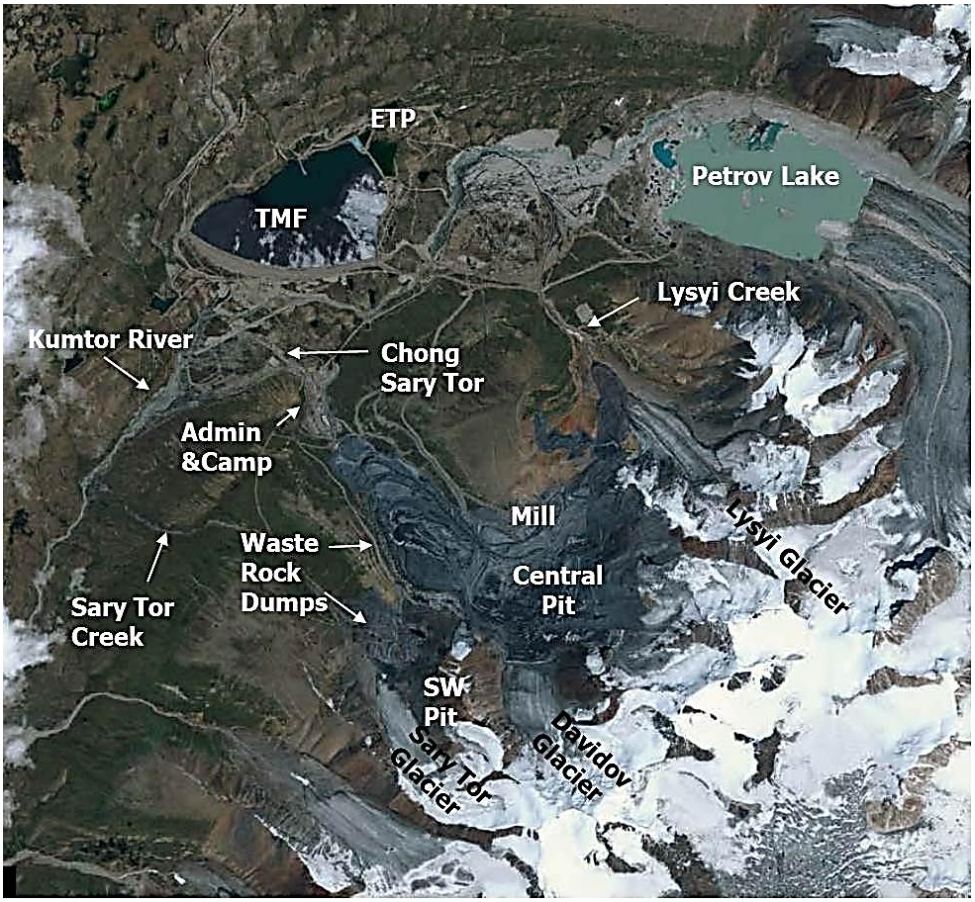
PRIZMA

Independent Assessment of the Parliamentary Commission Report

Final Report - 23 September 2012



Submitted to Kumtor Gold Company
Submitted by Prizma LLC
1972 Woodcrest Circle
Mosinee, WI 54455, USA
www.prizmasolutions.com

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Abbreviations

ABA	Acid Base Accounting
BGC	BGC Engineering Inc.
AER	Annual Environmental Report
ARD	Acid Rock Drainage
BMY	Balykchy Marshaling Yard
CAO	Compliance Advisor/Ombudsman
CCP	Conceptual Closure Plan
Centerra	Centerra Gold Company
CR	Corporate Responsibility
EBRD	European Bank for Reconstruction & Development
EDC	Export Development Canada
EHS	Environment, Health & Safety
ETP	Effluent Treatment Plant
EIA	Environmental Impact Assessment
ESIA	Environmental and Social Impact Assessment
EITI	Extractive Industries Transparency Initiative
EMAP	Environmental Management Action Plan
EMS	Environmental Management System
ERP	Emergency Response Plan
GLOF	Glacial Lake Outburst Flood
Golder	Golder Associates
GIIP	Good International Industry Practice
ha	Hectares
ICMI	International Cyanide Management Institute
ICMC	International Cyanide Management Code
ICR	International Consultant Report
ICSID	International Centre for Settlement of Investment Disputes
IFC	International Finance Corporation
IUCN	International Union for the Conservation of Nature
IH	Industrial hygiene
ILO	International Labour Organisation
KGC	Kumtor Gold Company
KOC	Kumtor Operating Company
KR	Kyrgyz Republic
KRIM	Kyrgyz Republic Institute of Rock Mechanics
Kumtor	KOC or KGC
LEAD	Leadership for Environment and Development
LLC	Limited Liability Company
LLP	Limited Liability Partnership
LOM	Life of Mine
MAC	Maximum Allowable Concentration
MAD	Maximum Allowable Discharge
MAE	Maximum Allowable Effluents
masl	meters above sea level
mbs	meters below surface
mg/l	milligrams per liter
Mica	Mica Environmental Ltd
NGO	Non-governmental Organization
masl	Meters above sea level
OPIC	Overseas Private Investment Corporation
PCR	Parliamentary Commission Report headed by S. Japarov
PMF	Probable Maximum Flood
PR	Performance Requirements
Prizma	Prizma LLC
QA/QC	Quality Assurance/Quality Control
RLC	Regional Liaison Committee
SCER	Sarychat Ertash Reserve (Zapovednik)
SENES	SENES Consultants Limited
SHE	Safety, Health and Environment
TDS	Total Dissolved Solids
TMF	Tailings Management Facility
TOR	Terms of Reference
TSS	Total Suspended Solids
UN	United Nations
UNECE	UN Economic Commission for Europe
UNESCO	UN Educational, Scientific and Cultural Organization
UNFCCC	UN Framework Convention on Climate Change
WESA	WESA Environmental Inc.
WWF	World Wildlife Fund
WRD	Waste Rock Deposition

1 Executive Summary

1.1 Background

Centerra Gold Inc.'s (Centerra) Kumtor Project is the largest gold mine operated in Central Asia by a Western-based company. Kumtor is operated as a high-altitude open pit mine and has produced over 8.4 million ounces since 1997 and has a current Life of Mine (LOM) extending to 2021.

Prizma LLC (Prizma) is an independent consulting practice based in the USA. Prizma's expertise includes Corporate Social Responsibility (CSR), Environmental & Social Impact Assessment (ESIA) and Auditing, Stakeholder Engagement and Sustainability, and the application of IFC Performance Standards and similar international benchmarks. Prizma also provides expert witness services in the context of international arbitration.

The Kyrgyz Government, through the on-going State Commission which is investigating Kumtor, requested and received details about Prizma's contracting with Kumtor. Prizma, a privately owned company, was first contracted by Kumtor Operating Company CJSC (KOC), acting on behalf and in accordance with the Operating Agreement with Kumtor Gold Company CJSC (KGC), in February 2012. Prizma had not completed any previous projects for Kumtor or Centerra.

Prizma was engaged in response to discussions among shareholders of Centerra[1] about the validity of the content and conclusions of a series of recent reports being generated by Kyrgyz Commissions about Kumtor. Prizma's contracting provides freedom for Prizma to determine its own approach relating to its work. Prizma and its owner/manager have no financial interest (such as ownership of shares) in Kumtor or Centerra. As typical for the consulting sector, Prizma's remuneration is based on a time and expenses-based fee structure. This does not include any incentives (such as bonuses) tied to particular outcomes of Prizma's work.

1.2 Approach and report structure

Prizma completed an Independent Assessment[2] of the InteragencyCommission[3] (also known as the Interdepartmental Commission or Interagency Commission) in April 2012. The resulting report is available in English and Russian languages on Kumtor's website. Already in mid-February 2012, the

[1] Centerra's largest shareholder Kyrgyzaltyn, which is owned and controlled by the Kyrgyz Government, owns approximately 33% of the common shares of Centerra.

[2] Prizma LLC, 2012. Independent Assessment of the "Interagency Report" and the "Moran Comments" on Compliance with Environmental and Industrial Safety Standards at the Kumtor Gold Mine, Final Report, 23 April 2012 (http://www.kumtor.kg/wp-content/uploads/2011/12/Prizma-Assessment-23-April-2012-ENG.pdf)

[3] Interagency Commission, 2011. Evaluation of Compliance with Environmental and Industrial Safety Standards at Kumtor Gold Mine, a Report, December 28, 2011

Kyrgyz Parliament had established a Parliamentary Commission, headed by S. Japarov. This report contains Prizma's Independent Assessment of the Parliamentary Commission Report (PCR).[4]

The key issues and assertions contained in PCR related to environmental issues provided a 'road map' for Prizma's review. Prizma identified and extracted PCR's key concerns. These were structured under seven major headings, listed below:

1. Geotechnical issues: TMF and Petrov Lake
2. Flora, Fauna and Biodiversity
3. Glaciers and water consumption
4. Groundwater
5. Environmental Management
6. Waste Management
7. Data reliability and transparency

The key issues described in the PCR were analyzed in a relevant context resulting in Prizma's statements of findings, conclusions and recommendations at the end of each section.

Our assessment was informed by the following key sources and activities:

1. Prizma's first Independent Assessment of the findings of the Interagency Commission, headed by E. Imankojoeva. This involved literature searches, and discussions with Kumtor's and Centerra's staff and senior management. We also had an opportunity to meet with key members and experts of the Interagency Commission to discuss Prizma's findings and report in June 2012.
2. Prizma participated in several mine site visits, including one organized for the Kyrgyz Prime Minister Babanov in July 2012 and another arranged for several NGOs in September 2012. Prizma also conducted a visit to Naryn and the Alex Stewart Laboratory in Kara Balta.
3. Prizma reviewed additional documents, including a series of international audits, which were also provided by Kumtor to the Kyrgyz Government/State Committee. Prizma also requested and obtained additional updates and clarifications related to two such audits (updates annexed to this report).

This Independent Assessment is structured based on the key topics raised by the PCR as noted further above. This Executive Summary (Section 1) describes our approach, contains a summary of our findings and recommendations, and presents the short biographies of the contributing authors. The key documents and references we relied upon are listed in Section 9, which is followed by the Signature Page.

[4] Parliamentary Commission Report, 2012. Report of the Interim Parliamentary Commission to inspect and review KOC compliance with standards and requirements on rational use of natural resources, environmental and operational safety, and community social protection in the Kumtor Mine impact area as well as government control status established by the KR Parliament Resolution #1642-V of February 15, 2012

1.3 Authors' background

This Assessment was completed by Mehrdad Nazari, MBA, MSc, LEAD Fellow, Senior Corporate Responsibility & ESIA Advisor, and Director of Prizma LLC. In addition, Don Proebstel, PhD, Senior Biodiversity & ESIA Advisor and Associate of Prizma LLC, also contributed to and co-authored this report. The bios of both authors are summarized below. In completing this assignment, both authors have provided their independent professional judgment and were not unduly influenced by Kumtor.

Dr. Proebstel's professional experience spans 25 years. This includes positions as Senior Environmental and Social Analyst with the Overseas Private Investment Corporation (OPIC), Market Analyst with Pike Research, Vice-President Environmental and Sustainability at Gold Reserve Inc., a junior mining company, Senior Environmental & Biodiversity Consultant with AATA International, an environmental consultancy, and Director of the World Salmonid Research Institute. He is a member of the International Association for Impact Assessment (IAIA). Don is currently also a scientific advisor to Natural Power Concepts, a renewable energy technology developer, and contributes to a case which is before the World Bank's International Centre for Settlement of Investment Disputes (ICSID). Dr. Proebstel holds a BS in Fishery and Wildlife Biology, and a PhD in Conservation Biology from Colorado State University.

Mr. Nazari has over 20 years of international professional experience, is the CSR and ESIA Practice Leader, and owner-manager of Prizma LLC, a niche consulting practice. Mr. Nazari's experiences include serving as an Expert Witness on an international arbitration case before the World Bank's ICSID in Washington DC. He was also an Expert Panel Member advising the Compliance Advisor Ombudsman (CAO) office of the International Finance Corporation (IFC). Previously, Mehrdad was a Project Manager; EHS Auditor; and a Contaminant Hydrogeologist with Dames & Moore (now URS), a leading international environmental and engineering consulting firm. He served also as the Head of CSR Research at CoreRatings, London (formerly part of Fitch, now DNV), which provided services to socially responsible asset managers and pension funds. Previously, Mehrdad served as a Principal Environmental Specialist at the European Bank (EBRD, until 2003[5]). Mr. Nazari holds an undergraduate degree in Mineralogy (geochemistry) from JW Goethe University in Frankfurt, Germany; a Masters degree in Hydrogeology from University of Birmingham, UK; and an MBA degree from Henley Business School in the UK. He is also a Fellow of Rockefeller Foundation's Leadership for Environment & Development (LEAD) program, a member of the International Association for Impact Assessment (IAIA), a licensed Sustainability Reporting Assurance Provider, a trained Lead Auditor for ISO 14,001 Environmental Management System, a GRI-approved trainer in sustainability reporting, and an expert practitioner and trainer on IFC Performance Standards and Equator Principles.

[5] During his tenure at the EBRD, Mr. Nazari was also involved in the Kumtor project. This includes spearheaded EBRD's follow-up activities relating to the accidental cyanide spill *en route* to the Kumtor in May 1998. This resulted in mobilization of technical assistance grants through the EBRD and IFC, which was funded by UK's Department for International Development (DFID), to assist with community engagement, conflict resolution and biodiversity related initiatives (see also Nazari, *et al*, 2001, and Fauna & Flora International, 2003).

1.4 Key context and project changes

Before we summarize our key findings further below, we note that the context of the Kumtor Project, which became operational in 1997, has changed significantly. We have highlighted some of the significant political and operational changes over the past few years below. These should be considered in the context of the scale of Kumtor to the Kyrgyz economy: Kumtor generates approximately 10% of the Kyrgyz GDP, about one quarter of its total industrial output and is the largest private sector tax payer. Also, approximately one-third of Centerra Gold Inc., Kumtor's listed parent company, is owned by Kyrgyzaltyn, the Kyrgyz state-owned mining enterprise.

Significant changes in the political and regulatory arena include (i) two revolutions and many more government changes[6] over the past few years, (ii) the introduction of a series of new framework laws, including those related to waste, which have yet to be fully codified, (iii) the signing of the 2009 New Terms Agreement[7] relating to Kumtor by the Kyrgyz Government and approval by the Kyrgyz Parliament, and (iv) the more recent launch of a series of highly critical government commissions/inspections against a backdrop of calls by a majority of Kyrgyz Parliamentarians for changes to the 2009 New Terms Agreement concerning the Kumtor Project. However, Transparency International's placement of Kyrgyzstan, which has a population of 5.3 million, in the lowest decile (10%) of the Corruption Perception Index ranking of approximately 180 countries has not changed.

Key operational changes at Kumtor include the (a) installation of the shear key and toe berm (buttress) to arrest creeping (movement) of the TMF dam, (b) significant expansion of Life of Mine (from a 2012 plan to, currently, 2021), (c) movement and ingress of ice and glacial materials into the open pit area resulting in significant delays to gold production during 2012, and (d) 'mothballing' of planned underground mining activities.

1.5 Summary of conclusions & recommendations

1.5.1 Geotechnical issues: TMF and Petrov Lake

The Parliamentary Commission raised concerns over geotechnical risks associated with the TMF and Lake Petrov, which is a lake contained by a natural moraine, and serves as the source of water use and consumption for both industrial and domestic water for Kumtor. PCR issues pertaining to the TMF focused primarily on movement of the tailings dam, which was first observed in 1999. PCR concerns

[6] At the time of writing this report, the Kyrgyz Government was dissolved once more

[7] NEW TERMS AGREEMENT on Kumtor Project between the KR Government on behalf of Kyrgyz Republic and Kyrgyzaltyn OJSC, and Centerra Gold Inc, Kumtor Gold Company CJSC, Kumtor Operating Company CJSC and Cameco Corporation as of April 24, 2009. In 2009 all the previously effective agreements on Kumtor Project were revised, and the New Terms Agreement on Kumtor Project between the KR Government, Kyrgyzaltyn OJSC, Canadian Company Centerra Gold Inc, Kumtor Gold Company CJSC, and Canadian Corporation Cameco was concluded on April 24, 2009, and was ratified by the KR Law #142 issued by KR Parliament on April 30, 2009. This Agreement is currently effective (File # 4-1, pp. 193-251): (PCR page 71) and is supplemented by a Restated Investment Agreement, Restated Concession Agreement, Restated Shareholder Agreement and Restated Gold and Silver Sales Agreement (among other agreements).

pertaining to Lake Petrov center on the possibility of a Glacial Lake Outburst Flood (GLOF), and projected resulting impacts to the TMF.

Our review found conclusions voiced in the PCR did not include adequate assessment of recent audits, initiatives and/or construction activities by KOC. Kumtor developed and applied externally vetted and Government approved remedial actions to arrest the TMF dam movement, including the addition of a shear key and buttress anchored to a depth of 10-12 m below surface and into competent permafrost/ground. Dam movement rate is gradually decreasing and will be below 3 mm/year by 2025.

Our review of the facts, studies and modeling carried out by experts, does not support PCR's assertions of an imminent catastrophic failure (caused by climactic changes and related impacts) which would result in a GLOF from Lake Petrov. We support recommendations already made to continue with monitoring and reporting, and additional measures aimed at increasing the factors of safety, such as armoring the shear key and reduction of water levels in the Petrov Lake, which has also been recommended in the PCR. Kumtor should also review its risk communication strategy.

1.5.2 Flora, Fauna and Biodiversity

Based on our evaluation of the PCR, our review of available information and important current and historical facts relating to KOC, we find that, overall, the company has been diligent in both monitoring and mitigating its impacts on flora and fauna, in addition to having a long track record of supporting regional biodiversity activities, which have also benefitted the Sarychat-Ertash Nature Reserve (SCER).

Based on review of pertinent information, documents and interviews with management, it is evident that biodiversity conservation has been, and remains, a high priority for Kumtor. In addition to our findings, the information contained in the PCR clearly demonstrate that the most significant and real impacts to regional biodiversity are poaching and overhunting, affects from grazing of livestock, overharvesting (of both animals and plant species) and limited Kyrgyz Government support of biodiversity related programs. A balanced review of available information underlines Kumtor's net positive contributions to biodiversity conservation.

In our opinion, the PCR omits significant facts and ignores the 'big picture' of real impacts and needs for biodiversity conservation in a regional perspective. We also note confusion regarding legality, and definition of the so-called SCER "Buffer Zones" and recommend an interactive approach with Kyrgyz Government and other stakeholders (including Kumtor) to resolve this confusion. We also point out that Kumtor has a significant opportunity to continue and increase its engagement and develop signature biodiversity programs to further demonstrate its conservation stewardship consistent with Kumtor's and Centerra's policies and commitments.

1.5.3 Glaciers and water consumption

The Parliamentary Commission voiced concerns of Kumtor's impacts to glacial melting, hazards associated with movements and interactions of Davidov Glacier with portions of the central pit, and concerns over water consumption by Kumtor. Our review finds that Kumtor's impacts to glacial melting and regional hydrology, including those associated with water consumption, are over-stated by the PCR. In our opinion, the data – including those produced by the Kyrgyz Government and submitted to the UN

Framework Convention on Climate Change (UNFCCC) - shows that Climate Change impact is the recognized driver of glacial ablation on a very visible and significant scale across Kyrgyzstan. These impacts have also been observed in the Kumtor Mine area, including for decades before it started its operation.

The available information, and the PCR, show that the challenge associated with glacial material movements by Davidov Glacier (and related issues) into the mine pit area provide a globally unique challenge to Kumtor's operations. In our opinion, the information available shows that Kumtor is aware of and is seeking to actively manage potential hazards associated with movement of glacial materials to the central pit. This includes monitoring, use of third-party experts and developing specific emergency response plans. We understand that this issue is being considered by Kumtor in its overall mine planning process and anticipate continued scrutiny by relevant government agencies.

In our opinion, water consumption by Kumtor is not significant on a local and, much less, on a regional scale and no credible evidence is provided in the PCR that would suggest 'competition' or 'missed opportunity' for the use of water consumed by Kumtor. Also, it is evident that the PCR has not reconciled its contradicting expectations relating to this topic from Kumtor. On one hand, Kumtor is expected to increase water recycling. This implies a reduction of water intake from the Petrov Lake. On the other hand, Kumtor is expected to lower the water level in the Petrov Lake to address PCR's concerns about a potential GLOF event at Petrov Lake. We recommend that the Government Commission develops a clear and consistent recommendation that considers the absence of water scarcity issues at the Kumtor mine, cost-benefit and water quality considerations which may be associated with water recycling efforts, and the apparent need to reduce the water level in the Petrov Lake.

1.5.4 Groundwater and permafrost

Kumtor is located in a high altitude (4,000 m) and permafrost environment. This means that, except for a relatively shallow 'active layer' (approximately one to a few meters below surface which thaws during the Spring/Summer Season), the ground condition is frozen down to 250 mbs. Kumtor continues to conduct water monitoring programs at the former seepage location.

In our opinion, the available data, including those generated by the PCR, does not support a causal linkage between Kumtor and asserted water quality concerns in Naryn, which is located approximately 200 km further downstream. We recommend that the Parliamentary Commission considers available data and publications, including the 2011 UNICEF publication and the 2011 EU-funded Environmental Management Plan developed for the Naryn Oblast described in Section 5.3, which have identified actual and much more likely pollution sources and concerns.

We recommend that Kumtor should continue its review of its mining and closure plans for issues related to elevated sulphate (SO_4) levels, including from the Waste Rock Deposition (WRD) areas. Kumtor should also consider the need for measures that support trust building in its water quality monitoring program. This might include community-supported monitoring concepts, a review of its overall sampling program originally established in 1995, and an assurance-oriented data management and reporting process.

1.5.5 Environmental Management

Kumtor has a known environmental footprint and related temporary and permanent impacts (as also discussed already in the 1993 EIA). Overall, we found the PCR sections relating to environmental management issues to be disjointed, selective and present a prejudicial image of Kumtor's environmental management practices.

The Commission appears to hold KOC to higher standards than any other entity in Kyrgyzstan, and does not acknowledge the body of historic environmental monitoring and reporting that has occurred, focusing on selective and, in our opinion, generally immaterial or unsupported examples, to infer lack of environmental responsibility.

With specific reference to effluents/impacts from streams originating at or near WRD areas, we recommend that KOC should further consider how issues relating to WRD effluent water quality and anticipated elevated sulfate concentrations in the future can be addressed and mitigated, as needed, as part of its on-going mine operations and closure planning processes.

In our opinion, the PCR does not present material and substantiated evidence that would point to material weakness in KOC's environmental monitoring program. However, recognizing that the origin of Kumtor's water monitoring program dates back to 1995, Kumtor would benefit from a review and, if required, update of the full chain of its water quality program that could also consider changes, such as LOM, increased overall size of operations, using modern IT tools to integrate data assurance process, and integrating modern community-supported monitoring concepts.

In our opinion, some important aspects of the most recent regulatory changes, standards and permitting expectations being applied to Kumtor since the launch of various government commissions in late 2011 appear to be largely void of a risk/impact focus; ignore the background/baseline conditions; ignore 15 years of operational history, inspection and reporting of Kumtor; and are inconsistent with accepted standards, such as those defined by the IFC. Kumtor should carefully review and update its permitting status and continue to constructively engage with the Government to develop a fair and reasonable approach to permitting and standards taking into account recognized Good International Industry Practice (GIIP).

1.5.6 Waste Management

The Parliamentary Commission raises concerns regarding Kumtor's waste management in general, with specific references to solid waste (both hazardous and non-hazardous), domestic waste, and particular attention to disposal practices of Kumtor's medical center at the mine site. In our opinion, Kumtor's past and current waste management practices are not always fully consistent with best international practice, largely because of very limited, if any, appropriate waste management capacity and markets in Kyrgyzstan.

In our opinion, the PCR has identified a number of important opportunities for improvement. Kumtor should continue to liaise with the government for guidance on planning and reporting of its waste streams in line with emerging regulatory requirements. Kumtor should further improve documentation and inventories, medical and hazardous waste disposal practices (including considering off-site

disposal/recycling options, if available), and scaling up Kumtor's other recycling/reuse efforts. This may also necessitate updating its Environmental Procedures and Operating Instructions.

It is perplexing to us that the PCR omits the context of real structural barriers to good waste management practices for all sectors in the Kyrgyz Republic. We recommend that the Parliamentary Commission should consider these facts described also in the latest UNECE and other studies (see Section 7.2 at page 69) and develop suitable recommendations for the Kyrgyz Government and the international donor community. Based on our review of publications which describe the conditions across Kyrgyzstan and contrasting this with the practices at Kumtor, it is our opinion that the thrust of the PCR is focused on painting an unbalanced and prejudicial image of Kumtor's waste management practices.

