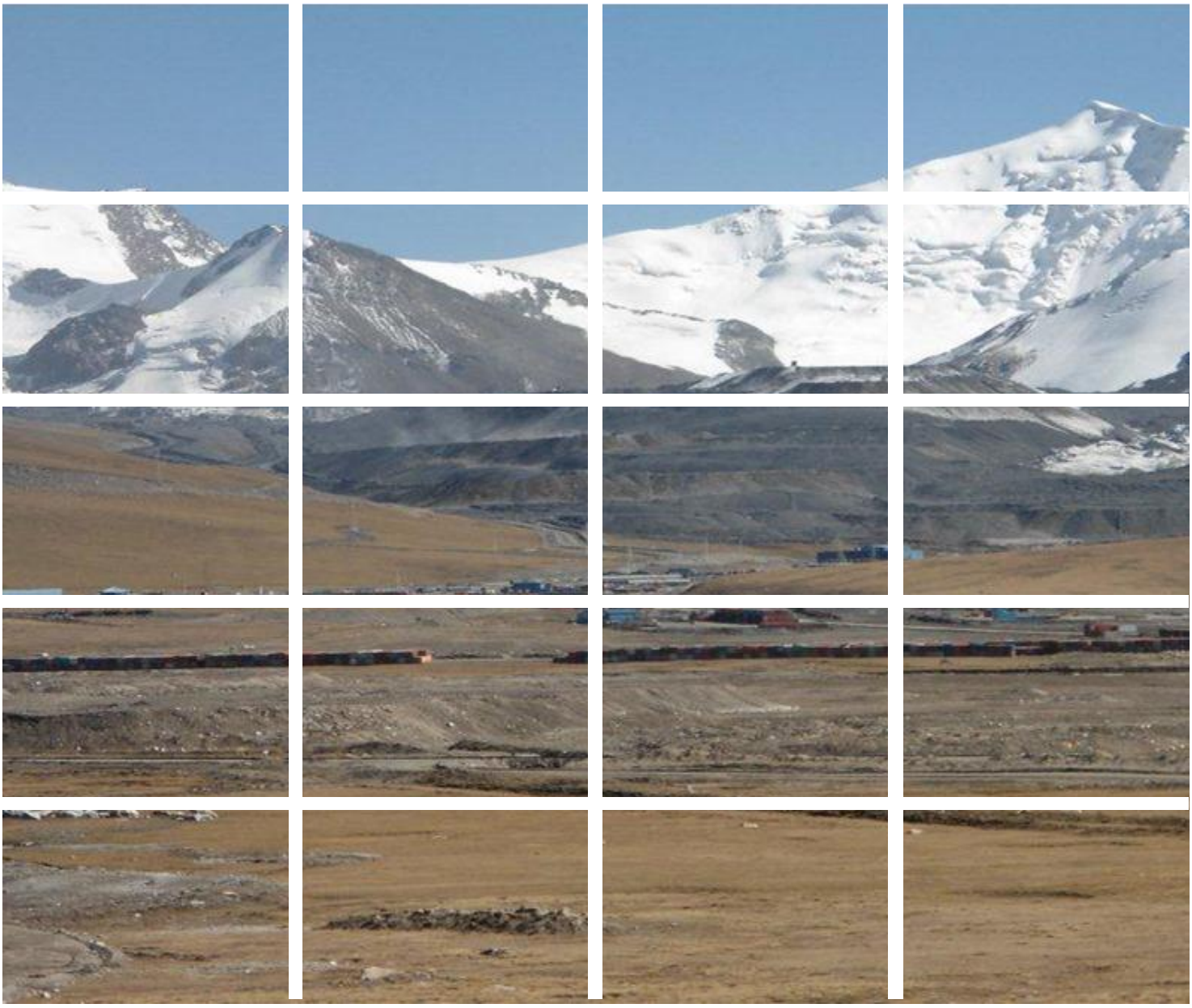

Environmental Due Diligence:
Kumtor Gold Mine, Kyrgyz Republic

Final Report

22 October 2012

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Environmental Due Diligence:
Kumtor Gold Mine, Kyrgyz Republic

Final Report

For and on behalf of
Environmental Resources Management

Approved by: Denis Daley

Signed: 

Position: Partner

Date: 22 nd October 2012

CONTENTS

1 INTRODUCTION

1.1 BACKGROUND AND SCOPE OF THE ENVIRONMENTAL ASSESSMENT

Kumtor is one of the highest mined gold deposits in the world and is situated in the southern region of the Central Tien-Shan at an altitude of 4,000 meters above sea level within a semi-permanent permafrost zone. The deposit is located in the Issyk Kul Province of Kyrgyzstan, some 350 kilometres from Bishkek, the capital of the Kyrgyz Republic and 80 km south of Lake Issyk-Kul near the border with China.

The mine has been producing gold since 1997 and is 100% owned by Kumtor Gold Company a subsidiary of Centerra Gold Inc. which is a Canadian based mining company with mines and interests in a number of countries within and close to the Former Soviet Union. Kyrgyzaltyn, a State-owned enterprise holds a 33% stake in Centerra Gold Inc. The agreements governing the Kumtor project, including a Restated Investment Agreement, were agreed in 2009 and approved by the Kyrgyz Parliament.

The mine and its operations have been subject to a number of audits and assessments over its operational period including assessments from the European Bank for Reconstruction and Development (EBRD), Kyrgyz regulators and independent assessments undertaken by consultants for various interested parties.

Environmental Resources Management Limited (ERM) has been commissioned by the SHE (Safety Health Environment) Committee and Board of Centerra Gold to carry out an independent review of the environmental status of the mine and associated operations as of August 2012 ("environmental assessment or review").

The review has been carried out in two phases:

- a desk review of documentation related to environmental compliance, previous assessments and environmental reviews conducted at Kumtor, and

- a site visit focused review of environmental matters related to the operations.

The review has been undertaken in terms of compliance against key Kyrgyz legal requirements and assessment against selected internationally accepted standards (IFC/EBRD as applicable). This has also included review against the ICMI Cyanide Code, to which the site operations have recently been certified as being compliant against.

ERM has undertaken the review against the International Standards whilst Central Asia International Consulting (CAIC) was commissioned to undertake a review against Kyrgyz regulatory requirements.

