental concerns are included in Box 5 (Annex A).

- **Silmak ferro-silicon plant (former HEK Jugochrom) at Jegunovce.** At this site, smelting of ferro-alloys took place. A sodium dichromate plant was also reportedly operated at the site. The uncontrolled disposal of waste material from the plant and the improper handling of material containing chromium salts have led to severe chromium contamination of groundwater and soil, including in the vicinity of the River Vardar. In 1982 the plant began monitoring soil and groundwater and the data confirmed contamination of the water by chromium. To address

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30 Ferroalloy refers to various alloys of iron with a high proportion of one or more other element, chromium, manganese or silicon for example. It is used in the production of stainless steels, steels and alloys as a raw material.
this problem the plant designed, installed and financed a groundwater abstraction system, which resulted in the concentrations of Cr$^{6+}$ decreasing by 200-800 mg/l to total contamination levels of 5-15 mg/l. The plant’s target was reportedly 1 mg/l.\textsuperscript{31} Chromium production ceased in 1993 and the building where chromium was produced and used has neither been cleared of chromium nor secured. Significant air pollution from the stacks, notably an estimated 9 000 to 17 000 tons of dust and fly-ash/yr., is the result of an absence of gas cleaning for the plant’s electric furnaces. Further details have not been received.

- **Oslinik lignite mine.** This site is reportedly to be closed. Further details have not been received.

- **Tajmite mine.** Closed ferro-nickel extraction, there is yet no strategy what to do with the mine. Further details have not been received.

\textsuperscript{31} For comparison a UNECE report addressing pollution at the site indicates target and intervention levels for the Netherlands are 0.001 mg/l and 0.03 mg/l.
<table>
<thead>
<tr>
<th>Site or area name</th>
<th>Activity</th>
<th>General description of likely hazards/risks and pollution pathways</th>
<th>Informants</th>
<th>Ref # in DA</th>
</tr>
</thead>
</table>
| Sasa (Kamenica) lead-zinc mine and mill | Lead-Zinc mining and beneficiation | In general, lead-zinc mining and beneficiation leads to concerns with geotechnically unstable tailings wastes that can generate ARD/AMD with a pH 3 containing sulphates, Pb, Zn, Cu, Fe, Zn, Cd. In addition particulates pollution as blown dust and mine water effluents can be an issue.  
Specifically for this site, it is reported that there are problems with poorly contained tailings waste and the results of a recent mass solids release (3-4Mt due to a failed collector pipe under the tailings dam in 2003), emissions of tailings dust to air, and pollution to the Sasa River, which discharges below the tailings dam, and is of poor quality at this stage. The tailings facility has no environmental safeguards with respect to the lining of its base; the treatment of wastewater discharged from its base; or dust emission controls under windy conditions.  
It is assumed that the Sasa is a tributary of the Vardar River. As of third quarter 2006, this site should be operational.                                                                 | B. Nikov (Senior IPPC expert)  
15/5/2006  
Adam Smith report supplied by L. Dika (AS report) | D14, D15, D17 |
| Veles Smelter (MHK Zletovo Pb-Zn) | Lead smelting  
Zinc smelting  
Sulphuric acid production  
Cadmium by ion exchange | In general, concerns for such smelter sites include: toxic solid waste, airborne particulate matter & SO2. Particulate matter: lead/zinc and iron oxides, plus oxides of As, Sb, Cd, Cu, Hg + metallic sulphates. Air emissions for processes with few controls may be of the order of 30 kg Pb or Zn/t lead or zinc produced. Water effluents generally contain Pb, Zn, As, etc. including dissolved and suspended solids, metals, and oil and grease. Discard slag typically contains up to 0.7% lead/zinc and up to 3 tons of solid waste per ton of lead/zinc is produced.  
Specifically for this site, there is clear evidence of soil pollution around the site (agricultural lands) caused by air emissions, significant water pollution, human and animal health effects and uncontained slag waste disposal.  
A fertiliser plant adjacent to the site reportedly also has a gypsum dump site containing radioactive waste material. The NEAP 1996 report also emphasized a waste dump failure risk. The fertiliser plant has not been included in the | B. Nikov  
15/5/2006V. Arsov  
15/5/2006  
AS report | D19, D20, D24 |
<p>| <strong>Bucim</strong> Copper mine and mill | Copper mining, milling and flotation (beneficiation) | In general, copper ore mining and beneficiation produces waste rock and tailings waste. Effluents that can be expected include ARD/AMD from mine workings and waste heaps. Effluent will typically contain metals/pollution such as sulfate, copper, zinc, and cadmium depending on the ore. Specifically for this site, there is a large uncontained waste rock dump of some 120Mt generating ARD, there is a large 80Mt tailings dam that affects local communities with airborne particulate pollution and soils and waters around the site are significantly affected by pollution from the site. AMD from the waste rock dump has a pH of 3 and contains 200-400ppm Cu (clearly visible blue/green tint). Surface water and sediment samples indicate heavy metals and Cu concentrations and mine waters flow onto agricultural lands. It appears that these flows could contribute to cross border pollution to Bulgaria then Greece via Nivicanska River a tributary of the Strumica then Struma, however, the mine is at or near a watershed boundary and it could also flow into the catchment of Bregalnica River, an upper tributary of Vardar River. The stability of the tailings dam has been raised as a concern by one informant to this mission. The tailings facility has no environmental safeguards with respect to the lining of its base and the treatment of wastewater discharged from its base at this time. However, the mine owners are interested in improved environmental management and operate 5 water monitoring stations. They await technical advice to properly and economically treat toxic leachates and effluents. |
| <strong>Zletovo (Probostip)</strong> Lead-Zinc mine and mill | Lead-Zinc mining and beneficiation | See comments above regarding general concerns for pollution from Pb-Zn mining and beneficiation sites. Specifically for this site, the current lead/zinc mine is located close to Dobrivo village, approximately 3 km from Probistip where the ore processing facility is located, with the tailings landfill a further 3 km to the south-west of this town. Both mine and tailings dump affect the Zletovo river by polluting tributaries. This joins the River |</p>
<table>
<thead>
<tr>
<th>Location</th>
<th>Activity Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vardar. Extensive contamination occurs by cadmium, lead and zinc in crops irrigated by river waters below the Zletovo mine and other nearby mines. In addition, there was a serious tailings dam failure at Probištip in 1975 due to poor performance of hydrocyclones and a minor failure was reported to have occurred during the 1980s. The tailings facility has no environmental safeguards with respect to the lining of its base; the treatment of wastewater discharged from its base; or dust emission controls under windy conditions. Zletovo-Dobrevo mine is reportedly to be opened in late 2006.</td>
<td></td>
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</tr>
<tr>
<td>Lojane Chromium &amp; Antimony mine</td>
<td>In general, mining and beneficiation activities of this kind can contribute to unstable tailings impoundments and mine workings, toxic materials in tailings containing arsenic, antimony, base metal sulfides and arsenides. Tails of this kind may include Mg and Ni, etc. Specifically for this site, mining and concentration activities were conducted from 1923 till 1979 but after cessation of activities, the flotation facilities, the open dump site for flotation waste and the production facilities were abandoned without undertaking any conservation measures. This site is located in Northern Macedonia north of Kumanovo and circa 1 million tonnes toxic mining tailings are deposited near the railway and the very frequent border crossing at Tabanovce. Tailings containing arsenic, antimony and other hazardous substances. Residual infrastructure and chemicals litter the site. The tailings facility has no environmental safeguards with respect to the lining of its base; the treatment of wastewater discharged from its base; or dust emission controls under windy conditions. In addition a waterway flows directly through/adjacent to the tails dump. The site has recently been the subject of a UNDP financed investigation and remediation plans for the site are being developed.</td>
<td>L. Dika/D. Mirakovski 12/5/2006 A. Kodzoman 12/5/2006 B. Nikov 15/5/2006 AS report.</td>
</tr>
<tr>
<td>Jegunovce – Jugochrom ferro-alloy plant</td>
<td>In general, smelting activities of this kind generate pollution via emission of Ni, Cr, Fe, Cu and Zn and total ferrochrome dust to atmosphere. Environmental concerns also include depositional soil contamination, waste/slag dumps and process chemical pollution. These pollution vectors can (do) also contribute to surface and groundwater pollution.</td>
<td>B. Nikov 15/5/2006</td>
</tr>
</tbody>
</table>
pollution.