In our opinion, a balanced review would identify improvement opportunities and that Kumtor's facilities are still superior to most, if not all, existing waste collection facilities in Kyrgyzstan. Unlike most, if not all, of its Kyrgyz 'counterparts', Kumtor's principle waste management facility is contained within the envelop of an engineered structure (TMF), has sufficient capacity, is located far from any populated areas or groundwater users, has adequate financial resource allocation, is actively managed on a daily basis, is routinely monitored/inspected and has also made provision for its eventual closure. However, we recommend that Kumtor should review and update its permitting status, explore opportunities to improve on-site landfills and continue to constructively engage with the government to develop a fair and reasonable approach to permitting and application of standards in line with GIIP (such as IFC guidelines).

1.5.7 Data reliability and transparency

The Parliamentary Commission raises concerns pertaining to the reliability of Kumtor's environmental data, in general, and directly alleges that Kumtor "falsifies" data or information. The PCR selectively cites information from independent audits by international consultants and, more broadly, raises general concerns about the overall transparency of Kumtor.

In our opinion, the assertions by the PCR pertaining to "falsification" or unreliability of environmental data, are misquoted, misleading, immaterial or have been remediated. We find the singular attention, and unfounded accusations, on lack of transparency (while the 2009 UNECE study singles out Kumtor as the only company in the country that transparently discloses its environmental performance) indicative of the application of standards to Kumtor which are not being applied to any other enterprise in the country. Our review of updates and clarification we requested form international auditors, do not support the PCR's assertions about calibration and related data quality. We find that the PCR disregards the limited practical implications (illustrated with examples in Section 8.5 at page 77) and ignores that relevant and material issues identified in dated audits, have since been remedied.

We recommend that Kumtor and Centerra continue with their auditing and continuous improvement programs. Kumtor may wish to explore the opportunity of applying (sustainability) reporting assurance approaches to its data management system to further boost data integrity and credibility.

Recognizing the challenges associated with its remote location and need for related capacity building, we recommend that Kumtor should continue to engage with youth groups, community representatives and NGOs in an effort to involve them in Kumtor's monitoring programs. This could also be integrated with biodiversity conservation initiatives.

We also recommend that Kumtor considers financial support (grants, prizes, competitions) for organizations and activities of youth groups, NGOs, academic and institutions and professional associations that aim to introduce or expand broader environmental monitoring, reporting and benchmarking in Kyrgyzstan.

Figure 1: Kumtor Project Location map (source Strathcona/Kumtor)

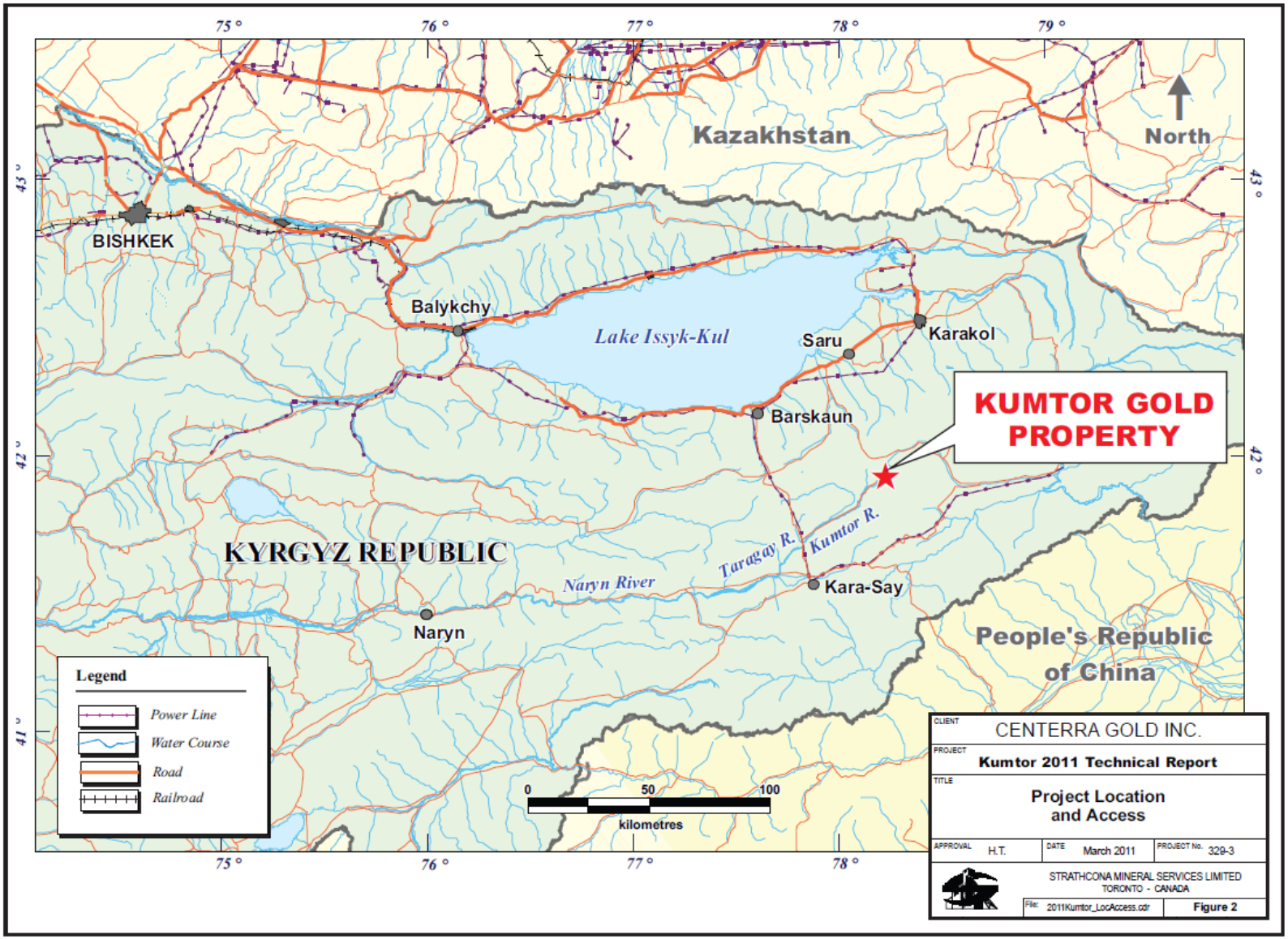
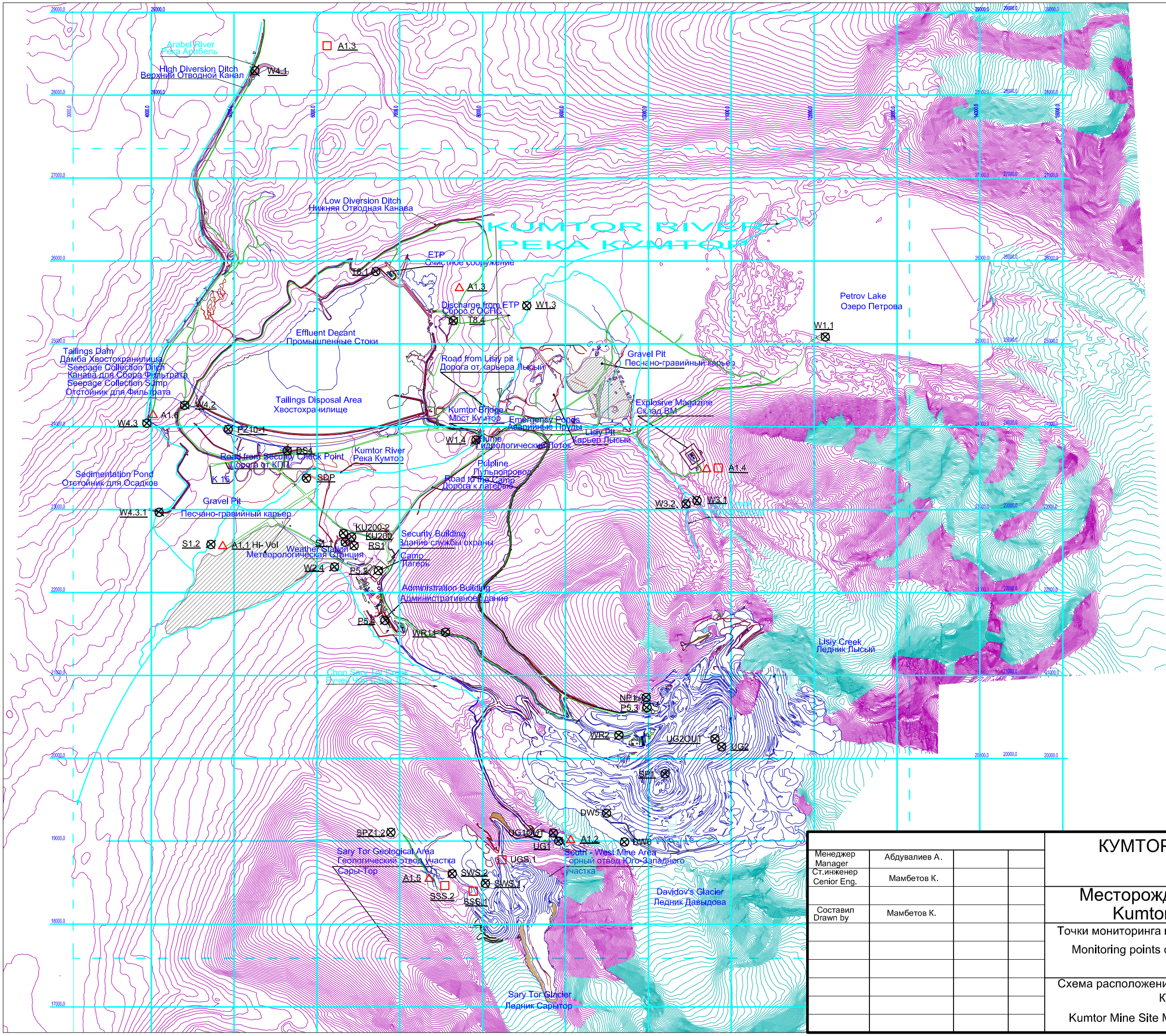


Figure 2: Kumtor's mine infrastructure and key environmental sampling points (source Kumtor)



Legends
Условные обозначения

- ⊗ - Станции отбора проб воды
  - Water sampling stations
- △ - Пробоотборник воздуха большого объема
  - High volume air samplers
- □ - Станции отбора проб снега
  - Snow sampling stations

Public roads
Автодороги общего пользования

Roads on the pit
Дороги на карьере

Road on South -West Zone
Дорога на Юго-Западный участок

Pulpline
Пульпопровод

Rivers
Реки

The distance (in km) from T8.4 sampling point to:
Расстояние (в км) от точки отбора T8.4 до:

by downstream по водотоку	by right line по прямой
to W1.5.1 = 12.36	до W1.5.1 = 10.97
to W1.6 = 24.36	до W1.6 = 21.97
to W1.7 = 42.36	до W 1.7 = 37.93
to W1.8 = 231.82	до W1.8 = 182.24

Менеджер Manager	Абдувалиев А.		
Ст.инженер Cenior Eng.	Мамбетов К.		
Составил Drawn by	Мамбетов К.		

КУМТОР ОПЕРЕЙТИНГ КОМПАНИ
Kumtor Gold Company

Месторождение Кумтор
Kumtor Project

Чертеж №1 Plot #1

Точки мониторинга воды, снега и воздуха
Monitoring points of ware, snow and air

Масштаб Scale	Лист Sheet	Листов Sheets
	1	1

Схема расположения основных объектов КОК
Kumtor Mine Site Major Facilities,

КОК КОС

2 Geotechnical Issues: TMF and Lake Petrov

2.1 Background

The Kumtor Mine has been operational for approximately 15 years and is currently expected to continue operations until 2021. It is located in a remote, high altitude (about 4,000 m elevation) and partially glaciated region. Kumtor is the largest operating publicly listed gold mine in Central Asia. Key infrastructure components with geotechnical components requiring management include: the Tailings Management Facility (TMF), and the natural moraine lake, Lake Petrov, situated directly below the toe of the Petrov Glacier and primarily charged by seasonal glacial melting.

Over the last fifty years, scientists have documented a significant retreat – or ablation – of all glaciers in the project area, as has been similarly observed and documented throughout all of Central Asia. One result of climate change and glacial ablation includes ancillary changes to natural features associated with glaciers, such as natural moraine dams and lakes. Glaciers and moraine dams are dynamic features on the landscape, subject to on-going changes through time, driven primarily by climate, temperature, geophysical occurrences and other cumulative local, regional and global conditions[8]. In response to changes described above, glacial lakes may be subject to a phenomenon described as Glacial Lake Outburst Floods (GLOF). These are not uncommon in Central Asia, and in Kyrgyzstan, 70 GLOFs have been documented over the last fifty years.[9]

Kumtor's Tailings Management Facilities (TMF) includes a compacted fill dam structure. This is approximately three km long. Kumtor's tailings dam is the largest such structure in the Kyrgyz Republic and continues to be raised in stages. Its purpose is to collect and contain the tailings[10] delivered in form of slurry which is generated as part of the mining and gold extraction process. During initial construction, a geomembrane liner was placed on the upstream face of the dam. This liner extends approximately one hundred meters upstream of the dam toe on natural ground into the impoundment. Associated infrastructure includes: two tailings (slurry) pipelines, two water diversion channels, and an effluent treatment plant. The dam and associated facilities continue to be subject to external expert review and Government approvals from time to time.

Lake Petrov is a relatively large glacial lake, with a current volume of 65 million m^3.[11] With specific reference to Lake Petrov, two natural processes are significant. First, an increase in the size and volume of the lake over the last several decades (see Figure 9 and Figure 10) and, second, changes to the moraine dam (particularly the north-east lower lobe) as part of natural processes.

[8] Natural Disaster Risks in Central Asia: A Synthesis, Michael Thurman, UNDP/BCPR, Regional Disaster Risk Reduction Advisor, Europe and CIS 11 April 2011
[9] Op cit.
[10] Tailings are finely ground waste materials left over after the process of separating the valuable fraction from the uneconomic fraction
[11] AER, 2011, page 99

2.2 Issues raised by the Parliamentary Commission

Before summarizing the key assertions contained in the PCR, we note that the report by the Parliamentary Commission was preceded by the Interagency Commission's report and Prizma's corresponding Independent Assessment[12]. The Interagency Commission also covered several issues associated with the TMF and Lake Petrov, but are now also covered in the PCR.

Though the Parliamentary Commission appointed a working group to focus on hydrological and geotechnical aspects of the Kumtor Mine, the report refers to concerns with the geotechnical issues relating to the Kumtor mine infrastructure, or location, in several places within the report, contributed by different authors. We have grouped issues that broadly relate to geotechnical aspects of Kumtor into the following headings:

a) Tailings Management Facility (including dam safety and impacts from TMF/ groundwater interactions).
b) Concerns over possible failure of the Lake Petrov natural moraine dam – and resulting Glacial Lake Outburst Flood (GLOF).

The Parliamentary Commission Report voiced several concerns about the TMF. Referring to outdated information, these relate mainly to the movement of the tailings dam and potential impacts that may be associated with any catastrophic dam failure. The PCR states:

> "The dam foundation has experienced horizontal deformations, believed to have been caused by creep deformation of the ice rich silt induced by the load from the dam embankment.
>
> At present, there is no decision on construction of new tailings facility or buildup of the current one; the works on strengthening the tailings dam for deformation decrease are going on.
>
> Thus, TMF is currently one of the serious sources of environmental risk due to the violations made during the design and construction period. KOC did not minimize but strengthened the risks of environmental contamination"[13]

Additional and more generic concerns were also raised about potential for TMF-related groundwater contamination and associated impacts to the nearest residents in Naryn (located some 200 km downstream of the TMF), and possible impacts to water quality.[14]

In addition, potential adverse impacts from a so called 'Glacial Lake Outburst Flood' (GLOF) were noted. These relate to the Petrov Lake, which is contained by a natural moraine dam. This lake serves as the source for Kumtor's domestic and industrial water. The PCR identifies three potential scenarios of impacts resulting from a GLOF of Lake Petrov. The PCR also predicts that a GLOF is imminent (within the

[12] Prizma, 2012. Independent Assessment of the "Interagency Report" and the "Moran Comments" on Compliance with Environmental and Industrial Safety Standards at the Kumtor Gold Mine, Final Report, 23 April 2012, which has also been web-posted on Kumtor's website.
[13] PCR at 201
[14] PCR at 201

"next few years"). The PCR also states that the repercussions of a GLOF to the TMF. The PCR includes the following conclusion and recommendations:

> "According to conclusion of specialists of the Kyrgyz Complex Hydrogeological Expedition of the State Agency for Geology and Mineral Resources under KR Government, the Petrov Lake moraine dam is losing its stability and will probably outbreak in the next few years. Outbreak flood will pass through the tailings facility and destroy it"[15] and notes elsewhere
>
> "Recommendations on elimination of catastrophic outburst hazard of the Lake Petrov:
>
> 1. Conduct in July-August, 2012, the repeated detailed study of the Lake dam and basin to get the data on risk assessment of current situation.
>
> 2. On the basis of this new information conduct a broaden council with regard to the Lake Petrov problem with participation of independent specialists from the other countries. According to the results of this council work make a conclusion on risk assessment on outburst hazard of the Petrov Lake and the concrete recommendations on elimination of this hazard.
>
> 3. It is required to decrease the lake water level by artificial discharge of some water and reduce the lake volume up to the safe level for elimination of the risks related with the Petrov Lake outburst."[16]

2.3 Movement of the TMF Dam

Since becoming aware of potential movement of the tailings dam in 1999, and subsequently documenting that the dam was indeed moving, Kumtor has consulted with numerous, reputable local and international engineering firms (including BGC, Golder Associates, Senes, Strathcona and others) and local regulators. As correctly noted also in the Parliamentary Commission Report, BGC was also directly involved designing the corrective actions which have now been implemented. Much of the work over the last seven years is a result of an independent Audit performed in 2005 by BGC. The following discussion tracks developments in the TMF dam safety issue since that audit, including implementation of major recommendations. This includes construction of a shear key and confining toe berm (buttress) concept depicted in Figure 3.

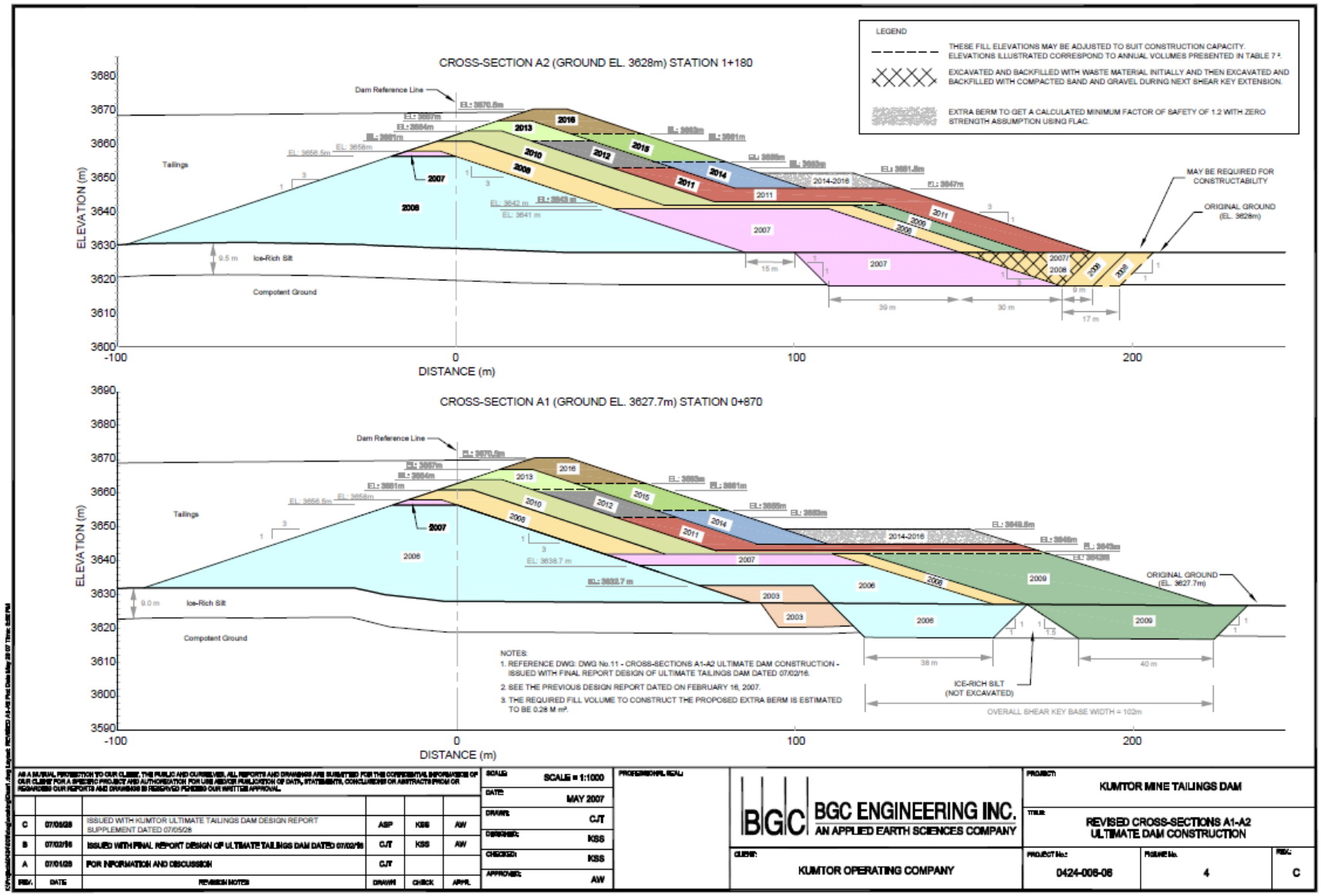
[15] PCR at 215
[16] PCR at 168

Table 1: Design, external review & approvals of key TMF dam developments since BGC's 2005 Review

Designer/Activity	"*Expertisa*" and Approval/Permit[17]
SPF "Eco-Service", Reconstruction design of the Kumtor Tailings Dam area. Stage 1.	Expert conclusion from Kyrgyzpromexpert of June 1, 2006 Conclusion from Kyrgyzstroyexpertise of 26.05.2006 Expert conclusion from State Agency on Environment and Forestry under the Government of the KR of 02.06.2006 #01-6/1092 Permit by the State Architecture and Construction Agency of the Issyk-Kul Region of the KR on construction performance, #24-КК
SPF "Eco-Service", The Kumtor Mill Tailings Dam Reinforcement Design, 2007-2008	Expert opinion by "KyrgyzPromExpert" Ltd, dated April 13, 2007, # КПЭ/2007 Expert opinion by KyrgyzGosStroyEzpertise, dated May 28, 2007, #ГЭ – РК - 226 Expert opinion by State Agency on Environment and Forestry under the Government of the KR, dated April 20, 2007 #01-21/843 Permit by the State Architecture and Construction Agency of the Issyk-Kul Region of the KR on construction performance, #21-КК
Geoservice, SDC under the Institute of Geomechanics and Subsoil's Development of the KR NAS's, The Kumtor Mill Tailings Dam Reinforcement Design, 2009-2010.	Experts' opinion from the State Architecture and Construction Agency under the KR # ГЭ – АУ – 548 dated of January 14, 2009 Decision of approval with regard to experts' opinion on industrial safety of the Northern Regional Department of Gosgortechnadzor. Positive experts' opinion on industrial expertise, Legim Ex, Ltd., #04-ПД-0040-2009 Experts' opinion of the State Agency of Environmental Protection and Forestry under the Government of the KR dated of March 19, 2009 # 01-21/580 Minute #1, Academic Council Meeting of Institute of Geomechanics and Subsoil's Development of the KR NAS's, February 13, 2009
Geoservice, SDC under the Institute of Geomechanics and Subsoil's Development of the KR NAS's, The Kumtor Mill Tailings Dam Reinforcement Design, 2011-2012.	Experts' opinion from the State Architecture and Construction Agency under the KR # ГЭ – АУ – 96/2011 dated of April 12, 2011 Experts' opinion on industrial safety from the GGTN under the Ministry of Natural Resources of the KR #01-ПД-0077-2011 dated of March 25, 2011 Experts' opinion of the State Ecological Agency of the Ministry of Natural Resources of the KR #06/99 dated of May 24, 2011

[17] Kumtor (2012) Passport of Tailings Management Facilities of Kumtor Mine

Figure 3: Cross section of ultimate dam construction (source Kumtor 2011 AER/BGC)



Since the adoption and implementation of the new designs, Kumtor benefited also from a series of independent audits and assessments focused on the TMF by competent engineering consultancies. These include a more recent audit conducted by SENES Consultants Limited in 2009 and Golder Associates' annual TMF inspection report (latest inspection completed in October 2011)[18]. The status of the TMF was also disclosed in a detailed technical report by Strathcona Mineral Services in 2011, completed pursuant to Canadian National Instrument 43-101. Kumtor also generates internal quarterly reports that facilitate management's review of a variety of TMF-related aspects. The latest such report[19] reviewed by Prizma includes: status of constructions (raises), monitoring data about movement, water balance and treated discharges, status of diversion ditches, and TMF capacity considerations and planning/approval needs relating to LOM.

