

# Silvercorp Metals Inc. China Environmental Due Diligence Review

Prepared for:



February 2008

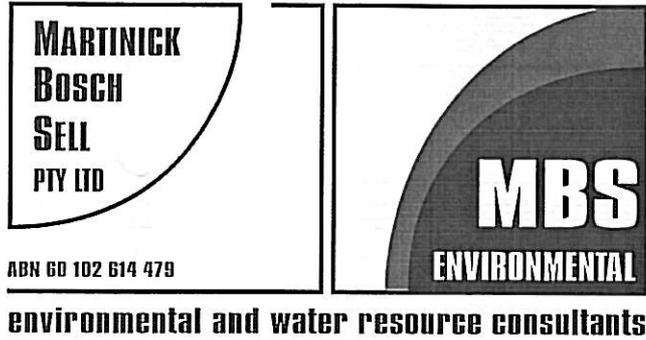
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SILVERCORP METALS INC. CHINA  
ENVIRONMENTAL DUE DILIGENCE REVIEW

PREPARED FOR

**SRK CONSULTING ENGINEERS AND SCIENTISTS**

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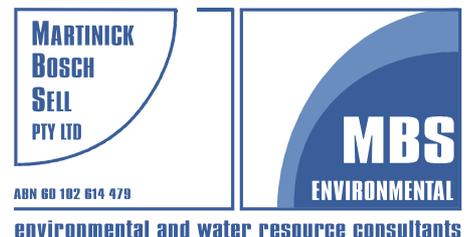
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## 1. INTRODUCTION

Silvercorp Metals Inc. (Silvercorp) is a Canadian public listed company engaged in acquisition, exploration and development of mining projects within China. Silvercorp through its subsidiaries, currently have the following exploration, mining and minerals processing projects within the Henan province of China:

- Luoning County – Ying Silver-Lead-Zinc Project (Ying) with exploration, operating underground mine and processing plant, and a smelter development project (Luoning Smelter), and the Hao Ping Guo Silver-Gold-Lead Project (HPG) with exploration, operating underground mine and processing plant.
- Nanzhao County – NZ Gold-Silver Exploration Project (previously operated underground mine and processing plant).

Silvercorp is currently seeking to list on the Hong Kong Stock Exchange. Silvercorp has commissioned SRK Consulting China Ltd (SRK) to undertake a due diligence audit of its China projects to meet the requirements for the proposed Hong Kong Stock Exchange listing. SRK commissioned MBS Environmental to undertake the environmental due diligence review of the Ying Project, HPG Project and the Luoning Smelter Project.

### 1.1 PROJECT LOCATIONS AND DESCRIPTIONS

The Ying Project is located in the Luoning area of western Henan Province of central China; it is approximately 240 kilometres west-southwest of Zhengzhou and 40 kilometres south west of Luoning. The Ying Project comprises an underground mine, a 600 tonne per day processing plant and an associated tailings storage facility (TSF). The Ying processing plant and TSF are located approximately 17 kilometres to the north of the Ying Mine, and approximately two kilometres north east of the Xia Yu Township. The HPG project comprises an underground mine, a 200 tonne per day processing plant and an associated TSF. The HPG project is located approximately 4.5 kilometres east of the Ying mine. Both the Ying and HPG mining operations lie within the catchment of the Luohe River and Guxian Reservoir. The Guxian Reservoir provides flood control, irrigation, hydro-power and drinking water supplies.

The Ying Project is 100% owned and operated by Henan Found Mining Company Limited (Henan Found), which is a co-operative joint venture between Victor Mining Limited (a wholly owned subsidiary of Silvercorp) and Henan Non-Ferrous Geological & Mineral Resources Company Limited. The Ying project has been in production since April 2006.

The HPG Project is 100% owned and operated by Henan Hua Wei Mining Company Limited, which is a co-operative joint venture between Victor Resources Limited (a wholly owned subsidiary of Silvercorp) and Luoning Huatai Mining Development Company Limited. The HPG mine and processing plant have historically been operational since 2002, the current HPG project (under the above co-operative joint venture) has been in production since May 2007.

The Luoning Smelter Project is located approximately 12 kilometres to the southwest of the Luoning town and approximately 48 kilometres to the north east of the Ying processing plant. The Luoning Smelter Project is a joint venture between Henan Found and three Chinese mining companies; Luoyang Luanchuan Molybdenum Group Inc. (Luomu), HT Mining Co. Ltd (HT Mining), and Luochuan Xinchuan Mining Co. Ltd (LX Mining).

The Luoning Smelter Project has a design capacity of 150,000 tonnes of lead per year, and will process the Ying and HPG lead/silver/zinc concentrates utilising the Shuikoushan (SKS) lead smelting process (jointly developed by Shuikoushan Mining Corporation and Beijing Central Engineering and Research Institute for Non-ferrous Metallurgical Industries - ENFI).

The Luoning Smelter Project has completed a Chinese Feasibility Study for the full design capacity of 150,000 tonnes of lead per year. It is proposed to develop the smelter in two phases; the first phase will comprise development and construction of the smelter with an 80,000 tonnes of lead per year smelter capacity, the second phase of the development will take the smelter capacity up to the full design capacity of 150,000 tonnes of lead per year. An Environmental Impact Assessment (EIA) has recently been completed (May 2007) for the 80,000 tonnes of lead per year first phase development and has been submitted to the Henan Provincial Government for approval to commence construction.

## 1.2 ENVIRONMENTAL REVIEW OBJECTIVE

The objectives of this environmental due diligence review are to:

- Identify and/or verify the existing and potential environmental liabilities and risks, and assess any associated proposed remediation measures for the Ying and HPG Projects.
- Review the Chinese feasibility study and environmental impacts assessment documentation, and assess the potential environmental liabilities and risks associated with the:
  - Proposed development of the Luoning Smelter Project.
  - Utilisation of the SKS lead smelting process.

## 1.3 ENVIRONMENTAL REVIEW SCOPE AND STANDARDS

Environmental conformance for Ying, HPG and Luoning Smelter Projects was determined through review of the operation's environmental performance against:

- Chinese National environmental regulatory requirements.
- World Bank/International Finance Corporation (IFC) environmental standards and guidelines.
- Internationally recognised environmental management practices.

In seeking to obtain project financing or to list on a stock exchange, these institutions themselves require the proponent to comply with such documents as the Equator Principles

and the IFC Performance Standards and Guidelines. This is exemplified by the following preamble from the Equator Principles (July 2006):

*Project financing, a method of funding in which the lender looks primarily to the revenues generated by a single project both as the source of repayment and as security for the exposure, plays an important role in financing development throughout the world. Project financiers may encounter social and environmental issues that are both complex and challenging, particularly with respect to projects in the emerging markets.*

*The Equator Principles Financial Institutions (EPFIs) have consequently adopted these Principles in order to ensure that the projects we finance are developed in a manner that is socially responsible and reflect sound environmental management practices. By doing so, negative impacts on project-affected ecosystems and communities should be avoided where possible, and if these impacts are unavoidable, they should be reduced, mitigated and/or compensated for appropriately. We believe that adoption of and adherence to these Principles offers significant benefits to ourselves, our borrowers and local stakeholders through our borrowers' engagement with locally affected communities. We therefore recognise that our role as financiers affords us opportunities to promote responsible environmental stewardship and socially responsible development. As such, EPFIs will consider reviewing these Principles from time-to-time based on implementation experience, and in order to reflect ongoing learning and emerging good practice.*

*These Principles are intended to serve as a common baseline and framework for the implementation by each EPFI of its own internal social and environmental policies, procedures and standards related to its project financing activities. We will not provide loans to projects where the borrower will not or is unable to comply with our respective social and environmental policies and procedures that implement the Equator Principles.*

Table 1 and Table 2 provide a brief summary of the Equator Principles and the IFC Performance Standards respectively. These documents are used by the EPFI's and stock exchanges in their review of the social and environmental performance of proponent companies.

**Table 1: Equator Principles**

<b>Equator Principles</b>	<b>Title</b>	<b>Key Aspects (Summary)</b>
1	Review and Categorisation	Categorise such project based on the magnitude of its potential impacts and risks.
2	Social and Environmental Assessment	Conduct a Social and Environmental Assessment (“Assessment”). The Assessment should also propose mitigation and management measures appropriate to the nature and scale of the proposed project.
3	Applicable Social and Environmental Standards	The Assessment will refer to the applicable IFC Performance Standards, and applicable Industry Specific EHS Guidelines (“EHS Guidelines”) and overall compliance with same.
4	Action Plan and Management System	Prepare an Action Plan (AP) which addresses the relevant findings of the Assessment. The AP will describe and prioritise the actions, mitigation measures, corrective actions and monitoring to manage the impacts and risks identified in the Assessment. Maintain a Social and Environmental Management System that addresses the management of these impacts, risks, and corrective actions required to comply with host country laws and regulations, and requirements of the applicable Standards and Guidelines, as defined in the AP.
5	Consultation and Disclosure	Consult with project affected communities. Adequately incorporate affected communities’ concerns.
6	Grievance Mechanism	Establish a grievance mechanism as part of the management system. To receive and resolve concerns about the project by individuals or groups from among project-affected communities. Inform the affected communities about the grievance mechanism in the course of the community engagement process and ensure that the mechanism addresses concerns promptly and transparently, and is readily accessible to all segments of the affected communities.
7	Independent Review	Independent social or environmental expert will review the Assessment, AP and consultation process to assess Equator Principles compliance.
8	Covenants	Covenant in financing documentation: a) to comply with all relevant host country social and environmental laws, regulations and permits; b) to comply with the AP during the construction and operation of the project; c) to provide periodic reports not less than annually, prepared by in-house staff or third party experts, that (i) document compliance with the AP, and (ii) provide compliance with relevant local, state and host country social and environmental laws, regulations and permits; and d) to decommission the facilities, where applicable and appropriate, in accordance with an agreed decommissioning plan.
9	Independent Monitoring and Reporting	Appoint an independent environmental and/or social expert, or require that the borrower retain qualified and experienced external experts to verify its monitoring information.
10	EPFI Reporting	Each EPFI adopting the Equator Principles commits to report publicly at least annually about its Equator Principles implementation processes and experience, taking into account appropriate confidentiality considerations.

**Table 2: IFC Performance Standards**

<b>IFC Performance Standard</b>	<b>Title</b>	<b>Objective (Summary)</b>	<b>Key Aspects (Summary)</b>
1	Social and Environmental Assessment and Management Systems.	Social and EIA and improved performance through use of management systems.	Social & Environmental Management System (S&EMS). Social & Environmental Impact Assessment (S&EIA). Risks and impacts. Management Plans. Monitoring. Reporting. Training. Community Consultation.
2	Labour and Working Conditions.	EEO. Safety and Health.	Implement through the S&EMS. HR policy. Working condition. EEO. Forced & child labour. OH&S.
3	Pollution Prevention and Abatement.	Avoid pollution. Reduce Emissions.	Prevent pollution. Conserve resources. Energy efficiency. Reduce waste. Hazardous materials. EPR. Greenhouse.
4	Community Health, Safety and Security.	Avoid or minimise risks to community.	Implement through the S&EMS. Do risk assessment. Hazardous materials safety. Community exposure. ERP.
5	Land Acquisition and Involuntary Resettlement.	Avoid or minimise resettlement. Mitigate adverse social impacts.	Implement through the S&EMS. Consultation. Compensation. Resettlement planning. Economic displacement.
6	Biodiversity Conservation and Sustainable Natural Resource Management.	Protect and conserve biodiversity.	Implement through the S&EMS. Assessment. Habitat. Protected areas. Invasive species.
7	Indigenous Peoples.	Respect. Avoid and minimise impacts. Foster good faith.	Avoid adverse impacts. Consultation. Development benefits. Impacts to traditional land use. Relocation.
8	Cultural Heritage.	Protect cultural heritage.	Heritage Survey. Site avoidances. Consultation.

## 1.4 SUMMARY OF ENVIRONMENTAL FINDINGS

### 1.4.1 Licences and Environmental Impact Assessment

The Ying Project operates under Mining Licence No. 4100000610045, which covers approximately 9.95 square kilometres of the Sha Gou (SGX) Area. This permit was granted to the Found Mining Company Limited by the Henan Land and Resources Bureau on 26 March 2006 and expires in May 2014. No environmental non-compliances and/or regulatory penalties issued against the above Mining Licence have been sighted as part of this review.