Specifically for this site, the uncontrolled disposal of waste material from the plant and the improper handling of material containing chromium salts have led to severe chromium contamination of groundwater and soil. To address this problem the plant designed, installed and financed a groundwater treatment system, which resulted in reductions of concentrations of $\text{Cr}^{6+}$. However, they reportedly remain high above acceptable levels. Dichromate production ceased in 1993 and the production buildings have not been cleared of toxic materials nor secured. Significant air pollution from the stacks are reported when the plant operates.

The site is located near Tetovo in NW Macedonia. South of border to Kosovo Territory, on the upper Vardar river, in Macedonia and bordered by high mountains.

| Toranica | Lead-zinc mine and mill (Kriva Palanka) | Lead-Zinc mining and beneficiation | See comments above regarding general concerns for pollution from Pb-Zn mining and beneficiation sites.

Specifically for this site, small communities are affected by the tailings dam, snowmelt and heavy runs cause run-off from the tailings disposal area to be washed downstream, min adits discharge AMD and are contaminated with oils and heavy metals. Further, there is extensive metal contamination (by cadmium, lead and zinc in particular) in the river waters downstream of the mine. Moreover, the tailings storage facility has no environmental safeguards with respect to the lining of its base; the treatment of wastewater discharged from its base; or dust emission controls under windy conditions

The mine is located at Kriva Palanka in far north eastern Macedonia and is currently the subject privatisation processes.

| V. Arsov | 15/5/2006 AS report | D18 |
Figure 4. Key industrial polluters and hotspots in the FYR of Macedonia

2.4 Republic of Serbia Hotspots

The mining industry in the Republic of Serbia represents a vital component of the economy in general. The Ministry of Energy and Mining lists 180 mining areas: The list of mines can be found at: www.mem.sr.gov.yu[PCP1].

Primary minerals extracted in Serbia include copper; coal; lead-zinc with associated gold, silver, copper, bismuth and cadmium; red bauxite and modest quantities of oil and gas. Prior to the conflicts of the 1990s, the country represented a significant proportion of European capacity for refined aluminium, copper lead, silver and zinc.

Rudarsko Topionicki Bazen’s (RTB) Bor mining, beneficiation, and smelting complex in Serbia accounts for all of Serbia and Montenegro’s total mine output of copper from its Bor, Cerovo, Majdanpek, and Veliki Krivelj open pit mines. Secondary precious metal refining at the complex is also substantial. Importantly in the context of this study, continued operations can be expected in the Bor region – as recently as 1994, a major 700 Mt copper ore (4 Mt copper) deposit was discovered.

Lead and zinc deposits and occurrences are mainly located in the regions of Ljubisnje and Bjelasica, with associated gold, silver, copper, bismuth and cadmium.

Serbia also hosts steel and magnesium metal production – the country’s major steel production site being the Sartid integrated steel mill. This facility was upgraded in 1999. Magnesium metal production takes place (has taken place) at the Bela Stena magnesium plant.

Moreover, electricity is predominantly produced by thermal stations fired with lignite obtained from extensive open cast mines. The largest facilities are in the Kolubara area. As such, Serbia has a long history of mining and an extensive list of mining areas – these are indicated in Figure 5 overleaf.

The privatisation process has started (especially for the non-metallic industry) but is complicated. A Serbian Strategy for Mining will be ready in 2008 (supported by WB). Mining (as part of the natural resources) will be addressed within the upcoming National Environment Strategy and NEAP are under preparation (EAR support).
Figure 5. Mining areas in Serbia

The candidate hotspots in Serbia as identified in the DA were principally associated with antimony, lead and zinc mining, processing, and smelting; and with very large operations for the mining, processing, and smelting of copper.

8 minerals related operations were listed as potential hotspots (both national and/or transboundary risk hotspots) in Serbia in that report.

In the mission conducted to support this analysis, operations based in eight (8) mining and metals related sites have been discussed and brought forward by informants as being of prime importance or of prime interest for action (6 of these listed in the DA priorities). Two of the DA sites (the antimony mines in Rajiceva and the Sabac electrolytic zinc smelter and refinery) were not indicated to be problematical or of priority by informants.
The Consultants were given a **government short list** (Ministry for Science and Environment Protection in coordination with the Ministry for Agriculture and Water Management) with the following sites:

1. RBB copper mines in **Bor**, including Bor, Veliki Krivelj and Cerovo mines
2. RBM copper mines in **Majdanpek**
3. **Kolubara** mine (open pits of lignite coal)
4. **Kostolac** mine
5. **Trepca** mine Kosovo Mitrovica
6. **Ljubovija** lead and zinc mine
7. **Zajaca** antimony mine.

Again of importance in Serbia is the presence of some local actors who appear to have skills and important links to industrial actors who operate in the country. The Consultants were supplied with details of a number of environmental studies, monitoring work and engineered interventions that indicate that there is a base of environmental engineering skills that can be built upon. Moreover, a working relationship between these actors, UNDP (both in Serbia and regionally) and a number of the key industrial sites appears to have been developed.

As such, and pursuant to interviews and discussions held in the Republic of Serbia and cross referencing with information in the Desk Assessment it is judged that the most important mining and metals processing sites, operations or areas, are:

- **Bor copper mines and smelting complex.** This suite of sites appears in every list and is brought forward by all informants in the region. As such, it represents arguably, the most serious environmental legacy in the region. Extreme pollution is released to the Borska, Timok and Kriveljska Rivers with the Danube River as the final receiving river. There is also a high risk of catastrophic failure in one or more engineered structures containing tailings. Extreme pollution is also released to air, thus affecting human and animal health seriously to catastrophically. The complex is currently undergoing a privatisation process (in parts) by the Ministry for Industry. There is strong engagement of the local municipality (LEAP under preparation). More mine specific information is included in Figure 6, and in Box 7 (Annex A).

- **Veliki Krivelj mine and mill.** This site is also part of the Bor complex and pollutes the Kriveljska River, Timok River and then the Danube (final recipient). This site hosts an engineered structure with a high probability of failure – the Veliki Krivelj tailings dam is located in the Kriveljska River valley, and has been created by the deviation of river (tunnel and collector) and by damming the river downstream and upstream. This collector is damaged and may fail, then releasing toxic substances to the river system. See also Figure 6, and Box 7(Annex A) for more detailed information, see Annex figure 18 for indications of pollution severity.

- **Cerovo mine.** This smaller copper mine and mill are also part of the Bor complex. Mine waters are heavily contaminated with copper. See also Figure 6, and Box 7 (Annex A) for more detailed information.

- **Veliki Majdan lead and zinc mine.** These operations are situated in the vicinity of Ljubovija close to River Drina. Apart from the usual environmental problems associated with Pb-Zn mines in Serbia, this site has been involved in at least one serious release of tailings. At the beginning of summer in 2001, the dam at the flotation tailing deposits was significantly damaged due to a flood. Part of the dam made of flotation waste was swept into the Crnacka
rika and then into Drina a few kilometres downstream. Tests carried out afterwards proved the presence of heavy metals above tolerable limit in the water of the Drina.