As detailed further below, the audits and other studies confirm that Kumtor has followed up on key issues identified in BGC's dated 2005 report, that the dam is performing as expected, and that it remains fit for purpose. More specifically, the 2009 Senes Report about the TMF System Audit notes:

> **"**Kumtor tailings system is well designed and operated, with frequent inspections by multiple departments (mine, site services, security, environment) and subject to routine and regular pipeline maintenance. With its twin tailings lines, the facility has tailings line redundancy that enhances reliability and maintenance. The system is also designed with substantial secondary and tertiary containment capacity".[20]

In 2007 and 2010, BGC was commissioned to use the extensive monitoring data and develop numerical models to predict dam performance and provide further guidance. As noted by BGC, a shear key buttress system acts much like a spring. This means that it must undergo a certain amount of deformation before it can carry the load and arrest deformation. In other words, expert engineers would not expect the remedial system applied to the TMF to result in an 'instant' standstill and lack of 'instant standstill' is not indicative of a major concern. BGC's latest (2010) numerical model, calibrated using previous monitoring results, also confirmed that the proposed shear key and buttress would effectively slow down deformations[21].

BGC was also the responsible author for geotechnical aspects of the tailings facility in the latest (March 2011) Technical Report[22] about the Kumtor project. BGC concluded the following:

> "The responsible author is of the opinion that the shear key and buttress are performing as designed and that the tailings dam is under no threat of failing."[23]

[18] Golder Associates, 2012. Report on October 2011 Inspection of Dams and Appurtenances
[19] K. Abdygaziev and S. Duishembiev, 2012. Q2 2012 TMF Status Review, Memorandum to J. Baker, June 5, 2012
[20] See Senes (2009), Tailings Management System Audit, 27 September- 3 October, 2009, at 4
[21] BGC Engineering Inc, 2010. Kumtor Ultimate Tailings Dam Creep Deformation Analysis Update, Dec 22, 2010
[22] The report was prepared pursing the standards of the Canadian Institute of Mining, Metallurgy and Petroleum and National Instrument 43-101 – Standards of Disclosure for Mineral Projects
[23] See Strathcona Mineral Services Limited (2011) at 123

Annual inspections of all key TMF facilities (including diversion ditches) continue to be carried out by Golder Associates. The most recent such inspection was conducted in October 2011. In its report, Golder concludes the following:

> "KOC has been proactive in providing leading edge technology and experience in the design, inspection/surveillance, monitoring and operation of the tailings facility in order to provide a safe and reliable tailings containment system" and noted further that, "in general, the visual inspections of the dams and appurtenances at the Kumtor site indicated that the structures were in good condition and were functioning as required at the time of our site visit", and that "Kumtor is currently doing an effective job of carrying out routine inspections, preparing monitoring records, reading instrumentation and implementing the necessary procedures or changes to operate the facility in a safe manner"[24].

Kumtor's TMF monitoring data is also provided to the Geoservice Scientific and Designing Center of the Kyrgyz Republic Institute of Rock Mechanics (KRIM) on a monthly basis. KRIM analysis of the data is summarized in quarterly reports. The latest available such report (translated into English) covers the Q1/2012 period and is dated April 20, 2012. It concludes the following:

> "[t]he inclinometers have indicated smooth reduction of displacement rates" and that the "[o]verall tailings dam condition is assessed as suitable for operation"[25].

In summary, Kumtor developed and applied externally vetted and Government approved remedial actions to arrest the TMF dam movement. This is being achieved with a 'door stop' concept comprising a shear key and buttress anchored to a depth of 10-12 m below surface and into competent permafrost/ground. The dam movement is expected to continue to decline, remains carefully monitored and inspected, and is performing as expected by competent engineers.

2.4 Petrov Lake natural moraine dam: Glacial Lake Outburst Flood (GLOF)

Concerns raised by the Parliamentary Commission are similar in content and nature to those discussed in the Interagency Commission's report[26] , but the Parliamentary Commission Report more accurately describes the presence of two natural barriers and the natural floodplain that separates and armor the TMF from a GLOF:

> "The huge water mass seems hanging over the tailings but it is separated by two barriers (pic. 2). The each barrier is a final-moraine bank. The first of them is lakeside bank which was formed for the last thousand years, at late Holocene age. The second lower bank is more ancient. It was formed 15-20 thousand years ago, in upper Pleistocene age. The banks are breached by the Kumtor River, its riverhead divides the upper bank near the right valley side, and the lower bank - at its left bank (pic. 2). However, the lakeside bank is holding 45 M m³ of the Lake Petrov water

[24] Ref: Report on October 2011 Inspection of Dams and Appurtenances, Golder Associates 2012, page 6
[25] See Kumtor Tailings Dam Monitoring Report For the period of January 1 to March 31, 2012, Based on monitoring data analysis, by the Geoservice Scientific and Design Center, April 20, 2012, page 61
[26] Interagency Commission, 2011. Evaluation of Compliance with Environmental and Industrial Safety Standards at Kumtor Gold Mine, a Report, December 28, 2011

from discharge down the valley. It is also supposed that the lower bank would hold the outburst flow in case of the Petrov Lake outburst and would diverse the water mass of the breached lake from the tailings facilities currently containing 100 M m³ of wastes with cyanide"[27] and continues that if "the outburst flow is significant (**up to several thousands of m³/sec**), its power will be enough for washing out of the second barrier and destruction of tailings dump"[28] (emphasize added).

In addition to routine monitoring, Kumtor commissioned a variety of studies to characterize the Petrov Lake and its moraine dam. Some included international collaborations and results have been published as conference posters or lecture notes.[29] The most recent reporting of an engineering review is BGC's 2012 study.[30] The goal of this study was to evaluate if an outbreak flood could be a potential risk to mine operations or after closure and help identify appropriate mitigation measures.

BGC developed and modeled failure modes (basal sliding, overtopping, piping), likely flood scenarios (ranging from 3,000 to 20,000 m^3/s peak water outflows[31]) and modeled their potential flows and impacts on the TMF structure (see Figure 5). We note that the range modeled by BGC covers "up to several thousands of m³/sec" mentioned in PCR, as shown above.

BGC concluded that the moraine dam at the present time can be classified as relatively stable. However, global warming is expected to destabilize the moraine dam over time. BGC also noted that all risks presently considered to be high, should such a flood event occur, can be reduced to moderate or lower levels through a combination of monitoring and construction efforts.

Based on BGC's study, Kumtor is currently planning to install a warning system for workers in the immediate vicinity below Petrov Lake and protecting the shear key of the TMF to reduce the vulnerability of the tailings dam to flood waters that are modeled to pond and flow at the dam base in the event of a GLOF. In addition, interviews with Kumtor's management confirmed that a Russian Design Institute has been approached to develop a plan to lower the water levels in the Petrov Lake in order to reduce risks and further increase the level of safety.

[27] PCR at 169
[28] PCR at 170
[29] See also Cerny *et. al.,* 2009 and Duishonakunov, 2010
[30] BGC Engineering, 2012. Geohazard Risk Assessment for the Potential Morain Dam Outbreak Flood at Petrov Lake, Kyrgyztsan. Final Report, dated 23 March 2012.
[31] For comparison: the recorded peak flow of the Kumtor River in 2011 was 24.02 m^3/s

Figure 4: Location of Petrov Lake's natural moraine dam and Kumtor's Tailings Management Facility (masl = meters above sea level, source: modified from BGC, 2012)

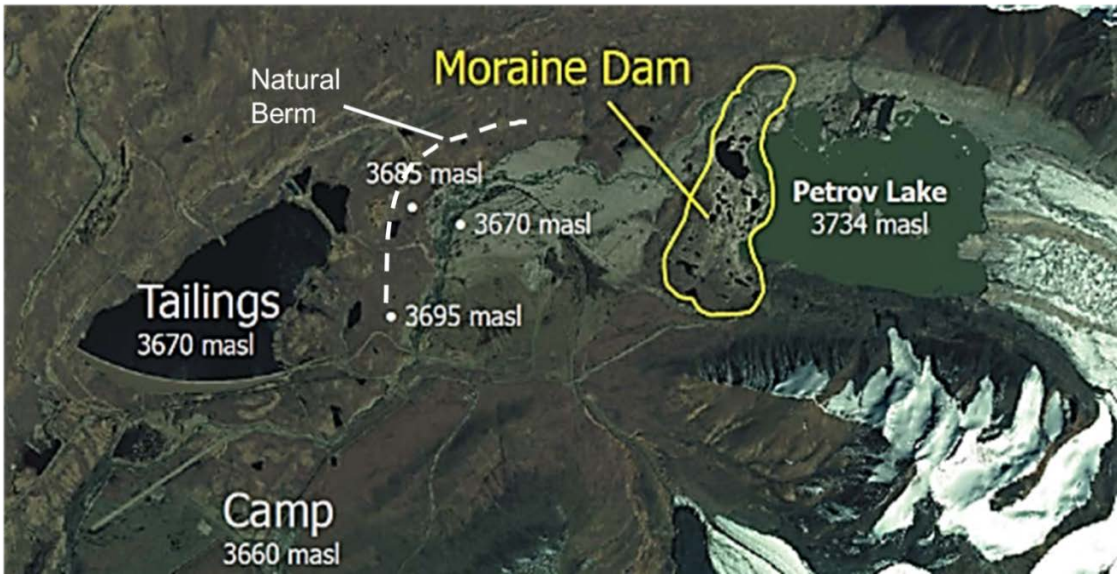
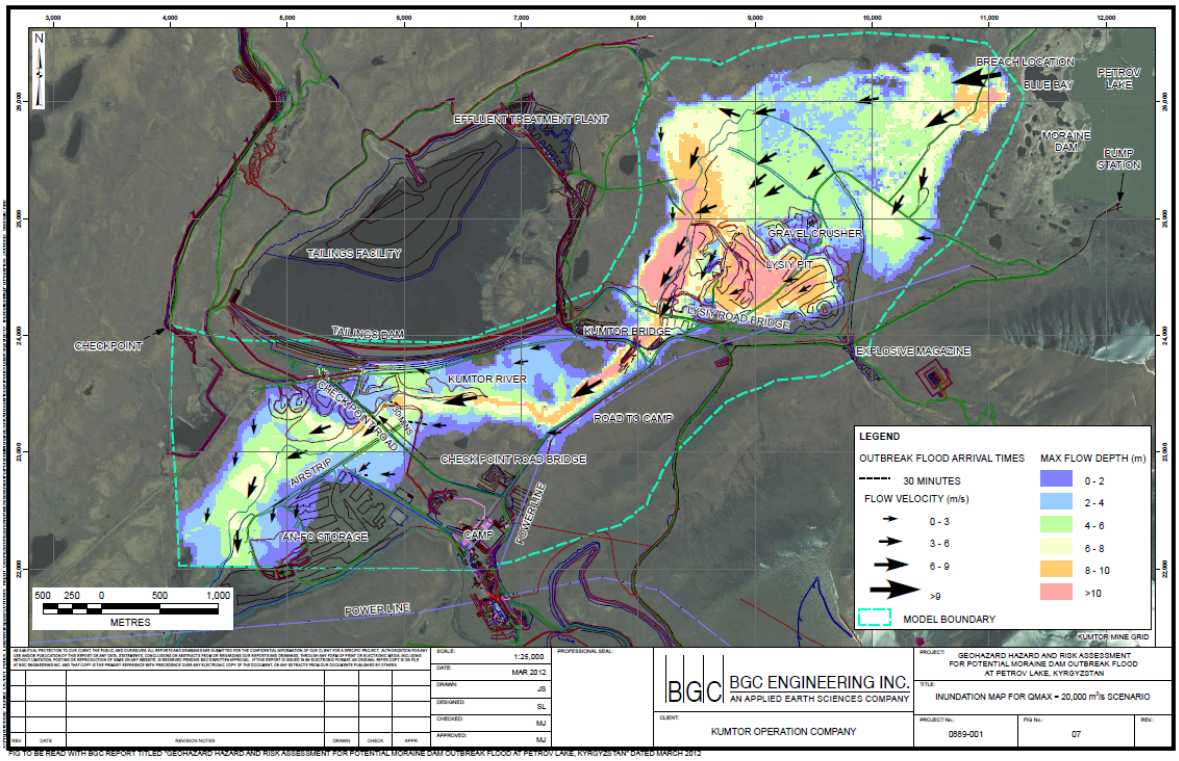


Figure 5: Modeled outcome of glacial lake outburst flood at Petrov Lake showing flood being channeled through the Kumtor River floodplain. Peak flow modeled was 20,000 m^3/s (source BGC, 2012).



2.5 Conclusions and recommendations

Based on Prizma's review of studies, audits and reports since 2005 (which are also available to the Government and its Commissions), interviews with and documents provided by Kumtor's staff and management, it is evident that Kumtor has taken concern raised about its TMF seriously. Documents reviewed by Prizma show that Kumtor has improved its documentation and data management, has benefitted from third-party geotechnical risk assessments of the TMF, has considered water handling for mine closure, further formalized risk management (including by routine use of local and international third-party experts), implemented corrective action plans to address TMF dam movement (including approved construction of a sheer key and toe berm), updated the Emergency Response Plan, and continues to conduct third-party reviews of the TMF. These have confirmed that the TMF is fit for purpose and is performing in line with experts' expectations.

In terms of TMF seepage contamination and concerns about impacts in Naryn (some 200 km downsteam of Kumtor), the Parliamentary Commission Report characterizes the shallow depths of the "active zone" (seasonally thawing zone below ground surface) and highlights the impermeable nature of permafrost and its extension to a depth of up to 250 m below ground surface. Any TMF seepage, even if present, would not be expected to play an appreciable role, if any, in determining the water quality at Kumtor's compliance point W.1.5.1 or the water quality of the residential users in Naryn, some 200 km further downstream (see also Section 5.3 for further discussion of water quality at Naryn).

Our review and BGC's assessment and modeling do not support the imminent catastrophic scenario and associated outcomes contained in the PCR relating to a potential GLOF from Petrov Lake. With regard to the TMF and related issues, Prizma recommends the following:

a) Kumtor should re-evaluate its communication strategy related to the TMF and risk communication more generally. This could be further enhanced through community-supported monitoring. The current approach[32] does not appear to be effective in communicating the actual status of technical performance of the TMF and/or allows for inaccurate hear-say public perception and media content.

b) A ledger-type documentation system is in place to record observations/inspections, actions, responsibilities, schedule/deadlines, and close out. Kumtor should consider the adoption of a more digitally oriented process to further improve documentation, tracking and management of the system and outcomes.

c) Kumtor should encourage its Kyrgyz TMF engineers to participate in relevant professional associations and (international) conferences. This would further enable continued learning and

[32] No discussion about TMF/dam was found in the Q1/2012 or the 2011 Annual Results sections posted on Kumtor's website. No dedicated press releases or other forms of communication about quarterly and annual external inspections confirming 'fit for purpose' status were seen in 2011/12 period on Kumtor's website. Kumtor's Annual Environmental Reports contains valuable disclosure relating to the TMF. However, this communication approach does not seem to be fully accessible or effective.

awareness of good international practice.

d) Kumtor should consider expanding the TOR of Golder Associates and KRIM and require them to highlight relevant changes to local and international requirements related to Kumtor's TMF. These should be maintained in a register by KOC.

e) Kumtor should consider co-sponsoring and participating in national and regional conferences and support further disclosure and discussion of tailings management practices in the Kyrgyz Republic and the region. Examples might include those focused on Soviet-era uranium tailings legacies and related donor-funded activities.

f) Kumtor should consider planning a mock ERP drill relating to TMF dam breach once the on-going Government Commissions and other audits have been completed. Kumtor may also wish to consider a follow-up review of Kumtor's TMF facilities against the (updated) Guidelines for Managing Tailings prepared by the Mining Association of Canada.

g) In terms of GLOF issues, Kumtor should consider directing future studies and actions towards designing and implementing solutions. These range from further armoring the shear key structure (from erosive forces associated with a GLOF) to reducing the water level in the Petrov Lake, as already being contemplated by Kumtor. These activities are expected to further increase the safety factors and serve also mine closure planning needs.

3 Flora, Fauna and Biodiversity

3.1 Background

The Kumtor Mine has been operational for approximately 15 years. It is currently expected to continue operations until 2021. The Kumtor Mine is located in a remote, high altitude (about 4,000 m elevation) and partially glaciated Tien Shan region. This region contains rare and endangered species, such as snow leopards, and relatively high amounts of endemism and unique species of flora, including onions and tulips.

The mining operation is supplied via the Balykshy Marshalling Yard (BMY), based in the city of Balykshy. Trucks deliver their goods via paved roads along the southern shores of Lake Issyk-Kul, where, near the village of Barskoon (also commonly spelled Barskaun), trucks exit the paved road and move along a technical (gravel) road through the Barskaun valley and pass to reach the mountain valley plateau leading further up to the mine site. The mine site is partly adjacent to the Sarychat Ertash Nature Reserve (SCER), established in parallel with the approval and financing of the Kumtor mine in 1995 and support from FFI, IFC and others. The SCER also serves as 'core' for the United Nations Educational, Scientific and Cultural Organization (UNESCO) Issyk-Kul Biosphere Reserve. The region is also recognized by Conservation International as a Biodiversity Hotspot[33], and garners attention from IUCN, WWF, ISNL, Birdlife International and several other leading international NGOs.

Although commonly and mistakenly assumed to be the case, the watershed in which the Kumtor Mine is located is not linked to the Issyk-Kul Lake. Instead, Kumtor's watershed drains through the Kumtor River, which originates at the glacial Petrov Lake (upstream and near the Kumtor Mine), into the Targai River and then into the Naryn River (which also drains many other tributaries).

3.2 Introduction

In evaluation of the Parliamentary Commission Report (PCR), our review of available information and important current and historical facts relating to KOC, impart that, overall, the company has been diligent in both monitoring and mitigating its impacts on flora and fauna. As detailed further below, it is evident that biodiversity conservation has been, and remains, a high priority for Kumtor. In addition, the facts and information contained in the PCR demonstrate that the most significant and real impacts to regional biodiversity are poaching and overhunting, affects from grazing of livestock, overharvesting (of both animals and plant species) and limited KR government support of biodiversity related programs. In other words, there is no material evidence that demonstrates significant adverse impacts from Kumtor's mining activities. Instead, a the information reviewed by Prizma underlines Kumtor's positive contributions to biodiversity conservation.

The information and conclusions related to flora, fauna and biodiversity presented in the PCR are are disbursed in various sections and, at times, are duplicated throughout the PCR. In addition, the PCR contains letters of support from international NGOs for the SCER which, in general, encourage the

[33] http://www.conservation.org/where/priority_areas/hotspots/europe_central_asia/Mountains-of-Central-Asia/Pages/default.aspx

Government to support and expand the SCER. We have summarized the key information, concerns and recommendations below. These are structured under three major headings, namely (a) baseline and monitoring issues, (b) issues related to the SCER, (c) and concerns about flora in the Arabal River Valley and the Barskaun Gorge. Prizma's analysis, conclusions and recommendations follow the same structure.

3.3 Key issues in PCR

The concerns contained in the Parliamentary Commission Report pertaining to flora, fauna and biodiversity can be segmented into these three major elements:

a) Baseline or monitoring issues: including lack of or insufficient baseline data during the preparation of Kumtor's Environmental Impact Assessment (approximately 20 years ago), some alleged mistakes in reporting and the need for additional data such as migration corridors of mammals and additional baseline data on regional vegetation;
b) Sarychat Ertash Reserve (SCER) related issues and Kumtor's exploration in the so-called SCER Buffer Zone;
c) Specific impacts to vegetation in the Arabal River Valley and traffic related dust impacts on (KR) Red Book-listed "Tulipe quadrifoliate"[34] and other vegetation in Barskoon Gorge

Alleged impacts on fish in Naryn are discussed at page 53ff which addresses water quality concerns. An overview and summary of KOC performance and impacts on regional biodiversity in relation to the PCR, response to specific concerns, in addition to perspective on important anthropogenic impacts to biodiversity, is presented below.

3.4 Baseline Data and Monitoring

The PCR alleges a number of inaccuracies in Kumtor's baseline data, contained in the 1993 Kilborn EIA[35]. The PCR alludes to inaccuracies in baseline information including: (a) overrating number of bird species, (b) no herbarium collected and made, (c) insufficient analysis from Kumtor and Targai rivers[36].

We note the approval and financing of the Kumtor project by the Kyrgyz Government and multilateral financial institutions and Export Credit Agencies in the mid-1990s are already clear indications that the baseline and other elements of the EIA (part of the Feasibility Study and other project documents) were contemporaneously considered 'fit-for-purpose'. This means that the information presented for the Kumtor Project, including in the EIA, to the Government, the *Experisa* (expert review) processes, and project lenders was considered adequate at that time to approve, permit, and finance the Project.

[34] Our research indicated that the correct scientific name for this species of tulip, discussed by A. Usupbaeve, Candidate Biological Sciences, KR Biological institute, reported in the PCR (page 178, is actually *Tulipe tetraphylla,* and listed as vulnerable, not Rare as stated in the PCR. The primary causes for decline of this species are identified as pasturing and over-grazing during the flowering period and collection of flowers and bulbs by local resident populations.
[35] Kilborn Western Inc., November 1993. Kumtor Feasibility Study and Environmental Impact Assessment. Volumes 1 through 6.
[36] PCR at 129

In terms of lack or insufficient data collection, we are unclear about the basis of comments in the PCR which, for example, states: "herbarium was not collected and made"[37]. Our review of the EIA points out that 159 species of vascular plants, belonging to 22 families were collected in the EIA study area, of which 8 were noted to be endemic to the Tien Shan Mountains.[38] In addition, a biophysical map was generated identifying 13 distinct habitat types and both terrestrial vegetation and wildlife components were assessed for the environmental baseline including the upper Targai River and the Kumtor River Valley. These baseline studies also included the access roads and utility corridors.

Our review also finds that the comments in the PCR such as "the number of bird species was significantly overrated (194 species), it is unreal for alpine area"[39] is both inaccurate and misrepresents the EIA. In fact, the EIA takes a conservative approach and identifies the total *potential* species abundance and states:

> "One hundred and ninety four species of birds **may breed** in the study area. Of these, 26 were confirmed for the study area. Five of the 194 species are considered to be rare." [40] [emphasis added].

We note that additional bird studies have also been conducted since the EIA and are a component of KOC's on-going monitoring plan. Kumtor's AER 2011, for example, notes that 54 kinds of birds live in the area of the Kumtor deposit and surrounding territories. This report also contains the results of data obtained from collection of birds to identify anthropogenic impacts and abnormalities. The results of the analysis did not contain any observations of abnormalities.

Further, our review of the EIA notes that sampling of water quality, fish species and other aquatic data (benthic macroinvertebrates, aquatic macrophytes, habitat, plankton, sediments, etc.) from the Kumtor River and Tagai River are indeed included.[41]

Portions of the PCR do infer the need for additional baseline and monitoring data specifically regarding migration routes of important species and broader impacts of the Kumtor Mine on the SCER ecosystem. However, the same sections also refer to positive biodiversity impacts from KOC's management strategies. Examples of statements made by A.P. Vereshagin, Scientific Director of the SCER, in PCR are recited below:

> "Except the route research of argali, the Kumtor impact on the Reserve reported additional studied in AERs ecosystem has not been studied. We may note between the Reserve animals relatively calm behavior of foxes and marmots. The argali, which formed the local grouping, does not leave the Kumtor area, they well adapted to the anthropogenic conditions of life: noise

[37] PCR at 128
[38] Kilborn Western Inc, Kumtor Mine Feasibility Study, 1993. Section 3, pages 3-8 to 3.9
[39] PCR at 128
[40] Kilborn Western Inc, Kumtor Mine Feasibility Study, 1993. Section 3, at 3-12
[41] Kilborn Western Inc, Kumtor Mine Feasibility Study, 1993. Section 3, at 3-4 to 3-7

and movement of transport, light at night time, explosions and constant contact with people. The presence of armed people and hunting are prohibited at the mine area."[42]

This and other information presented in the PCR means that, not only are species of animals important to conservation in Kyrgyzstan and the SCER currently abundant in the Project Area (see also below), but that they are also *not* negatively impacted by the normal mining activities such as lights, noise, presence of people associated with the Kumtor Mine.