The Board has not requested a socio-economic or community review or an assessment of compliance to health and safety or geotechnical issues, although where appropriate identified issues relating to these areas have been highlighted in outline.

1.2 LIMITATIONS

This report has been prepared by Environmental Resources Management the trading name of Environmental Resources Management Limited, with all reasonable skill, care and diligence within the terms of the Contract with Centerra Gold Inc. (the Client), and taking account of the resources devoted to it by agreement with the Client.

The scope and approach is provided in further detail within ERM proposal dated August 1st, 2012 which was approved by the Client (signed proposal acceptance form as of August 10th).

The programme is intended to provide a qualitative independent assessment of the environment at the site and has been undertaken on the assumption that:

- The scope is focused upon environmental areas only;
- Geotechnical issues in general but specifically those associated with glacial and impoundment and lake issues are excluded from the scope;
- The scope focuses on review of the existing extensive volume of environmental data held on site operations and a site visit to confirm the findings;
- The report presents identified positives and potential areas of improvement and is not focused at directly addressing the recent findings of the Parliament Commission Review; and
- Undertaking specific stakeholder engagement activities was not included in ERM scope of work.

Specific limitations on this assessment are as follows:

- This report is based primarily upon information provided through the Client, interviews and through first-hand observations; no primary data collection has been undertaken.

- A technical review of Project design and operational performance was not carried out. This assessment was limited to review of outputs and conclusions of technical studies performed by third parties.

- The information provided in this report is not to be construed as legal advice.

- We disclaim any responsibility to the Client and others in respect of any matters outside the scope of the above.

- This report is confidential to the Client and ERM accepts no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report at their own risk.

- ERM's findings are accurate and complete only to the extent that information provided to ERM was itself accurate and complete. It was assumed that the calculations and modelling outputs performed by third parties are accurate.

- No sampling or testing of soils, waters or other materials were included in the assessment. However reference has been made to previously reported testing and sampling.

- ERM's level of review was dictated by the timing allowed for review and compilation of our report. Any legislative assessment is based on the current status of regulations in Kyrgyzstan.

- The "bridging" of any identified gaps against the Reference Standards or mitigation of any identified risks for the Project was not included in ERM Scope of Work.

1.3 REPORT STRUCTURE

The remainder of the report is as follows:

- Section 2 – Provides an overall background to the Kumtor Mine operations
- Section 3 - Methodology – Gives information on the methodology used for the review
- Section 4 – Summary of Key Findings

- Annex A: Bibliography

2 SITE DESCRIPTION

2.1 SITE LOCATION

Kumtor gold mine is located in eastern Kyrgyzstan, approximately 350 km east of Bishkek and 60 km south-east of Lake Issyk-Kul. The site is located in a high mountain valley of the Tien Shan at an altitude of 3,500 to 4,500m. Kumtor valley is a broad glacial feature, with low grasslands in the valley, becoming more sparse on the lower valley slopes, with bare rock outcrop on the mid slopes and permanently snow-bound upper slopes to the peaks at well over 4,700m.

The valleys in the upper slopes are currently occupied by small glaciers, with five in or around the project area. These, along with all others in Kyrgyzstan and the wider Tien Shan and Himalayan massif are currently in a phase of rapid retreat; in and around the mining area they have withdrawn up from the lower valley slopes to the current positions. The main Kumtor valley head glacier (Petrov Glacier) has retreated several hundred metres since the 1950's; leaving a substantial moraine-dammed glacial lake.

The Kumtor River issues from the moraine dam at the north-eastern end of the valley, and enters a broad, braided glacial outwash plain, before diverting south around a north-south-trending bedrock crag, resuming a south-westerly route past the area of the mine infrastructure and down the valley. Studies of the moraine dam carried out by specialists (see *Annex A* for references) have shown the potential for dam failure to occur long-term, as a consequence of climate change, with corresponding flood events. The potential flood related consequences of such a failure have been modelled and mitigation measures identified to reduce this potential.

Four main tributaries join the Kumtor River in the mine area, three from the south (Lysyi, Chong Sary Tor and Sary Tor) which to a greater or lesser extent pass through waste rock dumps, and one from the north (Arabel), which has been diverted in two channels away from the Tailings Management Facility (TMF).

A regulatory water quality compliance point has been defined downstream of the confluences of these sub-catchment tributaries. This is known as the 'end mixing zone' and designated as monitoring point W1.5.1. This compliance point captures all the possible effects from the total mine footprint.

2.2 SITE DESCRIPTION

Kumtor mine comprises several major infrastructural units spread across the central and south-eastern half of the upper Kumtor Valley; with a footprint of

approximately 8 km by 8 km. *Figure 1* provides a generalized layout of the mine area.

Kumtor was originally project financed by the IFC, EBRD and EDC in 1995 following completion of an Environmental Impact Assessment & Pre-feasibility study undertaken in 1993 upon which the original design, construction and Environmental Management Action Plan (EMAP) was based. The mine has been subject to regular monitoring by EBRD and operations have significantly evolved since this time. The Kumtor management and Kyrgyz government agreed to the EMAP management plan which is referred to in the Restated Investment Agreement.

Open Cast Workings

Open cast gold mining has been undertaken at two locations along the southern flanking mountains of the upper Kumtor valley at elevations between 4,000 and 4,600 m above sea level. However, only the main Central Pit is currently active, being approximately 2km long, 1km wide and several hundred metres deep. This is worked by standard bench-cutting open cast techniques and is currently in the process of being expanded to access a southerly extension of the main ore body. This is undertaken by daily blasting, excavation with heavy plant shovels, and removal of either the overburden (to waste rock dumps) or ore (to stockpiles) by a fleet of dump haul trucks. Over 100 heavy plant vehicles are involved in the operation. This fleet is being progressively upgraded.