The Ying Project Environmental Impact Assessment (EIA) was completed by the Luoyang Environmental Protection Design Institute in January 2006, and subsequently approved for construction by the Environmental Protection Bureau (EPB) of Henan Province in February 2006. The key approval conditions relate to the location of the project adjacent to the Luohe River and Guxian Reservoir. The Luohe River and Guxian Reservoir is situated within the drainage catchment of the Yellow River. The management of the reservoir and associated drainage catchment are administered by the Yellow River Management Bureau and the Luoning County, who provided input into the setting of the project's environmental approval conditions.

The HPG Project operates under two Mining Licences within the Haopinggou Valley. Mining Licence No. 4100000410514 grants approval to mine between the elevations 640metres RL and 365metres RL, within an area of 0.3878 square kilometres, and Mining Licence No. 4100000620027 grants approval to mine between the elevations 830mRL and 440mRL, within an area of 0.1453k square kilometres. Both licences were granted to the Luoning Huatai Mining Development Company Limited by the Henan Land and Resources Bureau, in April 2004 and February 2006 respectively. No environmental non-compliances and/or regulatory penalties issued against the above Mining Licence have been sighted as part of this review.

The HPG Project Environmental Impact Assessment (EIA) was completed by the Luoyang City Environmental Protection Research Institute (certified - Class B) in November 2002, and subsequently approved for construction by Luoyang City Environmental Protection Bureau on 9 January 2003. Like the Ying Project, the key assessment and approval issues relate to the project being sited adjacent to the Guxian Reservoir and the environmental risks this presents to this water resource. It is worth noting that the approval for the HPG EIA was undertaken at the City/County level (i.e. not at the provincial level) and approval was given for 'trial production' at 100 tonnes per day throughput with a project life stated in the EIA of six years. The current HPG project throughput is 200 tonnes per day.

An EIA has been completed for the first phase of the Luoning smelter project development (80,000 tonnes of lead per year). This EIA report was produced by the SCIVIC Engineering Corporation in May 2007 and has been submitted to the Henan EPB for approval to commence construction. A Chinese Feasibility Study for the full design capacity of 150,000 tonnes of lead per year has also been recently completed in March 2007, by China ENFI Nonferrous Engineering Company. It should be noted that no detail design for the construction of the 80,000 tonnes of lead per year smelter, has been sighted as part of this review. During the site visit to the smelter on 17 June 2007, Silvercorp stated that approval to

commence construction of the smelter was in progress. No anticipated date for the receiving of approval to commence construction was put forward during this review

## 1.4.2 Potential Environmental Management Liabilities

SRK's environmental due diligence review identified the following as potential environmental management liabilities that relate to operation and development of the current Silvercorp China Ore Projects:

- Dust generation and management.
- Smelter gas emissions.
- Surface water management and discharges (i.e. tailings, mine dewatering and stormwater runoff).
- Groundwater management and discharges (i.e. seepage from TSF's and waste rock stockpiles).
- Rehabilitation of waste rock stockpiles and other disturbed areas.
- Storage and handling of hazardous materials.
- Waste generation and management (industrial and domestic wastes).
- Potential contaminated sites.
- Closure planning process.

Of these, it is considered that surface water/tailings management for HPG Tailings Storage Facility (TSF) represents the most significant environmental risk (i.e. very high risk) for the current Silvercorp China Projects.

In addition, the potential for generating contaminated sites and significant closure liabilities through poor management of tailings, hazardous materials and general waste; also presents high environmental risks. The absence of a structured process for the Silvercorp China Projects for undertaking of contaminated sites assessment and for broader operational closure planning is of concern to SRK.

The most significant environmental risks for the Luoning Smelter Project are likely to be associated with storage and handling of hazardous materials/wastes (i.e. including process slag). Air emissions also may present significant environmental risks if the proposed air pollution control measures (e.g. an acid plant for sulphur dioxide emissions) are not implemented and maintained as planned.

It is recommended that comprehensive operational environmental monitoring and management plans for each project be developed and implemented to address the identified environmental risks. These plans should be appropriately resourced and their implementation documented. In particular, consideration should be given to the implementing the following environmental management measures:

- Dust monitoring and management program to ensure occupational/environmental exposures from dust emissions of lead and other heavy metals are quantified and managed.

- Groundwater monitoring and management program focusing on mining and TSF facilities.
- TSF return water systems to operate within the ponds/embankments.
- Upgrade storage and handling of hydrocarbons and chemicals (i.e. properly designed and managed secondary containment storage facilities).
- Undertake contaminated sites assessment for areas where there is potential for contamination (e.g. unlined TSF return water pond, uncontained hydrocarbon/chemical storage areas).
- Site closure planning process that identifies and quantifies potential closure liabilities (e.g. contaminated areas), and implements remediation measures for these liabilities.

## 2. METHODOLOGY

The methodology that was applied for this environmental review of the Silvercorp China Projects comprised a combination of document review, site visit and interviews with Company technical representatives. The site visit was undertaken from 12 to 17 June 2007.

### 2.1 INFORMATION REVIEWED

Project due diligence information was provided by Silvercorp. All original documentation was provided in Chinese hard copies and/or electronically. Technical translation of relevant documentation was carried out in Beijing by qualified local translation agencies.

Other supporting background information reviewed, comprised:

- Chinese environmental and mining related legislative documentation.
- Relevant international environmental standards, guidelines and principles.
- Relevant publicly available international and Chinese technical supporting documentation.

This background information was sourced via websites of Chinese and international government agencies, technical/research agencies and industry associations.

All general and project specific documentation reviewed is presented in Appendix 1.

### 3. ENVIRONMENTAL ASPECTS AND MANAGEMENT

The significant environmental aspects for the Silvercorp China Projects are:

- Dust generation and management.
- Smelter gas emissions.
- Surface water management and discharges (i.e. mine dewatering and stormwater runoff).
- Groundwater management and discharges (i.e. seepage from TSF's and waste rock stockpiles).
- Rehabilitation of waste rock stockpiles and other disturbed areas.
- Storage and handling of hazardous materials.
- Waste generation and management (industrial and domestic wastes).
- Potential contaminated sites.
- Closure planning.

The following section summarises the environmental legislative background, compliance requirements, and the associated environmental management strategies for the above significant environmental aspects. The relevant environmental legislative background is provided in Appendix 2.

#### 3.1 PROJECT ENVIRONMENTAL IMPACT ASSESSMENT AND APPROVALS

##### 3.1.1 Ying Project

The Ying Project operates under Mining Licence No. 4100000610045, which covers approximately 9.95 square kilometres of the Sha Gou (SGX) Area. This permit was granted to the Found Mining Company Limited by the Henan Land and Resources Bureau on 26 March 2006 and expires in May 2014. No environmental non-compliances and/or regulatory penalties issued against the above Mining Licence have been sighted as part of this review.

The Ying Project Environmental Impact Assessment (EIA) was completed by the Luoyang Environmental Protection Design Institute in January 2006, and subsequently approved for construction by the Environmental Protection Bureau (EPB) of Henan Province in February 2006. The key approval conditions relate to the location of the project adjacent to the Luohe River and Guxian Reservoir. The Luohe River and Guxian Reservoir is situated within the drainage catchment of the Yellow River. The management of the reservoir and associated drainage catchment are administered by the Yellow River Management Bureau and the Luoning County, who provided input into the setting of the project's environmental approval conditions.

Silvercorp employs three environmental engineers for its Ying project and one environmental engineer for its HPG project, as specified in the respective EIA's.

The Ying project is currently operating under the ‘trial production’ phase of the Chinese National project environmental approvals process. This phase is to ensure that the project’s environmental programs are developed in line with statutory requirements, prior to the project undergoing final environmental checking and acceptance by the Henan EPB. This final project approval phase is expected to be completed by September 2007 for the processing plant and by May 2008 for the mine. The issuing of the project’s licence will occur after completion of the final environmental checking and acceptance, and is anticipated to be June 2008.

The Ying Project environmental approval conditions are specified within the Official Reply Given by the Environmental Protection Bureau of Henan Province for the Yue Liang Gou Lead- Zinc-Silver Mineral Exploitation Environmental Impact, by the Henan EPB dated 8 February 2006. Table 3 summarises these environmental approval conditions and the current project compliance status for each of these conditions. Details on the Project’s environmental compliance management measures are recorded within the Mine Design Plan and are summarised in the following sub-sections.

**Table 3: Ying Project Henan Provincial Environmental Approval – Compliance Status**

<b>Henan EPB Environmental Approval Condition</b>	<b>Project Compliance Status – June 2007</b>
New mine portals and ore stockpiles are to be located above the highest water level of the reservoir. Existing mine portals are to be closed except for CM 101 and PD16.	Compliant.
Effluent from the mining area and sewage waste be collected together, treated and recycled either for production or greening. Neither effluent waste is to be discharged.	Currently non Compliant – sewage is currently discharged to groundwater via seepage. The centralised sewage treatment plant for the Mine is under construction and will be completed by end of November 2007.
The treatment of the mine water treatment should be carried out according to the EIA report. The monitoring of water discharged into the reservoir is to be undertaken and timely countermeasures must be taken in case the limit is exceeded.	Compliant.
Discharge of mine drainage to meet a total discharge limit for Chemical Oxygen Demand (COD) of <29.3 grams per annum.	Compliance not known – mine water discharge is through seepage to groundwater, some COD monitoring of surface water is undertaken (i.e. in concentrations not discharge loadings).
All exploration portals and associated waste rock stockpiles are to be rehabilitated within a year of closure.	Compliant – some reclamation and tree planting works were noted, which also function as slope stabilisation.
TSF is to be sited eight kilometres downstream and outside of the catchment area of the Guxian Reservoir, 0.6 kilometres north of the Xia Shi Gou Village (Ying Processing Plant) and 2.6 kilometres northeast of the Xia Yu Township.	Compliant.

<b>Henan EPB Environmental Approval Condition</b>	<b>Project Compliance Status – June 2007</b>
Process plant tailings water and sewage waste water should be treated and recycled.	Partial compliance – the majority of tailings water is recycled through the return water system. However, there is potential for some water losses through seepage, either from the TSF pond or from the downstream unlined return water pond. The sewage waste water (with limited treatment) is being discharged approximately 0.5 kilometres upstream of the TSF pond. This results in the sewage water being lost to seepage and not available for recycling through the TSF return water system.
TSF is to be well constructed, and the pollution and accident prevention countermeasures should be carried out.	Compliant.
Ore should be transported by land with the route being outside the catchment of the reservoir.	Currently not compliant – ore is currently being transported on barges across the reservoir. A haul road to HPG and Xia Yu Township is currently being constructed which will resolve this compliance issue. This will be completed by October 2007 (i.e. within the trial production period and before the Mine’s final checking and acceptance in May 2008).
An accredited environmental management institute is to supervise the implementation of the environmental protection measures and produce an environmental management report for the project’s final inspection and acceptance. There is to be daily supervision by the EPB of the Luoning County and Luoyang City.	Compliance – The Luoning Environmental Protection Design Institute has been contracted to supervise the implementation of the environmental protection measures and produce an environmental management compliance report. This report is to be submitted to the Henan EPB for approval.
Pollution countermeasures and emergency plan must be completed before start up and implemented during operation.	Partial compliance – the measures not yet in place (e.g. ore road transport) are being addressed and will be completed before the completion of the project’s final checking and acceptance scheduled for June 2008.

### 3.1.2 HPG Project

The HPG Project operates under two Mining Licences within the Haopinggou Valley. Mining Licence No. 4100000410514 grants approval to mine between the elevations 640mRL and 365mRL, within an area of 0.3878 square kilometres, and Mining Licence No. 4100000620027 grants approval to mine between the elevations 830mRL and 440mRL, within an area of 0.1453 square kilometres. Both licences were granted to the Luoning Huatai Mining Development Company Limited by the Henan Land and Resources Bureau, in April 2004 and February 2006 respectively. No environmental non-compliances and/or regulatory penalties issued against the above Mining Licence have been sighted as part of this review.

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### 3.1.3 Luoning Smelter Project

An EIA has been completed for the first phase of the smelter project development (80,000t of lead per year). This EIA report was produced by the SCIVIC Engineering Corporation in May 2007 and has been submitted to the Henan EPB for approval to commence construction. A Chinese Feasibility Study for the full design capacity of 150,000 tonnes of lead per year has also been recently completed in March 2007, by China ENFI Nonferrous Engineering Company. It should be noted that no detail design for the construction of the 80,000 tonnes of lead per year smelter, has been sighted as part of this review.

During the site visit to the smelter on 17 June 2007, Silvercorp stated that approval to commence construction of the smelter was in progress. No anticipated date for the receiving of approval to commence construction was put forward during this review. It is worth noting that earthworks for the construction of the smelter have commenced. Silvercorp stated during the smelter site visit that these earthworks do not constitute formal commencement of the project construction.