Our review also notes that KOC has indeed conducted additional studies of the fauna of the Kumtor Mine site and adjacent areas and has also documented an increase in numbers of both argali and other species in the Project area[43]. This information is also confirmed and supported from data presented in the PCR:

> "In recent years (since 1999), the Sarychat-Ertash State Nature Reserve has achieved success not only in conservation of animal numbers, but has also restored (snow leopard and bear) and increased their numbers: Argali: before 1,100-1,250 head, now 2,600 head; Snow leopard: before 0, now 18 species (individuals); Bear: before 0, now 6-7 species (individuals); Capricorn: before 600, now 850-900 head."[44]

This data is significant in that it documents restoration of important rare and endangered species adjacent to and within the broader Kumtor Mine area that has occurred since the beginning of mining activities. This is at least, partially, a direct result of management strategies adopted by KOC in response to mitigation recommendations, such as those provided by the ISLT described below in Section 3.5.1.

In summary, KOC biodiversity baseline data was, contemporaneously with permitting and financing, deemed to be 'fit for purpose'. Kumtor has also directly supported third party surveys of snow leopard, Argali (Marco Polo sheep), and ibex populations to gain insight into population dynamics, predator-prey relationships, and stability of these and other species in the SCER. Recent surveys of the project area and surrounding areas described in Kumtor's 2010 AER have concluded that populations of argali, marmot, fox and birds have indeed increased over time, as confirmed by the data and opinions contained in the PCR. Interviews with Kumtor staff indicated that Marco Polo sheep, ibex, martin, marmots, wolves, foxes and large raptors, such as Golden Eagle, vultures and falcons, are regularly observed within the Kumtor area, which is essentially a biodiversity refuge due to no hunting and no firearms policies of Kumtor. More recent biodiversity studies have expanded to include important flora components, in addition to hydrobiological components of water bodies in and around the Kumtor Mine Area.[45]

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[42] PCR at 161

[43] KOC AER 2010 pages 7-20- 7-27

[44] JCER page 140

[45] KOC AER 2011, Section 7.1

3.5 Kumtor's exploration in "Buffer Zone" of the Reserve

The PCR sections that pertain to biodiversity raise issues and concerns in several different places and enclosed documents. These can be divided into the following main topics: a) concerns over accurate boundary delineations of the SCER where it borders the Kumtor Concession, and recent adjustment by the Kyrgyz Government relating to this boundary; b) issues pertaining to the so-called SCER 'Buffer Zones' and the legitimacy of related exploration licenses and activities in these areas; and c) issues pertaining to real sources of regional impacts to biodiversity and operational constraints for the SCER. A brief background of the SCER and our review of these are presented below:

3.5.1 Background of SCER with respect to KOC

As noted in the PCR, prior to the onset of the Kumtor mining project there was no formally protected area now known as the SCER. There was only a study area to justify establishment of a mountain nature reserve at the junction of the Central and Inner Tien Shan Mountains, when Kyrgyzstan was still a republic of the USSR.[46] A review of Kumtor's EIAs by the International Snow Leopard Trust (ISLT) on behalf of multilateral lenders had confirmed that mining activities *per se*, if combined with responsible mining practices, were not posing a material risk to the regional biodiversity. Instead, the NGO review identified, *inter alia*, overgrazing in the high altitude meadows, related and unrelated poaching (high-value species for trophy hunting, traditional medicinal markets, retaliation killing), and lack of sufficient resources to support conservation efforts as the main biodiversity risks in the region.

Although occasionally mentioning mining exploration as current and future threat, without providing any evidence to support this assertion, the PCR confirms that the risks identified by the ISLT review in the mid-1990s have manifested as the primary impacts to regional biodiversity today. For example, the PCR notes that

> "as the reserve was established in 1995, and also regrettable; within the initial period, until 1999, almost all population of snow leopard was exterminated by staff of the security department [allocated by the government to the SCER]… (p)oaching is very widespread and thriving across the whole territory of the Republic."[47]

Thus, it is evident that that documented and very significant impacts to regional biodiversity, discussed in greater detail below, are completely unrelated to the Kumtor Project or mining more generally.

3.5.2 SCER boundary delineation and area issues

In several places the PCR raises concerns about the correction of apparently overlapping boundaries of the Kumtor Concession with the SCER[48] and clarifies that the amount of area transferred to KOC from the actual SCER is 240 ha:

> "As a result, after conclusion of New Terms Agreement, in a hurry, one day before signing of other follow-up agreements under the Kumtor Project, i.e. on June 5, 2009, for the benefit of

[46] JPR page 150
[47] PCR page 151
[48] PCR page 147,

> Kumtor Project, **the area of Sarychat-Ertash state reserve was changed and totally only 4,380 ha was alienated,** including 240 ha of lands from category of specially protected lands [underlining added] as a part of Concession area of Kumtor deposit. At present the total area makes up **129,760 ha."**[49]

We note, however, that the PCR contradicts itself in several instances concerning the amount of area in question, as it also states:

> "4,380 hectares were taken from the Reserve's core zone and granted to Kumtor in 2009."[50]

Thus, it is understandable that confusion remains, apparently both among government officials and other stakeholders regarding this issue. Our review of materials described in the PCR and provided by Kumtor[51] shows that the KR Government Decree #76 of March 10, 1995 formally established the SCER with an area of 72,080 ha. Unlike the Kumtor Concession, whose coordinates are precisely defined (in degrees, minutes and seconds), the demarcation of the SCER relies on maps generated without use of modern technologies and software, and an imprecise and descriptive process, for boundaries and demarcation, such as: "in Northwest direction of watersheds of rivers Sarychat and Arabel…"[52]

To exacerbate this confusion, many of the maps about the SCER in circulation and use appear to show variances in size of the SCER which deviate from the Government Decree that established the Reserve. In the example shown in Figure 6, the size of the SCER is stated as 74,976 ha, while at one point the size mentioned in the PCR is 134,410 hectares[53] (inclusive of "Buffer Zone"). In contrast, the Government decreed size of the SCER is 72,080 ha. We note also that the exact coordinates of Kumtor's Concession are detailed in the New Terms Agreement which was approved by the Government and ratified by the Parliament in 2009.

Our interpretation of the facts is that the KR Government corrections in 2009 of the area of SCER which was overlapping with the Kumtor concession resulted in a virtual (apparent) loss of 260 ha (or 0.36%) of the SCER's area. In reference to this correction, the PCR notes:

> "Actually this area will be as specially protected because at the glacier area (we mean Petrov Glacier) not any surface exploration will be conducted".[54]

In our opinion, the correction of overlapping area described above, which appears fully in line with the original intent of establishing the SCER in the mid-1990s adjacent to but not overlapping with Kumtor, does not have a material adverse impact on the viability and value of the SCER and does not create any material adverse impact to local or regional biodiversity.

[49] PCR page 136-137
[50] PCR page 147
[51] Bashkirov, 2011
[52] See PCR page 136 -137 for detailed discussion of SCER boundaries
[53] PCR at 147
[54] PCR page 137

3.5.3 The SCER "Buffer Zone"

We noted confusion as to the size and legal standing of the SCER Buffer Zones and permitted activities in and around these areas. Based on our review, in 1999, the Resolution of Jety-Oguz District Administration (but not a central Government Decree) established a "Buffer Zone" for the SCER. This area is shown in an orange outline in Figure 6.

It also overlaps in part with areas covered by Kumtor's prospecting licenses (Karasay License with a size of 125 km^2 and Koendy License with a size of 134 km^2).[55] It is our understanding that these licenses have not been extended and/or were valid only through July 2012. It is also our understanding has Kumtor has suspended exploration in these areas. Also, we note other land use zones in close proximity and/or overlapping to the SCER and the buffer zones, such as hunting areas, outlined in purple, turquois and black outlines in Figure 6.

Although these and other maps are in circulation, it is our understanding that "Buffer Zones" for SCER have yet to be defined and approved through a Government decree, as required by KR Law 182 "On specially protected areas". In other words, a Resolution by Jety-Oguz District Administration is not sufficient to make changes to the SCER, including expanding the total size of the protected area and/or defining "Buffer Zones". This is also supported by statements contained in the PCR:

> "A Regulation on Sarychat-Ertash Nature Reserve borders, its buffer zone specifically, is not approved. A denial on approval was received from Z. K. Esenamanov, Minister of Natural Resources."[56]

[55] PCR pages 163-166
[56] PCR at 158

Figure 6: Location of Kumtor's concession and prospecting areas, the SCER, proposed buffer zones and other land use areas (blue arrow points to corrected area involving approximately 0.36% of the SCER's area. Source: Kumtor)

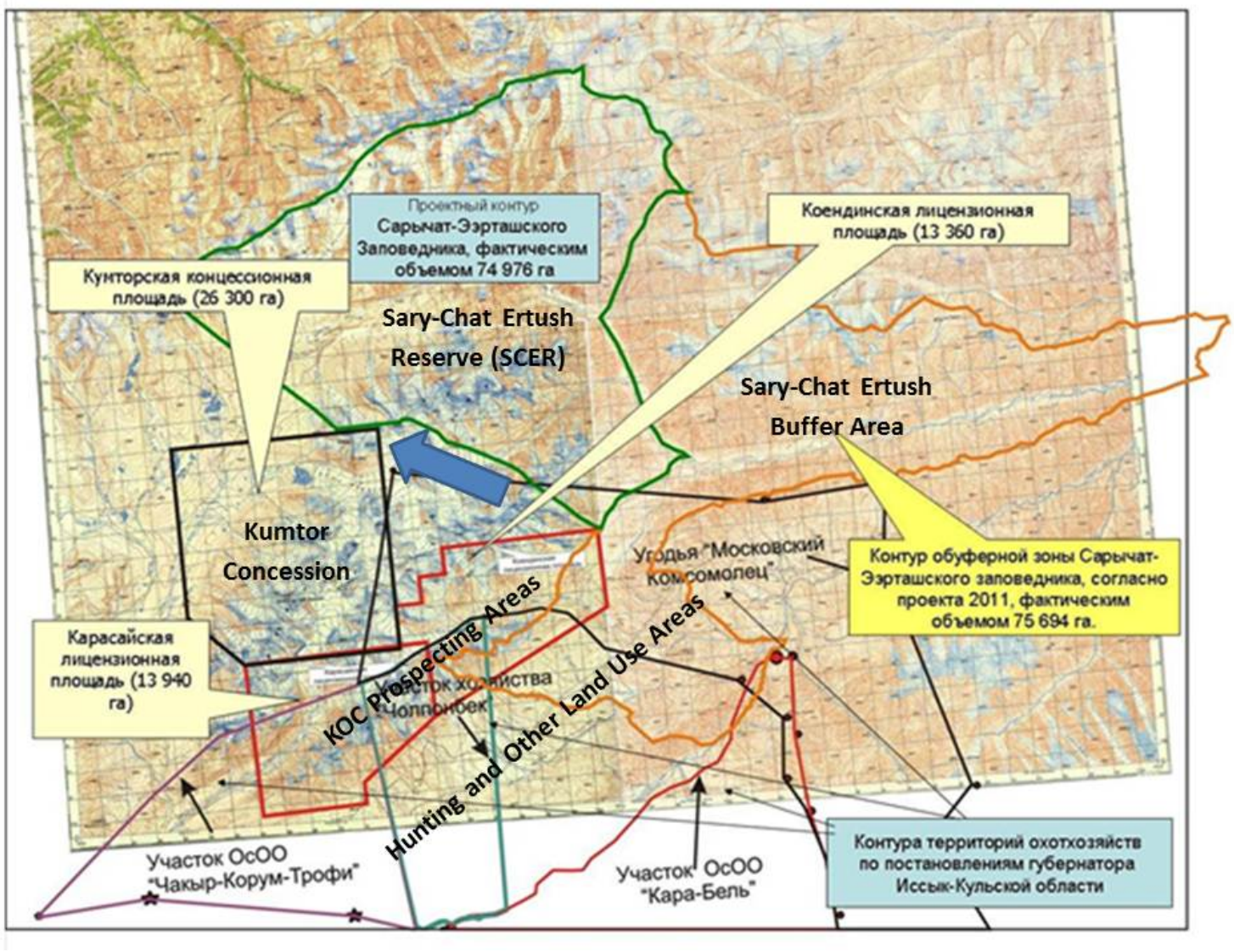
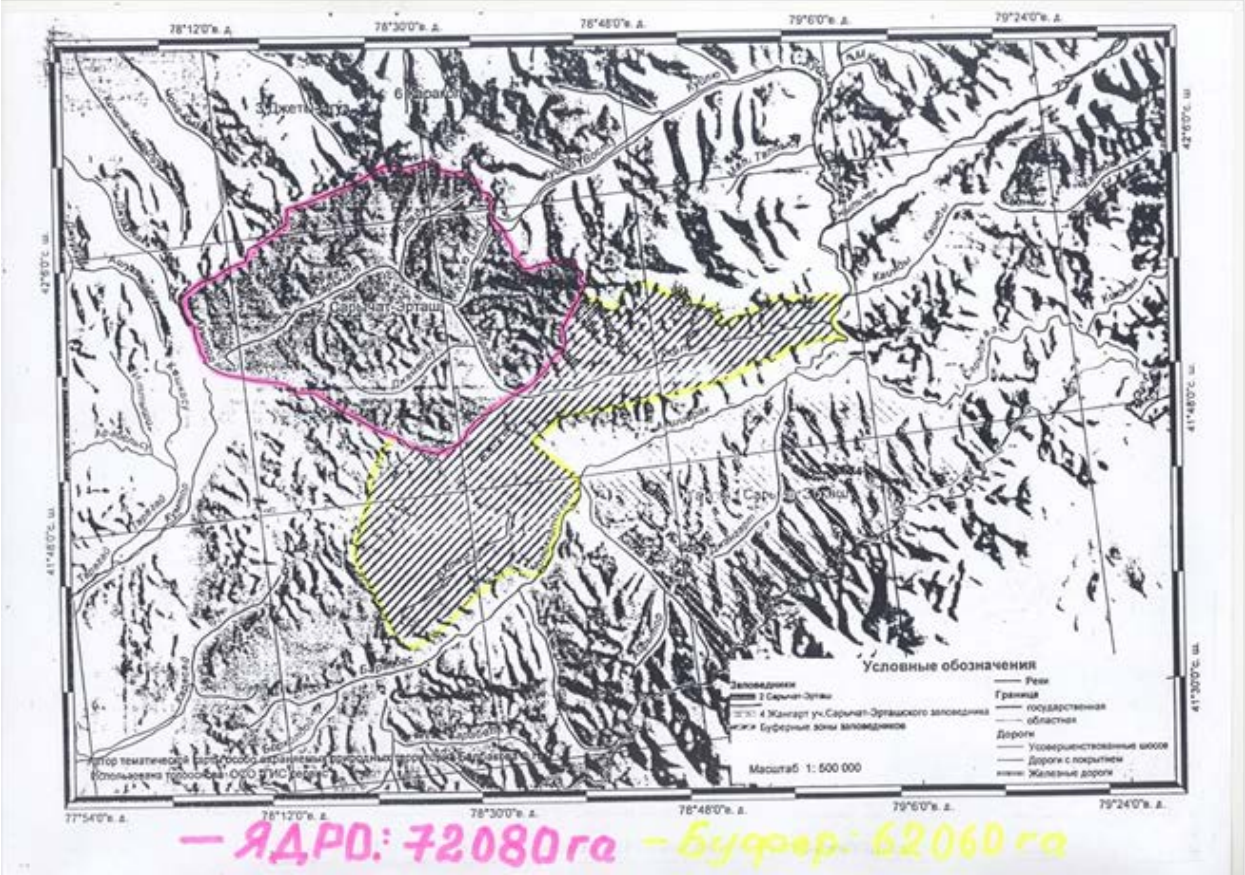


Figure 7: Map showing SCER and "Buffer Zone" based on Farida Balbakova (source Bashkirov, 2011)



In our opinion, the many different interpretations in the literature and available maps in circulation that show variable size, location and land use designations are inconsistent with KR Government Decrees and laws relating to the SCER.

3.5.4 KOC Exploration in "Buffer Zones"

In several sections,[57] the PCR discusses the issue of KOC exploration in the SCER buffer zone- or "Protected Areas", particularly with inference to negative impacts to biodiversity. Aside from the factual aspects associated with the SCER and its boundaries highlighted above, we have also considered perceived and real biodiversity impacts which may be associated with Kumtor's operations.

Our review of the facts and interviews with KOC officials also establish that exploration activities were licensed by KR, as detailed also in the PCR[58]. The exploration licenses, normally renewable, were dated from July 2010 to July 2012. It is our understanding that, currently, Kumtor is not conducting any intrusive exploration activities (typically comprising dozer roads, drilling and trenching to enable sampling) in the so called "Buffer Zone". Such exploration activities, which are localized and temporary

[57] PCR pages 147-155
[58] PCR pages 163-166

in nature, are typically not deemed to be sufficiently significant in scale to create material and lasting biodiversity impacts. Also, the PCR does not identify any substantiated material adverse impacts to biodiversity from Kumtor's actives.

3.5.5 Limited Government support for SCER and Biodiversity Conservation

The most significant and innovative elements of the SCER research has been carried with the support of international NGOs and academic research programs, some of which was also supported by Kumtor. In fact, according to the Scientific Director of the SCER, the KR government support of the SCER has been limited.

Specific concerns raised by the Management of the SCER in the PCR include failure on the part of the KR government authorities to adopt or respond to the Management Plan for the SCER, which was developed by the SCER staff with support by local and international conservation NGO input[59], and also the challenge of conducting any meaningful research without adequate financial support by the Government. The following statement from the Scientific Director of the SCER, contained in the PCR, highlights operational challenges, identifies pressing needs and lack of Government support:

> "Now, the Reserve does not have its own office and the current office has been rented since 1999.
>
> 1. Absence of a facility for the scientific department and absence of material and technical basis create certain difficulties for scientific researches, and, in many cases, makes it absolutely impossible to perform many researches in such areas as: climate, hydrology, glaciology, soil, botany, invertebrates, etc.
> 2. Field stations (houses, trailers) are in poor condition and require urgent repairs. There is no electrical lighting and no fuel for heating and cooking in field conditions, especially during winters.
> 3. The Reserve does not have its own library.
> 4. All major outfit and equipment is personal property of specialists participating in field work and office studies.
> 5. Management Plan for the Sarychat-Ertash Nature Reserve has not been approved, although, copies of the Plan were sent to KR State Agency for Environment Protection and Forestry (Biodiversity Department), KR Academy of Sciences, and General Directorate of the Issyk-Kul Biosphere Territory for familiarization and approval. However, we still did not receive their official response.
> 6. Another issue of the Reserve is condition of roads going from Ak-Shyirak to Issyk-Kul. The bridge over the Targai River has been ruined for 3 years and local residents have to travel additional 70 km through Kumtor. The roads are not cleared from snow in winter."[60]

[59] The Sarychat-Ertash State Reserve Management Plan 2007 – 2015 was compiled over a 20-month period by the staff of the Reserve with the help of Bashat's (CBF) staff [a Kyrgyz NGO]. Technical input was provided a number of national specialists, Fauna & Flora International and the International Snow Leopard Trust. The management planning process was facilitated by Fauna & Flora International.

[60] PCR at 153, 161

3.6 Impacts to vegetation in the Arabal Rriver Valley and Barskoon Gorge

While evaluating direct and indirect impacts to vegetation from the Kumtor Mine operations, including the road from Barskoon village to the mine site, the Parliamentary Commission appears to have largely ignored Kumtor's EIA and monitoring data and, instead, relied fully on one assessment conducted by a candidate of Biological Sciences from the KR National Academy of Sciences' Biological institute[61]. This graduate student appears to have conducted a brief study in May 2012, drew several conclusions regarding impacts from Kumtor operations and made seven specific recommendations. It is not clear if these recommendations were actually adopted by the Parliamentary Commission or are simply contained as supporting materials in the PCR. The key conclusions and recommendations from the "Assessment" contained in the PCR are presented below, followed by Prizma's evaluation.

The key conclusions of the assessment cited in the PCR are summarized – or directly quoted - as follows: a) impacts to vegetation in the Arabel valley from mining activities; b) impacts to vegetation along the road from Barskoon village to Barskoon pass due to dust contamination; c) the "rare, particular endemic, high decorative species recorded in the KR Red Book, *Tulipe quadrifoliate* is under anthropogenic impact in the Braskoon Gorge and may be totally destroyed" and d) "On May 13, 2012, we visited the Sarychat-Ertash State Nature Reserve. The soil and vegetation were impacted up to direct destruction at exploration area (it concerns the roads)…"[62] and recommends, *inter alia*, the need to "[p]rotect the vegetation from dust, especially the forest-meadow-shrubs belt. Thus, all roads in the limits or near the Kumtor mine must be obligatory laid with asphalt or concrete."[63]

Our review of the "Assessment of vegetation at Kumtor mine area" by A. Usupbaeve finds that while the work appears to provide a snap shot view of the state of vegetation, primarily along the Barskoon valley road, it is partially wrong, does not consider available data (for example Kumtor's dust monitoring and mitigation measures along Barskoon road), and does not provide sufficient data to fully justify all of its conclusions, nor warrant adoption of some of its recommendations. A. Usupbaeve fails to identify the effect of "anthropogenic impacts" along the Barskoon road from several sources, in addition to potential impacts from Kumtor activities, such as over-grazing and collection of flowers and bulbs by local inhabitants. There are also important facts that are misstated, as detailed below.

For example, the "Assessment" inaccurately describes a species of tulip (cited in the PCR to be a "rare, endemic KR species named *Tulipe quadrifoliate").* Based on our research, the plant cited in the PCR appears to be *Tulipa tetraphylla* (not *Tulipe quadrifoliate* as noted in the Parliamentary Report). It is listed as Vulnerable (which means not Rare) in the "Red Book" of the Kyrgyz Republic. The species is found from the Ferghana Valley to the Issyk-Kul Range and is therefore not endemic to Kyrgyzstan, as the species also grows elsewhere, including Kazakhstan and China. More importantly, similar to other tulips, the main conservation problem is ploughing-up, excessive pasturage and mass collection of flowers and bulbs by local residents (briefly alluded to – but not clearly explained - in the "Assessment").

[61] PCR page 177
[62] PCR at 176 to 181
[63] PCR at 181

In other words, potential impact from Kumtor's traffic dust, if any, is not the only, nor the most material impact to consider.

The final conclusion of the student's "Assessment" included in the PCR, which makes reference to impacts to soil and vegetation (from roads) in the SCER is also inaccurate and misleading. We assume this to be in reference to Kumtor's exploration activities in the so-called buffer zone (and not the SCER itself). We do concur, as stated in our conclusions and recommendations, that impacts from licensed exploration in the so-called "buffer zones" should be reclaimed by KGC once these activities have been completed.

Our review also notes that control and mitigation of dust on the Barskoon valley road has been an on-going part of KOC operations. This includes contracting a full time crew and a water truck charged with dust suppression. Also, Kumtor has installed dust monitoring equipment and reports dust levels along the Barskoon road which are generally well below MAE standards[64]. We note that dust control also occurs at the mine site and paving is generally not a practical or economically option typically employed at an entire mine site. Further, there is not enough data presented in the "Assessment" to justify this scale of a recommendation.

3.7 Conclusions and recommendations

Prizma's conclusions and recommendations relating to flora, fauna and biodiversity issues raised in the Parliamentary Commission Report are as follows:

a) Prizma concurs with the PCR which identifies the most significant impacts to regional biodiversity (particularly snow leopard and its prey species) to be unrelated to Kumtor's operations. The key adverse impacts are associated with poaching and overhunting, direct and indirect results from grazing of livestock, overharvesting (including plant species) and limited institutional support by the Kyrgyz Government. At the same time, several statements in the PCR highlights that Kumtor has actually played a supporting role in increasing wildlife numbers in and around the Kumtor mine site. We recommend that Kumtor should explore additional ways to further develop its nature conservation stewardship opportunities related to the SCER and associated areas.

b) Prizma's evaluation shows that Kumtor has (a) been studying the vegetation and (b) monitoring and mitigating dust impacts associated with its traffic along the Barskoon road. The actual monitoring data available, which appear to have been ignored in the PCR, suggests that dust suppression measures are largely effective and that dust levels are generally within regulatory limits. Our review also suggests that the 'rare tulip' was actually mis-identified in the PCR. In any case, similar to other rare/threatened tulips in Kyrgyzstan and beyond, and reminiscent of the situation with snow leopards described above, the survival status of tulips in Barskoon Valey or Kyrgyzstan more generally is not related to Kumtor's mining and transport impacts. Instead, it is linked to over-grazing and collection of flowers and bulbs by local inhabitants as alluded to, not very clearly, also in the PCR.