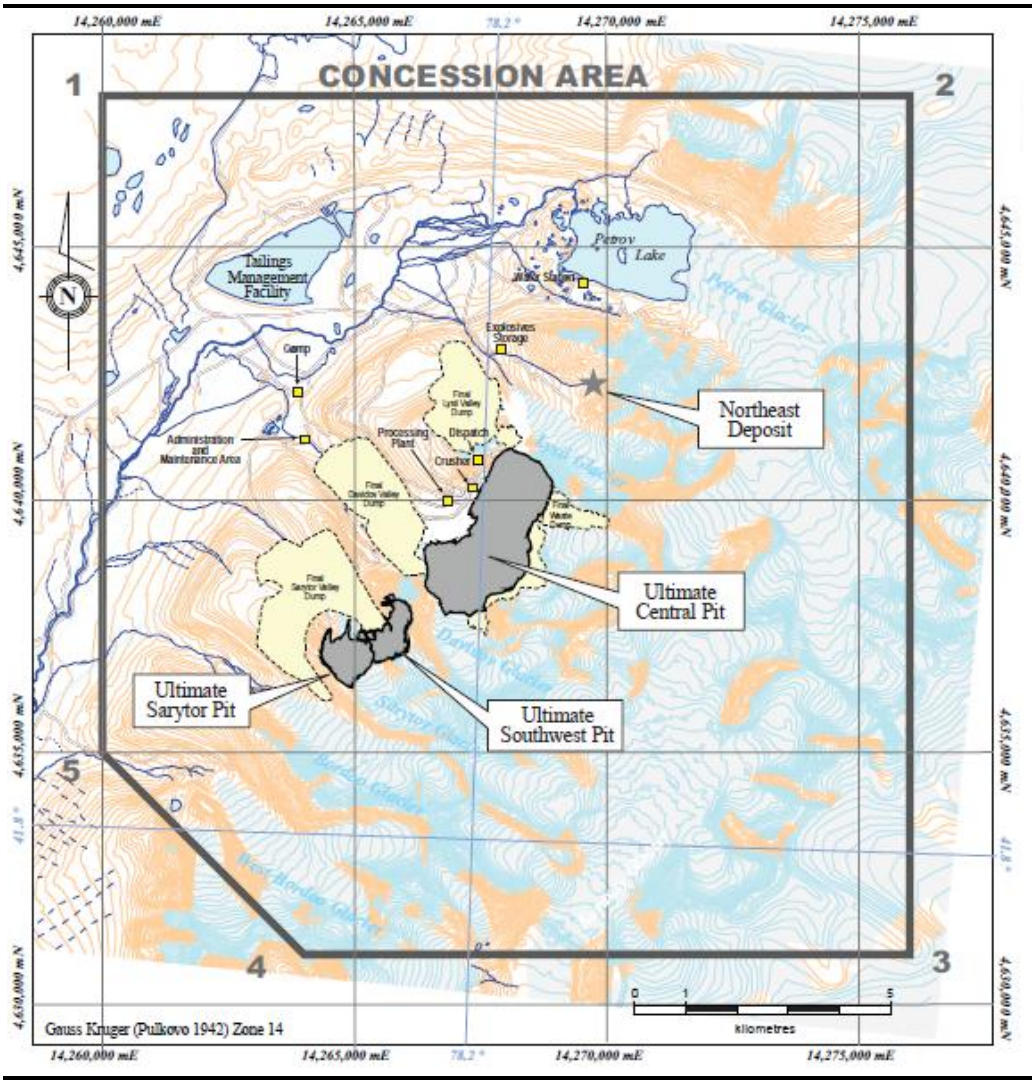
Further down strike, the ore body has been open cast mined at the South West pit, some 2 to 3 km to the south-west. Further gold ore bodies occur along the southern flanking mountains of the upper Kumtor valley.

Stockpiles, Crusher and Mill Processing Plant

Excavated ore is taken to the truck-fed gyratory crusher facility located adjacent to the Mill Processing Plant to the west of the main Central Pit where different grade ores are crushed using a belt-fed jaw crusher. These are then blended to produce mill feedstock.

The Mill Processing Plant is a large three-story steel framework building, partially clad, containing different process areas; milling (three stage, including an ultra-fine mill to help liberate the very fine grained gold particles), ore concentration separation (in floatation cells using xanthate-based solutions, with 500 l/day of diesel being added to 'blind' the high graphite content); re-milling of some concentrate; carbon-in-leach (CIL) cyanide circuit (producing carbon with adsorbed gold); carbon washing and electro-winning of gold and smelting of gold ore. Process fluids are recycled where possible (e.g. CIL circuit), but the process annually produces around 5 Mm^3 of mixed cyanide-bearing solution (typically 50 to 150 mg/l total CN) and tailings, formed into a slurry (*pulp*) and discharged to the pulp line. Seasonal, permafrost meltwater is pumped from under the mill building to

Figure 1 *General Location Plan Showing Main Features of the Kumtor Mine*



protect from basement flooding and provide structural stability. The meltwaters ultimately enter the river system via the Chong Sary Tor.

Tailings Pipeline

This comprises two HDPE pipelines that descend some 700 m from the Mill Processing Plant, across the Kumtor River, to the TMF, some 4 km distant. The tailings (50/50 mix of CN-bearing liquid and tailings) descends under gravity, but is of such density that four pressure reducing stations are required to control the flow and risk of erosion. The lines are within secondary containment (lined concrete troughs) in all but a central portion, where the road and catch-pit have been engineered to act as containment. Where the lines cross the River they are entirely contained on a suspended bridge section. The lines also feature several safety measures; real-time flow measurements and automated valve cut-offs, manual cut-off valves, hourly leak inspection, and a daily maintenance crew with a programme of wall-thickness testing and routine pipe-rotation and replacement.

Tailings Management Facility (TMF)

The TMF is located on the northern slopes of the upper Kumtor valley occupying the small tributary valley of the now-diverted Arabel river, and abutting against the bedrock crag that projects south into the main valley. It comprises a large dam constructed of local alluvial material, lined on the inner slope and 100m from the dam crest, unlined over the main tailings area, from where basal containment is provided by permafrost that prevents the ingress of leachate into the underlying soils. Currently the dam is approximately 3km long, and the construction has been significantly altered to incorporate a structural component (shear key and buttress) that now runs the entire length of the dam, 10 m deep and 60 m wide. This was required to prevent slippage of the dam along the active layer within alluvial soils at the top of the permafrost, which was not removed before the original dam construction.