## 3.2 LAND DISTURBANCE AND REHABILITATION

### 3.2.1 Ying Project

The Ying Project EIA Report states that total area of disturbance for the project is 326 *mu* (22 hectares - 1 *mu* = 0.0667 hectares). Silvercorp have since revised this initial estimate to 21.8 hectares. This revised total area of disturbance comprises:

- Mining area – 1.2 hectares.
- Office/residential areas – 0.4 hectares.
- Roads (ore haulage and processing plant roads) – 3.2 hectares.
- Processing plant - 2 hectares.
- TSF – 15 hectares.

Of the above total area disturbed, 0.3 hectares at the processing plant was forest/cultivated land. The remainder of the areas disturbed have been classified as previously disturbed wasteland (i.e. disturbed land not previously utilised for agricultural purposes).

The EIA Report also provides a breakdown of the areas of disturbance for the waste rock stockpiles. There are ten waste rock stockpile locations listed for the site with a total combined disturbance area of 1.3 hectares (i.e. approximately 90% of the total mining area disturbance).

The project has the following commitments in regards to site rehabilitation:

- Mining waste rock stockpiles:
  - Levelled (i.e. re-profiled to assist stability – no final slope angle is specified).
  - Capped with 0.6 metres of clay.
  - Covered with soil.
  - Compacted.
  - Replanted with vegetation.
- Ore transportation roads.
  - Covered with soil.
  - Compacted.
  - Replanted with vegetation.
  - Digging ditches for drainage.
  - Planting of trees at roadsides.
- TSF (including downstream flood/discharge containment dams and access roads).
- Outer slope of the TSF embankment is to be covered with soil and replanted with vegetation.
- Road and excavation slopes - to be covered with soil and replanted with vegetation (i.e. for slope stability).
- Processing plant and residential area – a green belt of trees is to be planted between the production and residential areas.

Of the above rehabilitation commitments, the replanting of the TSF road and excavation slopes and the tree planting between the production and residential areas, have been initiated. The Environmental Management and Monitoring Plan (EMMP) detailed within the EIA Report, also specifies that an 'annual ecological reclamation plan' is to be compiled and implemented. Silvercorp has stated that since 2006, an Annual Ecological Reclamation Plan is documented within its yearly operation plan and budget. Silvercorp has stated that in 2006, 41 reclamation related projects were completed with an expenditure of 1.69 million RMB. Silvercorp has stated that there is budgeted 508 million RMB for over 16 major reclamation projects at the both mine and mill sites. The documented Annual Ecological Reclamation Plan and the associated annual site reclamation expenditure/budgets have not been sighted by SRK as part of this review.

### 3.2.2 HPG Project

The HPG Project EIA Report provides an assessment of the land use areas within and surrounding the mining and processing plant sites. The total project area of disturbance is stated as being 69 hectares. Silvercorp have since revised this initial estimate to 23 hectares. This revised total area of disturbance comprises:

- Mining project area – 4.8 hectares.
- Office/residential areas – 1.12 hectares.
- Roads (ore haulage and processing plant roads) – 0.85 hectares.
- Processing plant – 0.1 hectares.
- TSF – 1.6 hectares.

All of the above areas of disturbance were previously classified as wasteland.

The EIA Report also provides a breakdown of the areas of disturbance for the waste rock stockpiles.

The project has the following commitments in regards to site rehabilitation:

- Mining waste rock.
  - Waste rock generated from construction is to be stored in a purpose built storage facility equipped with a slag barrier and slag dam for collection of runoff. At closure this waste rock storage facility is to be levelled (i.e. re-profiled to assist stability – no final slope angle is specified) and replanted with vegetation.
  - Waste rock generated from operations is to be backfilled underground within the mined out areas.
- TSF – levelled, covered with soil and replanted with trees and maintenance of flood control structures.
- Processing plant and residential area – after removal of infrastructure, level areas and replant with trees and grasses to reduce soil erosion.
- Mine and mill roads – replanting vegetation on the roadside slopes for stability and digging ditches for drainage.

Of the above rehabilitation commitments, the construction of the waste rock storage facility is an operational requirement. To date this facility has not been constructed and uncontained stockpiles are being utilised around the site for storage of waste rock (see Section 3.3).

Silvercorp has stated that since taking over control of the HPG projects, 500,000 RMB has been budgeted to fulfil the rehabilitation commitments specified in EIA and an environmental consultant has been commissioned to assess and implement the EMMP detailed within the EIA Report. The 2007 site reclamation expenditure/budget and the Environmental Inspection Agreement for the environmental consultant have been sighted as part of this review.

### 3.2.3 Luoning Smelter Project

The Luoning Smelter Project EIA Report states that total area of disturbance for the project is 35,910 square metres (approximately 3.6 hectares). A breakdown of this total area is not provided.

The project has the following commitments in regards to rehabilitation measures to be implemented during and at the completion of the construction program:

- Roads sides and excavation slopes:
  - Rock armouring of operational slope areas.
  - Soil stabilisation and replanting of temporary disturbed areas with shrubs and trees.
- Car parks, open areas and site boundary – establish green belts with replanting of trees and grasses.

There are no other site rehabilitation measures specified within the smelter EIA report.

## 3.3 WASTE ROCK, TAILINGS AND SLAG MANAGEMENT

Waste rock and tailings are generated at both the Ying and HPG projects.

### 3.3.1 Ying Project

The Ying EIA Report provides some detail on the leach toxicity testwork for the waste rock and tailings. Testing was conducted on waste rock from the mining operation. There was no testwork conducted on the tailings, results of existing leach test on tailings from a similar lead-zinc concentrator were utilised. The leaching test results provided are for lead, zinc, copper, cadmium, arsenic and silver. All results are within the Chinese National Standard *Identification Standard for Hazardous Wastes-Identification for Extraction Procedure Toxicity (GB5085.3-1996)*.

The waste rock produced at the Ying Mine is deposited within ten waste rock stockpiles around the site. The EIA report states that total design storage capacity for these stockpiles is 164,000 cubic metres and the total area disturbed is 1.3 hectares. The main waste rock stockpile area is situated adjacent to the ore stockpile/handling area, and has a design capacity of 45,000 cubic metres within a disturbed area of 0.4 hectares. Waste rock has also been utilised for construction purposes throughout the mine site. It should be noted that the main waste rock stockpile is utilised to filter the treated mine waters (i.e. settled mine water is allowed to percolate through the waste rock and then seep into the adjacent groundwater – see Section 3.4).

It was stated during the Ying mine site visit that the waste rock being generated and stockpiled at the site is non-acid forming. The mineral composition of the waste rock within a blended ore sample provided within Table 2 of the report *Technical Update for Silvercorp Metals Inc. on the Ying Silver-Lead-Zinc Project, Henan Province, People's Republic of China (26 May 2006)*, states that 'waste rock is mainly comprised of quartz (~50%), chlorite and sericite

(~25%), kaolin and clay minerals (~20%) and sulphide minerals such as pyrite, and pyrrhotite (~2.5%'. This mineral composition supports the statement that the waste rock is non-acid forming, but does not constitute a comprehensive and conclusive acid generating potential testwork program specifically undertaken for all of the project's waste rock types.

The Ying EIA Report states that the annual production of tailings from the Ying processing plant (i.e. based on the plant design capacity) is 182,100 tonnes (138,000 cubic metres). Silvercorp have stated that these tailings do not contain sulphide and have no potential for acid generation. No acid generating potential testwork program or geochemical assessment of the Ying process tailings has been sighted as part of this review.

The Ying process tailings are discharged into a purpose built TSF that has an effective design capacity 2.43 million cubic metres and a service life of approximately 18 years. The tailings are discharged via gravity through a 760 metre tailings pipeline that does not have secondary containment. This tailings pipeline, while located within the upstream drainage catchment of the TFS is outside of the TSF impoundment area. It is standard international industry practice and a component of IFC guidelines, to have secondary containment for tailings pipelines that are outside of a TSF impoundment area. This is to prevent accidental releases of tailings to the environment resulting from pipeline ruptures and to provide for the collection and recovery of spilled tailings. As it is not Silvercorp's intention to utilise the upstream catchment of the TSF for the storage and containment of tailings, the lack of secondary containment for the tailings pipeline is not consistent with standard international industry practice.

The Ying TSF is designed to have a freeboard of 6 metres, with current freeboard being at 12 metres. The TSF has a decant and underdrainage system which provides for flood protection and the mechanism for collection of return water. The current level of return water for the TSF is 70%. Daily inspections are undertaken of the tailings pipeline, TSF embankment, and the seepage/return water collection system. Annual external technically qualified engineering reviews are required to be undertaken of the TSF facility (NB: As the TSF has only been in use for approximately four months, the first of these external technical reviews has yet to be completed).

The Ying TSF underdrainage and return water collection system comprises a tunnel discharging directly into an unlined collection pond/pumping station just downstream of the TSF embankment. This TSF decant and underdrainage system provides a mechanism for the direct discharge of tailings and/or contaminated tailings water from the TSF. Consideration should be given to relocating this facility to within the TSF pond and have just a lined seepage collection and return system at the toe of the TSF embankment (i.e. collect seepage and return back within the TSF pond).

This existing unlined collection pond is designed to overflow into a second unlined containment/seepage dam. There are two further containment dams downstream, with a fourth dam, approximately one kilometre downstream, also acting as another pumping station. Site personnel stated during the site visit that the nearest residential area was a very small village approximately two kilometres downstream. It was also stated that the Luohe River is approximately eight kilometres downstream.

The sand and geo-fabric lining of the TSF allows for seepage, this is collected through a drain at the base of the TSF embankment which also flows directly into the first collection pond/pumping station.

Regular onsite monitoring of the TSF return water quality is undertaken for lead, silver and zinc. Silvercorp has stated that the Luoning County EPB has been contracted to undertake the external water quality monitoring program for the Ying Processing Plant and TSF (see Section 3.4.1). At the time of the site visit the first sampling round for this program had yet to be undertaken.

There is evidence of sediment build up in the first unlined collection pond/pumping station. Silvercorp has stated that these sediments were fines generated from excavating the discharging tunnels. However, as this pond receives tailings water via the TSF decant and drainage tunnel system, there is potential for this TSF discharge to contain some sediment.

At the time of the site visit, there has been no sampling and analysis of this sediment to determine the levels of contaminants and if the sediment presents an environmental risk. The potential for ongoing deposition of tailings could result in the development of a contaminated site and a closure liability (see Section 3.8). The sampling and analysis of this sediment will determine if this is currently the case. To remove the risk of any future contamination resulting from the operation of this unlined pond, it is recommended that consideration be given to relocating this facility to within the TSF pond.

Section 7.1 of the TSF preliminary design report provides a description of the hydrogeological condition of the TSF area. At the time of the production of the EIA report there was no hydrogeological survey conducted for the TSF. It was recommended that Company complete this survey as part of the TSF design.

### **3.3.2 HPG Project**

The HPG EIA report states that approximately 78,000 tonnes of waste rock will be generated during the project life of the HPG mine (i.e. stated in the EIA report as six years). Of that 41,000 tonnes is to be generated during construction/mine development and 37,000 tonnes is to be generated during mining operations.

The HPG EIA report also states that all waste rock generated from the mining operations will be backfilled underground within the mined out areas. The waste rock generated from construction is to be stored in a purpose built storage/containment facility equipped with a slag barrier and slag dam for collection of runoff. At the time of the site inspection, this facility had not been constructed and operational waste rock was being deposited in various waste rock stockpiles adjacent to the mine portals and was also being utilised for construction around the site.

Approximately 85 tonnes per day of process tailings are produced at the HPG processing plant and discharged into the purpose built TSF via a 300 metre gravity fed tailings pipeline. This tailings pipeline, while located within the upstream drainage catchment of the TSF, does not have secondary containment for collection and recovery of potential spillages of tailings resulting from pipeline rupture. The TSF has a design storage capacity of 155,000 cubic

metres, and has been constructed with upstream wall lifts and an upstream flood diversion/spillway system.

The TSF is constructed approximately 1km south of and upstream of the Xunyu River. The Xunyu Village is located between the TSF and the Xunyu River. The village comprises three residential areas with a total population of approximately 960 people. The nearest residential area is located approximately 50 to 100 metres downstream of the TSF. This area comprises about thirty residences with a population of 120 people. There are three residences within 50 metres of the TSF. The occupants of these residences (i.e. 17 people), have been relocated to an area north of the Xunyu River.