[64] Kumtor, 2012. AER, 2011 at 62-63

c) We note that the PCR does not document any causal linkage between Kumtor's current operation – or exploration activities - and significant adverse wildlife conservation impacts in the region. We recommend that KOC continues and further leverages its opportunities by developing a Biodiversity Management Strategy and/or Plan for the Kumtor project in line with good international standards and conceptual conservation models[65] within the context of KR's National Biodiversity Strategies and Action Plans[66]. These tools could also support Kumtor's future exploration activities, on-going monitoring activities and requirements relating to the mine's final closure plan.

d) Our review notes that KOC has compiled sufficient baseline data and monitors flora, fauna and biodiversity. However, the PCR points to a need for financing, appropriate technical support, qualified experts and monitoring of the high altitude ecosystems in and around the SCER. We concur with PCR statements that suggest the need for additional data collection to better understand corridors of movement and migration patterns of important species such as argali and ibex. This could also be developed and incorporated in collaboration with NGOs and the SCER staff as part of a Biodiversity Management Strategy or Plan (or similar processes and plans).

e) Kumtor's exploration activities in the SECR so-called Buffer zone have raised material concern and attention by some KR government officials and outside stakeholders. We recommend that Kumtor should consider the timing for any future exploration in light of clarification of boundaries of the so called buffer zones, identification of the presence and any exploration-related impacts on wildlife migration partners. KGC should also consider rapid biodiversity screening prior to exploration activities and planning the reclamation of its exploration areas in due course.

f) It is our understanding that efforts are already in progress by the Kyrgyz Government to clarify the standing of the SCER buffer zone and provide a more definitive map relating to the size, location and boundaries of the SCER and other adjacent land uses. We recommend that this process be designed to be a transparent and open process to improve its credibility.

g) Based on the facts available, we do not find a causal linkage between the impacts to vegetation cited (particularly any rare or endangered tulips along the technical (gravel) road in the Barskoon valley) in the PCR and Kumtor's activities. However, we recommend that Kumtor includes and targets regional flora in future monitoring and specifically includes other anthropogenic impacts (including grazing, harvesting flowers or bulbs etc.). We note that conservation of regional endangered, rare or vulnerable species provides an opportunity for Kumtor to demonstrate stewardship and develop signature sustainability programs.

Overall, because of the unique location of the Kumtor Mine, Kumtor has significant opportunities to demonstrate corporate responsibility and nature conservation stewardship. In contrast to the tenor depicted in some portions of the PCR, our review finds that Kumtor has no significant or irreversible biodiversity impacts. Instead, biodiversity conservation has been and remains a high priority for KOC.

[65] Nazari, M. & Proebstel, D., 2008
[66] See also http://www.cbd.int/nbsap/

Our interviews with Kumtor's management show an increase in planned engagement and support for important biodiversity related initiatives. These currently include advanced discussions with and potential support for national/international NGOs currently involved in establishing a national strategy for snow leopard conservation in the Kyrgyz Republic and/or implementing related programs, including those associated with the SCER Management Plan.

4 Glaciers and water consumption

4.1 Background

The Kumtor Mine has been operational for approximately 15 years and is currently expected to continue operations until 2021. It is located in a remote, high altitude (about 4,000 m elevation) and partially glaciated region. There are five active glaciers adjoining, or partially within the KOC license boundaries. The largest of these is the Petrov Glacier, which also is the source for Petrov Lake discussed in Section 2.4. The others are Davidov Glacier (which is in partial contact with the main pit), Lysyi Glacier (which partially covers the upper portion of the Kumtor deposit), Sary-Tor Glacier and Boordu Glacier. The lowest portions of these glaciers (toes) have an approximate elevation of 3,800 to 3,900 meters above sea level (masl).

Combined, these five glaciers currently occupy a surface area of approximately 100 km^2. As is the case with most glaciers, the ones in and around the Kumtor project continue a relatively slow down slope movement (see also Section 4.8 regarding Davidov Glacier moving towards the pit) and have a negative mass balance. This means that there is a net loss of glacial ice mass each year.

As approved, permitted or tolerated by KR regulators and international lenders (IFC, EBRD and EDC) until approximately 2009, and as disclosed in Kumtor's AERs, beginning early in the Kumtor project (1995), waste rock from the pit was deposited on – or near - lower portions of the Lysyi, Davidov and Sary-Tor Glaciers. These include the direct deposition of waste rock on and near the Davidov Glacier (discussed in detail in the PCR), a practice which has been discontinued since approximately 2009. Kumtor has monitored movement of the glaciers since 1995, as well as movement of Waste Rock Deposition areas (WRD) and continues to remove WRD from the Davidov Glacier.[67]

4.2 Glacial ablation and retreat in Kyrgyzstan

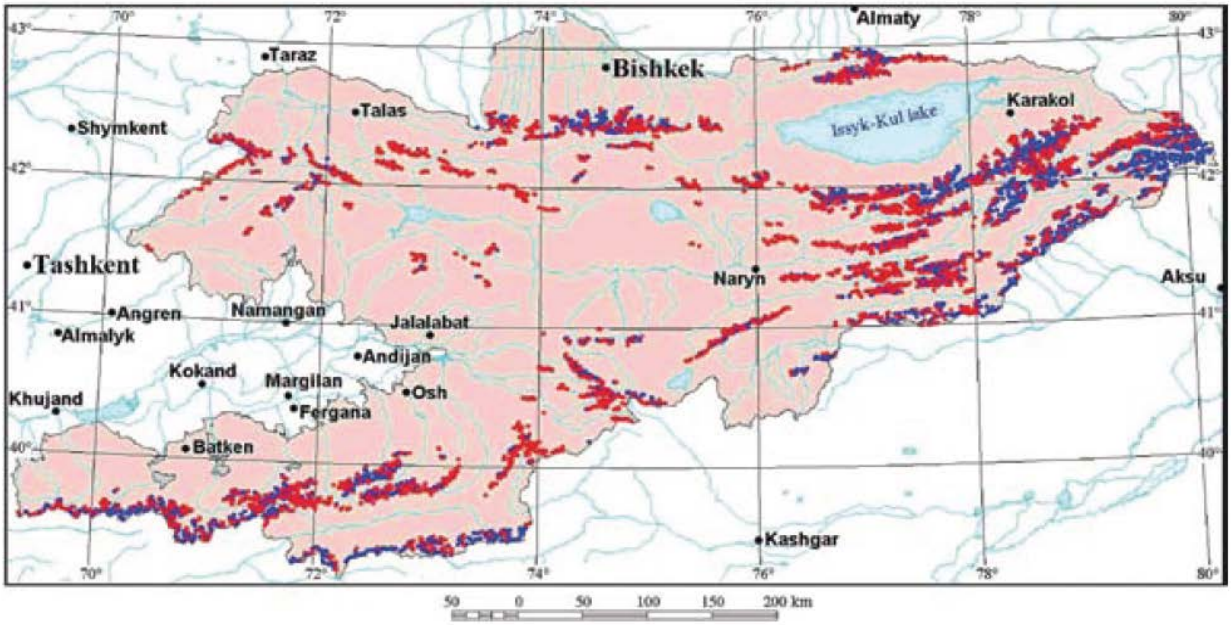
Over the last fifty years, scientists have documented a significant retreat – or ablation – of all of these glaciers, as has been similarly observed and documented throughout all of Central Asia. These include the discussions and predictions of Climate Change impacts on glaciers across Kyrgyzstan contained in the Second National Communication of the Kyrgyz Republic to the United Nation Framework Convention on Climate Change (UNFCCC) and recent studies by the United Nations Development Program (UNDP)[68]. The predicted state of glaciation in 2025 compared to KR's glacier catalogue developed in the 1960s is presented in Figure 8. KR's UN submission notes that:

> "[f]or the Republic as a whole, the reduction of glaciation area from 64 percent up to 95 percent from year 2000 till year 2100 is predicted, depending on the accepted variant of climatic scenario."[69]

[67] Kumtor,2012. AER 2011 at 106
[68] Natural Disaster Risks in Central Asia: A Synthesis, Michael Thurman, UNDP/BCPR, Regional Disaster Risk Reduction Advisor, Europe and CIS 11 April 2011
[69] Iliasov and Yakimov, 2009 at 126

This means that the glaciers across Kyrgyzstan, including those near Kumtor, are expected to largely disappear over the next few decades (with or without any mining impacts).

Figure 8: Predicted state of glaciation in 2025 compared to glacier catalogue developed in the 1960s (Extant glaciers marked with dark blue, extinct glaciers marked with red. Source: Iliasov and Yakimov, 2009)



4.3 Regional hydrology

The Kumtor River is located in the mountainous eastern part of Kyrgyzstan. Although commonly and mistakenly assumed to be the case, the watershed in which Kumtor is located is not linked to Lake Issyk-Kul. Instead, Kumtor's watershed drains through the Kumtor River, which originates at the glacial-fed Petrov Lake (upstream and near the Kumtor Mine), flowing into the Targai River and then into the Naryn River which is a major tributary of the Syr Darya River that passes through Uzbekistan after leaving the borders of Kyrgyzstan.

Concerns about water quantity or water quality issues in PCR are often noted in relation to Naryn, the administrative capital of Naryn Oblast (province) located over 200 km downstream of Kumtor (see Figure 1). As detailed below, our review suggests that the Kumtor River contributes less than 2% of the flow of the Naryn River at Naryn, which indicates insignificant impacts by Kumtor in terms of quality and quantity of water flows of the Naryn River at the city of Naryn.

In 2011, the peak flow of the Kumtor River was recorded at 24.02 m^3/sec on August 27. Average flows in the Kumtor River, below the Kumtor Mine, are approximately 1-2 m^3/sec from September through June, increasing to average flows of approximately 10 m^3/sec during the summer months. The literature shows that the average flows in the upper portion of the Naryn River basin (i.e. near the town of Naryn)

are approximately 90 m^3/sec. Maximum flows in the Naryn River at its mouth are approximately 850 m^3/sec.[70]

The size of the entire Kumtor River basin is approximately 233 km^2. For comparison, the Naryn River basin is approximately 59,000 km^2. Thus, the Kumtor River basin, including areas drained by tributaries below the Kumtor Mine Project amounts to approximately 0.0043% of the Naryn River basin.

Most significant and well-known regional impacts to water in this region of Central Asia, which is infamous for drying up the Aral Sea (by diverting/using tributaries for cotton production), include Soviet era trans-boundary treaties, pollution runoff, and water usage from agriculture (currently some 96% of the water resources in the SYR Darya River basin are used for Irrigation[71]), in addition to pollution from domestic and industrial sources. Further, existing regional water concerns are exacerbated by climate change, as has been documented in recent studies of meteorological and river flow data.[72]

4.4 Key issues raised by the Parliamentary Commission

Before summarizing the key issues relating to glaciers and water consumption contained in the PCR, we note that this report was preceded by the Interagency Commission's report (ICR) and Prizma's corresponding Independent Assessment[73]. The Interagency Commission also focused on alleged impacts to glaciers and water consumption in a regional context. The ICR also contained, as an annex, a separate document authored by Dr. Robert Moran[74]. We note that the same series of opinions, in form of bullet points, from the 2011 Moran comments contained in the Interagency Commission Report are also included in the Parliamentary Commission report.

As we have observed before, the PCR contains several sources with different authors in a disjointed fashion and does not clarify if these are informational or a significant parts of the Parliamentary Commission's report and/or part of its conclusions. We note that comments regarding glaciers and water consumption included at least the following sources: (1) the Kilborn EIA[75], (2) excerpts from a 2010-2011 research report from the Kyrgyzstan NAS[76], (3) Moran Comments (summary bullet points)[77],

[70] Naamatbekov, V. Hydrological Resources of the Naryn Oblast (in Russian)
[71] Drainage of the Basin of the Aral Sea and other Transboundary Surface Waters in Central Asia, http://www.unece.org/fileadmin/DAM/env/water/blanks/assessment/aral.pdf
[72] Darya Savitskaya, 2010. Statistical picture of climate changes in Central Asia: Temperature, precipitation, and river flow. International Environmental Modelling and Software Society (iEMSs) 2010 International Congress on Environmental Modelling and Software Modelling for Environment's Sake, Fifth Biennial Meeting, Ottawa, Canada, David A. Swayne, Wanhong Yang, A. A. Voinov, A. Rizzoli, T. Filatova (Eds.) http://www.iemss.org/iemss2010/index.php?n=Main.Proceedings
[73] Prizma, 2012. Independent Assessment of the "Interagency Report" and the "Moran Comments" on Compliance with Environmental and Industrial Safety Standards at the Kumtor Gold Mine, Final Report, 23 April 2012, which has also been web-posted on Kumtor's website.
[74] http://bankwatch.org/sites/default/files/Kumtor-MoranReport-31Jan2012.pdf (e-file dated January 31, 2012).
[75] Kilborn EIA, 1993
[76] Research Report of the KR National Academy of Sciences specialists "Research of negative geo-ecological processes of Issyk-Kul Province and development of recommendations on decrease of environmental risks" (File #9, pp. 1-4).

(4) comments from the Parliamentary Commission working group on hydro-geology[78], comments from the Scientific Director of the SCER[79], and even comments from a Letter from the World Wildlife Fund (WWF)[80].

The key issues raised throughout the above portions of the PCR relating to glaciers include:

a) General impacts from Kumtor to the surrounding glaciers;
b) Perceived effects on glacial melting from mining activities;
c) Hazards from failure of glacial ice near Kumtor pit;
d) Potential quick movement of Davidov Glacier, threatening the geologist camp;
e) Impacts to water quality from waste dumps on glaciers; and
f) Dust impacts to glaciers form Kumtor.

The key issues raised in the PCR addressing Kumtor's water consumption include:

a) Volume of Kumtor's water consumption on a regional scale;
b) Assertions about failure by Kumtor to pay separate fees for water consumption; and
c) Lack of recycling of process water.

Our interpretations offered relating to the scale of impacts to glaciers, including glacial melting/retreat (ablation), hazards associated with proximity of glaciers to mining activities, dust impacts to glaciers and water consumption concerns are presented below. The issues related to fee payments by Kumtor are enshrined in the 2009 New Terms Agreement and other associated agreements and are not analyzed any further in this report.

4.5 Scale of Kumtor's impact on glaciers

Based on our site visits, review of literature, AERs and aerial photographs provided by Kumtor, the mining operation has impacted a minor portion of the lower ends (snout or lobe) of the Davidov and Lysyi glaciers. Our estimated size of the affected areas is approximately 0.7 km^2 for the Davidov Glacier and 0.4 km^2 for the Lysyi Glacier. The Sary-Tor Glacier, as pointed out by the PCR, is largely unaffected by mining operations.[81]

We note that the five glaciers in the Kumtor area have a combined surface area of approximately 100 km^2. Thus, the impacted area, including areas used for waste rock deposition and areas removed, is less than approximately 1.5% of the major glaciers immediately surrounding Kumtor and far less on a

[77] http://bankwatch.org/sites/default/files/Kumtor-MoranReport-31Jan2012.pdf (e-file dated January 31, 2012).
[78] Preliminary examination of Kumtor mine problem areas. Conclusion of hydro-geological group.
Authors: S. A. Erohin, Mine Engineer, Hydrogeologist, Head of Engineer-Geological Group of KR State Agency on Geology; V. V. Zaginaev, Mine Engineer, Hydrogeologist of KR State Agency on Geology; B. O. Ermenbaev, Mine Engineer, Hydrogeologist of KR State Agency on Geology
[79] Opinion of A. P. Vereshagin, Director, Scientific Operations, Sarychat-Ertash State Nature Reserve
[80] Letter of Support for saving integrity of the Sarychat-Ertash Nature Reserve, World Wide Fund For Nature WWF Russia
[81] PCR at page 175

regional scale. In other words, Kumtor's anthropogenic impacts to glaciers are immaterial. This becomes even more obvious when considering this issue in the context of much more significant climate change driven impacts documented in the official Kyrgyz Government studies submitted to the UNFCCC which, essentially, suggest that the nation's glaciers are expected to largely disappear (see also Figure 8).

4.6 Kumtor effects on glacial melting

The PCR includes several comments inferring, or stating that Kumtor's activities on or near glaciers are significantly impacting glacial melting. We also reviewed studies relating to the retreat (ablation) of glaciers near the Kumtor mine and across the Kyrgyz Republic.

Kuzmichonok's study[82] of the Davidov Glacier (see Figure 9) and Duishonakunov's data[83] of the Petrov Glacier (see Figure 10), both adjacent to the Kumtor mine, show that the impacts observed have been documented for many decades before Kumtor's operations began. They are also similar to those observed elsewhere in Kyrgyzstan. These studies and data generated or analyzed by eminent Kyrgyz scientists point to Climate Change as the main driver of melting and retreat of glaciers near the Kumtor mine and elsewhere in Kyrgyzstan.

4.7 Kumtor's impact to movement of glaciers

Based on and consistent with Kumtor's monitoring results, engineering studies and disclosed reporting over the past decade, PCR discusses the movement of the Davidov Glacier and, to a lesser extent, the Lysyi Glacier and the Sary-Tor Glacier. As reported also by Kumtor, the movement of the Davidov Glacier has been influenced by previous waste rock storage practices. We note also that Kumtor has been discontinuing the practice of WRD on the Davidov Glacier. In this regards, Kumtor's 2011 AER states the following:

> "To this end, KOC is no longer planning to dump waste rock atop the Davidov Glacier, which should help minimize movement rates. As can be seen in Diagram 9-1, the majority of waste rock from the Central Pit, is now placed further down the Chon-Sary Tor valley. This revised dumping practice is anticipated to limit waste dump instabilities and movement, certainly into the closure phase."[84]

[82] Kuzmichonok, 2007
[83] Duishonakunov, 2010
[84] Kumtor, 2012. AER 2011 at page 104

Figure 9: Retreat of the Davidov Glacier near Kumtor Mine since 1869 (source: Kuzmichonok, 2002)

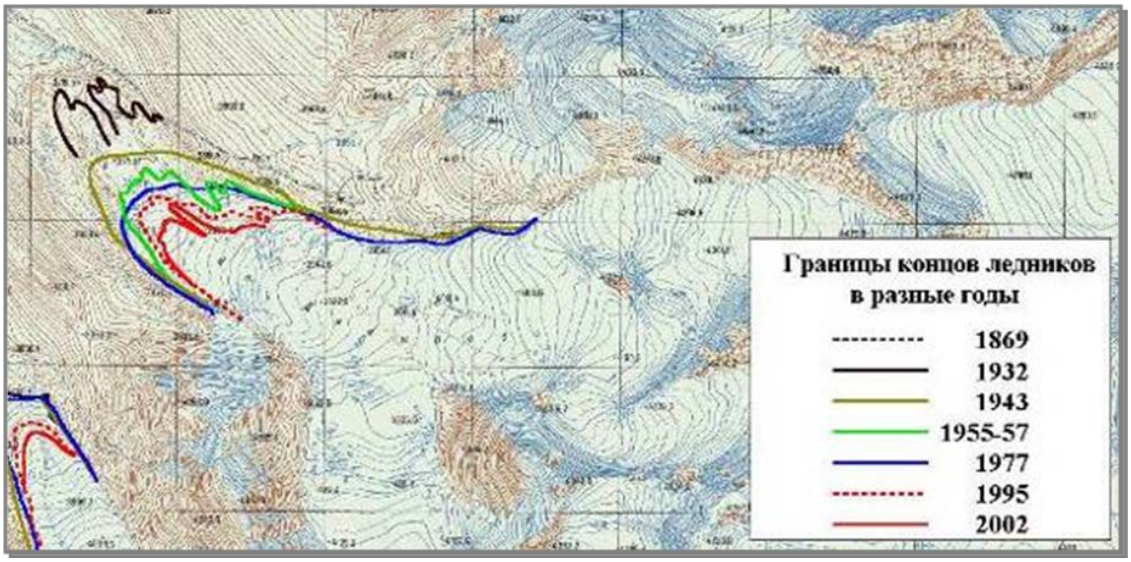
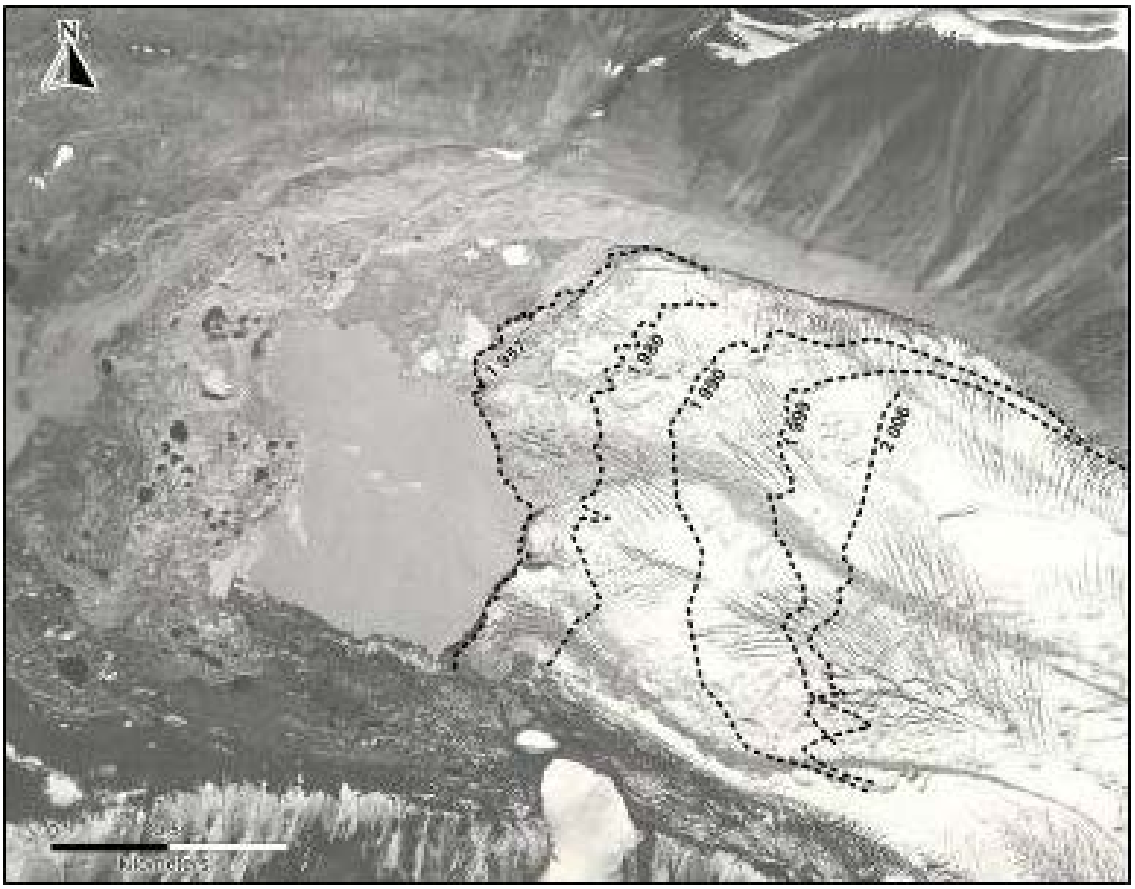


Figure 10: Retreat of the Petrov Glacier from 1957 (left) to 2006 (source: Musuraliev *et. al.*, 2008)



4.8 Pit hazards from Davidov Glacier

Members of the Parliamentary Commission working group charged with examining hydro-geological issues noted their concerns about potential displacement of a portion of the Davidov Glacier and subsequent hazards to workers in the pit area, stating:

> "The ice blocks broken from glacier bench threaten the life of people operating on the pit. The separate, breached ice blocks are not the main pit hazard but it represents by the impulsive glacier movement when the ice mass of several hundreds m³ may fall. It is unknown yet, how to protect the people working on the pit from this hazard"[85]

Our review and discussions with Kumtor's management determined that they recognize the unique challenges and risk associated with the movement of ice and glacial materials into the pit. This has resulted in additional monitoring and other operational responses. In 2009, for example, KOC retained Canadian engineering firm BGC to provide technical review and guidance to manage pit wall stability issues relating to both location and movements of the Davidov Glacier. Also, Kumtor is using an automatic monitoring procedure which incorporates a computer controlled Leica Monitoring System[86] to further support its regular inspections. Based on the recommendations provided, Kumtor has already developed an Emergency Response Plan (ERP) for pit hazards associated with the David Glacier (see further below).

4.9 Emergency Response Plan

In keeping with recommendations from BGC, KOC has developed an ERP to specifically address issues of concern pertaining to worker safety that may result from movement of the Davidov Glacier and resulting pit stability issues described above.[87] This specific ERP, a copy of which was provided to Prizma, contains the following essential elements: (a) definitions and ranges of specific emergencies, (b) responsible personnel and responses (including sirens for initiation of evacuation procedures, and specific protocols), (c) activities of spotters, (d) procedures to ensure industrial safety, (e) safety protocol to observe when mining ice from Creep Area, (f) safety measures associated with water flows from the pit wall, (g) monitoring procedures and thresholds, and (h) actions for retrieval of personnel/ equipment.