- **Zajaca smelter, mill and mine.** This operation, where antimony mining, beneficiation and smelting took place, is apparently close to Drina River. Mining operations were conducted underground and serious AMD and high concentrations of heavy metals in effluents are reported. Further details regarding this site have not been received.

- **Lece Pb-Zn mine and mill.** This site was listed as important by informants but insufficient data have been gathered to pass further comment. In general, operations of this kind in the region have AMD issues and may have tailings facilities that pose environmental risks. The site is apparently located adjacent to a tributary to the Southern Morava that flows through Serbia to the Danube.

- **Ljubovilja Pb-Zn mine and mill.** This site was listed as important by informants but insufficient data has been gathered on this site to pass further comment. Pollution of surface waters and groundwater was indicated. In particular, the overburden and waste rock disposal is of concern. It is located close to the Drina River and is directly influencing it.

- **Kolubara lignite pits.** This site was listed as important by informants. There are reportedly problems with particulates, phenols etc. in waste waters from the coal drying facility, problems with ash deposits, abandoned mine pits, un-revegetated areas and so forth. The site is adjacent to the Kolubara River, a tributary to the lower Sava.

- **Kostolac lignite pits.** There are reportedly problems with particulates, abandoned mine pits, un-revegetated areas and so forth. Groundwater extraction for open cast exploitation (2 Mm$^3$ water per Mt lignite) results in supply problems for local communities.
Figure 6. Mine layout within the Bor Copper Mines Area

Figure 7. Smelter emissions over the city of Bor.

Photo courtesy of D. Milenic
Figure 8. Bor smelter.

Photo courtesy of UNEP Geneva

Table 2-4. Serbia sites of priority concern

<table>
<thead>
<tr>
<th>Site or area name</th>
<th>Activity</th>
<th>General description of likely hazards/risks and pollution pathways</th>
<th>Informants</th>
<th>Ref # in DA</th>
</tr>
</thead>
</table>
| Bor mines, mill, smelter & refinery | Copper mining, beneficiation, smelting & refining  
Including: mining; production of Cu concentrate, pyrites, magnetite and Mo; smelting; refining of Cu, noble and rare metals; production of sulfuric acid, Cu billets and blocks, Cu alloys and alloy-based casts. | Bor complex of 8 mines, mill, smelter and refinery. The full suite of possible impacts for these industrial activities is experienced by the City of Bor and its environs. In general for this type of site, severe air pollution is generated by mining and smelting operations and toxic dust emissions from tailings impoundments. Extensive land and soil degradation, including loss of agricultural land and destruction of local buildings from failed pit slopes can be expected. Specifically for this site, potential collapse of the concrete culvert/collector running beneath flotation tailings identified as most urgent key intervention required for site (estimated 250 000 EUR for short-term risk reduction without current donor). Heavily contaminated industrial wastewater discharged into local receiving waters. PCB-containing capacitors buried on the surface of an uncontrolled industrial landfill. Specifically for smelting operations: environmental issues with solid waste slag, dissolved and suspended solids of Cu, Cd, Pb, Zn, As, Hg residues (lime or Al(OH)x), fluorides, spent electrolytic baths, slimes recovery, spent acid, wastewater treatment sludge. With particulate emissions containing Cu; Cu/Fe compounds; sulfides, sulfates, oxides, chlorides; fluorides of As, Sb, Cd, Pb, Hg, Zn and more. Inadequate smelting technology at the copper smelter and refinery are reportedly leading to ongoing severe problems with sulphur and arsenic to air. Specifically for mining and beneficiation, Serious problems with ARD/AMD from mine workings and waste heaps with a pH of 3 or lower. This contains high to extreme concentration of sulfates, Cu, Fe, Pb, Zn, Cd, and more depending on the contents of the ore. Both surface and groundwaters are seriously affected. Significant levels of dust are generated from waste dumps, extraction activities, crushing, ore beneficiation, transport and traffic, and wind-borne losses. These affect both the urban area and agricultural land. The Bor open cast pit, Jama underground mine, Krivelj pit, Cerovo pit were given special mention by informants. | Ministry for Science & Environmental Protection (MFSEP) | E19, E20, E22 |
<p>| Majdanpek mine and mill | Copper mining &amp; beneficiation | See the impacts for mining and beneficiation of copper as listed above. This site has also been subject to previous tailings releases of extremely serious nature to the Pek River, then Danube. In 1974 the entire River Pek was reportedly &quot;wiped out&quot; by a spill involving 7 Mm³ tailings material and cyanide contaminated waters. | MFSEP | E23 |</p>
<table>
<thead>
<tr>
<th>Site</th>
<th>Type</th>
<th>Notes</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Veliki Krivelj</em> – mine &amp; mill</td>
<td>Copper mining &amp; beneficiation</td>
<td>As above for copper mining and beneficiation for Bor. This site affects the Kriveljska River, Timok River and then the Danube (final recipient). Note that the Veliki Krivelj operations are “part of Bor” – see Figure 6. The collector that</td>
<td></td>
</tr>
<tr>
<td><em>Cerovo</em> mine and mill</td>
<td>Copper mining &amp; beneficiation</td>
<td>As above for copper mining and beneficiation. This site is directly upstream of Krivelj. Note that the Cerovo operations are “part of Bor” – see Figure 6</td>
<td>MFSEP</td>
</tr>
<tr>
<td><em>Zajaca</em> smelter - Zajaca mill - Zajaca mine</td>
<td>Antimony metal mining, beneficiation and smelting</td>
<td>Generally for mining and beneficiation operations of this kind: There may be problems with unstable workings and overburden storages: tailings wastes containing As, Sb, base metal sulfides and arsenides, even Mg, Ni etc; wastes containing As, Sb, base metal sulfides and arsenides, even Mg, Ni etc. to water/gwater, and the risk of a mass release of solids. Generally for smelter sites of this type see notes on smelter emissions above. Specifically for this site: It is apparently close to the Drina River, it is an underground mine, and it has serious AMD and high concentrations of heavy metals in effluents.</td>
<td>MFSEP</td>
</tr>
<tr>
<td><em>Krupanj - Veliki Majdan</em> Mine and mill</td>
<td>Pb-Zn mining &amp; beneficiation</td>
<td>In general, lead-zinc mining and beneficiation leads to concerns with geotechnically unstable tailings wastes that can generate ARD/AMD with a pH 3 containing sulphates, Pb, Zn, Cu, Fe, Zn, Cd. In addition particulates pollution as blown dust and mine water effluents can be an issue. Specifically for this site, Previous serious release events have been documented for this site close to Ljubovija. Apart from the fact that previous serious release events to the River Drina have been documented, insufficient data has been gathered on this site to pass further comment. See case box (Annex A).</td>
<td>E24</td>
</tr>
<tr>
<td><em>Lece</em></td>
<td>Pb-Zn mining &amp; beneficiation</td>
<td>See above for typical environmental issues for Pb-Zn mining and beneficiation. Specifically for this site, although no specific data on this site has been received apart from the fact that it is a priority site, there appear to be the similar environmental issues to those listed above. The site is apparently located adjacent to a tributary to the Southern Morava that flows through Serbia to the Danube.</td>
<td>Inferred as probable by Ministry of Agricult. and Water Mgmt. (MoAWM) In text only</td>
</tr>
<tr>
<td><em>Ljubovilja</em> mine</td>
<td>Pb-Zn mining &amp; beneficiation</td>
<td>See above for typical environmental issues for Pb-Zn mining and beneficiation. Specifically for this site, pollution of surface waters and groundwater was indicated.</td>
<td>MFSEP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not listed</td>
<td></td>
</tr>
</tbody>
</table>
particular, the overburden and waste rock disposal is of concern. It is located close to the Drina River and is directly influencing it.