The situation of the TSF directly upstream of a residential area presents an environmental risk in regards to potential impacts resulting from TSF discharges and embankment overflows and/or failures. The upstream wall lift construction method also has the potential to present higher stability risk than the use of a downstream construction method. An assessment of the risks and potential downstream impacts of TSF embankment failure was undertaken as part of the HPG EIA. The conclusion of this assessment was that the situation of the TSF presents a significant risk, which can be addressed if the construction is completed as per the design.

Direct discharge of tailings water from the TSF to the Xunyu River can occur via a pipe and open drain system which passes through the Xunyu Village. In addition, evidence of historical tailings discharge was also observed at one of the stormwater bypass drains. This is in contravention of the design and operating methodology approved in the EIS and poses a significant environmental risk to the downstream residential areas.

Silvercorp have stated that since taking control of the HPG operations in January 2007, the Company has been assessing the TSF to determine what measures will be implemented to minimise the risk. No documented details of this assessment process have been sighted as part of this review. The outcomes of this process were also not available at the time of the review and no timetable has been provided by Silvercorp for completion of this process.

During the site visit it was stated that the TSF does not have a return water collection system, but there is some recovery of process water back within the plant. The HPG EIA report states that a return water pumping station was to be constructed within the upstream area of the TSF pond. This was to pump return water at a rate of 207 cubic metres per day, resulting in 80% reuse.

As part of the HPG EIA, leaching tests for metals and pH were undertaken on the tailings. The leachate results were within the Chinese National Standard *Identification Standard for Hazardous Wastes-Identification for Extraction Procedure Toxicity (GB5085.3-1996)*.

Monthly quality monitoring of the TSF discharge water and the Xunyu River receiving waters has been undertaken by the Luoning Environmental Monitoring Station. Results for April and May 2007 monitoring were provided, and results are within Chinese National Standards.

### 3.3.3 Luoning Smelter Project – Slag Wastes

Process slag wastes (such as furnace slag) will be generated from the operation of the Luoning Smelter. It is proposed to recover these solid wastes and either recycle them through the plant, sell them as by-products or where required, dispose of them in a purpose built landfill facility (i.e. constructed in line with Chinese National Standards – see Section 3.7.2). Some general comments are made within the smelter feasibility study regarding the potential for the sale of process slag wastes. However, there are no specific statements made in regards to the physical and chemical suitability of these wastes for this potential sale/reuse.

## 3.4 GROUNDWATER AND SURFACE WATER

The water supply for the Ying and HPG projects is mainly sourced from the Guxian Reservoir however there is also one make-up water pump station situated at a spring near the Ying processing plant.

The management of potential impacts to the water quality of the Guxian Reservoir from the operation of the Ying and HPG projects has been identified as a key component in the project environmental approvals.

### 3.4.1 Ying Project

The management of surface water discharges for the Ying mine comprises the:

- Collection and sedimentation treatment of mine dewatering, and a containment system (i.e. zero surface water discharge).
- Installation of a stormwater drainage bypass system for the segregation/diversion of clean stormwater and for flood protection.

Mine water is pumped to surface via the mine portals, and then pumped to Sedimentation Pond 1 via a lime dosing system to assist in flocculation. The settled water is then drained to Sedimentation Pond 2, where the overflow is then allowed to seep through the main waste rock stockpile to a further unlined containment pond. From this collection point the treated water is removed through seepage (i.e. to the adjacent reservoir) and evaporation.

Chapter 4 of the Ying EIA states that the water quality protection for the Guxian Reservoir and the Ying project area is subject to Chinese National Standard *Environmental Quality Standard for Surface Water (GB3838-1988 - Class II)*. However, the mine discharge water quality is to meet *Class III* of this Standard (i.e. at the point of discharge).

Quality monitoring of the mine waters and the surrounding receiving surface waters is carried out under contract with the Luoning County Environment Institute, in line with the specifications of the site EMMP. The surface water quality monitoring program was initiated in June 2005, with follow up sampling programs being undertaken in July, September and December 2006, and in April and May 2007. All mine discharge water quality monitoring results up to May 2007 have been within the *GB3838-1988 - Class III*.

It should be noted that values for some of the relevant parameters from this Standard (e.g. values for nitrogen/nitrate, phosphorous and total petroleum hydrocarbons) were not included within the monitoring results provided. Silvercorp have stated that these parameters will be analysed in future water samples.

There is no corresponding monitoring of the groundwater within and surrounding the mine to determine the extent and potential impacts from seepage of the collected mine waters. It is recognised that there is no requirement under the Chinese environmental approval to monitor this potential impact. However, international standards and guidelines require that the impacts to groundwater from mining operations are determined. As the discharge of mine water to the Guxian Reservoir occurs via seepage, this would suggest that there is a potential for quality impacts to localised groundwater and in turn the Guxian Reservoir. The implementation of an appropriate groundwater monitoring program to complement the existing surface water program will provide data to confirm the actual impacts to groundwater from the seepage of mine waters. It is recommended that consideration be given to developing a groundwater monitoring program for the Ying Project, with specialist hydrogeological input. Silvercorp has stated that the Company is considering this recommendation and intends to initiate such a program.

The natural stormwater drainage flows for the Ying mine site are through the valley where the mine has been constructed down into the reservoir. Stormwater diversion drains have been constructed upstream of the site to divert stormwater flows into adjacent valleys. In addition, an underdrainage diversion tunnel is being constructed to divert the remaining upstream stormwater flows into the reservoir. At the time of the site visit, the construction of the diversion tunnel was to a point upstream of Settling Pond 2 and as such, discharging stormwater flows into the mine water stream. Completion of construction of this tunnel through to a point beyond the mine operational area and with direct discharge into the reservoir, is required for this tunnel to act as a site stormwater diversion drain.

The surface water management for the Ying processing plant comprises the:

- Collection and reuse of process and surface drainage waters from within the plant facility.
- Collection and reuse of tailings water (i.e. return water system – described in Section 3.3).
- The direction and discharge of stormwater within the upstream catchment of the TSF (described in Section 3.3).

At the time of the site visit, the only water quality monitoring in place for the Ying Processing Plant was the regular onsite monitoring of the TSF return water quality (see Section 10.3). Silvercorp has stated that the Luoning County EPB has been contracted to undertake the external water quality monitoring program for the Ying Processing Plant and TSF. At the time of the site visit the first sampling round for this program had yet to be undertaken. No water quality data from this external water quality monitoring program has been sighted as part of this review. Silvercorp have since stated (August 2007) that this program started on 26 June 2007, and that water quality results have been received and they are all within Chinese National standards.

There has been no corresponding monitoring of the groundwater within and surrounding, the Ying TSF to determine the extent and potential impact from seepage of the collected tailings waters/sediments. Silvercorp have stated that the Ying TSF groundwater monitoring program will be initiated soon.

### 3.4.2 HPG Project

The surface water discharges for the HPG mine and processing plant comprises the:

- Untreated mine waters.
- Stormwater directed into surface drainage lines/features (i.e. no stormwater diversion measures).
- Tailings water (i.e. no return water system – see Section 3.3).

Surface water management at the HPG project is limited and requires improvement. At the time of the site visit there was no evidence noted of any current water quality monitoring program being carried out at the HPG mine. Silvercorp has stated that settling ponds and a lime dosing system will be constructed for the treatment of mine water. A corresponding water quality monitoring program will also be implemented after the completion of this mine water treatment system.

A surface water quality monitoring program water undertaken by the Luoning Environmental Monitoring Station was in place for the HPG processing plant. The focus of this program has been mainly on monitoring of TSF discharges and the Xunyu River downstream receiving waters. Results for April and May 2007 monitoring were provided, and results are within Chinese National Standards.

There is no management or monitoring of potential impacts to groundwater at the HPG project.

It recommended that consideration be given to developing a surface and groundwater monitoring program for the HPG Project, with specialist hydrogeological input.

### 3.4.3 Luoning Smelter Project

The Luoning Smelter Project is located approximately three kilometres upstream and south of the Luohe River and approximately 1.5 kilometres km to the west of the Jingyanghe River. The Luonan irrigation channel is also located approximately 1.2 kilometres to the north of the project site.

Water supply for the Luoning Smelter will be sourced from groundwater wells to be located near the Luohe and/or Jingyanghe Rivers.

The Luoning Smelter Project will operate on a zero water discharge principle; all process waste water (acid waters), stormwater (including from slag storage areas), sewage and general operational (washdown) wastewaters are to be collected, treated and then reused within the

process. Reference is made within the smelter EIA Report to minimising potential impacts to surrounding groundwater via adopting this zero water discharge principle.

Stormwater will be treated via settling ponds. Process waste water will be treated via a three stage process comprising neutralisation (i.e. with lime), precipitation/sedimentation (i.e. using a combination of lime, iron and aluminium salts) and filtration. Treatment of sewage and washdown waters is discussed in Section 3.7.

## 3.5 CHEMICALS AND HAZARDOUS MATERIALS

### 3.5.1 Ying and HPG Projects

The hazardous materials utilised within the Ying and HPG projects comprise:

- Diesel and oils for mobile plant.
- Explosives.
- Processing reagents – zinc sulphate, bluestone, sodium sulphite, No.2 (pine) oil, ammonium dibutyl dithiophosphate, butyl xanthate, ethyl xanthate, and lime.

Hydrocarbons are stored on site within 205 litre drums. Storage and handling of hydrocarbons (including fixed plant) occurs without any secondary containment, either within open areas or within small sheds.

At the time of the site visit there were no designated facilities for servicing and maintenance of mobile equipment (which was being undertaken in open uncontained areas) and the storage and handling of hydrocarbons within the Ying and HPG projects did not conform to international industry standards (e.g. Australian Standard *AS1940-2004: The storage and handling of flammable and combustible liquids*).

Since the site visit, Silvercorp have stated the following in regards to hydrocarbon management:

- 5,500 litre tanks have recently been purchased and installed within secondary containment.
- A facility has been designated for mobile equipment servicing and maintenance, however contractors are still undertaking such work in open areas due to the project still being in the construction stage and the constraint with land space. Maintenance shops for contractors will be built by November 2007.
- Silvercorp is progressing towards conforming to international industry standards with respect to hydrocarbon storage and handling.

Processing reagents are stored under cover within the plant facilities. At the time of the site visit, there was little segregation of reagents and there was also some potential for stormwater ingress into the reagent storage areas. Since the site visit, Silvercorp have stated the following in regards to storage of process reagents:

- Segregated storage of reagents within brick walled areas will be completed by the middle of August 2007.
- Stormwater diversion drainage/ditches are proposed to prevent stormwater ingress into the reagent storage area.

### **3.5.2 Luoning Smelter Project**

The Luoning Smelter EIA refers to use of only one reagent – hydrogen nitrate, which will be used as the silver electrolyte. There is no detail provided in regards to proposed storage and handling measures.

The smelter will produce sulphuric acid as a by product of treating the smelter's sulphur dioxide emissions. The EIA report states that 'waste acid' production will be 84 cubic metres per day and the total operation storage acid capacity will be 6,530 cubic metres (i.e. approximately two to three months storage). The collection and transport from site will be the responsibility of the individual customers.

There will two storage tanks each having a capacity of 3,215 cubic metres and an additional tank of the same size to be used as a reserve. There will also be secondary containment and spillage recovery sumps around each of the tanks. Each containment area will be designed to hold approximately 50% of the tank volume, and there will be a pumping/pipeline system for transfer of acid spillage to the reserve tank. In addition there will also be a further back up pumping/pipeline system for transfer of acid spillage into the stormwater collection/storage system (i.e. an additional 3,000 cubic metres of storage capacity), in the event that there is a tank and/or pump failures.

## **3.6 AIR EMISSIONS**

### **3.6.1 Dust Emissions**

#### **3.6.1.1 Ying and HPG Projects**

The dust generation sources for the Ying and HPG projects are primarily from vehicle movements, materials handling and open/unsealed areas.

The proposed operational dust management measures mainly comprise:

- Regular wetting of roads, waste rock stockpiles and open/unsealed areas.
- Dust suppression and collection equipment on materials handling (e.g. sprays, dust extraction, wet scrubbers).

Silvercorp have stated that water trucks have been purchased to implement dust management measures by wetting roads and open working areas. The operation of these water trucks was not observed during the site visits. However, Silvercorp have since stated (in August 2007) that they have purchased a water truck during July 2007 and have provided a photo of this water truck (see Plate 1).