Tailings enter the TMF from the tailings pipeline that is spigotted such that flows are switched between numerous points along the dam wall; in this way tailings deposition is managed so that layers build up evenly across the surface of the TMF, and tailings water collects at the northern bank where it is pumped to the Effluent Treatment Plant (ETP). The open water area of the TMF varies by process flow rates throughout the year, but typically occupy at least a quarter of the TMF surface area. The open water is frozen for 7 to 8 months of the year, and when ice free is pumped to the ETP. Whilst ice-free, cyanide in the TMF is significantly reduced by exposure to ultraviolet light through the process of natural degradation.

Effluent Treatment Plant (ETP)

The ETP is located to the north-east of the TMF and is an INCO Process with three lined pits. The first is for cyanide destruction, second for metals removal and the third for final polish, settlement and storage before licensed discharge

to the Kumtor River. Discharge is subject to permitted discharge quality standards.

Treatment reagents are stored on the ETP site and include sodium metabisulphite, copper and iron sulphates and caustic soda. A new ETP facility is currently being constructed further to the east to allow for the expansion of the area of the TMF.

Waste Rock Dumps

Waste rock (mainly overburden) is removed by dump haul trucks to various locations on upper valley slopes and dropped to form waste rock dumps. These form extensive artificial slopes, partly infilling the mid-to lower-slope areas of the Lyisi, Chong Sary Tor and Sary Tor valleys. The waste rock contains a high proportion of rock ground or blasted to fine grain sizes. High level dumping on the upper slopes and partly on the glaciers has been discontinued and waste rock is in the process of being removed from the Davidov glacier to other Waste Rock Dumps.

Heavy Plant Shop and Fuel Tank Farm

This facility is located 500m south-west of the Processing Mill, near the access to the main Central Pit. Here all the heavy plant is maintained in a large workshop hangar and vehicle yard. Waste oils and hydraulic fluids are generated in such volumes that dedicated 20,000 l tanks are utilised for their temporary storage before removal offsite.

The main fuel storage facility is located adjacent to the Heavy Plant Shop, comprising 27 above-ground storage tanks (75t each) and two larger silos (678t each), with on-loading and off-loading facilities. Together the tank farm has the capacity to store over 3,200 t of diesel fuel, enough for several days of continuous operation.

Seasonal, permafrost meltwater is pumped from under the Heavy Plant Shop building to provide structural stability. The meltwaters ultimately enters the river system via the Chong Sary Tor.

Mine Camp and Administration Buildings

This is located on the lower southern slope of upper Kumtor Valley and comprises accommodation blocks for around 1,700 workers arrayed around a central canteen and kitchen area and including ancillary services (administration, IT, vehicle stands, site security, meeting rooms and so on). A separate administration building located 1 km to the south also houses the main laundry facilities, small clinic/hospital, vehicle maintenance, fuel store and fuel dispensing and a large outside storage area. Adjacent to this is the main power line transformers (the site is largely powered by national grid electricity) and emergency diesel generators.

Sanitary wastes from the mine camp and administration building are collected and piped to a dedicated treatment plant that discharges to the Kumtor River

at permitted water quality standards. Solid material separated from the treatment process is placed in the TMF.

Seasonal, permafrost meltwater is pumped from under the Administration Building to provide structural stability. The meltwaters ultimately enters the river system via the Chong Sary Tor.

Ancillary Stores and Activities

Several isolated project elements are situated distant to the main camp, TMF and mill areas. These include the ammonium nitrate storage area, explosives magazine, aggregate extraction and crushing plant, water extraction plant, mine gate security and various small and derelict buildings from before the mine was developed.

Transport node and Haul Roads

Supplies of raw materials are convoyed from the Balakchy marshalling yard, located at Balakchy. Here materials are transhipped from rail and road delivery to road supply convoys which leave for the mine on a daily basis.

The site has only been occupied for approximately one year, and is in the process of significant upgrade to suit requirements; with a new fuel tank storage facility under construction and plans to pave the yard.

The unpaved haul road and road bridges to the site are maintained by Kumtor and are subject to dust suppression during the summer months.

3 METHODOLOGY

3.1 INTRODUCTION

As noted earlier, the principal aim of this report is to provide an independent due diligence review of environmental performance associated with the Kumtor site, its operations and ongoing compliance and assurance programme instigated by Centerra Gold to meet local Kyrgyz regulatory needs and the requirements of the International Financial Institutions (IFI) lending to the mine operation, specifically the EBRD. In addition we understand that Kumtor recently achieved ICMI CN Code certification and has published a detailed Annual Environmental Report (AER) since its start. This review has been undertaken at the request and under the direction of the Safety Health and Environment Committee of the Centerra Board of Directors.

To complete these objectives, the review team carried out the following:

- **Document Review**: The document review began in August 2012 as ERM started to receive the review document package (a full list of received documents is provided in *Annex A*). The review was undertaken by the main project consulting staff, but detailed review was also undertaken by additional ERM technical specialists, covering the following topics:

  - TMF and the closure plan more generally;
  - Air emissions;
  - Surface water flood modelling;
  - Waste management;
  - Water quality;
  - Biodiversity; and
  - Cyanide auditing.

  A list of queries, comments and issues was assembled by these specialists prior to the site visit. In addition detailed travel risk assessment and health and safety plans were also developed.

- **Site Visit:** This was undertaken by ERM in September 2012. In addition, ERM subcontracted the review of national Kyrgyz policies and site-specific permits to *Central Asia International Consulting (CAIC)*, whose staff joined ERM for the site visit.

  Following medical checks, ERM received an introduction to Kumtor by environmental and H&S staff (principally Ben Ferris and Paul Tilley) and consultant (Mehrdad Nazari of Prizma). ERM visited all areas of the site and interviewed key site process managers, whilst CAIC split time between site observations and on-site document review.

The team departed the mine on Monday 10th September. On the return journey a stop was made at the Balykchy marshalling yard to undertake a site walkover and interview the facility manager, as well as meeting Rodney Stuparyk, VP of Mine Operations.

In addition, ERM and CAIC visited Kumtor's Bishkek office on Tuesday 11th September to review further documentation relating to compliance with local and national legislation and operating permits.

The site management have subsequently supplied further documentation and reference material to address some of the queries raised by the site visit. These are also included in the Bibliography in *Annex A*.

3.2 SCOPE

The review was focused on the following key areas:

- Environmental management system
- Biodiversity
- Waste management
- Water management
- Air emissions and Greenhouse gases
- Closure plan

Some areas such as TMF, cyanide management and erosion flood risk are cross-cutting and appear in a number of sections.