The site was listed as important by informants. Insufficient data has been gathered on this site to pass further comment.

| Kolubara lignite pits | In general, environmental concerns for these sorts of operations include: massive disturbances of large areas of land and possible disruption of surface and groundwater patterns; AMD; fugitive dust; uncontrolled disposal of overburden and waste rock; methane generation and release possible under certain geological conditions; and the release of highly saline or highly acidic waters. Coal or lignite beneficiation plants produce large volumes of tailings and solid wastes; generate large quantities of dust and can also generate effluents polluted with phenolics etc. Specifically for this site, there are reportedly problems with particulates, phenols etc. in waste waters from the coal drying facility, problems with ash deposits, abandoned mine pits, unrevegetated areas and so forth. The site is adjacent to the Kolubara river a tributary to the lower Sava. Site listed as important by informants. Insufficient data has been gathered on this site to pass further comment. | MFSEP | Not listed |

| Kostolac lignite pits | Specifically for this site, there are reportedly problems with particulates, abandoned mine pits, unrevegetated areas and so forth. Groundwater extraction for open cast exploitation results in supply problems for local communities. Site listed as important by informants. Insufficient data has been gathered on this site to pass further comment. | MFSEP | Not listed |
Figure 9. 2004 Map showing some indicated sites of concern in Serbia
2.5 Republic of Montenegro Hotspots

Red bauxite and coal represent the major strategic mineral raw materials in Montenegro. Bauxite mining, alumina refining, and aluminium smelting are located chiefly in Montenegro. The country’s principal bauxite mines are located in Montenegro’s Niksic area. Primary aluminium was produced at the smelting facilities on the outskirts of Podgorica. This smelter has a capacity to produce over 100 000 t/yr primary aluminium. Montenegro also hosts some lead zinc deposits, at least one that may become operational again.

Mining is concentrated in several sites of the small country, with bauxite exploitations most affecting the natural landscape visually but with lead and zinc mines leaving serious environmental legacies. Gravel and sand excavations are also major problems in the south of the country. Privatisation is already advanced.

In 2005, important legal framework (EIA, SEA, waste management and environment pollution/IPPC laws) was endorsed and will enter into force in 2008. The government still lacks capacities to implement this framework. A new EPA was recently opened.

Candidate hotspots in the Republic of Montenegro identified in the DA were associated with the full aluminium process chain and with the mining, processing, and smelting of lead and zinc. Four (4) minerals related operations were listed as potential hotspots (both national and/or transboundary) in Montenegro in that report.

In the mission conducted in May 2006 to support this analysis, operations based in three (3) mining and metals related sites have been discussed and brought forward by informants as being of prime importance or of prime interest for action. Two (2) more sites/areas received mention and require further investigation. All the priority sites were listed in the DA priority list. One DA site (Brskovo mine) was removed from the list as informants maintained that the site is satisfactorily revegetated and closed.34

Further and relevant to this mission, governmental informants indicated that there are major challenges with capacity in the country. While SEA, EIA, hazardous waste management and IPPC laws are endorsed (and are to be in force in 2008); enforcement capacities remain very weak. This said, a new EPA organisation has been opened with EAR funds.

As such, and pursuant to interviews and discussions held in the Republic of Montenegro and cross referencing with information in the Desk Assessment it is judged that the most important mining and metals processing sites, operations or areas, are those listed below.

Mojkovac (Zn, Pb) tailings storage facility. This site, the storage facility for material from the closed Brskovo mine, is located directly on the Tara river and essentially within the town of Mojkovac. The Tara River and its gorges are UNESCO World Heritage Listed. While the Ministry of Environmental Protection and Physical Planning has prepared a detailed remediation project (>5M Euros) and it is understood that Phase I of the remediation is now underway, there may be a number of political issues of particular interest to the ENVSEC/ADA project35 – See also Annex Figure 23 and Box 9 (Annex A) for more detailed information.

Red mud storage facilities at Podgorica Alumina/Aluminium plant. The storage facilities for “red muds” (residues of alumina production from bauxite) are located 10 km from Podgorica in the Zeta Valley upstream of Lake Skutari. More than 7 Mt of red mud are accumulated at two

34 The mission consultants however, would reserve judgement on AMD effluents from the site until further verification of this is received.
35 Reportedly, the community is both “anti-government” and distrustful of both the funding and execution of remediation works.
conjoined disposal sites. Both storages leak contamination to groundwater and the effects have been detected in the Lake. Apart from the serious problems with leachate with a pH as high as 13 and containing significant fluorine, phenolics, arsenic, cyanides; some 10 tonnes of PCBs were disposed of in the facility and have contaminated groundwater. There are conflicting reports regarding the current status of these extremely hazardous pollutants. Since 2005, the plant has been owned by the Russian based company RUSAL. See also Annex Figure 25 and Box 10 (Annex A) for more detailed information.

**Supla Stijena Pb-Zn mine and mill.** At present, the mines and flotation facilities are closed and approximately 7 Mt (1.2 Mt?) of toxic tailings are deposited on the bank of the River Cehotina. As there are significant resources left in the deposit, the possibility remains that the mine will be opened again. At the time of the mission a tender call was being processed for a study to define rehabilitation, reopening or closure options for the site(s). Of particular interest for rehabilitation works is that trace metals in the tailings are reportedly of commercial interest (germanium, uranium) indicating that several pathways for making safe and/or remediating the tails facility may be open in the future.

**Other sites of concern:**

- **Pljevlja coal mining area.** This site was raised as a concern by two groups of informants. The area encompasses several sites: the Borovica coal mine which requires rehabilitation and revegetation; the Potrlica lignite cast near Cehotina river that reportedly has reserves for another 50 years but has significant environmental degradation; and the thermal power plant ash dump at Maljevac that causes alkali pollution, dust and is a structural risk. Added to these concerns, the town is subject to severe air pollution due to temperature inversions. Further details regarding this site have not been received.

- **Niksic steel plant.** This site reportedly has caused serious soil pollution, has released phenolic water to the Zeta and then Moraca Rivers, which has resulted in fish kills. The plant also reportedly generates very significant quantities of dust containing PCB, PCHC and dioxins. The plant was purchased by Russians and reopened but has still operated without acceptable air pollution controls. At the time of the May 2006 mission, a search for a new investor was underway. Further details regarding this site have not been received.
Table 2.5. Montenegro sites of priority concern