**Plate 1: Water Truck at Ying mine**

The Ying EMMP also states that the monitoring of total suspended particulates (TSP) be undertaken twice yearly at one monitoring point for the mine, processing plant and residential area. At the time of the site visit, this environmental dust monitoring program had not been initiated. Silvercorp have stated that this program is scheduled for commencement in mid August 2007.

### ***3.6.1.2 Luoning Smelter Project***

The dust generation sources for the Luoning Smelter Project in the construction phase will be from earthworks, vehicle movements and general open/unsealed areas. The proposed construction dust management measures will comprises regular watering of roads and unsealed areas (including stockpile areas), regular cleaning/washdown of vehicles and the setting of vehicle speed limits.

The dust generation sources for the operations phase will be from ore handling, furnace exhausts, electrolysis, coal handling/combustion and general non-point fugitive emissions. The proposed operational dust management measures will comprise:

- An enclosed materials handling system.
- Dust suppression/collection measures - sprays, bag filters and stack precipitators and wet scrubbers for exhaust emissions.
- Regular watering of roads and unsealed areas (including stockpile areas).

The smelter gas emissions are not discharged after dust collection but are sent to the acid plant for sulphur dioxide removal (see Section 3.6.2).

### 3.6.2 Gas Emissions – Luoning Smelter Project

The smelter EIA report describes the process of for the treatment of gas emissions. After dust collection the smelter gas emissions will be sent to the acid plant for sulphur dioxide removal/sulphuric acid production. The gas scrubbing system utilises weak acid and has a predicted sulphur dioxide removal efficiency of approximately 98%. The predicted concentration of sulphur dioxide in the emitted tail gas is 732 milligrams per cubic metre.

All gas emissions are predicted to meet Chinese National Atmospheric Pollutant Emission Standards. Predictive ground level concentrations of sulphur dioxide and particulates from gas stack emissions have also been modelled for various locations outside of the site boundary and under various meteorological conditions. All these predicted ground level concentrations are within the Chinese National *Ambient Air Quality Standard (GB3095-1996)*.

### 3.6.3 Greenhouse Gas Emissions

There is no Chinese National legislative requirement for the project to estimate its Greenhouse Gas emissions or to implement any emissions reductions. As such none of the project environmental assessment documentation reviewed address the issue of Greenhouse Gas emissions. However, energy efficiency and the reduction of Greenhouse Gas emissions are now considered as Chinese National policy directives. In addition, these are also components of IFC environmental requirements and are considered as internationally recognised environmental management practices.

There is some minor reference to energy efficiencies within the Ying EIA report (i.e. in the context of the application of cleaner production principles). The Luoning Smelter EIA report presents a more detailed discussion on energy efficiencies in relation to the use of the SKS smelting process.

## 3.7 WASTE MANAGEMENT

### 3.7.1 Waste Oil

#### 3.7.1.1 *Ying and HPG Projects*

Waste oil is generated through maintenance of mobile and fixed plant. As maintenance activities to date appear to be generally ad hoc and small scale, minimal volumes of waste oil have been generated to date. No designated waste oil collection and management facilities were observed during the site visits and management of waste oil is not addressed within the reviewed project environmental assessment and approval documentation. However, Silvercorp have stated that waste oil is collected and stored in 205 litre drums and sold to Sinopec for recycling.

### **3.7.1.2 Luoning Smelter Project**

The management of waste oil is not addressed within the smelter EIA report. However, Silvercorp have stated that a similar recycling program for waste oil as implemented in its other operations will be initiated as soon as smelter construction commences.

It is worth noting that the IFC requirements and internationally recognised environmental management practice with regards to waste oil is to explore commercial alternatives for environmentally sound disposal, recycling or reuse.

## **3.7.2 Solid Wastes**

### **3.7.2.1 Ying and HPG Projects**

Solid industrial and domestic wastes are disposed of directly to land. This practice is in line with provisions made in the Ying EIA for centralised disposal areas which are to be landfilled (i.e. buried) at the end of their service life. This solid waste disposal method is in line with international sanitary landfill practice.

### **3.7.2.2 Luoning Smelter Project**

General solid industrial and domestic wastes are proposed to be disposed of directly to landfill.

In addition there is also a proposed hazardous wastes landfill facility, which will receive acid waste slag that contains arsenic (NB: Estimated level of arsenic present within this slag is not provided). This hazardous wastes landfill will reportedly be lined with a geo-membrane and have stormwater diversion drains to minimise potential seepage, in line with the Chinese National *Standard of Landfill and Pollution Control of Hazardous Waste (GB 18598-2001)*. The proposed capacity of this landfill is 12,000 cubic metres which will have a service life of 20 years.

## **3.7.3 Sewage and Oily Waste Water**

### **3.7.3.1 Ying and HPG Projects**

Sewage generated at the Ying and HPG projects are currently treated through a below ground septic systems, and then discharged.

The Ying EIA report and approval refers to the recycling of the treated sewage for irrigation; to date this yet to occur. It should be noted there is a proposal to develop a centralised sewage treatment plant for the Mine. Design for a centralised aeration and chlorination based sewage treatment system has been completed. The level of treatment of the sewage waste will be to Chinese National Standards and to a level that will allow for the reuse of the treated wastewater on site for irrigation and dust suppression.

The management of oily waste water/washdown waste water is not addressed in the Ying EIA report. The washing the mobile equipment currently occurs without any containment or

collection measures. Silvercorp have stated that a centralised mobile equipment washdown facility will be established and that the washdown waste water will be collected for treatment.

### 3.7.3.2 Luoning Smelter Project

The Luoning Smelter Project will operate on a zero water discharge principle and it is proposed to collect, treat and reuse sewage and operational washdown/oily waste water.

## 3.8 CONTAMINATED SITES ASSESSMENT

There is no documented contaminated sites assessment process for any of the Silvercorp China projects. The current and proposed practices of fuel storage without secondary containment have the potential to result in the development of contaminated areas.

In addition the build up of sediments within the unlined Ying TSF collection pond/pumping station may present an environmental risk and also constitute a contaminated site. It is recommended that sampling and analysis of this sediment be undertaken to determine if this is currently the case.

## 3.9 SKS SMELTING PROCESS

The SKS smelting process was jointly developed by Shuikoushan Mining Corporation and ENFI in China. It is an advanced bottom blown smelting process utilising oxygen enriched air to smelter lead sulphide concentrates. The process replaces the conventional sintering circuit resulting in significant reductions in discharge levels of lead dust and sulphur dioxide. In addition the SKS is also credited as being more energy efficient than conventional smelting.

The Luoning Smelter Feasibility Study provides the following as being the environmental benefits presented by the SKS smelting process:

- The process is carried out in an enclosed furnace, which is maintained at negative pressure to minimise potential for releases of sulphur dioxide.
- The sulphur dioxide produced from the process is very suitable for use in acid production (i.e. a greater potential for transformation and absorption than sintering gases).
- All lead ash is handled within enclosed conveyors and returned for batching.
- Lead and slag discharge outlets are equipped with smoke ventilators.
- The sulphur content in the high lead slag is low (i.e. 0.3-0.5% sulphur) and can be discharged without further desulphurisation.
- The use of pure oxygen for smelting reduces the need for additional coal fired heating.
- Waste heat from the furnace gas emissions are able to be recovered.
- Primary crude lead is produced by the smelting furnace, greatly reducing the quantities of materials to be processed in the blast furnace (especially the consumption of coke).

### 3.10 QUALITATIVE ENVIRONMENTAL RISK ANALYSIS

A qualitative environmental risk analysis has been used to assess the various environmental aspects discussed in above sections.

To ensure the technical integrity of this developed risk analysis process, the following Australian Standards for risk analysis and risk management have been utilised for overall guidance:

- *AS/NZS 3931:1998 Risk Analysis of Technological Systems – Application Guide.*
- *AS/NZS 4360:1999 Risk Management.*
- *HB 203:2004 Environmental Risk Management – Principles and Process.*

These Australian Standards have been developed in line with comparable international standards.

A risk is generally described in terms of the severity/consequence and likelihood of an undesirable occurrence or incident. The greater the potential severity and likelihood of an undesirable occurrence, the higher the level of risk associated with the related activity. An environmental risk can be defined as both a risk to the environment resulting from an organisation's activities and also as a risk to an organisation from related environmental issues.

The generic approach for this qualitative environmental risk analysis has the following three steps:

1. Establish the context/define the scope of the analysis – goals/objectives, the analysis strategy and evaluation criteria.
2. Identify and analyse the environmental risks in terms of consequence and likelihood.
3. Evaluate and rank the environmental risks.

Further detail on the environmental risk analysis process and a summary table of environmental risks for the Silvercorp China Projects are presented in Appendix 3. The following section summarises the outcome of the environmental risk analysis.

#### 3.10.1 Evaluation of Environmental Risk

The sources of inherent environmental risk are project activities that may result in potential undesirable events/environmental impacts. These project activities have been previously described within this report. In summary they are as follows:

- Dust generation and management.
- Smelter gas emissions.
- Surface water management and discharges (i.e. mine dewatering, TSF discharges and stormwater runoff).
- Groundwater management (i.e. seepage from TSF's and waste rock stockpiles).
- Rehabilitation of waste rock stockpiles and other disturbed areas.

- Storage and handling of hazardous materials.
- Waste generation and management (industrial and domestic wastes).
- Potential contaminated sites.

It should be noted that the sources of environmental risk for the Luoning Smelter are proposed only. The potential environmental risk rankings for these proposed sources of environmental risk have been based on the project information reviewed and associated environmental management statements made by Silvercorp.

The categories of environmental risks posed by the Silvercorp China Projects range from Acceptable to Tolerable Risks (i.e. there are no Unacceptable Risks). The Tolerable environmental risks for the project are:

### **Very High Environmental Risks**

- HPG Processing Plant - surface water/tailings discharges.

### **High Environmental Risks**

- Ying and HPG Mines - dust emissions.
- HPG Mine - surface water discharges.
- HPG Processing Plant - groundwater discharges.
- Ying and HPG Processing Plants - land disturbance and rehabilitation (i.e. TSFs).
- Luoning Smelter - land disturbance and rehabilitation.
- Ying and HPG Mines - hydrocarbon storage and handling.
- Luoning Smelter - storage and handling of slag materials.
- Luoning Smelter - storage and handling of hydrocarbons and chemicals.
- Ying and HPG projects - oily wastewater disposal.
- Ying and HPG projects - solid waste disposal.

Of the above environmental risks, surface water/tailings management for the HPG TSF represents the most significant environmental risk (i.e. very high risk) for the current Silvercorp China Projects.

It is worth noting that the storage and handling of hazardous materials/wastes and air emissions for the Luoning Smelter Project have the potential to present significant (i.e. very high) environmental risks if proposed management measures are not implemented as planned.

Generally all of the above Tolerable Risks are able to be reduced to Acceptable Risks through application of appropriate remedial/risk management measures; including implementation of a comprehensive and appropriately resourced, operational environmental monitoring and management plan for each project (i.e. fully implement and update plans documented as part of the project EIA process).

### 3.11 SITE CLOSURE PLANNING

Silvercorp have stated that the Company will comply with the Chinese National requirements for mine closure. These comprise Article 21 (Closure Requirements) of the *Mineral Resources Law (1996)*, and Articles 33 and 34 of the *Rules of Implementation Procedures of the Mineral Resources Law Of The People's Republic Of China (2006)*.

A component of World Bank/IFC and internationally recognised environmental standards and practices, is that an operational site closure planning process be developed and implemented, and that a Closure Plan is documented to guide this process. It should be noted that this is an operational process that is designed to address, where possible, the identified site closure liabilities, during the operational phase of the project. With the overall objective being to minimise the liabilities that will need to be addressed upon site decommissioning and closure. The development and implementation of a plan to decommissioning a site at or near closure is the end point of this longer term operational planning process. The operational site closure planning process should include the following components:

- Identify all site closure stakeholders (e.g. government, employees, community etc.).
- Undertake stakeholder consultation to develop agreed site closure criteria and post operational land use.
- Maintain records of stakeholder consultation.
- Establish a site rehabilitation objective in line with the agreed post operational land use.
- Describe/define the site closure liabilities (i.e. determined against agreed closure criteria).
- Establish site closure management strategies and cost estimates (i.e. to address/reduce site closure liabilities).
- Establish a financial accrual process for site closure.
- Describe the post site closure monitoring activities/program (i.e. to demonstrate compliance with the rehabilitation objective/closure criteria).

The Silvercorp China Projects do not have in place a closure planning process in line with the above components. Silvercorp have stated as the projects are still in the construction and trial production stages, site closure planning has yet to be initiated. Silvercorp have also stated that a site decommissioning plan will be produced in line with Chinese National and international requirements, at least one year before mine closure.