In our opinion, KOC, relevant Kyrgyz Government agencies and various Government Commissions have a largely shared understanding of risks associated with, both pit stability and potential unexpected movement of the Davidov Glacier near the pit and associated safety concerns more generally. We note, however, that the acceleration of ice and glacial material movements has adversely impacted Kumtor's operations in 2012.

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[85] PCR at 174

[86] Kumtor, 2011. AER 2010 at A-3

[87] Kumtor, 2012. Procedures to ensure industrial safety when mining ithin the creep area in the SE Wall of the the South Bottom of the Kumtor Central Pit in 2012 (updated version of May 2012)

The PCR also raises a concern about a possibility of rapid movement of the Davidov Glacier impacting the "camp of geologists" (which we interpret to mean mine camp):

> "One more threat from Davydov Glacier is the possibility of overlap of its ending part overloaded with waste rocks to the camp of geologists (pic. 8). The glacier movement rate may reach several km/h.[88]

Although Kumtor's monitoring data, which shows movement rates in the order of tens of m/year suggests that the rate of "several km/h" in PCR is highly exaggerated, continued monitoring and contingency planning by Kumtor may be indicated.

4.10 Dust impacts from Kumtor

The PCR makes a brief reference to impacts on regional glaciers from dust associated with Kumtor's blasting activities: "intensive melting of Ak-Chyirak Range glaciers is going on due to the dust from blasting operations."[89]

As discussed above, compared to the observed scale of impacts from Climate Change throughout Kyrgyzstan, Kumtor is unlikely to have a material anthropogenic impact that would be the dominant driver of glacial melting. With specific reference to dust, our data review also showed that Kumtor had conducted an assessment of dust levels deposited on the glaciers to determine what, if any, impacts the mining operations are having on the glaciers. This research, which was also discussed in the Kumtor AER 2009[90], was carried out by V.A. Kuzmichonok, Head of the Laboratory of Mathematics-Cartographic modeling process of KR Institute of Water Problems and Hydro Energy. The results of that study confirm that mining and any related dust deposition is not a driver for glacial retreat in the Kumtor region. As shown in the preceding section, it is evident that climatic conditions are the dominant (overwhelming) drivers of glacial ablation near the Kumtor mine and across Kyrgyzstan.

4.11 Kumtor's impact on regional hydrology

The estimates provided in the EIA indicate that the five glaciers in the Kumtor region occupy approximately 100 km^2, with the majority of the surface area occupied by the Petrov Glacier (approximately 24 km long and 4 to 5 km wide). As summarized in Section 4.5, the scale of Kumtor's impact on the Davidov and Lysyi Glaciers is less than approximately 1.5 km^2 or 1.5% of the areas of only those glaciers which are located in the vicinity of the Kumtor mine.

Although glaciers are generally believed to be a part of the regional recharge process, other and more dominating contributors – given their scale - include precipitation in the form of snow and rainfall. We also note that rainfall is far more important than glaciers and accounts for approximately 82% of the water to regional rivers (as also noted in the PCR[91]). In addition, studies of isotope concentration in the

[88] PCR at P 175 "One more threat from Davydov Glacier is the possibility of overlap of its ending part overloaded with waste rocks to the camp of geologists (pic. 8). The glacier movement rate may reach several km/h.
[89] PCR at 123
[90] Kuzmichonok, 2009, also discussed in KOC 2009 AER, page 7.3
[91] PCR at 123

Naryn River indicate that glaciers do not contribute measurably to the water content of the Naryn River at Naryn[92].

The Kumtor River is one of many tributaries to the Naryn River which, in turn, is over 535 km long with a total area of the catchment basin of approximately 59,000 km^2. The mountainous portion of the basin above the town of Naryn, that recharges the river annually, has an area of over 5,000 km^2. Thus, in the context of hydrological relationship to the potential users in Naryn, the entire Kumtor River basin represents 0.046 % of the region above Naryn, and far less of the entire basin as stated above. This means that Kumtor's impact on regional water quantity from its impact on glaciers and/or water consumption is immaterial.

We note that the Parliamentary Commission Report raises concerns relating to Kumtor's water consumption and/or some associated regional impacts:

> "KOC uses annually about 6 M m³ of pure glacial water from the Petrov Lake for industrial and household needs. The KOC limit of water consumption is 6.2 M m³, the **circulating water system in the technological process is not provided** whereas the practice of analogous productions is based on such system." And later in the same page:
>
> "It is indicated in the Kumtor mine Ecological Passport (2004) that the volume of Mill **circulating water system was** 13,587 K m³/year" [93]

We will address these issues below.

Kumtor's approximate water balance data from 2010 and 2011 related to the intake from the Petrov Lake are shown in Table 2. In 2010, Kumtor's total water intake (which does not equal "consumption") from Petrov Lake for both the camp and the mill was approximately 5.9 % of the total inflow from Lake Petrov.

Table 2: Key water consumption for Kumtor for 2010 and 2011 related to Petrov Lake (source: Kumtor's AERs)

Year	Total intake from Lake Petrov million m^3	Total treated discharge to Kumtor River million m^3	Net consumption million m^3	Percent of total inflow to Lake Petrov
2010	5.952	5.2	0.752	5.9 %
2011	6.3	5.0	1.3	7.89%

[92] Amsonova, A.A. and I.V. Tokarev. Study of Naryn river (Central Asia) runoff formation by stable isotope composition, Mineralogical Magazine www.minersoc.org: "In conclusion, Naryn river runoff is formed at the expense of winter and spring precipitations. Summer precipitations can be neglected, as their volume is insignificant, and at altitudes to 1600 m precipitations are completely absorbed by evaporation. Disappearance of glaciers won't render essential influence on a river Naryn runoff."

[93] PCR at 209

The vast majority of this intake eventually reports to the TMF and, the majority of that is subject to treatment to meet defined standards, and is discharged back to the Kumtor River. In quantitative terms, using the 2010 data as an example, the measured volume of Kumtor's water intake was 5.952 million m^3. The water quantity discharged back to the Kumtor River (following treatment) was 5.2 million m^3 in 2010. This post-treatment discharge volume equates to approximately 87% of Kumtor's intake from the Petrov Lake. Therefore, Kumtor's net consumption in 2010 was approximately 0.752 million m^3. In 2011 total consumption was 1.3 million m^3, or 7.89 % of inflow to Lake Petrov.

As we have discussed elsewhere, the concerns about Kumtor's potential impacts on water quality and quantity issues are typically made in the context of Naryn, the administrative capital of the Naryn Oblast (province) located some 200 km downstream of the Kumtor mine (see Figure 1). As shown in Table 2 and discussed also in Section 4.3, Kumtor's water consumption is a small fraction (<8%) of the annual inflow into the Petrov Lake which feeds the Kumtor River. This, in turn, contributes only a small faction (<2%) of the flow of the Naryn River, as it drains also a number of other tributaries.

In our opinion, it is quite inaccurate to suggest that Kumtor's water consumption represents a substantial decrease of the amount of water available to users at Naryn. Also, it is implausible to raise Kumtor's operation and water use as a major driver of 'water competition' on a regional scale that, according to statements included in the PCR[94], could apparently be felt as far away as Uzbekistan. It is well-known that the water competition in Central Asia is driven by agriculture consumption, including wasteful practices and aging Soviet-era water distribution infrastructure[95].

4.12 Recirculation water for the process facility

The PCR also asserts that Kumtor does not recycle its process water, alluding also to an outdated Ecological Passport from 2004:

> "[T]he circulating water system in the technological process is not provided whereas the practice of analogous productions is based on such system"[96] and notes similarly elsewhere that "[w]ater recycling system at KOC technological process is not provided;"[97]

As discussed in a summary report presented by Kumtor to its Lenders in in 1998[98], which reviewed the history of decision making associated with the abandonment of reclaim water use and location and type of cyanide effluent treatment plant, there were material technical and economic reasons leading to the changes and current arrangement of the INCO effluent treatment plant. The report identifies significant metallurgical risks by reusing cyanide-laden (even post-treatment) reclaim water. It also identifies major benefits associate with natural degradation of cyanide by UV light (given high altitude, cutting down on reagents/costs), improved constructability and containment within TMF envelop, reduced use of reagent and costs by treating only liquid effluents instead of treating the entire tailings (solids plus

[94] PCR at 134
[95] http://www.fao.org/nr/water/aquastat/countries_regions/KGZ/index.stm
[96] PCR at 209
[97] PCR at 171
[98] Kumtor, 1998. Reclaim Water and Effluent Treatment, Report to Lenders, November 1998

liquids), limited environmental benefits, and ample water availability (Petrov Lake). In addition, the current arrangements also offered material economic benefits.

In reviewing these and other comments raised in the PCR, we find the concern regarding recycling of process water to be in complete contradiction to other concerns raised and recommendations made elsewhere in the PCR regarding Lake Petrov (see Section 2.4). On one hand, the JRC highlights the need for recycling, which would, presumably, substantially reduce Kumtor's fresh water intake sourced from the Petrov Lake. At the same time, the PCR recommends that, to address concerns associated with a potential failure at the Lake Petrov, Kumtor should decrease its volume:

> "It is required to decrease the lake water level by artificial discharge of some water and reduce the lake volume up to the safe level for elimination of the risks related with the Petrov Lake outburst."[99]

Overall, a review suggests that there was a good technical and economic justification which supported the decision to change of the previously planned effluent recycling process. Also, there is no water shortage and, as discussed further above, the volume actually 'consumed' (mainly by retention in TMF) is, in relative terms, insignificant.

4.13 Conclusions and Recommendations

a) Based on our review, it is evident that Kumtor's impacts on glaciers partially covering the deposit were already noted in the EIA and known and accepted by lenders and the Kyrgyz Government in advance of commencing the project. In our opinion, the data available does not suggest any material anthropogenic impacts to glaciers by Kumtor, particularly when considering the observed impacts on glacial ablation across Kyrgyzstan due to Climate Change impacts.
b) The available information shows that the challenge associated with glacial material movements (and related issues) into the mine pit area provide a globally unique challenge to Kumtor's operations. In our opinion, the information available shows that Kumtor is aware of, and is seeking to actively manage potential hazards associated with glaciers and ice movement to the central pit. This includes monitoring, use of third-party experts and developing specific emergency response plans. We understand that this issue is being considered by Kumtor in its overall mine planning process and anticipate continued scrutiny by relevant government agencies.
c) Although the movement rates of the Davidov Glacier with respect to possible impacts to the "geologist camp" (assumed to refer to the mine camp) suggested by the PCR do appear to be inconsistent when compared to Kumtor's detailed monitoring data and appear exaggerated, Kumtor should consider continuing careful monitoring and, determine a schedule/cut off point at which time, contingency planning and movement of mine camp might be indicated.
d) In our opinion, water consumption by Kumtor is not significant on a regional scale. Also, Kumtor had good technical and economic justifications to abandon previous plans for effluent water recycling (including option for cyanide treatment at the mill site). It is evident that the PCR has not reconciled

[99] PCR at page 169

its contradicting expectations relating to this topic from Kumtor. On one hand, Kumtor is expected to increase water recycling. This implies a reduction of water intake from the Petrov Lake. On the other hand, Kumtor is expected to lower the water level in the Petrov Lake to address PCR's concerns about a potential glacial outburst flood at Petrov Lake. We recommend that the Parliamentary Commission develops a clear and consistent recommendation that considers the absence of water scarcity issues at the Kumtor mine, cost-benefit and water quality considerations which may be associated with water recycling efforts, and the apparent need to reduce the water level in the Petrov Lake.

5 Groundwater and permafrost

5.1 Background

The Kumtor Mine has been operational for approximately 15 years. It is currently expected to continue operations until 2021. The Kumtor Mine is located in a remote, high altitude (about 4,000 m elevation), partially glaciated permafrost region. There are no permanent dwellings, known groundwater wells or groundwater users within a distance of many dozen km from the TMF or the waste rock storage areas.

The PCR[100] and the EIA contain a detailed description of the groundwater condition associated with the Kumtor project. The groundwater conditions in the vicinity of the project are controlled by the presence of permafrost which can reach from the surface down to 250 mbs. This means that ground temperatures are well below freezing and the ground (and any groundwater contained in porous or fractured areas) is frozen for up to 250 mbs. This creates an impermeable barrier to groundwater movement – including movement of any associated groundwater pollution - down or through the frozen permafrost.

The exception to this is the near-surface so called active zone. As described in the PCR, this zone is characterized by seasonal thawing (typically between May and October). The depth of this active zone is, in general, approximately s few meters. This water source is not considered to be significant. It can provide the water source for springs of small discharge (< 1 L/s) which emerge at the surface forming a haphazard pattern of seasonal small rivulets, bogs and lakes. This is why these sources are considered part of the surface water inventory.

5.2 Context of water monitoring in Kyrgyzstan

UNECE's Second (2009) Environmental Performance Review of Kyrgyzstan provides a credible high level review of water monitoring activities and its challenges in the country. As detailed further with relevant excerpts in the following sections, the country's monitoring network is considered inadequate, it does not meet Kyrgyzstan's own water monitoring legislation, state laboratories are not certified and accredited, and they don't meet the requirements of international standards, and there is no integrated data management system in place. At the same time, Kumtor is singled out in the same UNECE study as the only company in Kyrgyzstan which publishes an annual environmental report, and the time, was one of a handful of organizations whose laboratories were selected to participate in inter-calibration exercises.

More specifically, the UNECE notes the following:

> "Kyrgyzhydromet currently monitors hydrochemical parameters of surface water quality at 24 gauges on 11 rivers, as compared with 105 gauges at 54 rivers and lakes in 1990. The network monitoring glaciers and snow level in the mountains, which served as the basis for hydrological forecasts and natural disaster prevention, was drastically reduced in the early 1990s and has not been restored since that time.

[100] See PCR, 2012, Section 2.3.1 Groundwater at 123

> The number of observation points [see Figure 11] is far below the requirements of the applicable water monitoring regulations. […].
>
> Discharges reported to the Division of State Environmental Control during its inspections call for regular (if not continuous) monitoring of water quality in the Botken oblast (pollution from mercury and antimony production plants and from agriculture), on a tributary to the Naryn in Jalal-Abad oblast (pollution from gold mining [this is not a reference to Kumtor]) and on the Lake Issyk-Kul (pollution from tourism installations and houses on the coastline). **Diffuse pollution of surface waters is not monitored in Kyrgyzstan**."[101] [emphasis added]

In its description of analytical laboratories, the UNECE study points out the following:

> "Kyrgyzhydromet has three central laboratories in Bishkek specializing in observations of air pollution, inland water pollution and radioactivity. Its two regional laboratories located in Cholpon-Ata and Osh are responsible for air pollution observations only. **Kyrgyzhydromet has not certified and accredited its laboratories. They do not meet the requirements of the recommended international standard in the joint ISO/IEC1 publication 17025:2005, General requirements for the competence of testing and calibration laboratories**. [emphasis added] However, measurement devices are certified" and notes later on that:

In terms of information management and reporting, the UNECE study finds the following:

> "There is neither an integrated nor interconnected environmental electronic database in Kyrgyzstan" and highlights also that in "2007, data submission to the Monitoring Division [of the SAEPF] was discontinued. Kyrgyzstan is facing the challenge of establishing, without delay, legal requirements and operational procedures for regular environmental reporting to environmental authorities, at least by its larger enterprises (some 500 at present).
>
> **Only one company in Kyrgyzstan, Kumtor Operating Company, publishes a (voluntary) annual environmental report.**"[102] [emphasis added]

[101] UNECE, 2009 at 48-50
[102] UNECE, 2009 at 52

Figure 11: Main environmental monitoring network in Kyrgyzstan, 2008 (source, UNECE, Map 3.1)

5.3 Water quality concerns in Naryn

Unlike the hear-say based and speculative assertions about pollution from Kumtor and its potential impact over 200 km further downstream in Naryn, a 2011 UNICEF publication (see cover page reproduced as Figure 12)[103] identifies the existing water quality concerns which are currently being experienced in schools and elsewhere in the Naryn Oblast. This UNICEF report identifies inappropriate sewage and waste disposal practices, lack of access to safe drinking water and inadequate hygiene as causal linkages with gastrointestinal diseases affecting school children.

Similarly, the EC-funded 2011 Environmental (Ecological) Management Plan of Naryn Oblast[104], which was developed with the support of the European Commission, identifies a series of much more likely pollution sources. These range from inadequate waste management to coal/lignite mining related activities. Looking at the mining sector in the Naryn Oblast in particular, the report notes that all organizations involved violate their environmental requirements, ranging from inadequately treated discharges to inadequate reclamation activities and funding.

5.4 Key issues raised by Parliamentary Commission

The PCR asserts that Kumtor's operations have changed the hydrogeological situation of this area by changing groundwater flows and contamination of groundwater by mine wastes. The PCR speculates further that the former could result in outbursts below the TMF dam, while the latter "will cause the appearance of harmful chemicals in the Naryn River, which is hazardous for the population of this valley."[105] Similar assertions are also made elsewhere in the PCR and recommendations are made to conduct detailed hydrogeological investigations at the mine site.

[103] Baseline assessment of Access to Water, Sanitation and Hygiene in Schools and Hospitals in the Northern Oblasts of Kyrgyzstan (Issyk Kul, Naryn and Talas) / I. Domashov, V. Korotenko, G. Gorborukova, M. Ablezova, A. Kirilenko Bishkek, Altyn Tamga Publishing House, 2011, 104 pp.

[104] The 2011 Naryn Oblast's Environmental (Ecological) Management Plan was developed with the support of the EC project "Civil society Network on Access to Information, Participation in Decision-making and Access to Justice in Matters relating to the Environment in the Kyrgyz Republic" in partnership with BIOM, a Kyrgyz NGO.

[105] See PCR, 2012 at 170-171

Figure 12: Realities of water quality concerns in Naryn Oblast and elsewhere (source: UNICEF)

5.5 Analysis of issues raised

There are no permanent dwellings, known groundwater wells or groundwater users within a distance of many dozen km's from the Kumtor mine. This suggests that, in addition to the installation of a synthetic geo-membrane liner, naturally permafrost conditions protective of groundwater resources, there are no human receptors that would be exposed to contaminated groundwater, even if present.

Overall, the dominant contributors to the water quality of the Kumtor River at Kumtor's compliance point W1.5.1 include the natural background conditions (which contain elevated levels of certain metals)[106], treated effluent discharges, direct discharges (from dewatering activities) and run/off or drainage from waste rock storage areas. Contributions from TMF-related seepage, if any, are unlikely to be measurable even at Kumtor's compliance point W1.5.1, let alone near the residential community of Naryn, located some 200 km further downstream of the TMF.

5.6 Conclusions and recommendations

The construction of the Kumtor operation, by design, involved localized changes to certain water streams and, as identified in the EIA, is expected to have some temporary and permanent impacts (commonly referred to as 'project footprint'). In our opinion, with certain known exceptions noted below, the PCR does not provide convincing or substantiated arguments that demonstrates a material impact related to hydrological changes which would materially exceed those normally associated with a project footprint of a mining operation like Kumtor. Exceptions may be described as 'hydrological issues' related to the TMF (historic seepage and movement), the Davidov Glacier (movement) and mine closure (need to manage surface water flows), are discussed elsewhere in this report and have been disclosed in Kumtor's AERs and its latest CCP.

Given the permafrost conditions (creating barriers to groundwater movement/contamination), lack of groundwater users/receptors and the context of assertions made with regard to "ground water contamination" being associated with TMF-related issues (seepage from active zone) and waste rock storage areas means that these are, in fact, largely concerns about surface water contamination issues (discussed in other parts of this report). In any case, there are numerous piezometers (which are small diameter wells) installed within and around the TMF dam which can support groundwater quality monitoring. In our opinion, the water quality monitoring program of Kumtor does not support a causal linkage with hear-say based allegations of adverse water quality impacts in the Naryn region.

Prizma's recommendations are provided below:

a) We recommend that the Parliamentary Commission and other stakeholders consider the presence of other actual pollution sources likely present closer to Naryn (and nearby tributaries). We also

[106] The 1993 Kilborn EIA describes the baseline conditions of the Kumtor Mine. Background water conditions include high levels of several heavy metal parameters, including aluminum, copper, iron and zinc. These exceed the Canadian Water Quality Guidelines (CWQG) for the protection of aquatic life. The EIA also notes the background presence of several other metals (below CWQG- but detectable). This is indicative of a natural occurrence of many metals in the regional watercourses.

refer to the UNICEF study and the EC-funded Naryn Environmental Management Plan mention in Section 5.3, which have identified a variety of sources directly impacting local water quality human health of the population of the Naryn valley.

b) In our opinion, the Parliamentary Commission should also consider how the national capacity limitations related to Kyrgyzstan's water monitoring network and analytical capabilities, which were identified in the 2009 UNECE quoted further above, might impact the accuracy and reliability of data being generated by this and other Government Commissions.

c) In our opinion, Kumtor should consider how the adoption of community-supported monitoring concepts and/or a review of its water quality monitoring program could address the apparent trust deficit relating to its water quality data which may be leading to an exaggerated expectation of actual impacts of Kumtor's operations.

6 Environmental Management

6.1 Background

Kumtor Mine has been operational for over 15 years. It is located at a high elevation, mountainous region approximately 50 km from the nearest community, 80 km from the nearest industrial center, and 200 km from the nearest downstream community (i.e. aquatic receptor). Annual temperatures range from -49 degrees C to + 23 degrees C, with an average temperature of -8 degrees C. Average precipitation is 323 mm, of which 60 mm (equivalent) is from snowfall. Groundwater is controlled by the presence of up to 250 m of permafrost, reaching a depth of 100m to 250 m below surface.

The 1993 Kilborn EIA describes the baseline conditions of the Kumtor Mine. The mine is situated in the headwaters of the Kumtor River drainage (area of approximately 233 km^2), originating at Glacial Petrov Lake, which joins the Taragay River and later the Naryn River, eventually flowing to the Syr-Darya River and finally the Aral Sea. Background water conditions include high levels of several heavy metal parameters, including aluminum, copper, iron and zinc, exceeding the Canadian Water Quality Guidelines (CWQG) for the protection of aquatic life. This indicates naturally elevated background presence of many metals in the regional watercourses.

The regional flora and fauna is also described in detail in the EIA. It identifies several protected (International and KR Red Book) species with conservation status, high levels of endemism and important "charismatic mega-fauna" such as snow leopards, golden eagles, Marco Polo sheep, ibex, and others. Fisheries resources are very limited, with no fish found in Petrov Lake (located near the mine site) and just two small species (osman and loach) found in only some of the project areas larger streams and rivers. Macroinvertebrates are also limited, due to generally low nutrients and water temperatures.

Soils are typical of high altitude or arctic tundra with severe climate conditions and are poorly developed over the shallow permafrost layer found in the Project area. The Kumtor Mine is situated in an area of relatively large active glaciers, including five glaciers in immediate proximity with a combined surface areacovering approximately 100 km^2, but undergoing significant ablation (melting and reduction in size) over the last decades, due to impacts from global climate change.

6.2 Key Environmental Management issues raised by the PCR

Before summarizing the key assertions contained in the PCR, we note that the report by the Parliamentary Commission was preceded by the Interagency Commission's report and Prizma's corresponding Independent Assessment[107]. The Interagency Commission focused on the following key issues: (a) transparency, (b) water quality (including arsenic and cyanide), (c) biodiversity, (d) glaciers

[107] Prizma, 2012. Independent Assessment of the "Interagency Report" and the "Moran Comments" on Compliance with Environmental and Industrial Safety Standards at the Kumtor Gold Mine, Final Report, 23 April 2012, which has also been web-posted on Kumtor's website.

and water consumption, (e) geotechnical issues and the Petrov Lake moraine dam, and (f) mine closure issues. We note that several of these issues continue to be discussed also in the PCR.

Key issues regarding KOC's environmental management, in general, raised by the PCR addressed in this section include:

a) Environmental Management Action Plan (EMAP);
b) Access to documents;
c) Water quality, surface water;
d) Soil monitoring and impacts; and
e) Air quality issues.

Other topics related to Kumtor's environmental management, including reliability and transparency of data, biodiversity, glaciers and water consumption, geotechnical issues (TMF and Petrov Lake), groundwater contamination and mine closure discussed in the PCR are addressed elsewhere in this report.

6.3 Review of Parliamentary Commission Assessments

Overall, we found the PCR sections relating to environmental issues, and water quality to be very disjointed and selective. The report includes a large collection of independent documents drafted by many different authors. The report also fails to provide a clear summary of conclusions and recommendations, or provide context and explanation of all the included content. It is also not clear where the content and/or conclusions provided by outside individuals or organizations have been adopted by the Parliamentary Commission.