3.3 APPLICABLE STANDARDS

This report reflects ERM's assessment of the overall compliance of the current Project status with the applicable Reference Standards which were selected and agreed with the Client at the preliminary stage of the Project.

The following good practices are applicable in terms of managing the current and anticipated impacts of the Project:

- Applicable IFC Performance Standards (2012) and EBRD Performance Requirements;
- ICMM Climate Policy
- ICMM Mining and Protected Areas Policy
- ICMI Cyanide Code

The listed requirements represent an industry benchmark for determining, assessing and managing environmental risks in order to ensure the projects are developed in a manner that reflects sound environmental management practices.

3.4 SUMMARY OF THE SCOPE OF WORK

ERM's assessment was conducted in August-September 2012 and comprised the following:

- Delivery of documentation request lists to the Company in July 2012;
- Selection and development of criteria spreadsheets from August 3-August 20th;
- Information review from August 3– September 6th;
- Planning for site visit from August 24th-September 6th;
- Bishkek and Kumtor visit from September 7th-12th;
- Verbal presentation of findings to the Kumtor VP Operations, Mr Rodney Stuparyk and President, Mr Michael Fischer on September 14th, 2012;
- Meeting with EBRD Environmental Advisor David Williamson;
- Delivery of this report dated October, 2012.

The following facilities were visited in the course of the site visit:

1. Tailings Management Facility
2. Waste Management areas
3. Lake Petrov
4. Moraine dam
5. Waste Rock Dumps
6. Open pit
7. Mill
8. Maintenance workshops
9. Fuel storage tanks and chemicals area
10. Electrical substations
11. Effluent Treatment Plan (ETP)
12. Balykchy marshalling yard

The following representatives of Kumtor Operation Company and their contractor were interviewed in the course of the site visit:

Name	**Position**
Rodney Stuparyk	Kumtor VP Operations
Paul Tilley	HSET Manager
Ben Ferris	Environment Director
John Baker	Mine Manager
Terry Schultz	Mill Technical Advisor
Carson Samuels	Electrician/Instrumentation Leadhand
Kanybek Kazybekov	Senior Supervisor-Short Range Planning
Djumashbek Baubekov	Warehouse Superintendent
Melis Turdukeev	Hydraulic Engineer
Usonkul Egizbaev	Mine Maintenance General Foremen
Kamchybek	Senior Environment Engineer

Mambetov	
Geoffrey James	Balykchy marshalling yard (BMY) Coordinator
Asykbek Chekirbaev	BMY Safety Coordinator
Jarkynbek Syrtbay uulu	Warehouse Coordinator Assistant
Mehrdad Nazari	Director, Senior ESIA & CSR Advisor at Prizma LLC (Kumtor contractor)

3.5 NATIONAL REGULATORY REVIEW

As noted above, ERM and CAIC undertook an evaluation of the compliance status of Kumtor operations at the Kumtor mine and Balykchy Marshalling Yard with respect to relevant key Kyrgyzstan Environment laws and regulations.

The environmental regulatory instruments governing the mining industry against which the mining operations have been assessed were:

- Law on Environmental Protection, 1999;
- Decree of the Government of the Kyrgyz Republic #103, February 02, 2004 on approval of the list of permits being issued by the executive authorities and their departments;
- Law on Ecological Expertise, 1999;
- Law on Production and Consumption of Wastes, 2001;
- Guidelines of Ministry of Justice for the state environmental expertise/review of pre- project, project documents and related other materials, # 407, October 15, 1997;
- Instruction on the Regulation of Solid Waste Management, 1999;
- Law on Tailings and Mining Waste Dumps, 2001;
- Rules of safety under operation of tailing, sludge and hydro-sludge ponds, 2000;
- Hygienic norms "Maximum permissible concentration (MPC) of chemicals in water of water objects of drinking, and cultural and community water use", the Ministry of Justice of the Kyrgyz Republic (reg. № 64-04 June 10, 2004);
- Law on Water, 1994;
- Law on Water, 2005;
- Decree of the Government of the Kyrgyz Republic # 379, May 31, 1994.

In addition to, or within, these laws and regulations the operation at Kumtor is permitted under a total of 25 specific operating permits (or "passports"), each subject to differing durations and regulated by different Government departments.

4 SUMMARY OF FINDINGS

No major or materially significant environmental issues were identified by the ERM document review, site visit and legislative review. Kumtor management appear to have identified the main environmental issues associated with their activities and be working towards resolving these.

Overall, from the data reviewed by ERM, there is no evidence for significant uncontrolled environmental impact, or credible risk of future significant environmental impacts from the current operation under the mitigations and procedures currently in place. However, looking to the future and the potential for continued global and regional conditions such as climate change to impact the operations, Kumtor management will need to continue to actively manage their impacts and identify new issues as they arise.

Several minor issues were identified and are described in the following sections as opportunities for improvement.

The mine operation was observed to be well organised with:

- good logistical and management capacity, including environmental management – the strategic overview for which has been collated into an EMAP agreed with the Kyrgyz Government;
- although not a focus of the assessment, good safety culture and procedures were noted, including environmental incident response and reporting procedures, together with task-specific and scenario training;
- comprehensive and robust environmental monitoring for air and water quality; and
- good internal QA/QC standards for the environmental sampling undertaken, including the use of blank and duplicate samples, regular duplicate laboratory samples and quality assessment procedures applied to all data.

Large-scale potentially contaminating structures (such as the fuel storage areas, waste oil and hydraulic fluid in the Heavy Plant Shop) were considered to be well engineered, maintained and managed with adequate control structures and procedures in place.

The Mill operation shows evidence for high levels of environmental management and organisation, tight control of hazardous materials and strict monitoring of air and dust. The tailings pipeline was considered to be very well maintained with good secondary containment provisions and appropriate emergency procedures in place.

The site operations are certified under the ICMI Cyanide Code, which provides further, third-party confirmation of these impressions.
In terms of biodiversity, a number of independent studies provided to ERM for review have shown that the development of the Kumtor mine has seen an increase in both the numbers of species and numbers of each species, likely due to a ban on hunting within the concession area and the adjacent Sary Chat Ertash Reserve (SCER).