#### 3.11.1 Site Rehabilitation and Closure Cost Estimates

At the time of this review, there have been no comprehensive site closure cost estimates undertaken for the Silvercorp China Projects (i.e. cost estimates for addressing all of the identified site closure liabilities). However, within the Ying and HPG EIA reports, the following cost estimates have been made in respect to soil and water conservation and for site rehabilitation measures:

- **Ying EIA** – Table 12.1 in the hard copy provided or Table 11.1 (Schedule of Environmental Protection measures and Investment Budget) presented in Section 11.2.2 (Environmental Protection Measures and Investment Budget) in the electronic copy

provided (Schedule of Environmental Protection measures and Investment Budget), provides cost estimates for the project's operational soil and water conservation scheme of 3.187 million RMB, and 0.785 million RMB for the rehabilitation of the TSF.

- **HPG EIA:**

- Table 7.3 (Investment Status of the Water and Soil Conservation measure of the Project) provides a cost estimate for the project's operational soil and water conservation scheme of 0.323 million RMB.
- Table 8.1 (Summary of Environment Protection) provides a cost estimate for site rehabilitation of 0.137 million RMB.

In addition Silvercorp have stated that following site rehabilitation cost estimates have been provided within the project EIA reports:

- 15.163 million RMB – quoted from page 12-18 of the Ying EIA report.
- 0.466 million RMB – quoted from Appendix 1 of the HPG EIA report.

It should be noted that indicative site closure costs can be developed as a component of a Preliminary Site Closure Plan. This process will determine (through stakeholder consultation), the site's closure criteria and associated closure liabilities. Indicative site rehabilitation and closure measures can then be developed along with cost estimates for their implementation.

## 4. SOCIAL ASSESSMENT

### 4.1 SOCIAL AND COMMUNITY INTERACTION

The nearest significant community for the Ying and HPG projects is the Xia Yu Township, which is approximately two kilometres to the south west of the Ying processing plant. The Luoning County is approximately 40 kilometres to the north east and the town of Lushi is approximately 30 kilometres to the south east.

The project area's surrounding land use is predominantly agriculture.

Records of donations and contributions made by Silvercorp to communities within the Luoning County were provided as part of this review. These comprise a range of cash donations/contributions to local capital projects and community support programs, as well as the undertaking of capital projects such as road construction and school repairs/upgrading. The total amount of socials funds expended to date by Silvercorp is 7,495,680RMB (517,680RMB in 2005, 1,770,000RMB in 2006 and 5,208,000RMB to date in 2007).

Other positive effects to the surrounding local communities are mainly in the form of direct employment of local contractors and the use of local suppliers/service providers where practical.

No records of public complaints in relation to the activities of Ying and HPG Projects were sighted as part of this review. There is also no documented procedure for the response to and recording of public complaints.

### 4.2 CULTURAL MINORITIES AND HERITAGE

There are no cultural minority groups within the general project area surrounds. The cultural make up of the broader Luoning County is predominantly Han Chinese.

No records of cultural heritage sites located within or near the Ying and HPG project area, were sighted as part of this review.

### 4.3 RELATIONSHIP WITH LOCAL GOVERNMENT

Silvercorp has a close relationship with the local Luoning County, evidenced by the following:

- The Company consults with the Luoning County on local issues.
- The Luoning County is utilised to undertake regular water quality monitoring for the Ying and HPG Projects.
- Relations with statutory bodies are also reported to be positive as evidenced by no notices of breach of environmental conditions have been issued to Silvercorp.

## 5. OCCUPATIONAL HEALTH AND SAFETY

As a component of the environmental review, the following activities were undertaken for occupational health and safety (OHS):

- During the site visits opportunistic observations were made in respect to OHS work practices.
- OHS documentation provided by Silvercorp was noted and recorded.

This report section is not intended to be, nor should it be considered as a comprehensive safety due diligence review.

### 5.1 OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT

Silvercorp have stated that the following OHS management components are in place for the Ying and HPG Mines:

- There are OHS departments for each site; the Ying Mine is staffed six safety officers and the HPG mine with three safety officers.
- The OHS departments are to provide safety training, enforce the OHS policies and procedures, make recommendations on mine safety issues and carry out daily inspections of the underground workings and explosive usages.
- Each of the four mining contractors is required to appoint one to two safety officers of their own.
- Safety committees comprising of 10 members each are maintained for the Ying and HPG mines. These safety committees are headed by the General Manager of Found and made up of Deputy General Manager of Henan Found, the Mine Manager, Safety Department Supervisor, Safety Officer, and representatives of the four mining contractors. The committees are coordinated by each mine's Safety Department and the mine management and the safety officers are required to have valid mine safety training certificates issued by the Provincial Bureau of Safe Production and Inspection.
- Insurance policies covering death and injury have been purchased for all of the staff and workers in the mine.
- The mine and the mining contractors supply PPE to their own staff or miners. The PPE includes hard hats, gum boots, work gloves, face masks, and ear plugs.
- There is a proposal to establish a mine rescue team in the near future.

Silvercorp have stated that in regards to the provision of occupational medical services the following have been established:

- A medical clinic has been established at the Ying Mine staffed with a licensed medical physician to perform injury treatment, emergency and routine health check.
- A contract with the Luoning County General Hospital to take and treat injured workers from the Ying and HPG mines.

An inspection of the above clinic was not undertaken as part of this review. The licence of the medical physician and the contract with the Luoning County General Hospital, have been sighted as part of this review.

Silvercorp has stated that the following OHS policies and procedures have been established for the Ying Mine, in line with the Chinese health and safety laws and regulations:

- Personal responsibilities of safe production, which covers safety responsibility for all management and staff.
- Safety inspection policies, which outline the procedures for daily, monthly and quarterly safety inspections.
- Safety training policies.
- Accident reporting policies.
- High-risk source monitoring policies.
- Correction policies of safety rule breach.
- Safety management policies for equipment.
- Safety incentive and punishment policies.
- OHS record-filing policies.
- Safety fund collecting policies.
- Operating procedures for underground mining equipment.
- Incentive and penalty policies.

Silvercorp has provided SRK with scanned copies of the following OHS documentation:

- External Safety Manuals/Textbooks:
  - Safety Training Textbook for Non-Coal Mines, Directors and managers – Training Centre of Luoyang Production Safety Supervision Authority.
  - Safety Knowledge for Employers – Editorial Department of Labour Safety.
  - Safety Knowledge for Employers – Edited by Luo Yinyu and Jiang Zhongan, China Social Sciences Publishing House.
  - Knowledge of Safe Production Management – Table of Contents.
  - Basic Knowledge of Safety Technology – Table of Contents.
  - Basic Knowledge of Occupational Health – Table of Contents.
  - Contents from Chapter 1 to Chapter 6, including Introduction of Safety Production in Mine, Mine Safety Regulation and Supervision and Management System in China, Safety Security of Mine Construction, Safety Security of Mining, Safety Management System in Mine, Modern Safety Management Methods.
  - Contents from Chapter 7 to Chapter 9, including Mine Accident Prevention Technology in Non-Coal Mines, Emergency Response and Treatment of Accidents, and Laws and Regulations.

- Safety Knowledge – Edited by Beijing Dafei Safety Science Technology Company Limited.
- Safety Knowledge – Table of Contents (Chapters 1 to 3) - including Regulations for Report and Investigation of Accidents in Production Safety, Henan Safe Production Regulation, Introduction of Safe Production, Management of Safe Production, and Technology of Safe Production.
- Safety Knowledge – Table of Contents (Chapters 4 to 6) - including Knowledge of Labour Protection, Accident Prevention and Emergency Response, and Serious Accident Cases.
- Safety Knowledge in Non-Coal Mines – Edited by Li Xiaofei and Wang Honghan Chinese Workers Press.
- Safety Knowledge in Non-Coal Mines – Table of Contents (Chapters 1 to 5), including Supervision and Management of Safe Production in Mines, Safety Management of Mine Construction, Safety Management of the Mine Enterprise, Basic Safety Requirements, Mine Tunnel Safety Requirements.
- Safety Knowledge in Non-Coal Mines – Table of Contents (Chapters 6 to 11), including Safety Requirement of Underground Mining, Open Pit Mining Safety, Blasting Safety Requirements, Transporting and Hoisting Safety Requirements, Ventilation and Dust-Prevention Safety Requirements, Electricity and Gas Safety Requirements of the Mine.
- Safety Knowledge in Non-Coal Mines – Table of Contents (Chapters 12 to 15), including Mine Surface Industry Square and Surface Production System, Mine Water Prevention and Discharge, Mine Fire Protection, Mine Accidents Ambulance.
- Safety Management and Regulations (Part 1) – Table of Contents.
- Fire and Explosion Prevention (Part 2) – Table of Contents.
- Chemical Safety (Part 3) – Table of Contents.
- Personnel Safety Certificates:
  - Qualification Certificate of Intermediate Professional Title in Guizhou Province, Guizhou Personnel Bureau.
  - Cover-Safety Qualification Certificate for the Principal Responsible Person of Production and Operation Units, Guizhou Production Safety Supervision Authority, issued 30 August 2006.
  - Safety Technical Engineer Certificate, Name-Zhu Xuewen, Sex-Male, Date of Birth-1957.8, Certificate Issue Date 1 April 1, 2002, Certificate Number-20010012.
  - Safety Training Certificate of Zhu Xuewen, Course Studied-Safety Regulation and Management, Course Hour-90, Mark-99.
  - Safety Training Certificate of Zhu Xuewen, who participated in the safety training from 3 December, 1990 to 20 December, 1990 and passed the examination, certificate number 075, certificate issue date 28 February 1991.
  - Safety Qualification Certificate of Zhu Xuewen, who participated in the safety qualification training from 22 April, 2005 to 29 April, 2005, passed the examination.

- Certificate issue date 20 May, 2005, certificate number-050547, Zhu Xuewen-Director of Guizhou Zijin Mining Co., Ltd.
- Safety Qualification Certificate of Zhu Xuewen, Course studied-safe production law and regulation, safe production management and safety technology of non coal mine, mark-passed.
  - Safety Training Certificate, Ministry of Geology and Mineral Resources, People's Republic of China.
  - Safety Qualification Certificate of Fang Jianzhong, who is a Safety Technician in Henan Faende Mining Co., Ltd. Certificate Issued by Henan Production Safety Supervision Authority to Certify that Mr. Fang participated in the Safety Training from 18 April, 2006 to 26 April, 2006 and passed the examination. Certificate No. 06523000001615, Issue Date 29 May, 2006.
  - Safety Qualification Certificate of Feng Yanping, who is a Section Chief in Henan Faende Mining Co., Ltd. The certificate is issued by Henan Production Safety Supervision Authority to certify that Mr. Feng participated in the safety training from 18 April, 2006 to 26 April, 2006 and passed the examination. Certificate No. 06523000001616, Issue Date 29 May, 2006.
  - Safety Qualification Certificate of Hua Housheng, who is a Safety Technician in Luoning Faende Mining Co., Ltd. This is to certify that Mr. Hua participated in the safety training from 15 November, 2005 to 22 November, 2005 and passed the examination. Certificate No.06523000000298, Issue Date 23 January, 2006. The certificate is issued by Henan Safe Production Supervision Authority.
  - Safety Qualification Certificate of Liu Jinping, who is a section chief in Hennan Faende Mining Co., Ltd. This is to certify that Mr. Liu participated in the safety training from 18 April, 2006 to 26 April, 2006, and passed the examination. Certificate No. 06523000001617, Issue Date 29 May, 2006. The certificate is issued by Henan Safe Production Supervision Authority.
  - Safety Qualification Certificate of Zhang Xiaotao, who is a Safety Technician in Hugou Gold Mine in Luoning County. This is to certify that Mr. Zhang participated in the safety training from 15 November, 2005 to 22 November, 2005 and passed the examination. Certificate No.06523000000253, Issue Date 23 January, 2006. The certificate is issued by Henan Safe Production Supervision Authority.
  - Safety Qualification Certificate of Wang Huanxiang, who is a section chief in Hennan Faende Mining Co., Ltd. This is to certify that Mr. Wang participated in the safety training from 18 April, 2006 to 26 April, 2006, and passed the examination. Certificate No.06523000001614, Issue Date 29 May, 2006. The certificate is issued by Henan Safe Production Supervision Authority.
- Operational Safety Licences:
    - Safe Production Licence of Dongzigou Tailings Reservoir of Luoning Huatai Mining Co. Ltd. - License Number [2006] CWK433, Company Name - Dongzigou tailings reservoir of Luoning Huatai Mining Co. Ltd, Responsible person-Song Xiumiao, Validation Period 30 August, 2006 to 29 August, 2009. Licence issued by Henan Production Safety Supervision Authority.