6.4 KOC Environmental Management Plan

In the final section of the PCR pertaining to environmental issues, the report refers more generally to the KOC Environmental Management Action Plan (EMAP) latest version, 2010[108] and describes several key components of the EMAP, including the environmental policy statement, commitment to compliance, general policies on recycling of industrial wastes and pollution prevention, in addition to availability of the KOC environmental policy to the public.[109] This section of the PCR then makes a highlighted apparent conclusion: "**Available materials, reports, documents, information related to KOC operations provide a solid basis to state that none of the above provisions of KOC environmental policy are observed."** The Parliamentary Commission provides no reference to any data, factual examples or other information as to how this conclusion was reached.

Our review of KOC's reporting finds this statement to be inaccurate, misleading and apparently based largely on unsubstantiated opinion. Our review suggests that KOC's environmental policies, management, monitoring and reporting is generally in keeping with good international practice, are

[108] Kumtor, 2010. EMAP
[109] PCR at 212-213

subject to regular review, updated and improved, and accessible in summary format to the public in the form of Annual Environmental Reports that are published in both English and Russian languages.

The PCR reference to KOC's EMAP is not only inaccurate, but it also does not give any context as to the purpose of the EMAP, which is fulfilling requirements originating from the involvement of international financial institutions (i.e. IFC, EBRD and EDC). Thus, the primary objective of EMAP is not to serve, by itself, as a test of compliance with KR regulations, which are more fully addressed in the KR Ecological Passports and some 30 other KR environmental permits, registrations and licenses published annually in Kumtor's AERs[110] .

6.5 Access to documents

The PCR makes statements that KOC did not provide access to documents and requested information. Our review notes that, in addition to voluminous amounts of publically available information, KOC provided numerous reports and documents to the commission for review. According to the information contained in the PCR, it sent out 200 letters of inquiry, 31 of which were sent to Centerra Gold, KOC and KGC and resulted in 26 responses. The PCR notes that it reviewed 15,000 standard typeset pages and processed these in 50 files. [111] All this suggests that there was, in fact, access to voluminous information about the Kumtor Project.

We note that, subsequent to the publication of the PCR, Kumtor continued to receive, and continued to provide, additional information requested by the State Commission and Government Agencies. We also note contradiction pertaining to this accusation relating to lack of access to documents in the PCR. For example, a very perplexing point raised in the PCR includes a statement that KOC did not provide the KOC Feasibility Study (EIA):

> "In spite of the repeated requests KOC did not provide all required materials. Thus, the KOC Feasibility Study was not provided with reference that it had lost its actuality. This document is required for assessment of initial parameters of environmental state which were put in the basis of design decisions on construction of industrial and environmental facilities, environmental management action plans within the fulfillment of Kumtor Project." [112]

However, we also observed that the PCR contains several pages of baseline information covering climate, air quality, water resources, fisheries, soils, vegetation, fauna, glaciers, etc. which were apparently based on, or directly quote, information contained in the EIA.[113] This appears to be another example of misleading statements in the PCR, both noting that the EIA was not made available, yet including a rather extensive portion of information from the EIA in the same report.

[110] e.g. AER 2010 page 3.1-3.3.
[111] PCR at 2
[112] PCR at 193
[113] PCR at pages 123- 129

6.6 Key Water Quality Issues raised in the Parliamentary Report

The Parliamentary Commission report raises a number of water quality issues, though it acknowledges that the data it accumulated and analyzed to date is in compliance, as detailed further below. In this section, we focus our analysis and discussion on the key issues pertaining to water quality, which can be segmented into the following major elements:

a) references to reliability of KOC water sampling data
b) the relevance of drinking water standards, which were used by the Commission, in view of the standards and defined compliance points which actually apply to Kumtor,
c) issues relating to results of commission sampling of 42 sites within the Kumtor Mine Area and compliance points; and
d) groundwater issues.

6.6.1 Reliability of KOC Water Quality Data

PCR comments pertaining to reliability of KOC data more generally, including a specific statement referring to water sampling, are also discussed in detail further below. Our review of KOC's reported water quality sampling and disclosure of results in AERs does not suggest material deficiency. We also note that for compliance, KOC relies on a third party, independent, Kyrgyz certified laboratory (Alex Stewart Assayers), which was also visited by Prizma in preparation of this report and which is subject to Quality Assurance and Quality Control.[114] It is our opinion that the PCR's assertions relating to reliability of water quality sampling and data lacks supporting or material evidence and is contrary to the processes described in Kumtor's AERs.

6.6.2 Other water quality and QA/QC issues

While the PCR does not provide a description of QA/QC protocol for its samples, our review shows that Kumtor proactively determines the reliability of water quality measurements through annual QA/QC protocol. In fact, the QA/QC protocol is described in Kumtor's AERs and is aimed at providing consistent collection and handling of samples and data. Kumtor's QA/QC process includes the submission of approximately 10% of the samples analyzed at Kumtor's contract laboratory and involves duplicate, blind and random blank samples. The results of this QA/QC process are also reported in Kumtor's AERs and do not appear to suggest material shortcomings.

6.6.3 Applicable water standards

As noted in the Parliamentary Commission report, the Commission appears to be using the Hygienic Rules GN 2.1.5.1315-03 on Maximum Allowable Concentrations (MAC) of Chemicals in Water for Drinking[115], Household and Domestic Use as its benchmark to evaluate the data obtained from the May, 2012 sampling round. This suggests that the Commission appears to have applied the wrong benchmark in terms of applicable water standards. The Kumtor River, which receives treated effluents, direct discharges and run-off, is classified as a "Communal Use Stream" (and not a drinking water source

[114] AER, 2010 page 6.19 AER 2011,
[115] PCR at 190

stream). This signifies the need for the Commission to use other MAC values as the appropriate benchmarks (see also discussion on compliance provided in Section 6.6.4 below).

We also note that elsewhere in the PCR references are made to the appropriate MAC-MAD standards:

> e.g. "The environmental normative-technical documentations were analyzed (ecological passports, standards of MAC, MAD of pollutant substances"[116]

A diagram of Kumtor's surface water sampling locations- including the 'End of Mixing Zone' (W.1.5.1) compliance point is presented in Figure 2. It is also important to note that concerns about water quality are often raised in the context of the nearest town of Naryn (shown in Figure 1), which is located some 200 km downstream of the Kumtor mine and close to Kumtor's sampling location W1.8. This has important implications in terms of contributions and/or dilution by dozens of other tributaries which form part of the same hydrological system. We also note that the reporting of water data analyzed from this point do not point to material compliance concerns with KR water quality standards.

Reviewing standards contained for specific parameters in Kumtor's discharge requirements for effluent shows that, for some parameters, these have become substantially more stringent since various government appointed commissions have started their critical investigations of Kumtor. Several important parameters, such as Total Suspended Solids (TSS), are either materially out of touch with reasonable and achievable industry standards (as defined by IFC guidelines), do not appear to be risk or impact driven, or do not recognize the existing background levels.

6.6.4 Kumtor's compliance point

The Commission's assertions that samples taken within Kumtor's boundaries, particularly those from Kichi-Sary-tor River, Chong-Sary-Tor River and the TMF may be exceeding certain MAC values in water samples conjure up compliance concerns. It is, therefore, important to note the location of the compliance point that actually applies to Kumtor. Overall, this is defined by two points: first, the sampling point W1.8 (approximately 2 km upstream of Naryn as per Kyrgyz regulatory requirements) and sampling location W1.5.1, the latter also referred to as 'End of Mixing Zone' and shown in Figure 2.

In addition, Kumtor has to meet certain 'end of pipe' discharge requirements relating to its Effluent Treatment Plant (ETP, involving the INCO/cyanide treatment processes) and Sewage Treatment Plan (STP). Both of these 'end of pipe' compliance points discharge upstream of Kumtor's mixing zone, at the end of which certain water quality standards have to be met.

The Commission's allusion to possible elevated concentrations of constituents (i.e. 'spot checks' within the Kumtor mine infrastructure) can provide useful performance information (assuming results are reliable). However, 'spot conditions' within and around the Kumtor concession area do not provide the most appropriate basis to determine Kumtor's overall compliance status, an important omission in the PCR, which specifically expresses concern over elevated concentrations of lead in the tailings pond,

[116] PCR at 196

within the Project Area and above the compliance point, and alludes to concerns in small streams originating at, or near, waste rock areas.

Though omitting any data from, or discussion of, the Kumtor Project surface water compliance point, the PCR does note that for the water quality parameters sampled, KOC was indeed in compliance even with the more rigorous MAC Household and Community water quality standard – stating the following:

> "The analysis data of the table shows that … at all streams of Kichi-Sary-Tor River, in the water of mountain flows from the melting Glacier Kichi-Sary-Tor, Davydov Glacvier, pump station of Petrov Lake, the Lake Petrov itself, the River Kumtor… Lysyi Creek, the River Chon-Sary-Tor comply with MAC for household and community water."[117]

6.6.5 Kumtor's impacts on local fisheries

The PCR makes a brief reference to the need to assess impacts to fisheries in the river Kichi-Sary-Tor[118]; another reference to fisheries (red river trout) in relation to groundwater impacts from the TMF: "ground water and adjoining water bodies flowing to the red trout River are polluted by toxic substances that have a negative impact on leaving organisms and water quality due to the lack of protective liner in the tailings bottom"[119]; and there is also an allusion to possible impacts from Kumtor to fish populations near the village of Naryn: "Before the mining, the Red Trout inhabited the river, now moved to the shallow water, and the creeks near the river".[120]

Our review notes that presumed impacts, if any, to fish populations in Kichi-Sary-Tor River are not likely to be significant. The baseline data (from the EIA- also included in the PCR) and other facts do not support the notion that there is a significant historic population of fish in the streams in question, or the greater Kumtor project area. We note that the PCR cites the baseline study and presents this information citing that the loach, in particular, has no economic value. Impacts from groundwater seepage from the TMF are also discussed further below. Further, based on our earlier reviews of data, impacts, if any, to fish as far away as Naryn (at a distance of 200 km from Kumtor) would not be expected to associated with Kumtor's operations[121] and reports by UNICEF and the EC-funded Naryn Environmental Management Plan discussed in Section 5.3 identify other and more relevant source of water quality degradation.

6.6.6 PCR commission sampling of surface water within the Kumtor Mine Area

Owing, in our opinion, to unresolved questions on the part of some Parliamentary Commission members concerning water quality issues raised by earlier government evaluation of the Kumtor Mine, samples were collected at 66 sites within the Project Area and analyzed for a variety of parameters[122]. Results

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[117] PCR at 188
[118] PCR at 191
[119] PCR at 201
[120] PCR at 122
[121] Prizma, 2012 at page 33
[122] The analysis comprised the following parameters: pH, conductivity, temperature and concentrations of six parameters, including: Zinc (Zn), Arsenic (As), Selenium (Se), Cadmium (Cd), Lead (Pb), and Copper (Cu)

presented in the PCR represent 42 of the samples collected during the May, 2012 site visit. The results of the remaining samples have not been reported and our discussion is, therefore, limited to the results presented by the PCR.

Our review points out that the PCR finds Kumtor to be in compliance for the parameters sampled:

> "The analysis data of the table shows that the background concentrations of zink (Zn), arsenic (As), selenium (Se), [cadmium] (Cd), lead (Pb) and copper (Cu) at all streams of Kichi-Sary-Tor River, in the water of mountain flows from the melting Glacier Kichi-Sary-Tor, Davydov Glacvier, pump station of Petrov Lake, the Lake Petrov itself, the River Kumtor (from the north bridge side), Lysyi Creek, the River Chon-Sary-Tor comply with MAC for household and community water consumption (hygienic standards HS 2.1.E.1315.-03)".[123]

We note that Table 3 "Table 3 Microelement analysis of water samples (order 583D)" appears directly below this statement from the PCR quoted above, thus we assume it to be in reference to Table 3.

We observe many opportunities for confusions, especially for the lay reader, as unit of measure for data presented in Table 3 is stated as ug/l: "Mass concentration of elements, ug/l (relative fault of measurements results from 10 to 40 % under P=0.95". MAC standards are presented as mg/l: "Note: MAC for As-0.01mg/l, Cb-0.001mg/l Pb-0.01mg/l, Cu-1 mg/l, Zn-1 mg/l, St- 0.01mg/l (as per HS 2.1.т.1315-03."[124]

We also point out that after Table 3 the following statement appears, which reiterates compliance, but also refers specifically to data observed from a water sample from the tailings pond:

> "It should be noted that the content of zinc, cooper, [cadmium] and other ingredients in water samples are varied in the limits of 0.01-0.03mg/l, 0.008-0.02mg/l, 0.0005mg/l, accordingly, under the MAC of 0.01mg/l, 1mg/l, 0.001mg/l for household and community water consumption. **At the point T8.1 of tailings pond the samples contained zinc–1.45mg/l, selenium-0.21mg/l, CNDmium-0.001mg/l, cooper-12.95mg/l accordingly, thus, it is required that the significant tributaries containing these HM will be** analyzed in details" [emphasis added]. [125]

As discussed elsewhere in our assessment, there is no context in terms of significance of sampling locations presented in the PCR. We note that the samples collected at the tailings pond would be expected to have relatively higher concentrations of these parameters. This is why, in fact, Kumtor designed and built an Effluent Treatment Plant to treat the tailings pond water prior to discharge. In any case, the Parliamentary Commission samples collected in 2012 are, in fact, in line (or even at lower concentrations) than those reported by KOC in AERs.(e.g. AER 2010 page 7-14). We point out that there is no qualifying statement as to the fact that this sample location is above the compliance point, would

[123] PCR at 188
[124] PCR at 188 - 190
[125] PCR at190

be expected to have high concentrations of metals and is subject to treatment and dilution prior to reaching Kumtor's compliance points at W1.5.1 and/or W1.8.

Other references to surface water in the PCR make note that there is a need to pay particular attention to water quality in the small streams that flow below Waste Rock areas: e.g. "Contamination of melting water flowing from the Glaciers Davydov, Lysyi and Sarytor by ferrum compounds which is abound in waste rock stored on the glaciers."[126]; "Offer to Kumtor mine to be more humane with environment of the foothills and mountain areas of Kichi-Sary-Tor and Chon-Sary-Tor as well."[127]

The PCR also comments on high conductivity values associated with samples from some of these streams:

> "The analysis results of the Table 2 show that considerable content of heavy metals was identified in the water samples of upstream, downstream and middle stream of the River Kichi-Sary-Tor, confluents points of water flowing from the wastes to the aforesaid river, pump station №1, ETP (from tailings pond) comparing to the other water samples-code. Possibly it is related to considerable content of heavy metals though PH indicated in the table 2."[128]

We note that the issue of management of water quality in these streams has also been identified by KOC (and previous KR commission reports), with specific reference to both on-going operations and closure planning. For example, Kumtor's latest CCP study notes that:

> "Forecasting water quality at the end of operations suggests that there is a likelihood that sulphate concentrations at the EMZ will routinely exceed 500 mg/L. However, it should be noted that sulphate at these concentrations is non-toxic to aquatic organisms and the levels anticipated do not pose a serious threat to degradation of water quality in the Kumtor River."[129]

In our opinion, the Commission's sampling results do not contribute new information that is not already disclosed by Kumtor. However, some of the Commission's results, which are consistent with Kumtor's own reporting (including 2010 Conceptual Closure Plan), indicate a need for Kumtor to further consider certain water quality aspects related to, for example, waste rock storage, in future mining plans and mine closure plans.

[126] PCR at page 176
[127] PCR at page 191
[128] PCR at page 187
[129] Lorax Environmental, 2011, p. v
*PCR at 209
**PCR at 177

6.7 Soil issues

The PCR makes only brief references to soil monitoring or data, but states that there is no monitoring for soil in the final sections pertaining to environmental issues:

> "The complex monitoring program of all environmental components at the area of Kumtor mine impact zone is not worked out, there is the state monitoring only for water quality, the system of public environmental monitoring is not worked out, there is no monitoring of soils state, Flora and Fauna."[130]

Additional references to soil-vegetation impacts are discussed in the "Assessment vegetation at Kumtor Mine Area" by KRNAS Biological Sciences graduate student. A. Usupbaeva, stating: "The **direct soil-vegetation (destruction)** because of the KOC operations was detected"

Our review notes that soil monitoring was part of the EIA baseline studies and has also recently been included in the EMP. During 2011, soil samples were collected and analyzed from 11 sites within the Project area, including several around the TMF, the explosive magazine, mill, several buildings, several sites in the Pit, and a background control near the Kumtor River.[131]

6.8 Air Quality monitoring

The PCR contains a short section pertaining to air quality monitoring by Kumtor, where it challenges the completeness of KOC reporting, questions the legality of burning of solid domestic wastes and food wastes, raises concerns about the validity periods of some State authorized permits (though it also acknowledges that no issues were raised by KR State authorities in this regard)[132], raises concerns regarding evaluation methods used by KOC to estimate emission volumes from fixed and mobile sources[133], and briefly alludes to impact assessment from dust in Barskoon Gorge and at the Kumtor mine site.

The PCR also presents a discussion of apparent changes in MAE norms – stating: "For KOC, the MAE must be estimated on the basis of OND-86 (ОНД-86); and KOC violated the established order of design and approval of MAE norms. The design of MAE norms is conducted annually whereas the actual volume of emissions should be determined annually and MAE norms are approved for 5 years".[134]

We observe that the PCR recognizes the fact that KOC does indeed have an air quality monitoring program, stating:

> "KOC program on control of emissions caused by operations and environmental monitoring program provides: determination of scrubbers effectiveness; monitoring of emissions to the

[130] PCR at 209
[131] AER 2011 page 79-80
[132] PCR at 207: "KOC violated systematically the validity terms of permits received for emissions. Annually, there were some operational periods without the permits. The State authorized bodies did not raise the claims for the damage from unauthorized environmental contamination"
[133] PCR at 206-207
[134] PCR at 206-207

> atmospheric air from the fixed sources at 4 monitoring points – near the TMF, at the Mill South-West, on the East of waste rock dumps and at the area of South-West mining area."[135]

The PCR also includes an unsubstantiated statement pertaining to reliability of KOC (air) emissions which also makes a reference to "payment for environmental contamination", stating:

> "KOC data on emissions to the atmosphere is not reliable; KOC does not include the data on all pollutant substances to the emissions content. Thus, the rate of economic impact caused by KOC pollutant emissions, determined on the basis of this data is not full (normative payment for environmental contamination."[136]

Finally, the PCR makes a blanket conclusion stating: "'The KOC investigations on environmental assessment of emissions impact are not sufficient."[137]

Our review notes that the KOC air quality monitoring program has been operational since the beginning of the mining operations, and key parameters of concern have been, in general, negligible throughout 15 years of operation. As noted in Kumtor's AERs, air monitoring at the mine site now includes five sampling stations (not four as stated by the PCR) at the mine site and additional monitoring station in the Barskoon Gorge (also discussed in Section 3.6), is effective and generally demonstrates levels within compliance of MAE standards for Kyrgyzstan.[138]

6.9 Conclusions and recommendations

Overall, we found the PCR sections relating to environmental management issues to be disjointed and selective. Notwithstanding any opportunities for improvement which can generally be found at every operation, statements contained in the PCR appear to present a prejudicial image of Kumtor's environmental management practices. The report includes independent documents from many different authors and fails to provide a clear summary of conclusions and recommendations, or provide context and explanation of the content included. It is also not clear whether the content and/or conclusions provided by outside individuals or organizations have been adopted by the Parliamentary Commission, or are merely included as content.

The Commission appears to hold KOC to higher standards than any other entity in Kyrgyzstan, and does not acknowledge the extensive body of historic environmental monitoring and reporting that has occurred, focusing on selective and, in our opinion, generally weak or unsupported examples, to infer lack of environmental responsibility. Also, the PCR contradicts itself in many instances, and presents very weak documentation, for many of its assertions. For example there is a complaint about not having access to baseline information contained in the EIA, yet the PCR utilizes this information in various sections.

[135] PCR at 207
[136] PCR at 206
[137] PCR at 207
[138] AER 2011 page 63

Our general recommendations related to the environmental management issues identified by the Parliamentary Commission are as follows:

6.9.1 Water quality

In our opinion, the Commission's water sampling results do contribute materially new information. However, some of the Commission's results are consistent with Kumtor's own reporting (including AERs and 2010 Conceptual Closure Plan). Our review suggests that Kumtor conducts water quality monitoring, particularly including sampling analyzed by accredited and third party laboratories, and discloses results also in its AERs. We find that the PCR does not provide material and substantiated evidence in support of its concerns regarding the overall reliability of KOC water monitoring data and reporting.

a) We recommend that Kumtor should further consider certain water quality aspects related to, for example, waste rock storage, and streams originating at or near these areas, in future mining plans and mine closure plans.
b) We recommend that KOC should further review WRD drainage/effluent water quality and anticipated sulfate concentrations as part of its on-going mine operations and closure planning processes.
c) We recommend that Kumtor reviews opportunities to further reduce the apparent distrust about some its monitoring activities and results. This could include the adoption of community-supported (joint) monitoring, more stringent reporting and assurance processes, review and updates to its water quality program.
d) Kumtor should also consider opportunities to encourage and increase the capacity related to water quality sampling and reporting, particularly in areas such as Naryn, where other documented and likely pollution sources are being attributed to Kumtor.
e) We also recommend that Kumtor reviews the full chain of its overall water quality monitoring program, which largely originated in the mid-1990s, with a view to further upgrade its activities, documentation, training and data management. The latter should be structured to further support internal compliance and assurance processes.
f) Given the major shift in certain applicable standards as of May 2012 for Kumtor, some of which appear inconsistent with a risk or impact based approach and/or generally accepted good industry practices (as defined by IFC requirements), we recommend that Kumtor continues to engage with the regulator to develop more reasonable and feasible standards to avoid 'artificial' non-compliance issues and unnecessary fines.

6.9.2 Soil Issues

Our review notes that soil impacts are not significant on a regional scale. In addition, evidence of soil monitoring was also provided in Kumtor's AER 2011. In our opinion, given the importance of flora related conservation concerns both regionally and within the vicinity of Kumtor, it would be beneficial to explore ways to include additional soil studies as part of Kumtor's routine monitoring program. These could also be performed in conjunction with monitoring of Kumtor and regional flora and include participation with community-based monitoring programs, or outside conservation and research groups, adding transparency and credibility to KOC commitments to environmental responsibility.

6.9.3 Air Quality/Dust Issues

In our review, the PCR did not identify material and substantiated issues that would suggest material violations of MAE standards. However we recommend that KOC should review the specific allegations in the PCR to resolve any differences in understanding of regulatory, monitoring or reporting issues pertaining to air emissions.

7 Waste Management at Kumtor

7.1 Background

Kumtor has been an operational mine for approximately 15 years. It is located at a high altitude (approximately 3,500 – 4,000 m) and subject to permafrost conditions (down to a depth of up to 250 m). The nearest residential community is the village of Barskoon, which is located very close to Lake Issyk-Kul and several hours drive away from the mine site.

The Kumtor mine generates large amounts of waste rock and tailings (which are not discussed further in this section) and, in addition, smaller volumes of different types of industrial and hazardous waste. These wastes are generally stored and/or disposed of within designated areas within the basin of the TMF. During the first stage of the construction of the TMF, a synthetic geomembrane liner was installed to approximately 100 m upstream of the TMF dam. This means that the temporary and/or permanently stored industrial and hazardous waste are located over permafrost and upstream of an engineered and lined TMF structure. In addition, Kumtor's AERs describe efforts to separate and recycle wastes since 2005, which are largely focused on waste oil, scarp metals, wood pallets and plastics.

Also, Kumtor's industrial and hazardous waste will be subject to mine closure activities. This is also noted in Kumtor's latest (2010) Conceptual Closure Plan (CCP). The CCP is updated approximately every three years and is also provided to the Kyrgyz Government. The CCP details also the financial provisions made for the eventual reclamation of Kumtor's industrial and hazardous waste facility.[139]

7.2 Waste disposal context in Kyrgyzstan

A review of the international literature documents major structural challenges related to waste management and disposal in the Kyrgyz Republic. The UNECE's latest (2009) Environmental Performance Review of Kyrgyzstan[140], which was completed with input from Kyrgyz Government and other international experts, summarizes the country's waste disposal conditions as follows:

> "The collection of municipal waste in urban areas has been drastically reduced since the beginning of the 1990s due to the financial difficulties experienced by the municipal sector. In rural areas, many settlements do not have any regular waste collection at all.
>
> Almost all municipal waste disposal sites are lacking bottom-sealing to prevent the pollution of soil and groundwater, and there is no collection of drainage water. Due to the lack of inspection of delivered waste, hazardous waste such as from household chemicals, luminescence devices, mercury lamps, asphalt, oil-contaminated sand, paint, hospital waste and pesticides can be found in the municipal waste disposal sites. The decrease in waste collected by public collection systems has also increased the number of illegal dumping sites. There is a great risk that

[139] Lorax, 2011, see, for example, Table E-1: Summary of LOM Closure Costs for the Kumtor Gold Mine at iv

[140] United Nations Economic Commission for Europe (UNECE) Committee on Environmental Policy, 2009. Environmental Performance Reviews, Kyrgyzstan, Second Review, Environmental Performance Reviews Series No. 28 at page 52

leachate from both legal and illegal waste disposal sites may pollute the groundwater and/or surface water bodies" [141] and;

In terms of hazardous wastes, the 2009 UNECE report notes the following:

> "The number of landfills for non-toxic waste and of repositories for hazardous waste has not been increased and therefore remains insufficient. More than half of existing sites do not satisfy sanitation standards. Uncontrolled dumps are widespread. There is only one landfill site in Bishkek, whose capacity is severely stretched. Only 1 per cent of municipal waste is recycled. There is no waste separation. Charges for waste collection amount to about 30 per cent of costs, in part due to poor payment discipline and little private involvement in waste collection, which is a municipal monopoly."[142]

Based on the above, it appears that the engineered waste disposal facilities available to Kumtor at its mine site are superior to most, if not all, such facilities in the Kyrgyz Republic.