4.1 COMPLIANCE WITH NATIONAL REGULATION AND LAWS

The mine operations are substantially in compliance with the primary legislation, regulations and with the following operating permits:

- Licence on hazardous facility operation;
- Licence on export and import of specific goods in Kyrgyzstan (cyanide sodium);
- License on disposal, storage, destroying and landfilling of hazardous materials and substances, including radioactive materials;
- License on subsoil use;
- Land allocation;
- Permit for water use;
- Permit for construction, reconstruction, conversion and redevelopment of the facility;
- Permit for purchasing, storage, transportation of strong toxic agents, explosive and pyrotechnic materials;
- Permit for transportation of hazardous, valuable and other cargos, that needed special on-the-spot check;
- Positive conclusion of state ecological expertise;
- Positive conclusion of state expertise on industrial safety;
- Positive conclusion of state expertise on design and technical solutions of the constructed facility;
- Certificate of facility acceptance by State Acceptance Inspection.

The following permitting documents and approvals are currently not formally in place and should be obtained from the relevant supervisory agencies by the Site:

- Permit for wastes (solid domestic waste and secondary production waste) disposal into environment;

- The State Ecological Expertise resolution for arrangement of a new site for solid domestic waste and secondary production waste disposal (scrap metal, tires, used oil, etc.)

The following permits are in place, but their quality standards (Maximum Permitted Discharge or Maximum Permitted Concentration) have been exceeded for one or more compounds:

- Permit for air emission (relating to total emissions for SO_2 in 2011, based on a calculation of actual emissions compared to ones calculated in the MAE (Maximum Allowable Emissions) permit); and

- Permit for wastewater discharge; and

- End Mixing Zone compliance.

Further discussion on these regulatory compliance issues is provided in Section 4.3 below.

Additionally, the Water Code of Kyrgyzstan was issued in January 12, 2005. Within this code there are specific limitations on activity within a glacier area (Provision 62. Glacier Protection) specifically an activity is defined as that which accelerates the process of glacier melting by using coal, ash, oils or other substances or materials, that can impact on glacier condition or its water quality is prohibited. The former practice of waste rock storage on the Davidov Glacier would be prohibited under this code.

However this Code was not in force at the time of mine operation start up. The original mining operations (including waste rock storage) were approved by the local authorities and relevant permits (in particular for waste rock storage on glaciers) were obtained before it came into the force. Based on review of Kyrgyzstan legislation such laws/codes are not retrospective although Kumtor should obtain a legal view to confirm this assessment.

Kumtor receives permission from the governmental agencies on an annual basis for the mine plan, which includes ice handling.

4.2 COMPLIANCE WITH INTERNATIONAL GOOD PRACTICE

Overall ERM considers that the mining operation at Kumtor undertakes processes using environmental management policies and procedures that are broadly compliant with international good practise, although opportunities for improvement exist in a number of areas, discussed below. Three examples of international good practice assessed against IFC 2012 Guidelines at Kumtor are:

- *The undertaking of biodiversity impact assessment in the early 1990's and the incorporation into the pre-feasibility document*. Although substantially pre-dating the provisions in the current IFC guidelines, the biodiversity impact assessment is largely similar in objective, scope, methodology and outcomes. Kumtor has continued to undertake studies to understand ongoing effect of the project on the surrounding biodiversity.

- *The assessment of the potential for acid generation and leachate impacts from the major waste product of the mine; tailings*. Many mines around the world produce tailings that leach eco-toxic compounds into the environment, and international best practice guidelines are numerous and detailed in this area. Kumtor has undertaken all requisite testing to demonstrate that this is not occurring at the mine, as well as built containment structures that, after initial design flaws, are now compliant with guidelines. Furthermore, Kumtor has strong institutional controls in regard to water quality control through management plans, detailed monitoring programs with excellent levels of quality control, and good containment practice on major plant infrastructure and storage.

- *Environmental management planning and emergency response*. Kumtor has a well-developed combination of policies and procedures that are in line with international good practice, starting with the 1993 EIA, subsequent Health Safety and Environment Policies, EMAPs, written Operating Procedures and iterations of the Closure Plan. These are particularly strong in regard to the supply, storage, use and destruction of cyanide, and the mine has recently received certification following ICMI assessment, the most robust international good practice in this area.

As noted above, Kumtor was originally project financed by the IFC, EBRD and EDC (IFIs) in 1995 and subject to regular monitoring by EBRD. The parties and Kyrgyz government agreed to an Environmental Management Action Plan (the EMAP management plan).

Kumtor has been subject to the Kyrgyz regulatory system and IFIs scrutiny since conception, as with many parts of the former Soviet Union and the world; these requirements are evolving and becoming more stringent. Kumtor should continue significant levels of engagement with the regulators and other stakeholders within the context of a fully structured engagement plan, backed by comprehensive studies.

Due to its remote location, the mine faces many challenges. To keep abreast of operational and environmental issues, technical studies are conducted by local and international specialists. This is good practice and should be continued.

Kumtor recognises the need to move from a reactive to proactive approach and has reflected this in its Corporate standards to complement and help drive the SHE agenda. Recent appointments of a Sustainability Director and an Environmental Director are positive steps. Kumtor should also consider development of an overarching Sustainability approach for the environment department to include mining operations.

4.3 OPPORTUNITIES FOR IMPROVEMENT

The document and site review process has identified a number of areas with opportunities for improvement based on compliance with national regulations

and international good practice. These areas together with recommendations for actions that could be implemented in order to mitigate, reduce or manage the environmental gaps and risks are set out below.

4.3.1 Biodiversity

Kumtor have commissioned a number of species- or habitat-specific studies which have indicated an overall increase in numbers, suggesting a net benefit from the mine development in the upper Kumtor valley. The increased populations observed may be attributed in large part due to a ban on hunting within the concession area and the adjacent SECR. In addition, Kumtor's collaboration with NGOs (e.g. in regard to the snow leopard and with FFI) and lenders (IFC, EBRD) supporting adjoining nature reserves goes some way towards the development of a biodiversity management programme. However, the resulting Draft Management Plan developed for SCER has been awaiting Governmental approval since 2008.