- Safe Production Licence of Haopinggou Lead Mine of Luoning Huatai Mining Co. Ltd -License Number [2006] CJC432, Company Name- Haopinggou Lead Mine of Luoning Huatai Mining Co. Ltd, Responsible Person - Song Xiumiao, Validation Period 30 August, 2006 to 29 August, 2009. Licence issued by Henan Production Safety Supervision Authority.
- Safe Production Licence Change Application Form of Haopinggou Lead Mine, Henan Huawei Mining Co., Ltd.
- Filing Note of Safe Production Licence Change Application Form of Haopinggou Lead Mine, Henan Huawei Mining Co., Ltd.
- Contents of Safe Production Licence Change Application Form of Haopinggou Lead Mine, Henan Huawei Mining Co., Ltd, from Chapter 1 to Chapter 3, including Introduction of Haopinggou Lead Mine, Business Licence and Copy of Safe Production Licence, Responsibility System for Production Safety.
- Contents of Safe Production License Change Application Form of Haopinggou Lead Mine, Henan Huawei Mining Co., Ltd, Chapter 4 Production Safety Regulations.
- Contents of Safe Production License Change Application Form of Haopinggou Lead Mine, Henan Huawei Mining Co., Ltd, from Chapter 6 to Chapter 17, details of the safety measures in Haopinggou Lead Mine.
- Background of Safe Production License Change Application of Henan Huawei Mining Co., Ltd and Luoning Huatai Mining Co., Ltd.
- Cover of Safe Production Licence Application of Henan Faende Ming Co., Ltd, application number-Fs[2005]CSG022, application date – 15 December, 2005.
- Filing Note of Safe Production Licence Application of Henan Faende Ming Co., Ltd.
- Annex of Safe Production Licence Application of Henan Faende Ming Co., Ltd.
- Comment of Safe Production License Application of Henan Faende Ming Co., Ltd.
- Safety Personnel CVs:
  - CV of Zhu Xuewen, Director of Safety and Environment Department of Henan Huawei Mining Co., Ltd.
  - CV of Wang Huanxiang, Mining Safety Engineer in Henan Faende Mining Co., Ltd.
  - CV of Fang Jianzhong, Safety Technician in Henan Faende Mining Co., Ltd.
  - CV of Feng Yanping, Mining Safety Engineer in Henan Faende Mining Co., Ltd.
  - CV of Hua Housheng, Safety Technician in Henan Faende Mining Co., Ltd.
  - CV of Li Lianguo, Safety Technician in Moon Valley Lead Zinc Silver Mine of Henan Faende Mining Co., Ltd.
  - CV of Liu Jinping, Mining Safety Engineer in Henan Faende Mining Co., Ltd.
  - CV of Zhang Xiaotao, Safety Technician in Henan Faende Mining Co., Ltd.
  - CV of Song Peiting, who is a doctor in Henan Faende Mining Co., Ltd.
- Internal OHS Management Documentation:

- Rewards and Punishments for Production Safety Management of Henan Faende Mining Co., Ltd 3 April, 2007.
- Responsibilities of the Employees at all Levels in Henan Huawei Mining Co., Ltd. - 5 March, 2007.
- Responsibility System for Safety in Production of Henan Faende Mining Co., Ltd.
- Registration Form for the Workers of Henan Huawei Mining Co., Ltd.
- Assessment Method for Seasonal Award of Production Safety.
- Emergency rescue planning for accidents in Henan Faende Mining Co., Ltd.
- Annual review form for the Supervision Card of Purchasing Explosive Articles in Luoning County of Henan Faende Mining Co., Ltd.
- Form-1 for ratification of the permit for the use of explosive articles in Henan Faende Mining Co., Ltd.
- Form-2 for ratification of the permit for the use of explosive articles in Henan Faende Mining Co., Ltd.
- Safety Performance Statistics:
  - Safety Operational Regulation of Henan Faende Mining Co., Ltd, July 2004. Industrial injury of workers of Henan Faende Mining Co., Ltd in 2006 and 2007.
  - Industrial injuries of the workers in Haopinggou mine in Henan Huawei Mining Co., Ltd. in each month from February to July.

## 5.2 OCCUPATIONAL HEALTH AND SAFETY OBSERVATIONS

OHS observations made during the site visits have been noted in respect to a comparison with standard international industry work practices. They are not intended and should not be considered as, an assessment of compliance against Chinese National OHS regulatory requirements. The following is a summary of the key OHS observations made during the site visits:

- **Dust Management and Exposure:**
  - Within the Ying and HPG mines the dust suppression measures observed were limited (i.e. some minor hand watering was observed around the ore handling areas). Silvercorp stated during the site visit that a water truck is used to suppress dust around the mine haul roads and ore handling areas. The operation of this water truck was not observed during the site visits. However, Silvercorp have since stated (in August 2007) that they have purchased a water truck during July 2007 and have provided SRK with a photo of this water truck.
  - Dust masks were observed being used within the crushing facility at the Ying Mine.
  - No environmental dust monitoring is undertaken to determine ambient dust levels and no personal dust exposure monitoring is undertaken for employees and contractors. As the dust has the potential to contain significant levels of lead and heavy metals, it is considered that this monitoring should be undertaken to accurately

define the environmental and OHS risks presented by the operation's fugitive dust emissions. Silvercorp has stated that an environmental dust monitoring program is to be initiated.

- At the time of the site visit, a few of contract workers at the Ying mine were observed near the active ore handling areas taking water and preparing and consuming food. These individuals are at risk of potentially being exposed to elevated respirable lead dust levels. There is a risk of direct exposure through inhalation and/or indirect ingestion through dust deposited onto drinking and eating facilities. Silvercorp have since stated (in August 2007) that houses have been built for workers and that no contractors and their families now live near the ore handling areas.
- At the time of the site visits, it was observed that use of personal protective equipment (PPE) such as hard hats, safety boots/glasses and hearing protection was not consistent. For example, workers were observed within active ore handling areas, such as adjacent to mine portals, without any PPE. Silvercorp have since stated (in August 2007) that all workers have now been issued with PPE and that the standards of PPE usage have now been raised.
- At the time of the site visits, it was observed that the housekeeping within the Ying and HPG processing facilities were of a good standard. However, housekeeping within the Ying and HPG mining operations generally requires improvement. Silvercorp has since stated (in August 2007) that housekeeping at both the Ying and HPG sites has been improved substantially.

### 5.3 SAFETY MONITORING AND RECORDS

Silvercorp has stated that comprehensive safety monitoring and the maintenance of safety records, is undertaken for both the Ying and HPG Mines. This comprises the monitoring and recording of accident/injuries and the detailed investigations related to the accidents and injuries. The mine safety department reports the OHS status on a weekly basis.

Silvercorp has stated that to date the mines have not recorded any serious injury or fatality. Silvercorp has provided two summary tables of safety statistics, for the Ying and HPG projects.

The Ying project has, up to June 2007, recorded a total of 13 minor injuries, of which nine occurred 2006 and four in 2007. The table provided for the HPG project covers February to July 2007 and states that no injuries have been have occurred during this period. Details are shown in Table 4.

**Table 4: Accident Statistics of Henan Found Mining Co., January 2006 to June 2007**

2006					2007				
Month	Date	Level of the Injury			Month	Date	Level of the Injury		
		Minor	Serious	Fatalities			Minor	Serious	Fatalities
1		0	0	0	1		0	0	0
2		0	0	0	2		0	0	0
3		0	0	0	3	5	2	0	0
4		0	0	0	4	22	1	0	0
5	22	1	0	0	5		0	0	0
6	1	2	0	0	6	26	1	0	0
	30	3	0	0					
7		0	0	0					
8		0	0	0					
9		0	0	0					
10	1	1	0	0					
	5	2	0	0					
11		0	0	0					
12		0	0	0					
Total 2006		9	0	0	Total to June		4	0	0

SRK has not seen similar statistics for the Haopinggou Mine of Henan Huawei Mining Co.

Silvercorp has also stated that instruments have been purchased to test and monitor any toxic gas in tunnels to maintain high health and safety standard for its workers.

Silvercorp states that on a quarterly basis, it assesses the OHS performance for each of contractors using the following criteria:

- Attitude to health and safety.
- Any improvement made in compassion to previous quarter.
- If safety training and records are maintained.
- If unsafe areas and items have been improved in a timely manner.
- If routine safety inspections are performed.
- If safety officers are competent.
- Number of accidents and injuries.
- Warning signs properly posted.
- Safety training posts are renewed periodically.
- Explosive usage properly accounted and balanced.

Silvercorp states that at the end of the second quarter of 2007 and as an outcome of the above quarterly assessment, two cash awards of 18,000 RMB each were given to two contractors who had the first and second best safety performance. In addition, three cash awards 4,500 RMB each were also given to the three best performing contractor safety officers.

# APPENDICES

# **APPENDIX 1: INFORMATION REVIEWED**

All general and project specific documentation reviewed is presented below in chronological order.

### ***General Documentation***

1. Annual Information Form for the Year Ended March 31, 2006 – Silvercorp (29 June, 2006 – as amended 3 July, 2006), Silvercorp Metals Incorporated.
2. Summary Table of Donations and Contributions to Communities in Luoning County by Silvercorp Metals Incorporated (June 2007), Silvercorp Metals Incorporated.
3. Summary Presentation –‘To Become a Premier Chinese Silver Producer Through Exploration, Mine Development and Consolidation’ (7 June 2007), Silvercorp Metals Incorporated.
4. Silvercorp Metals Incorporated - Corporate Organisational Chart (Draft – 4 June 2007).

### ***Ying Project Documentation***

1. Henan Luoning Yue Liang Gou Lead-Zinc-Silver Metallurgical Test Research Report (July 2005), Henan Non-Ferrous Research Institute.
2. Preliminary design for the Metallurgical Engineering for Henan FaEnDe Mining Co., Yue Liang Gou Pb-Zn-Ag Deposit (December 2005), Engineering and Exploration Design Research Institute of Maanshan - Mining and Research Institute.
3. Henan Fa En De Kuangye Company Yue Liang Gou Lead-Zinc-Silver Mine – Mining and Dressing Preliminary Design Safety Report (December 2005), Maanshan Mining and Engineering Exploration Design Institute.
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**APPENDIX 2:  
ENVIRONMENTAL LEGISLATIVE BACKGROUND**

The Chinese *Mineral Resources Law (1996)* and *Environmental Protection Law (1989)* provides the main legislative framework for the regulation and administration of mining projects within China. The *Environmental Protection Law (1989)* provides the main legislative framework for the regulation and administration of mining projects environmental impacts.