<table>
<thead>
<tr>
<th>Site or area name</th>
<th>Activity</th>
<th>General description of likely hazards/risks and pollution pathways</th>
<th>Informants</th>
<th>Ref # in DA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suplja Stijena mine and mill</td>
<td>Pb-Zn mining &amp; beneficiation</td>
<td>In general, lead-zinc mining and beneficiation leads to concerns with geotechnically unstable tailings wastes that can generate ARD/AMD with a pH 3 containing sulphates, Pb, Zn, Cu, Fe, Zn, Cd. In addition particulates pollution as blown dust and mine water effluents can be an issue. Specifically for this site, it is reported that the principle issues are related to flotation tailings. About 1.2 million tons of toxic tailings are deposited at the landfill, which is located on the bank of the River Cehotina, a tributary to the Drina River. This landfill is neither monitored nor maintained. Heavy metals are washed out by rain and migrate into groundwater and into the river. There is also concern with the structural status of the impoundment.</td>
<td>For MNE. in text only. Page 113 Listed in Kosovo D24,D25</td>
<td></td>
</tr>
<tr>
<td>Mojkovac mill</td>
<td>(former) Pb-Zn beneficiation plant</td>
<td>See above for typical environmental issues for Pb-Zn mining and beneficiation. Specifically for this site, it is reported that stage 1 of remediation works is underway at site. Circa 3.5 Mt toxic mining and processing waste Tailings pond occupies 20 ha, with an average depth of 12 m, (807.5 m ASL), and also receives overflow from the municipal sewerage system. The dump is situated on the bank of the Tara River, which downstream becomes part of the Durmitor national park and then crosses the border to BiH. The Tara River is protected by an earth-gravel dam, reinforced by concrete slabs. Water from the sites has a pH of up to 12 and is contaminated by sulphides and sulphates, radioactive substances, heavy and other toxic metals and pesticides.</td>
<td>D13, D14</td>
<td></td>
</tr>
<tr>
<td>Podgorica – Alumina plant, Aluminium smelter and rolling mill(s)</td>
<td>Alumina refining, Aluminium reduction (smelting) and downstream metal processing (rolling)</td>
<td>In general, environmental concerns for alumina refineries and smelters include uncontained and unprotected wastes, residues and chemicals, particularly red mud wastes and spent pot linings (SPL) etc. from smelting operations Red mud dams often generated very high pH leachates (circa pH 12) and the geotechnical stability of red mud storage can be an issue. There is often an acute risk of groundwater and surface water pollution from associated with SPL. Specifically for this site, it is reported that both of the red mud storage facilities (one lined, one unlined) are leaking and that codisposal of toxic residues from the smelter operations and PCBs from transformers has led to leachate pollution containing a</td>
<td>D4</td>
<td></td>
</tr>
</tbody>
</table>
A suite of toxics including: PCBs, phenols, mercury-containing waste, fluorides, polyaromatic hydrocarbons (PAHs), fluorine gases, PAH coke residues, cyanides and more. In addition, contaminated groundwater has been shown to have entered Lake Skadar (shared with Albania) and concentrations of PCBs have been confirmed in the biological cycle (milk, eggs etc.).

| **Pljevlja coal mining area** | Lignite mining  
Coal mining  
Thermal power plant  
Ash disposal | **In general**, environmental concerns for these sorts of operations include: massive disturbances of large areas of land and possible disruption of surface and groundwater patterns; AMD; fugitive dust; uncontrolled disposal of overburden and waste rock; methane generation and release possible under certain geological conditions; and the release of highly saline or highly acidic waters. Coal or lignite beneficiation plants produce large volumes of tailings and solid wastes; generate large quantities of dust and can also generate effluents polluted with phenolics etc.  
**Specifically for this site**, it is reported that several sites in this area have considerable environmental concerns, these include: the Borovica coal mine which requires rehabilitation and revegetation; the Potrica lignite cast near Cehotina river that has significant environmental degradation; and the thermal powerplant ash dump at Maljevac that causes alkali pollution, dust and is a structural risk. No additional information has been received on this site. | Not listed |
| **Niksic steel plant** | Iron and steel smelting | **In general**, environmental concerns for steel plants include particulate emissions and slag from blast furnaces; volatiles including materials released ammonia, benzol, xylene, toluene, tar, pitch and tar acids from coking operations; and particulate emissions from sintering plants.  
**Specifically for this site**, the plant has caused serious soil pollution and has released phenolic water to the Zeta and then Moraca River. The plant also reportedly generates very significant quantities of dust containing PCB, PCHC and dioxins. No additional information has been received on this site. | Not listed |
3 Mission results and conclusions

The assessments undertaken in 2004 and 2006 allow a number of qualified conclusions to be drawn that are based on the main criteria for selection and prioritisation chosen for this ADA/UNEP project (cf. chapter 1.1. on page 4). These include:

- Identification, delineation and cataloguing of mineral resource-related sites that pose substantial transboundary risk to the environment, public health and safety, and to the regional socio-political stability in SEE;

- Development of policy and technical options suitable for the region and selection of demonstrations or pilot activities, in particular focusing on innovative, local and cost-efficient risk reduction and management measures;

- Identification of five hotspots requiring follow-up through risk mitigation as well as emergency measures;

- Building of capacities to address problems at a regional and local level, including tools for early warning, civil protection and conflict resolution;

- Local capacity building for early warning, conflict resolution and emergency response, reaching international (EU) standards.

The conclusions presented here are considered the best possible within the significant limitations in place upon the assessment work (within the given conditions: see Section 1.3 on page 1). As such, these should still be considered to be open to change. Justifying a certain ranking and selection of pilot remediation sites requires further specific technical discussions and, in particular, field checks.

It is stressed that the final selection of sites is not likely to be based just upon quantitative estimates of the relative harm that the location may be inflicting upon the environment or communities. Rather, it is considered that a number of other criteria will be very important. These are discussed briefly below.

3.1 Additional parameters for short-listing sites

An important task at this project stage is the reduction of the long list of inventoried sites to a "short list" of sites that are candidates for demonstration and/or pilot activities. This new selection is based on a number of parameters related to the anticipated usefulness or practicality of engaging in work at a site. Such “soft site selection parameters” are that the site:

- Be representative of the environmental and technical problems of the mining activities in SEE
- Pose a significant environment risk and/or impact (pollution), if “possible” of a transboundary dimension
- Have a high local ranking and government interest to mitigate the site problem
- Be supported by existing local institutions capable of working immediately or in the short term on problem mitigation
- Have relatively good accessibility and visibility (particularly for demonstration sites).

Sites recommended for further examination and eventual project activities

The following sites are considered to be most relevant and interesting to work with in SEE.- It should be noted that there is no ranking inferred or intended in this list. Moreover, the indicated “possible” activities related to the site are indicative only and are intended to promote discussion. For the majority of sites, there currently remains insufficient data, on either site physical
parameters or desired activities of the key local stakeholders, for definitive suggestions to be made of remedial activities.