ERM recommend that Kumtor develop a document for their formal biodiversity strategy to demonstrate that the site has a clear vision of the future for the site post closure and how that will be achieved. It is recommended that such a plan incorporates the overall 'closure vision' and details of how the vision will be enacted in the next iteration of the closure plan. The biodiversity management plan will need to also show how aquatic habitats are being managed, confirm the current position that dust from the site activities and vehicle movements on the haul road at the site is not impacting surrounding flora and that cyanide levels in the open waters of the TMF are not negatively impacting wildlife.

4.3.2 Waste Management

Overall good compliance with training, documentation, emergency response and planning, signage, monitoring, handling SOPs and reporting procedures were observed, especially for hazardous materials

Additionally and as demonstrated by the ICMI certification of compliance, the mine site has overall compliance with good waste management practices, especially for hazardous materials (including Cyanide).

Segregation of plastic, metals, timbers and cardboard is being carried out with recycling contractors being sought for these materials. The recycling of wastes generated demonstrates good practice with respect to the waste hierarchy. Waste oils are also collected for off-site recycling.

However, there is an acknowledged issue with both the permitting and the operation of domestic waste disposal. Despite the mine being operational for

15years, there is no agreed permitting regime for this activity, although requirements are described in Kyrgyz law (1). The laws noted also call for areas where wastes are handled and processed (e.g. the scrap sorting and storage areas) to be paved and bunded (contained) where necessary.

In addition to the permitting issues, the current landfilling operation does not meet good practice; having waste placed in cells with poor compaction and cover, leading to uncontrolled leachate generation within the cell.

ERM suggest that Kumtor management seek formal permitting of the operation, as well as adopting good landfill engineering and waste placement procedures. Additionally it is recommended that secondary containment and paving is provided for the waste oil transfer points.

It is further suggested that the potential for the further recycling of domestic wastes is considered via either composting or anaerobic digestion or potential via incineration to generate heat/energy as part of a wider sustainability strategy for the site. This should also look at and document the disposal or recycling options for the significant volumes of tyres present on-site.

4.3.3 Petrov Lake and the Risk of Flooding

The moraine-dammed glacial lake at the head of the Kumtor valley has been subject to numerous external studies regarding the potential for a glacial lake outburst flood (GLOF) to occur and the consequences of such an occurrence.

Although judged "relatively stable" at this time by BGC, specialist studies conclude that a flood via piping and channelling through the moraine dam as a result of ice melt is likely at some (unknown) point in the future. The channelling has the potential to eventually lead to catastrophic collapse of a substantial part of the moraine dam, and in the worst case scenario a full-scale GLOF.

BGC have modelled various GLOF scenarios, up to and including catastrophic collapse. In the worst case scenario the flood model shows likely damage to roads and bridges, the aggregate extraction facility, and flooding over a small proportion of the length of the shear key at the base of the TMF dam, albeit at low velocities.

Kumtor is considering options and designs for armouring the TMF shear key (using rip-rap and other flood defences) and lowering water levels in the lake by 5-10m to alleviate risk in line with specialist technical recommendations.

(1) Law on Environmental Protection (1999); Decree of the KR Government № 103 as of 25.02.2004 "About approval of the list of permits being issued by the executive authorities and their departments"; Law on Environmental Expertise (1999); Law about the wastes of production and consumption (2001); Instruction about regulation of solid waste management (1999); Guidelines for the state environmental expertise/review of pre- project, project documents and related other materials, № 407 as of 15.10.1997, Ministry of Justice

ERM suggest that Kumtor management carry out a cost benefit analysis (to include an understanding of any environmental impacts) of the proposed solution against identified alternatives and clearly document findings justifying the option(s) selected.

The assessment of the most appropriate mitigation measure or measures, should also take into account the impact upon biodiversity within the lake and receiving river system should anthropogenic intervention be deemed necessary to control the risk of GLOF.

Other considerations that should be implemented to guard against failure in advance of water level lowering, or other flood mitigation measures are:

- Instrument and monitor the moraine dam;
- Protect the tailings pipeline (to survive potential GLOF);
- Protect the gravel crusher (to survive potential GLOF);
- Develop an emergency response plan for GLOF,
- Train staff on emergency procedures during potential GLOF events,

4.3.4 Secondary Containment Provisions

Given changing environmental conditions since conception of the mine, summer meltwater pumping is now undertaken for structural stability and flood control at the mill, workshop and administration buildings (called the vertical drainage system). The summer meltwater is discharged to drainage channels which enters the river system via the Chong Sary Tor.

Although it is acknowledged that formal spill response procedures are in place, it is considered that secondary containment provisions associated with fuel offloading areas and workshops where small scale chemical usage is undertaken are generally poor, and there is the potential for small-scale uncontrolled releases to ground and for contamination of meltwaters.

ERM have recommended, as a precautionary step, the instigation of meltwaters quality monitoring from monitoring wells and on discharges to drainage channels, to which Kumtor management have immediately agreed. It is also recommended that secondary containment provisions are reviewed and assessed as to whether they are fit for purpose, and to upgrade where necessary. Furthermore, Kumtor management should develop procedures for control of meltwaters discharge in event of impacts being detected.

4.3.5 Water Quality

The site undertakes detailed and appropriate monitoring of surface water quality, and it can be demonstrated that most compounds assessed are in compliance with quality standards, especially for highly ecotoxic compounds

(such as cyanide and arsenic). However, there are minor exceedances of quality standards at both compliance points, specifically:

- sodium (Na) and sulphate (SO_4) at the ETP effluent discharge point; and,
- manganese (Mn) and iron (Fe) at the end mixing zone.

Mn and Fe reflect natural background concentrations in Petrov Lake (and therefore are likely not to be attributable to the mine operations). Na and sulphate are by-products of the cyanide treatment reagents.

It is considered likely that the sodium and sulphate are predominantly from ETP reagents used in the treatment of cyanide. It is suggested that an assessment is carried out on whether reagent usage can be optimised (or additional treatment is required) to reduce sulphate and sodium concentrations in the effluent to below current discharge consent levels.

In the event that no sustainable or cost-effective solution can be reached, it is recommended that discussions with the regulators take place concerning the ETP discharge and particularly the receiving water body classification and (based on the low ecotoxcity of these compounds) the potential to justify an increase consent level for Na and SO_4. If necessary, such a discussion should be backed with ecotoxicological study data for the flora and fauna within the receiving water body to the end of the current mixing zone to demonstrate no additional impact.