The following articles of the *Mineral Resources Law (1996)* summarise the specific provisions in relation to environmental protection:

- **Article 15 Qualification & Approval**  
*Anyone who wishes to establish a mining enterprise must meet the qualifications prescribed by the State, and the department in charge of examination and approval shall, in accordance with law and relevant State regulations examine the enterprise's mining area, its mining design or mining plan, production and technological conditions and safety and environmental protection measures. Only those that pass the examination shall be granted approval.*
- **Article 21 Closure Requirements**  
*If a mine is to be closed down, a report must be prepared with information about the mining operations, hidden dangers, land reclamation and utilisation, and environmental protection, and an application for examination and approval must be filed in accordance with relevant State regulations.*
- **Article 32 Environmental Protection Obligations of Mining License Holders**  
*In mining mineral resources, a mining enterprise or individual must observe the legal provisions on environmental protection to prevent pollution of the environment. In mining mineral resources, a mining enterprise or individual must economise on the use of land. In case cultivated land, grassland or forest land is damaged due to mining, the mining enterprise concerned shall take measures to utilize the land affected, such as by reclamation, tree and grass planting, as appropriate to the local conditions. Anyone who, in mining mineral resources, causes losses to the production and well-being of other persons shall be liable for compensation and shall adopt necessary remedial measures.*

The following articles of the *Environmental Protection Law (1989)* summarise the specific provisions for environmental protection in relation to mining:

- **Article 13 Environmental Protection**  
*Units constructing projects that cause pollution to the environment must observe the state provisions concerning environmental protection for such construction projects. The environmental impact statement on a construction project must assess the pollution the project is likely to produce and its impact on the environment and stipulate the preventive and curative measures; the statement shall, after initial examination by the authorities in charge of the construction project, be submitted by specified procedure to the competent department of environmental protection administration for approval. The department of planning shall not ratify the design plan descriptions of the construction project until after the environmental impact statement on the construction project is approved.*
- **Article 19 Statement of requirement for Environmental Protection**  
*Measures must be taken to protect the ecological environment while natural resources are being developed or utilised.*

- **Article 24 Responsibility for Environmental Protection**  
*Units that cause environmental pollution and other public hazards shall incorporate the work of environmental protection into their plans and establish a responsibility system for environmental protection, and must adopt effective measures to prevent and control the pollution and harms caused to the environment by waste gas, waste water, waste residues, dust, malodorous gases, radioactive substances, noise, vibration and electromagnetic radiation generated in the course of production, construction or other activities.*
- **Article 26 Pollution Prevention & Control**  
*Installations for the prevention and control of pollution at a construction project must be designed, built and commissioned together with the principal part of the project. No permission shall be given for a construction project to be commissioned or used, until its installations for the prevention and control of pollution are examined and considered up to the standard by the competent department of environmental protection administration that examined and approved the environmental impact statement.*
- **Article 27 Report on Pollution Discharge**  
*Enterprises and institutions discharging pollutants must report to and register with the relevant authorities in accordance with the provisions of the competent department of environmental protection administration under the State Council.*
- **Article 38 Violation Consequences**  
*An enterprise or institution which violates this Law, thereby causing an environmental pollution accident, shall be fined by the competent department of environmental protection administration or another department invested by law with power to conduct environmental supervision and management in accordance with the consequent damage; in a serious case, the persons responsible shall be subject to administrative sanction by the unit to which they belong or by the competent department of the government.*

The following are other Chinese laws that provide environmental legislative support to the *Minerals Resources Law (1996)* and the *Environmental Protection Law (1989)*:

- *Environmental Impact Assessment (EIA) Law (2002).*
- *Law on Prevention & Control of Atmospheric Pollution (2000).*
- *Law on Prevention & Control of Noise Pollution (1996).*
- *Law on Prevention & Control of Water Pollution (1996).*
- *Law on Prevention & Control Environmental Pollution by Solid Waste (2002).*
- *Forestry Law (1998).*
- *Water Law (1988).*
- *Water & Soil Conservancy Law (1991).*
- *Water Conservancy Industrial Policy (1997).*
- *Land Administration Law (1999).*
- *Protection of Wildlife Law (1989).*
- *Energy Conservation Law (1998).*

- *Electric Power Law (1995).*
- *Management Regulations of Prevention & Cure of Tailings Pollution (1992).*
- *Management Regulations of Dangerous Chemical Materials (1987).*

The relevant environmental protection related Chinese legislation utilised for project's design are a combination of the following National design regulations and emissions standards:

- *Environment Protection Design Regulations of Construction Project (No.002) by Environment Protection Committee of State Council of PRC (1987).*
- *Regulations on the Administration of Construction Project Environmental Protection (1998).*
- *Regulations for Quality Control of Construction Projects (2000).*
- *Regulations for Environmental Monitoring (1983).*
- *Regulations on Nature Reserves (1994).*
- *Regulations on Administration of Chemicals Subject to Supervision & Control (1995).*
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- *Environment Protection Design Regulations of Metallurgical Industry (YB9066-55).*
- *Comprehensive Emission Standard of Wastewater (GB8978-1996).*
- *Environmental Quality Standard for Surface Water (GB3838-1988).*
- *Environmental Quality Standard for Groundwater (GB/T14848-1993).*
- *Ambient Air Quality Standard (GB3095-1996).*
- *Comprehensive Emission Standard of Atmospheric Pollutants (GB16297-1996).*
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- *Environmental Quality Standard for Soils (GB15618-1995).*
- *Standard of Boundary Noise of Industrial Enterprise (GB12348-90).*
- *Emissions Standard for Pollution from Heavy Industry; Non-Ferrous Metals (GB4913-1985).*
- *Control Standard on PCB's for Wastes (GB13015-1991).*
- *Control Standard on Cyanide for Waste Slugs (GB12502-1990).*
- *Standard for Pollution Control on Hazardous Waste Storage (GB18597-2001).*
- *Identification Standard for Hazardous Wastes-Identification for Extraction Procedure Toxicity (GB5085.3-1996).*
- *Standard of Landfill and Pollution Control of Hazardous Waste (GB 18598-2001).*

**APPENDIX 3:**  
**QUALITATIVE ENVIRONMENTAL RISK ANALYSIS**

## Qualitative Environmental Risk Analysis – Scope

The scope definition and context for the qualitative environmental risk analysis can be summarised as follows:

- **Goals/Objectives** – The primary objective is to analyse the qualitative environmental risks associated with the project’s environmental aspects.
- **Strategy** – The strategy employed comprises the application of a qualitative risk analysis where the ‘relative magnitude’ of environmental risks associated with the project are estimated. Inclusive within this process are also the concepts of inherent and residual environmental risks. Inherent environmental risks being those environmental hazards that are present within the project without any remedial management, and residual environmental risks defined as those environmental hazards remaining after the application of remedial risk management measures. The focus for this qualitative risk analysis is mainly on the definition of the inherent environmental risks.

This qualitative risk analysis strategy has the following key steps:

- **Step 1 – Develop a qualitative environmental risk matrix.** This has relative significance rankings for the potential environmental consequences/impacts, levels of event likelihood and the corresponding risk rankings from negligible to extreme.
- **Step 2 – Define the inherent environmental risks.** List the sources of environmental risks and apply the qualitative environmental risk analysis to define the level of inherent environmental risk.

## Qualitative Environmental Risk Analysis Matrix

The proposed qualitative environmental risk matrix uses the following definitions for environmental consequence and likelihood:

- **Environmental Consequence:**
  - **Catastrophic:** Environmental disaster with potential to lead to ecological/business collapse.
  - **Major:** Critical event/environmental impact, which with proper remedial management, will be endured.
  - **Moderate:** Significant event/environmental impact, which may be managed under normal procedures.
  - **Minor:** Consequences/environmental impacts that may be readily absorbed, but some remedial management effort is still required.
  - **Insignificant:** No remedial management required.
- **Likelihood:**
  - **Certain:** The event is expected to occur in most circumstances.
  - **Likely:** The event probably will occur in most circumstances (i.e. also could be on a regular basis such as weekly monthly).
  - **Possible:** The event should occur at some time (i.e. once in a while).
  - **Unlikely:** The event could occur at some time.

- **Rarely:** The event may occur only in exceptional circumstances.

Based on these definitions the Qualitative Environmental Risk Matrix is presented in Table 1.

**Table 1: Qualitative Environmental Risk Matrix**

Likelihood	Consequences				
	Catastrophic	Major	Moderate	Minor	Insignificant
<b>Certain</b>	Extreme risk	Very high risk	High risk	Moderate risk	Low risk
<b>Likely</b>	Very high risk	High risk	Moderate risk	Moderate risk	Low risk
<b>Possible</b>	High risk	Moderate risk	Moderate risk	Low risk	Negligible risk
<b>Unlikely</b>	Moderate risk	Moderate risk	Low risk	Low risk	Negligible risk
<b>Rarely</b>	Moderate risk	Low risk	Negligible risk	Negligible risk	Negligible risk

The risk definitions from this risk matrix can be further grouped into environmental risk evaluation categories that are based on regulatory compliance and conformance with industry standards, guidelines and/or codes of practice. These are:

- **Category 1 – Unacceptable Risks (Extreme risks)** – can be defined as those sources of environmental risk that are essentially unacceptable and are non-compliant/non-conforming in any circumstances.
- **Category 2 – Tolerable Risks (Very high/high risks)** – can be defined as those sources of environmental risk that are tolerable and while non-compliant/non-conforming, can be made to be compliant/conforming (acceptable risks) through the application of risk management measures.
- **Category 3 – Acceptable Risks (Moderate/low/negligible risks)** – can be defined as those sources of environmental risk that are acceptable and are compliant with environmental legal requirements and conform to recognised industry standards, guidelines and codes of practice.

### Evaluation of Environmental Risks

The sources of inherent environmental risk are project activities that may result in potential undesirable events/environmental impacts. These project activities have been previously described within this report. In summary they are as follows:

- Dust generation and management.
- Smelter gas emissions.
- Surface water management and discharges (i.e. mine dewatering, TSF discharges and stormwater runoff).
- Groundwater management (i.e. seepage from TSF’s and waste rock stockpiles).
- Rehabilitation of waste rock stockpiles and other disturbed areas.
- Storage and handling of hazardous materials.
- Waste generation and management (industrial and domestic wastes).
- Potential contaminated sites.

The corresponding project activities, the ranking of environmental risks are summarised in Table 2. It should be noted that the sources of environmental risk for the Luoning Smelter are proposed only. The potential environmental risk rankings for these proposed sources of environmental risk have been based on the project information reviewed and associated environmental management statements made by Silvercorp.

**Table 2: Summary of Environmental Risks**

Sources of Environmental Risk	Consequence Severity	Likelihood	Environmental Risk Ranking
<b>Air Emissions</b>			
Mining dust emissions (Ying and HPG)	Major (high toxicity of lead dust)	Likely (high potential for exposures to elevated lead dust levels)	High
Processing dust emissions (materials handling)	Major (high toxicity of lead dust)	Possible	Moderate
Luoning Smelter dust and gas emissions	Major (high toxicity of lead dust and SO <sub>2</sub> emissions)	Unlikely (if air pollution measures are implemented as planned)	Moderate
Greenhouse gases (inventory of emissions)	Minor	Certain	Moderate
<b>Surface Water Management and Discharges</b>			
Ying Mine	Major (location adjacent to Guxian Reservoir)	Unlikely (surface water containment measures)	Moderate
Ying Processing Plant	Moderate	Unlikely (surface water/tailings water containment and reuse measures)	Low
HPG Mine	Moderate (surface water discharge into Guxian Reservoir)	Certain (currently limited surface water containment/treatment measures)	High
HPG Processing Plant	Major (TSF location upstream and adjacent to residential village)	Certain (currently limited surface/tailings water containment measures)	Very High
Luoning Smelter	Major	Unlikely (if surface water containment and reuse measures are implemented as planned)	Moderate

Sources of Environmental Risk	Consequence Severity	Likelihood	Environmental Risk Ranking
<b>Groundwater Management and Discharges</b>			
Ying Mine	Major (location adjacent to Guxian Reservoir)	Possible (treated discharges occurring through seepage, no groundwater monitoring)	Moderate
Ying Processing Plant	Moderate	Likely (TSF discharges occurring through seepage, no groundwater monitoring)	Moderate
HPG Mine	Moderate	Possible (no groundwater monitoring)	Moderate
HPG Processing Plant	Major (TSF location upstream and adjacent to residential village)	Likely (TSF discharges occurring through seepage, no groundwater monitoring)	High
Luoning Smelter	Major	Unlikely (if surface water containment and reuse measures are implemented as planned)	Moderate
<b>Land Disturbance and Rehabilitation</b>			
Mining	Minor (small areas of disturbance and also assuming minimal potential for acid drainage from waste rock)	Certain	Moderate
Processing	Moderate (TSF's - larger areas of disturbance and assuming some potential for acid drainage)	Certain	High
Luoning Smelter	Moderate (some potential for rehabilitation/ remediation of contaminated areas)	Certain	High
<b>Hazardous Materials Storage and Handling</b>			
Mining: - hydrocarbons (lack of secondary containment) - explosives storage	Moderate	Certain	High
	Minor	Certain	Moderate

Sources of Environmental Risk	Consequence Severity	Likelihood	Environmental Risk Ranking
Processing: - hydrocarbons and chemical/reagent storage	Minor	Certain	Moderate
Luoning Smelter: - Slag materials - hydrocarbons and chemical (acid) storage	Moderate	Certain	High
	Moderate	Certain	High
<b>Waste Generation and Management</b>			
Ying and HPG Projects: - disposal of waste oil - sewage - oily wastewater disposal - solid waste disposal	Moderate	Unlikely (if recycled)	Moderate
	Minor	Certain	Moderate
	Moderate	Certain	High
	Moderate	Certain	High
Luoning Smelter: - disposal of waste oil  - sewage  - oily wastewater disposal  - solid waste disposal (including hazardous wastes)	Moderate	Unlikely (if recycled)	Low
	Minor	Unlikely (if recycled)	Low
	Moderate	Unlikely (if recycled)	Low
	Major	Unlikely (if hazardous waste facility implemented as planned)	Moderate
<b>Contaminated Sites Assessment</b>			
All projects: - No contaminated sites assessment	Major	Possible (with current and proposed practices)	Moderate