Table 3-1. Sites short-listed for further assessment

<table>
<thead>
<tr>
<th>Site</th>
<th>Country or territory</th>
<th>Main character</th>
<th>Asset / comment</th>
<th>Possible ENVSEC/ADA activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Elbasan</td>
<td>S ALB</td>
<td>Smelter complex with large metallurgy waste; dump polluting Shkumbini river</td>
<td>Most highly prioritised ALB minerals location</td>
<td>Assessment and delineation of risk/impact</td>
</tr>
<tr>
<td>2. Albanian copper mining areas</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1 Rubic &amp; Rreshen</td>
<td>N ALB</td>
<td>Copper mining waste located very close to Fani River</td>
<td>Complex area and lack of data; “best” site or area still to be identified</td>
<td>Feasibility assessment of Cu rich tailings reprocessing and safe disposal away from riverbanks.</td>
</tr>
<tr>
<td>2.2 Kurbnesh</td>
<td>N ALB</td>
<td>Copper mining area in the upper Mati catchment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3 Fushe-Arrez</td>
<td>N ALB</td>
<td>Largest copper mining and beneficiation complex on Fani river</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.4 Kukes / Gjejan</td>
<td>NE ALB</td>
<td>Mine and copper smelter on Middle Drini river, including the dumps of Kalimash and Repsi mines</td>
<td>High priority for ALB government Cu smelter is likely to have similar but less serious issues to Bor.</td>
<td>As above for tailings.</td>
</tr>
<tr>
<td>3. Srebrenica</td>
<td>BiH-RS</td>
<td>Pb-Zn mine and beneficiation mill near middle Drina (transboundary to SRB)</td>
<td>Site located within the municipality; spa activities previously associated with springs in area</td>
<td>Assessment or remediation of mine waters.</td>
</tr>
<tr>
<td>4. Vares</td>
<td>BiH-Fed</td>
<td>Pb-Zn mining and beneficiation; contaminated mine lake</td>
<td>Close to Sarajevo; nearby culture tourist activities and farming; potential for mining heritage site(s)</td>
<td>Related to mine pollution risk amelioration; assessment of social or tourism projects.</td>
</tr>
<tr>
<td>5. Bucim</td>
<td>MAK</td>
<td>Copper mine (leachate from waste rock heap and tailing dam)</td>
<td>New owner is ready to remediate</td>
<td>Support demonstration of novel water treatment(s).</td>
</tr>
<tr>
<td>6. Probistip &amp; Dobrevo</td>
<td>MAK</td>
<td>Lead zinc mine releasing contaminated waters; tailings dam that has failed at least twice</td>
<td>Extensive (chronic) land contamination from waters and tailings releases contaminated with heavy metals</td>
<td>Assessment of widespread chronic soil pollution (irrigated farm lands); potential for phyto-remediation projects; water cleaning wetlands; community spill preparedness/learning</td>
</tr>
<tr>
<td>7. Sasa</td>
<td>MAK</td>
<td>Lead zinc tailings dam</td>
<td>Site of recent serious tailings release and clean-up</td>
<td>Documentation of risk reduction works and post-clean-up status for spill site; community spill preparedness &amp; lessons project</td>
</tr>
<tr>
<td>--------------</td>
<td>-----</td>
<td>----------------------</td>
<td>---------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>8. Lojane</td>
<td>MAK</td>
<td>Mining and beneficiation of chromium and antimony, unstable tailings</td>
<td>UNDP works commenced. Donor fund search still underway</td>
<td>Support to UNDP and consultants; capture knowledge for dissemination</td>
</tr>
<tr>
<td>9. Bor mines including Bor, Veliki Krivelj &amp; Cerovo</td>
<td>SRB</td>
<td>Complex of 8 mines, mill, smelter and refinery / Cu mining.</td>
<td>Top SRB spot; strong interest of municipality. Extremely complex site. All conceivable problems present. Draft proposal(s) already under development with UNDP.</td>
<td>Assessment and delineation of risk/impact; initial scoping of risk reduction measures; demonstration of novel water treatments; community spill preparedness &amp; learning project.</td>
</tr>
<tr>
<td>10. Majdanpek</td>
<td>SRB</td>
<td>Copper mining and beneficiation</td>
<td>1974 River Pek spill (tailings material and cyanide contaminated waters)</td>
<td>River studies for residual pollution from spills and pollutant fate – understanding river recovery; community spill preparedness.</td>
</tr>
<tr>
<td>11. Krupanj - Veliki Majdan</td>
<td>SRB</td>
<td>Pb-Zn mining and beneficiation</td>
<td>2001 tailings release</td>
<td>River studies for residual pollution from spills and pollutant fate</td>
</tr>
<tr>
<td>12. Kolubara</td>
<td>SRB</td>
<td>Lignite mine (3 open casts) and ash deposits on Kolubara (Sava) river</td>
<td>Pilot WFD area (for SRB within Sava and Danube basin)</td>
<td>Scoping of innovative ash deposit stabilisation or re-vegetation works.</td>
</tr>
<tr>
<td>13. Suplja Stena</td>
<td>MNE</td>
<td>Pb-Zn beneficiation mill and mine; Dump on Cehotina River(^{36}) in very bad state</td>
<td>Tailings are deposited beside River Cehotina.</td>
<td>Short term risk amelioration; dump assessment reprocessing feasibility study.</td>
</tr>
</tbody>
</table>

This first ADA/UNEP short list “excludes” a number of sites of serious pollution presented within this study as well as sites that have been the topic of earlier ENVSEC discussions and documentation. Reasons for removing these sites from further direct ENVSEC/ADA activities are provided in the table 3.2 below.

In a number of cases it is noted that there is likely to be value in this project maintaining “contact” with eventual projects at the sites (thus monitoring the work of others on the sites).

\(^{36}\) Some texts indicate that the Lim River is affected.
Table 3-2. Sites where ADA/UNEP project action is currently NOT recommended

<table>
<thead>
<tr>
<th>“De-selected” Site</th>
<th>Country or territory</th>
<th>Main character</th>
<th>Reason for NOT short-listing</th>
<th>Possible ENVSEC / ADA activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pogradec</td>
<td>ALB</td>
<td>CrNi crusher deposits leaking into lake Ohrid</td>
<td>Site is already part of a WB-GEF project</td>
<td>Assess current status and monitor progress</td>
</tr>
<tr>
<td>Tuzla</td>
<td>BiH</td>
<td>Lignite mine impacts</td>
<td>Not listed as a serious pollution area; main focus of proposal is social</td>
<td>No ADA/UNEP action proposed at present</td>
</tr>
<tr>
<td>Mojkovac</td>
<td>MNE</td>
<td>Poorly contained and leaking tailings into nearby Tara River</td>
<td>Rehabilitation ongoing via CZ project</td>
<td>Monitor activities and consider as demonstration site</td>
</tr>
<tr>
<td>Podgorica Aluminium plant</td>
<td>MNE</td>
<td>Unprotected wastes (red mud with co-disposed smelter wastes and PCBs)</td>
<td>Site is extremely large and relatively unique in the region</td>
<td>Monitor activities, in particular special groundwater programmes.</td>
</tr>
<tr>
<td>Veles Smelter</td>
<td>MNE</td>
<td>Uncontrolled dumping of metallurgical slags and local depositional soil pollution.</td>
<td>Appears to be less critical than other smelter sites in region with similar problems.</td>
<td>Monitor national activities. Transfer knowledge from other sites.</td>
</tr>
</tbody>
</table>

The exclusion of a site from the shortlist above does not indicate that there would be no significant environmental or health problem associated with it. However, it is necessary to focus on a more limited number of locations. Further, it has been necessary to seek to cover a suite of different types of environmental challenges within the shortlist. Reasons for exclusion include: that other sites better fit to the criteria applied here for demonstration or pilot value; that other sources of funding (or economic actors) are available to rehabilitate them or commence works upon them in some manner; that a similar site has been selected from another location and duplication is not needed or desirable.

It should be noted that a number of donors (WB, UNDP, EU, bilateral donors etc.) are active in the area and are already engaged in site assessment, mitigation and remediation. For some sites and urgent problems, concrete measures were already identified but a donor is still to be found (e.g. activities at Bor and Lojane). In Macedonia, new solutions for 15 hot spots (some related to mining) are expected from new EU feasibility studies that are currently being tendered; results are expected for spring 2007. It is important that the character and impacts of related measures in those sites should be compared with the identified ADA/UNEP risk and pollution reduction needs. Moreover, it is important that ADA/UNEP work and actors be informed, or keep themselves informed of the ongoing projects of other organisations. This work has clearly noted a disjointed approach to this problem area in the region.

### 3.2 Capacity-related Issues

Besides action needed at the sites there is also work required to ensure that capacity building and learning take place in the region. This has significant potential to enhance the ability of national agencies and mines inspectorates to deal with the legacy of mining sites in the region. Further, such works can help to start the process required to ensure that new mining projects are based on sound social and environment and security principles.

It is considered that the ENVSEC initiative and this ADA/UNEP project should apply a combination of capacity-building tools to achieve such objectives. These can include: knowledge transfer activities from experienced jurisdictions and industry experts, case study analysis, regional experience-sharing workshop(s), and collaborative development of country action programmes. The work will also follow-up earlier work concerning the environmental and safety performance of
mining operations in the project countries, and track and seek to influence, the policy and regulatory procedures used by national agencies to adequately (or not) licence and control such operations.

In this regard, the project aims to fill a number of well-documented gaps. Indeed, on a number of occasions, frustration has been expressed among mining and environmental actors in the region about the lack of:

- documented cases of successful mine site rehabilitation work in the SEE context – especially those involving robust but low technology solutions, embodying natural attenuation systems, achieved with low cost, and so forth;
- a forum for best practice dissemination that can provide help in overcoming (or avoiding) problems and help with access to information and consulting resources;
- capacities within national environmental agencies and mining inspectorates to ensure current best-practice mining; effective risk amelioration, and/or best practice remediation of environmental problems.