There is an additional source of sulphate via the southern tributaries from waste rock dumps and mine water discharges. These, together with the contribution from the ETP pose a future risk of exceedance at the end mixing zone compliance point, although this is not currently the case on yearly sulphate averages.

ERM suggest a detailed mass-water balance is undertaken to understand the relative contribution of sulphate, and to extrapolate predictions into post-closure scenarios and develop long-term action plan.

4.3.6 Tailings Management

The tailings discharge pipelines are considered to be well designed, with duty and duty-standby pipelines. Secondary containment provisions consist of either membrane lined concrete channels or bunded (contained) roadways with catchment ponds in case of releases. The lines are inspected hourly and are subject to routine maintenance to ensure that integrity breaks are identified and mitigated. It is considered that the potential for significant releases of tailings from this system is low.

Historical issues regarding TMF stability have been addressed by significant remedial works and monitoring by third parties (local and international). ERM regard the mitigation measures carried out on the TMF dam (based on

evaluations and inspections by Golder Associates, The Kyrgyz Academy of Sciences and BGC) to be satisfactory at this time and broadly in line with good practice.

The tailings currently in place have been conclusively shown, through a number of studies and direct measurement, to have low potential to form acids; one of the main concerns of many similar facilities across the world. Cyanide present in the tailings pore water has been shown to degrade to non-detect with depth (which is equivalent to age). However, two areas that ERM feel warrant further attention are:

- Ongoing seasonal (early summer) presence of weak acid dissociable (WAD) cyanide >50mg/l (as opposed to total or free) in TMF open water (certified with deviation by ICMI as acceptable based on monitoring results and mitigation measures); and

- Potential loss of partial basal containment in the event that the permafrost below the Impoundment was to melt in the future.

In regard to the first point (present day issue), monitoring data from the effluent treatment plant (ETP) confirms influent WAD cyanide levels dropping from 60 to 16 mg/l over the course of the 2012 summer season, and following treatment the cyanide levels meet permitted consents for discharge to the Kumtor River. Notwithstanding this, ERM recommend that wildlife studies are continued and open tailings water and bird repellent mitigation measures accepted by ICMI/assessors as part of certification requirement. Kumtor management need to ensure full documentation and incorporation of these procedures into environmental management plans.

In regard to the second, potential future issue, ERM suggest that additional monitoring points at locations immediately south of the TMF should be established as part of an extended monitoring programme to verify basal containment during the Life of Mine (LOM). In any case, at closure, the CN-depth profiling should be repeated to demonstrate biodegradation and the issue of TMF containment continued to be evaluated as part of the closure plan (see below).

4.3.7 Closure Plan & Financial Provision

In line with EMAP, the current closure plan (3rd iteration) is at the conceptual stage, with the next iteration due in 2013. The 2010 plan is focused on engineering considerations and in ERMs view does not adequately cover socio economic issues or stakeholder engagement. It is also considered that the Conceptual Closure Plan (CCP) frequency and content falls a little short of good international practise for other large mining projects.

The plan estimates the closure costs at approximately $30 million; the plan costs are reviewed annually as part of the Kumtor financial controls related to Sarbanes Oxley certification.

ERM suggest that, going forward, Kumtor management use the current CCP as a basis to develop a more comprehensive closure plan incorporating clear plans for the management of stakeholders, biodiversity and socio-economic issues together with the technical. ERM have been informed that the development of these aspects is part of the budgeted 2013 plans for the mine.

ERM also recommend that future iterations of the CCP include plans to address the projected sulphate impacts, and define how these can be addressed post-closure.

Finally, it is suggested Kumtor management review the costing of the closure plan; incorporating socio-economic issues (including retrenchment and community development exit strategies) and realistic contingencies, and that in line with existing practice, the technical aspects of the closure are revisited and tested on an ongoing basis.

4.3.8 Balykchy Marshalling Yard Facility

The Balykchy facility acts as a staging facility for the transfer of goods from rail or road transport to storage and then to planned road transfer convoys to the mine. The current site has been occupied in the last year and is in the process of being upgraded and modified to fit Kumtor requirements, with all permits in place. This includes the construction of a bulk fuel storage facility and the laying of hardstanding across the majority of the site.

The facility appeared well managed with work well underway to ensure the segregation of raw materials and the containment of hazardous liquids.

Two issues were identified during the site walkover:

- An area of the site was observed to have been subject to historical spillage of what appeared to be hydrocarbons, not related to Kumtor activity. It is recommended that the nature and extent of the impact is investigated and remedial action is taken to mitigate the impact. This is likely to include the removal of impacted soils. The investigation, remediation and verification works required should be subject to consultation with the authorities and be fully documented.

- Plans for the paving of the facility are understood to be on hold until direction is given by the authorities on the specification required for the paving. It is recommended that plans are drawn up meeting good international standards and submitted proactively to the authorities. It is not good practice to continue to operate the facility with areas unpaved and others areas in poor condition.

4.3.9 Air Quality

The Kumtor operation is mostly powered by electricity fed from the national grid. ERM understands this is 93% energy derived from 'green' hydro-power creating a very favourable GHG profile for remote mining operations.

In addition, the Kumtor management is proactively looking at efficiency and energy reducing projects (solar panel assessment, phasing out of diesel pumps in favour of electric, investment in more fuel-efficient heavy plant fleet, resource efficiency signage etc.)

ERM suggest that Kumtor management clearly document its strategy for the reduction of GHG emissions (from operations upon which Kumtor has direct influence) as part of an overall sustainability statement and strategy. This represents good international practice. It is likely the biggest opportunities in GHG reduction will come from supply chain or other third-parties.

In regard to air quality and air emissions, the regulatory review indicated that the Maximum Allowable Emissions (MAE) permit for total sulphur dioxide for 2011 was exceeded at the mine. The MAE is based on a calculation made by the site and declared to the Authorities. The actual emissions total was 12.436 tonnes, versus a calculation of 10.036 tonnes. It is understood that the under calculation was in part due to an under estimation of the emissions from generation sets and pumps.

ERM suggest that Kumtor management revisit the assumptions for the emissions predictions within the context of projections for equipment types and numbers and operations.

Annex A

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