Indications of capacity need from the focus countries/territories

During the conduct of the missions detailed in this report, the topic of “lack of” capacity and “needs for capacity building” were taken up explicitly with most counterparts. Information provided in this regard was sketchy, and it was noted that it is not always easy for informants to “criticise one’s own organisation”, or to provide indications of what improvements are needed, when experience of work in a skilled, broad and effective organisation is lacking. However, a number of specific comments or expressions of capacity building needs were provided during the spring 2006 missions. The form and nature of these comments generally reflect the content of the ENVSEC 2004 assessment. A notable difference that has arisen since that time is that environmental protection bodies in line with EU forms are now generally in the process of being officially formed – albeit without sufficient staff. (In the DA see: Chapter 4, Environmental institutions and institutional frameworks – where much of the information summarised was obtained from UNECE assessments conducted in 2002 and 2004).

While these comments were generally very brief and a detailed examination of the issue was not possible, observations and notes are listed by country below.

Albania

Informants indicated that while the NEAP 2001 identifies mining and minerals related hot spot rehabilitation as a priority, the country’s monitoring capacity (e.g. for mining sites) remains insufficient. Moreover, it was stated that there remains a clear lack of coordination among the various specialised institutes under the Ministry for Environment. As yet, there is no governmental mining programme despite the relatively high priority of mining related sites reported by informants.

Moreover, it was noted that while there is an ongoing closure programme for mines that is managed by the MoEFWA, and implemented by the Institute of Mining Technology (ITNPM), the closure of mines is not always achieved adequately, and risks and pollution often persist impacting for local communities. It was indicated that the ITNPM will soon become an official agency and new environmental legislation surrounding mining (governing exploitation and post mining management) is to soon be implemented. Special capacity building needs were indicated in regulatory frameworks, monitoring, environmental strategising and land planning.

Bosnia & Herzegovina

The country suffers from serious institutional problems (particularly in the Federation where government is decentralised down to the canton level). Environmental capacity at the state level is very limited with very few personnel – only one met had a detailed environmental background. Mine waters are simply not a priority issue within legislative frameworks and only process effluents are currently considered in institutional and legal frameworks. Moreover, mining impacts are currently not monitored. All existing and small mining sites (in the Federation) are managed at canton level but there is no priority list for inspection of certain sites. While physical planning is currently under way, it was reported that an environment strategy for the country has not been developed.

Secondly, the institutional structures are cumbersome and governmental environmental resources are completely inadequate with informants stating "only 3 people versus 300 for Croatia" and "Institutional reform is just talk - there are too many vested political interests."). Due to many other ongoing donor projects, the understaffed central government bodies have very little capacity to absorb new capacity building. As such, it is therefore important to carefully coordinate UNEP/ADA work with other donors. Informants indicated that capacity in EIA for mine closure is required (part of closure work) and significant efforts were required to build links between the Water Framework Directive and IPPC. As IPPC is to be valid from 2008 it was indicated that this is still ignored by the mining industry.

Other items noted by the mission were that National actors consider that the degree of transboundary cooperation with Montenegro, Serbia and Croatia is still insufficient and that interestingly, no mining hotspots were identified in the BiH NEAP.

**FYR Macedonia**

While it was clear that the implementation of the new National Waste Management Plan 2006 (which includes mining hot spots) is underway, informants indicated that authorities require significantly more capacity (i.e. more qualified staff for implementation, enforcement, monitoring in the form of an IPPC department at the MoE). Further, while MoE commitment to such moves were noted, an informant indicated that the major reason for failure to establish an EPA as an effective vehicle for action was due to a chronic lack of governmental interest. Moreover it was stated that there is also a lack of competent government staff to both contribute to, and to absorb the results of EU funded reports.

The Ministry of Environment informed that a new ENVSEC coordination body has been formed with a broad representation from government, industry, academia, donor agencies and UN bodies. While new, this body should constitute a firm foundation for coordinating UNEP/ADA and ENVSEC efforts in the country. Hopefully, this body will also help catalyse a mobilisation of resources to support capacity building efforts.

Other specific items from the mission included indications of the remaining lack of a modern mining policy structure (beyond privatisation efforts) and a perceived need to develop the coordination/responsibility sharing between relatively strong municipalities and the government.

**Montenegro**

Informants indicated that capacity (both personnel resources and skills) required to perform work in areas of strategic environmental assessment (SEA), environmental impact assessment (EIA) and IPPC are low. It was stated that enforcement was very weak and that the MoE only has 12 to 14 people available for work with this overall issue.

**Serbia**

Informants indicated that while the mining industry is recovering and improving their (environmental) performance, the ministries and environment inspectorates are understaffed (e.g. 7 people deal with environment protection at the Ministry for Energy and Mining). On the other hand, international bodies such as the World Bank demand that total government staff numbers must be reduced and as such there are concerns that additional personnel will not eventuate in the near term. According to the Ministry, a Serbian mining strategy supported by the World Bank is
to be ready in 2008. The privatisation process that is a part of this focuses on Bor (8 mines) and the non-metallic industry.

With regards to monitoring, inspection and enforcement, it was indicated that if industry knew how few personnel were available to conduct inspections then deliberate exceedences of environmental limits and/or other abuses would be far more common than they are. It was underlined by informants that the disaster management process remains poor and much improved warning systems, particularly for floods, is required.

The EAR informant indicated that the EU is working to assist in building the legislative framework, administrative capacity and infrastructure (e.g. the national environment strategy and the draft NEAP are being finalised). EAR support is also given to the municipalities to prepare a LEAP.

Activities to build capacity

Pursuant to discussions during this mission, and in many other interactions with national actors during ENVSEC and UNEP workshops and missions, it is considered that interventions can be implemented that address capacity problems related to the gaps outlined above. In particular, it is considered that desired results can be achieved through activities such as focused learning workshops conducted at pilot sites where participants can engage in an ongoing programme of field workshops to be conducted at pilot site(s).

Within the scope of the UNEP/ADA work, it is proposed that two such workshops of approximately 4 days duration be conducted. Initial planning indicates that each can involve a group of approximately 30 persons in an interactive setting. It is anticipated that the programme will involve one to two days of workshop briefing, knowledge exchange and guest instruction from selected international experts working in a key technical challenge area; followed by at least one day of site visit(s), and a final day of review, technical planning and idea exchange regarding potential activities at other mining sites.38

Within these workshops it is possible that a broad range of challenge areas can be examined, experiences tested, and knowledge documented. Examples of topics identified as being of interest or relevance to actors in the region include:

- the best manner in which to collect field/technical information required to supporting site remediation/risk amelioration;
- delineation of which “off the shelf” technologies for pollution treatment or risk amelioration are relevant and available in the regional context;
- delineation of innovative technologies are applicable to the region (e.g. for removal of heavy metals from water, for acid neutralisation, for processing of tailings for residual metal removal, for tailings stabilisation, and so forth);
- how to effectively mobilise international funding and investment in activities to make safe environmental legacies related to mining;
- which stakeholders should be engaged in mine site activities and why;
- how best to prioritise among sites of acute risk, ongoing chronic pollution, and so forth;
- how best to build and maintain sub-regional professional contact and information exchange networks;
- how to best identify and implement “best practice” solutions from outside the region;
- how and where to test and apply innovative solutions;
- how to manage tradeoffs associated with lack of funds, application of innovative solutions, technical limitations and so forth.

38 It is noted that in order to achieve more effective results in the longer term, that ENVSEC and UNEP will need to seek donor support to build upon these initial workshops with an ongoing series of interactions that extend beyond the remit of this project. Work to extend the programme of workshops is underway within the ENVSEC partnership.
In this light, it is proposed that the content of the two workshops within the ENVSEC/ADA work will focus on the demonstration of practical solutions for challenges that are shared across the region. In particular, it is felt that geochemical and hydro-geological site characterisation, treatment of chronic water pollution and risk amelioration for hazardous tailings impoundments should be topics to be addressed in the first instance.

Further to these practical engineering type subjects, earlier ENVSEC work and the outcomes of this analysis indicate that measures in the management and policy sphere are also required. Four key areas for action among regional decision-makers, policy makers, and leading industrial actors have been identified. These key action areas translate directly into a definition of capacity requirements for the region. Simply put, at present there is insufficient knowledge, skills and experience in mining countries in South Eastern Europe to carry out such actions. These include inter alia:

- **risk reduction at abandoned or orphaned sites** – actions among regional actors that can facilitate the reduction of the very significant risks associated with non-operational, abandoned and/or orphaned sites where large quantities of physically and chemically unstable, and/or poorly contained mine wastes are stored;

- **risk reduction at operational sites** – actions that can facilitate the reduction of the very significant risks associated at sites of mining or minerals processing that are operational via enablement of the existing economic actors and industrial activities with a key part of this being the development of an effective and efficient approach to the funding of closure that enables mine rehabilitation;

- **development of new resources and re-mining aligned with sustainable development** – actions that can stimulate development of institutional capacity, a culture of risk control, and markedly improved operational procedures throughout the region to create a norm of mine planning that encompasses mine closure plans as an integral part of a project life cycle; thus preventing future risk.

- **fostering of institutional frameworks for abandoned or orphaned site management and sustainable mining and minerals processing practice** – further development of legislative frameworks addressing mining and minerals processing legacies; clear accountability (and jurisdictional remit) for the environmental aspects of mining and minerals processing activities in the region; and the further development of institutions supporting transboundary risk management and/or disaster response.

Consideration of these needs should be included in the execution of the two workshops discussed above. Further, the conduct of the workshops should seek to form a foundation for further work in the above areas.

### 4 Further Actions required

This report has examined many potential hot spots identified throughout the countries and territories that were addressed by the ENVSEC mining desk assessment of 2004 and found that they are indeed of concern. It has also uncovered a number of mining related pollution sources or risk sites that were not detailed in that study. The findings of this study are clear - all such sites of high concern require risk reduction and or rehabilitation works in the short to medium term.

Despite progress in recent years in improving the environmental conditions in SEE, there remains a distinct lack of documented cases of successful mining and minerals-related site remediation in the region. It is important that such examples will be created and documented, so that others can learn from them. Moreover, it is extremely difficult to obtain an overview of mining
and minerals-related remediation activity in the region – a better documentation and monitoring of projects would be extremely valuable.

While some of such work can be performed with low cost and low technology solutions, it is evident that in many sites large (or very large) amounts of money will be involved. All remediation and risk reduction works, however, must start somewhere, and a comprehensive solution can also be achieved in a stepwise approach.

Moreover, an **information network** for the dissemination of best practice is required. Pilot cases and actual sites of work where practitioners can learn from each other (as well as from outsiders) will constitute important resources for such networks. It is suggested that the work of networks and the foci of dissemination efforts will need to encompass at least three distinct levels. These include:

- **at a site level** – e.g. "How can we best and cheapest reduce this risk?".
- **at a national level** – e.g. "How do we best support such works? How can we make rules to govern such works, and how can rules prevent such problems in the future?" etc.
- **at a transboundary and regional level** – E.g. “How do such works contribute to national interests? How can such works contribute to cooperation between jurisdictions?” and so forth.

### 4.1 Activities related to Site Selection

Despite similarities between some sites (e.g. copper tailings dumps, lead-zinc tailings dumps, etc.) each site is quite unique. This will always make it difficult to generalise from one site to another. This said, the sheer scale of the problems in SEE require that sites in this programme must be clustered – and as much a possible, one site will need to provide experiences that have relevance to others in the same cluster. It is suggested that UNEP/ADA work focus upon a differing aspect of mine site risk at each location but that the individual problem addressed have broader relevance to most if not all sites.

The current level of understanding of sites (with the exception of some sites in Macedonia) does not allow specific choices to be made at this stage. It is strongly recommended that a number of the candidate sites listed in Table 3-1 be visited.

Assessment-specific local conditions will allow identification of those sites that best suit the following desired categories:

- **Risk mitigation pilot or donor mobilisation sites** where works towards the effective risk and impact mitigation can be conducted that have learning value in the region. Such sites would typically be subject to a major environmental and/or health problem (possibly also transboundary), needing urgent remediation and more investor interest (example candidate: Bucim/MAK). Meaningful work could include the mobilisation of funds to enact pilot risk reduction works, but could also involve preliminary stages required to delineate the problem well enough for donors (or industrial actors) to become interested in the site.

- **Environmental rehabilitation pilot or demonstration sites** where typical environmental problem management technologies or techniques can be presented (example candidate: Vares/BiH). Such techniques could focus on both better remediation techniques and better investigation techniques. These sites in particular will need to be easily accessible, subject to a typical mining problem in SEE and have problems that allow simple, low-cost and highly visible or instructive solutions.

It can be expected that sites in these two different categories could coincide.

The **candidate site selection mission** should take place in autumn 2006. It should result in a report proposing concrete risk and environment impact reduction measures in the desired 5-7 pilot mining sites in SEE.

Respective **project concepts for those pilot sites** can be elaborated in spring 2007 and should be ready for presentation to potential donors in late summer 2007.
These site visits and discussions will allow more specific data collection and verification as well as coordinating meetings with Beneficiaries (government bodies, mining operators) and other donors.

4.2 Activities related to Capacity Building

For capacity building, it is proposed that the first workshop should be organised after the candidate site inspection mission, tentatively in early 2007. The second workshop should be held in late spring 2007.

It is considered that two main topics need to be addressed in these workshops. It is anticipated that these can be covered in the following themes: innovative solutions for common problems and legislative and regulatory frameworks for risk mitigation. The content of workshops will be managed to maintain relevance for a common audience drawn from the principal actor groups. It is felt that there would be value in presenting the “solutions” workshop first (creating a positive and results orientated atmosphere); however this is not a necessity. Current ideas for content include:

- **“innovative solutions for common problems workshop”** focused on first class delineation of problems and on potential solutions for environmental challenges experience by most sites and/or most regulatory bodies. Content would focus on “best practice” and upon “cost effectiveness”. Topics could include items such as: site pollution assessment techniques, stability assessment, ground water problem delineation and waters characterisation, innovative water treatment technologies and required data sets; modern stabilisation techniques; tailings reprocessing case studies; site re-use and land-use case studies; and so forth.

- **legislative and regulatory frameworks for risk mitigation** workshop focused on best practice policy making, monitoring and enforcement, with a focus on the progress of other mining countries dealing with similar environmental challenges. Content would again focus upon “cost effectiveness” with important themes being the achievement of a stable, fair but strict policy environment for industrial activity and the generation of incentives for good environmental performance. Topics could include: public health and safety, emergency preparedness, environment protection, transboundary cooperation, financial incentives for mine-site rehabilitation, financial environmental guarantees, the general improvement of cooperation between government and mining companies, and more.

It is desirable that the workshop locations should be a mining city centrally located in SEE. Proximity to demonstration sites will be a very strong factor in location selection. It is considered that both workshops will need to include components where national actors can contribute with explicit details of desired capacity building content for future works in this area.

The target group for attendees include key experts from government (mining and environment), specialised institutions (mining institutes and universities), mining industry and competent NGOs. It is intended that the workshops be quite technical in nature and hence the audience will be more practitioner weighted. It is preferred that participants attend both workshops.

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39 However, it is likely that the ease of arranging visas etc. for attendees could also be a strong factor in selecting location.
### 4.3 Proposed Timeline for the ADA/UNEP Project

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