In terms of waste tires, the UNECE report shows that the State Agency of Environmental Protection and Forestry (SAEPF) issued 64 permits in 2007 for the import of used car tires classified as waste.[143] It is unclear which organizations in the Kyrgyz Republic have the capabilities of utilizing waste tires, why such permits appear to have been issued only once (possibly suggesting no routine/continuous process of waste tire utilization, if any at all) and if any of these organizations would also be able to use Kumtor's waste tires.

The UNECE review did not contain any details in terms of hazardous medical waste disposal in the Kyrgyz Republic. However, a 2008 USAID sponsored study[144] sheds light on this aspect and notes:

> "There is lack of appropriate equipment for segregation, collection, transportation and final disposal of health care waste, and for personal protection of health care workers. Health care waste (sharps, infectious, non-infectious) are dumped together in an unprotected area that is accessible to people, animals and birds. There are no incinerators in any of the hospitals for treatment of sharps and infectious waste. Burning (in a hole or in a container) was the main method of sharps disposal causing serious environmental hazards."[145,146]

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[141] UNECE, 2009 at page 52
[142] UNECE, 2009 at 150
[143] UNECE, 2009,Table 2.1 at 40
[144] I. Hossain and J. Songa. 2008. Situation Analysis of Infection Prevention and Control in Bishkek and Osh, Kyrgyzstan. Bishkek, Kyrgyzstan: AIDSTAR-One through the Making Medical Injections Safer Project for the Office of the Global AIDS Coordinator and the US Agency for International Development.
[145] I. Hossain and J. Songa. 2008, at 8
[146] Since the USAID sponsored study published in 2008, additional work has been carried out with the support of the Swiss Government and the Swiss Red Cross focused on Health Care Waste Management in Kyrgyz Hospitals (project area - Batken, Osh, Jalal-Abad, Chui oblasts), [although the result of this effort has not been published – I have requested an update from the source].

The above highlights the structural capacity limitations and challenge that apply to Kumtor and, presumably, all other medical waste generators across the Kyrgyz Republic, to source appropriate national medical waste management and disposal services.

In terms of the institutional and regulatory context associated with waste disposal in Kyrgyzstan, the UNECE report notes the following:

> "Many existing environmental protection and natural resources laws in Kyrgyzstan, e.g. on environmental protection, air protection, industrial and domestic waste and fauna, are framework acts. To be implemented, they need to be reinforced by more detailed regulations from the Government or the competent ministries, committees and agencies. This is not always the case."[147]

This means that the detailed requirements relating to such framework laws needed for organizations for appropriate planning, implementation and reporting of waste management strategies are still not fully or clearly defined and, thus, create very practical challenges.

7.3 Key issues raised in the Parliamentary Report

The PCR notes that Kumtor "disposes of industrial and domestic wastes at the disposal areas without the appropriate permits of the KR state authorized bodies"[148]**.** Several similar allegations are also provided elsewhere in the PCR, such as one stating "solid industrial (toxic and nontoxic) and domestic wastes are stored at several non- authorized and not equipped areas; there are no facilities specially constructed for disposal of solid wastes"[149].

PCR criticizes waste disposal practices related to the mine site's medical center, and lack of use of "accessible modern technologies" for tires stored at the mine sites.[150] Based on these and other alleged inadequacies, the PCR alleges "many faults in [Kumtor's Operating] [I]nstructions" with "many provisions [in] direct violation of provisions of laws and other KR regulative-legal acts."[151]

The PCR notes that Kumtor has not provided complete and reliable waste inventories, including "full information on industrial wastes to the State Statistic Report (form – 1-wastes)"[152], exemplifying this and other alleged deficiencies by noting that carbon fines, waste rock dumps and sewage sludge were not reported as wastes.[153]

The PCR also raises questions why environmental pollution charges (the term used in the 2009 New Agreements) have been capped to US$310,000.

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[147] UNECE, 2009 at 32
[148] PCR, 2012 at 198
[149] PCR, 2012 at 200
[150] PCR, 2012 at 201
[151] PCR, 2012 at 202
[152] PCR, 2012 at 202
[153] PCR, 2012 at 202-203

7.4 Analysis of assertions

PCR's selective and disjointed review of information is confusing. In terms of licenses and permitting related to hazardous materials, the PCR lists, for example, License № 014. This was issued by the SAEPF and is entitled "Dispose the toxic materials and substances at Kumtor mine TMF in the volume of (two hundred) 200 m³ annually."[154] Also, comments by PCR appear to omit the broader context, history, reporting, permitting and inspections of the Kumtor project over the past 15 years.

The approved 1993 EIA already identifies the presence of a waste disposal site adjacent to the tailing containment area and that hazardous wastes will be collected and stored on site, although their removal to acceptable (licensed) facilities was also anticipated (the UNECE study discussed in Section 7.2 further above highlights the lack of such acceptable off-site facilities). Also, a review of Kumtor's old and new AERs, for example the AER for 2006, report Kumtor's routine domestic, industrial and hazardous waste disposal practices on-site, and highlight the presence of related permits which do not appear to have been challenged by various Government inspections carried out from time to time. In fact, unlike assertions by the PCR suggesting Kumtor was not meeting all its environmental policies and instructions, it appears that Kumtor was interpreting and adopting most of them in line with its available (limited) options and, through that process, generally attempting to reduce its operational footprint.

The references to alleged insufficient waste reporting related to carbon fines, waste rock and sewage sludge in PCR do not seem to add up to material non-compliance or reporting issues for these three reasons. First, it is unclear why Kumtor would be making a material omission by not reporting its carbon fines as wastes. This is because recovered carbon fines, which are stored in secured containers at the mine sites for future processing, contain recoverable gold, as recognized elsewhere in the PCR[155]. Second, the volume and characteristic of waste rock places it in its own reporting category and it is understood that Kumtor routinely reports these in its general mining plans to the relevant Government agencies. And finally, Kumtor's AERs, including for 2011, show the presence of a permit for treated sewage discharge[156] and related Government inspections[157] that appear to generally sanction (accept) Kumtor's management of its sewage sludge.

In terms of the set pollution fees, our review shows that this was part of a considered contractual agreement approved by the parties involved with Kumtor and Kyrgyz Government, and that the agreement was also approved by the Kyrgyz Parliament.

[154] PCR, 2012 at 200
[155] PCR, 2012 at 202-203
[156] See Kumtor, 2012, Table 3-1: KOC Environmental Permits at 28
[157] See Kumtor, 2012, Section 3.6 Inspections noting: "March 28: Inspector Ch. Chukumbaev and O. Shestova, Chief Specialist of ITDEPDFE, with participation of T. Chynybaev, Engineer of Eco-Service Design Organization, conducted inspection of KOC Sewage Treatment Plant (STP) and Effluent Treatment Plant (ETP); samples of wastewater before and after treatment, and after disinfection were taken in order to analyze effectiveness of STP and ETP operations" at 30.

7.5 Prizma conclusions and recommendations

In our opinion, Kumtor's past and current waste management practices are not always fully consistent with best international practice, largely because of very limited, if any, appropriate waste management capacity and markets in Kyrgyzstan.

In our opinion, the PCR has identified a number of important opportunities for improvement. Kumtor should continue to liaise with the government for guidance on planning and reporting of its waste streams in line with emerging regulatory requirements. Kumtor should further improve documentation and inventories, medical and hazardous waste disposal practices (including considering off-site disposal/recycling options which are now available), and scaling up Kumtor's other recycling/reuse efforts. This will also necessitate update to its Environmental Procedures and Operating Instructions.

However, it is also our opinion that the thrust of the PCR is focused on painting an unbalanced, confusing and prejudicial image of Kumtor's waste management practices. This becomes obvious when considering that PCR omits the severely limited, if not complete absence of, appropriate municipal and hazardous waste collection and recycling facilities across Kyrgyzstan. These structural deficiencies are clearly identified in seminal UNECE and other studies.

It appears that a more balanced review of Kumtor's waste management facilities, which does not ignore capacity limitations in the country, would identify that Kumtor's facilities are still superior to most, if not all, existing waste collection facilities in Kyrgyzstan: unlike most, if not all, of its Kyrgyz 'counterparts', Kumtor waste management facility is contained within an engineered structure, has sufficient capacity, is located over permafrostand far from any populated areas or used groundwater resource, has adequate financial resource allocation, is actively managed, is routinely monitored,inspected and has made provision for its eventual closure.

8 Data Reliability and Transparency

8.1 Background

Before summarizing the key assertions contained in the PCR, we note that the report by Parliamentary Commission was preceded by the Interagency Commission's report and Prizma's corresponding Independent Assessment[158]. The Interagency Commission also covered several issues associated with data reliability and transparency, which we found to be baseless, and observe that similar issues now also covered in the PCR.

However, unlike the Interagency Commission, the PCR not only asserts data reliability concern, but also accuses Kumtor of data falsification. We reviewed related examples provide in the PCR and found its accusations to be baseless, out of context, immaterial or misleading, as detailed below.

To provide a context and show the contrast to Kumtor's approach to ensuring data quality, we refer the reader also to Section 5.2 (Context of water monitoring in Kyrgyzstan) and the sections quoted therein from the UNECE Second (2009) Environmental Performance Review of Kyrgyzstan. In summary, the country's monitoring network is considered inadequate, it does not meet Kyrgyzstan's own water monitoring legislation, state laboratories are not certified or accredited, they don't meet the requirements of international standards, and there is no integrated data management system in place. At the same time, the 2009 UNECE study singles out Kumtor as the only company in Kyrgyzstan which publishes an annual environmental report.

8.2 Key data reliability issues raised in the Parliamentary Report

The PCR focuses on the following topics pertaining to reliability of Kumtor environmental data:

a) Alleged falsification of data;

b) Alleged reliability of data;

c) Specific references to international audits; and

d) Transparency

Our interpretations of PCR discussions of falsification and/or reliability of data, based on our review of the facts, including several independent international audits performed at Kumtor since 2005, and issues pertaining to transparency are presented below.

8.3 Alleged "falsification" of data

At several points, the PCR asserts that Kumtor "falsifies" information in official documents. At one point, in a general context, the PCR states that:

[158] Prizma, 2012. Independent Assessment of the "Interagency Report" and the "Moran Comments" on Compliance with Environmental and Industrial Safety Standards at the Kumtor Gold Mine, Final Report, 23 April 2012, which has also been web-posted on Kumtor's website.

> "KOC provides the falsified environmental data regarding the real state of environmental activity at the facilities, and compliance with the KR environmental legislation requirements. Many KOC statements are not complying with the real state; the data on industrial and domestic wastes, pollutant emissions are not full and reliable"[159] and "KOC enters not reliable information to the technical documentation and KOC Annual Environmental Reports (AER), i.e. **falsified** information is entered to the official documents."[160]

Elsewhere in the PCR, specific examples are presented to provide evidence of "falsification". We reviewed several specific examples provided in the PCR pertaining to "falsified" information and determined most of these are actually based on mis-quoted or mis-translated statements, or are otherwise immaterial or baseless issues. For example, the PCR notes the following regarding the geomembrane liner installed in the TMF:

> "c) In the Report of Centerra Gold of March 15, 2012 "Annual Information Form for 2011" it is indicated that «geo-membrane liner of high density (HDPE) is laid up to the dam on the natural soil at the area on impoundment, which is extended to the upstream on **hundreds meters** [*sic*] from the downstream of the dam toe» (p.41). As per KOC AER and the words of KOC staff, the liner is put only on 100 m."[161]

Our review of the Centerra Gold's Annual Information Forum covering 2011 reveals a different sentence, which is, in fact, consistent with the information provided by KOC staff:

> "A high-density polyethylene ("HDPE") geomembrane liner has been placed on the upstream face and extends **one hundred metres** upstream of the dam toe on natural ground into the impoundment" [emphasis added].[162]

Further reviews show that the identical information ("one hundred metres") is also provided in Centerra Gold's AIFs covering 2010 and 2009. In other words, the information being consistently provided by Centerra and Kumtor in numerous public disclosures relating to the extent of the geomembrene liner in the TMF has not been "falsified" but is being misread, misquoted or misrepresented by the Parliamentary Commission.

Similarly, we are unable to find the basis for the following reference in the PCR, which is used as another example of "falsified information":

> "In 2010 AER it was noted that special plots surrounded with earth banks and isolated with liner were constructed for different wastes (pp.6.15), filtrate is discharged from the wastes to the

[159] PCR, 2012 at 197
[160] PCR, 2012 at 205
[161] PCR, 2012 at 205
[162] Centerra Gold, 2012. Annual Information Forum For the Year Ended December 31, 2011, dated March 15, 2012

tailings facility and further is treated (pp.6.16). Actually, this is not true, the prove is the acts drawn up within the visits to Kumtor mine on April 29, May 11-15, 2012;"[163]

Based on our review of the 2010 AER, we assume this refers to section 6.7: "Pads and trenches have been constructed with earthen berms and liners, to handle the various types of waste materials"[164] Speculating about the context and content of the above quote from the PCR, we assume that this may relate to mistranslation or misunderstanding on the part of the Commission. We note that any fluids in or reporting to the TMF are subject to treatment by the ETP prior to discharge to the Kumtor River. In any case, this does not appear to be a real or material example that justifies the use of and implications of the term "falsified information".

8.4 Alleged unreliability of data

At several points in the report, the Parliamentary commission implies, or directly states that Kumtor's environmental data is "unreliable". We reviewed and include the following examples to highlight the baseless statements in the PCR in relation to reliability of Kumtor's data.

The PCR makes a brief statement referring to reliability of KOC water quality monitoring of surface and ground water, based on two references: a) Professor K. A. Kojobaev (2010) on the basis of his water analysis at the mine area makes a conclusion about "inadmissible high content of toxic heavy metals" in the water; and b) reference to comments by Dr. Robert Moran that point out high conductivity in the Kumtor River. The PCR then states: "These separate facts put apprehensions in trustworthiness and reliability of ground and surface water monitoring conducted by KOC."[165]

Prizma's review of the facts concludes that this statement is misleading and out of context; makes no reference to where "inadmissible high content of heavy metals" occurred; ignores extensive KOC data, including use of third-party laboratories and QA/QC (see also discussion in section 6.6.2) and also relies on speculative opinions from the Moran Comments[166] based on his sampling which were not even collected within the Kumtor mine site.

The comment of K.A. Kojobaev appear to relate to implied concentrations of heavy metals that are not based on actual samples or actual analytical results, but rather implied from conductivity readings observed below the Kumtor Mine. In our opinion, using high conductivity from a sample taken off-site to support such a comment about "inadmissible high content of toxic heavy metals" – inferring that

[163] PCR at 205
[164] KOC, AER 2010, 6-14
[165] PCR at 172
[166] Prizma has reviewed the full report containing these Moran Comments in detail. Dr. Moran was not a part of this – or any other - official KR Commission. He also did not participate in any on-site sampling activities by any of the official Kyrgyz Commission. In our opinion, simply appending his comments without clarification and context to the PCR is misleading. In any case, Prizma assessed Dr. Moran's comments, which formed an appendix to the Interagency Commission's report. We found his comments to be tainted by a conspiratorial tone, questioning the competency and capacity of Kyrgyz agencies, international lenders and their consultants, and professional capabilities and ethical conduct of numerous international engineering and environmental consultants. We also found his comments to be largely baseless, scientifically implausible and quite inaccurate.

Kumtor is the (only) source – do not substantiate conclusions drawn by the PCR and ignore that water quality parameters are generally within allowable concentrations at the regulated KOC compliance point (see also further below for further discussion and clarification of compliance). As we have noted in earlier reviews, the specific Moran Comments cited here appear to ignore readily available information that addresses Kumtor's water quality and, instead, speculates – based on hearsay - that Kumtor's monitoring data may be unreliable.

It is our opinion that the assertions relating to reliability of water quality sampling and data in the PCR are not substantiated with supporting and material examples and are contrary to processes described in Kumtor's documents, also reported in AERs which describe methods of collection, handling, preservation and documentation of water samples. We also note Kumtor's use of the international and locally accredited Alex Stewart Laboratory based in Kyrgyzstan.

8.5 References to international audits

In an effort to strengthen its accusations relating to lack of reliability of Kumtor's monitoring data, the PCR also makes reference to its evaluation of audit reports by international consultants SENES[167], WESA[168] and Citrus[169]. As detailed further below, we note that the issues raised by the PCR rely on a preliminary draft report, are misquoted, ignore the context, are immaterial, or have since been resolved as explained in detail and with specific examples further below. We also note that, given the large body of internal and external monitoring and inspections, the issues noted in the PCR do not change the overall conclusions of Kumtor's monitoring program.

In reference to the SENES audit of the HSE Management System in 2009, the PCR states:

> "The data of instrumental measurements of pollution substances conducted by [KOC] is not reliable. KOC did not execute properly the requirements on calibration of laboratory equipment; the correctness of measurements results process was not provided; there are mistakes in indication of measurements units: milligrams instead of grams (the mistake in 1,000 times), liters instead of m³ (the mistake in 1,000 times)."[170]

Apparently citing directly from the SENES Audit, the PCR includes:

> "p.7: «there is no any objective or indirect indication that the monitoring equipment underwent the regular calibration ». p.8: «The usage of not calibrated equipment may cause the collection and provision of incorrect, not reliable data and negative public opinion»."[171]

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[167] Senes, 2009. Kumtor Operating Company: Safety Health and Environmental Management System Audit September, 27 - October 3, 2009

[168] Wesa Inc., 2008. Industrial Hygiene Assessment (Gap Analysis) and Sampling Program Development, Preliminary Report dated December 2008

[169] Citrus Partners LLP, 2008. Environmental Management Assessment, Kumtor Operating Company Kyrgyzstan, December 2008

[170] PCR at 198

[171] Op cit. or PCR at 198

We note that, as in other instances in the PCR, we did not find these citations (even allowing for translation drift) in the original SENES document or that important additional information and context provided were omitted by the PCR. We observe that the PCR omits the fact that SENES's identifies calibration issues only for a selected few instruments. Also, the PCR omits the fact that SENES did not explicitly state or otherwise imply that Kumtor's monitoring data was actually unreliable and/or indicative of the presence of serious and undetected hazards. This is also clearly noted in recent statements provided by SENES following Prizma's request to clarify the comments contained in the PCR (see Appendix 3).

A balanced expert review of the impacts of theoretical 'calibration drift' on data accuracy that may or may not be present in the instruments identified by SENES would confirm that the related theoretical margin of error would be insignificant when compared to the compliance margin that is generally demonstrated by Kumtor's data against relevant standards. These, in turn, have additional wide margins of safety to safeguard against occupational health and safety risks. This is described more fully using specific examples of relevant equipment and Kumtor's data in SENES' recent update contained also in Appendix 3.

Moving away from theoretical discussions, we note that Kumtor actually acted on the recommendation provided in the international audits and, using new and/or calibrated equipment, continues to demonstrate compliance with relevant standards. In other words, the accusations in the PCR are misleading at both theoretical and practical levels.

The improvements made to equipment, calibration, training, data management and revalidation of certain erroneous (old) data entries are discussed more fully in updates provided by WESA (see Appendix 4). In its update, WESA notes the following:

> "Kumtor currently only carries out industrial hygiene sampling using validated and globally accepted NIOSH Methods […] with sample analysis using an AIHA-accredited laboratory. […]" and continues that Kumtor's "Industrial Hygiene Quarterly Monitoring Plan has been diligently adhered to for over a 4-year period. There is sufficient data to give the site evidence of worker exposures to various contaminants in order to determine appropriate and adequate controls (engineering, ventilation, isolation, enclosures, personal protective equipment, ongoing monitoring) are in place for the protection of workers and to prevent exposures."[172]

Finally, based on misrepresented or omitted information relating to the SENES and WESA audits, the PCR makes the following baseless and misleading statement:

> "In this connection, the conclusion was made about unreliability of these instrumental measurements on pollutant substances conducted by KOC. However, these facts were not

[172] WESA, 2012 at 6-7

shown in KOC AER, there are no measures taken to eliminate the identified lacks and violations."[173]

As shown further above, concerns raised by the PCR pertaining to reliability of data appear to be misquoted, misstated, misrepresented, resolved or immaterial. This means that the PCR statement noting that "no measures taken to eliminate the identified lacks and violations [sic]" is simply baseless and misleading.

The Parliamentary Report includes also an apparent quote form the Citrus Audit Report. The English translation of the quote in PCR reads as follows:

> "It is not clear from the analysis results of KOC activity how the environmental standards and requirements are taken for execution and how they are actually performed at Kumtor Project."[174]

The original quotes in Citrus' executive summary and the main report are provided below and show that the quote in the Parliamentary Commission Report was both inaccurate and out of context. The relevant section in Citrus' Executive Summary reads as follows:

> "Overall Findings
>
> The overall findings from this assessment are:
>
> - **KOC is in substantive compliance with the requirements of the EMAP**:
> - **Given the age of the EMAP and the associated reference standards (dating to 1995) it is not possible to determine the degree to which the specific provisions of regulations have been implemented as the original regulations are often unavailable;** [emphasis added]
> - The regulatory and commercial environment in which KOC operates has changed significantly since the Project was first approved in 1995. As a result, the degree to which the structure and content of the EMAP is still fully relevant to current and future KOC operations is an open question."[175]

[173] PCR at 209
[174] PCR at 198
[175] Citrus Partners LLP, 2008, at 2

Similarly, the relevant section in Citrus' main report reads as follows:

> "4.2 Regulatory Standards
>
> The EMAP states that:
>
> The Companies shall meet the environmental standards set forth in Volume 3 - Environmental Impact Statement of the Kumtor Operating Company Feasibility Study (KOCFS) dated November 1993 (Attachment 1), as revised April 1994 and May 1995 and shall comply with the Environmental Requirements as defined in the Common Terms Agreement.
>
> **Based on a review of KOC operations, it is not clear how the environmental standards set out (and dating from 1995) are fully integrated into and implemented by the Project**"[176] [emphasis added].

It is evident that the Citrus report simply highlights that some of the references in the EMAP, designed originally to satisfy the requirements of project financiers, are now about 20 years old and may no longer be ideally suited to the current project context. Even without relying on Citrus explicit and repeated statements that Kumtor was "in substantive compliance with the requirements of the EMAP", an important fact omitted in the PCR, a reasonable reading of the Citrus Report does not lead to a conclusion that there are any material performance deficiencies of Kumtor's operations.

8.6 Transparency

The PCR makes also a broad, unsupported statement that KOC does not hold the declared principles of environmental policy regarding transparency, simply stating that: "transparency of activity is not provided."[177] It remains perplexing why a Government Commission laments Kumtor's nationally leading efforts related to transparency and disclosure, instead of encouraging the broader national adoption of Kumtor's routine practices. We observe that the United Nations Economic Commission for Europe (UNECE), which published its Second (2009) Environmental Performance Review of Kyrgyzstan, states:

> "Only one company in Kyrgyzstan, Kumtor Operating Company, publishes a (voluntary) annual environmental report."[178]

As we have also noted in Prizma's review of the 2011 KR Interagency Commission,[179] documenting Kumtor's activities that pertain to transparency, Kumtor is annually subject to approximately 25-30 site visits by regulatory agencies and international auditors and consultants (also on behalf of international

[176] Citrus Partners LLP, 2008, at 14
[177] PCR at 198, 199
[178] United Nations Economic Commission for Europe (UNECE) Committee on Environmental Policy, 2009. Environmental Performance Reviews, Kyrgyzstan, Second Review, Environmental Performance Reviews Series No. 28 at page 52

[179] Prizma Independent Assessment of the "Interagency Report" and the "Moran Comments" on Compliance with Environmental and Industrial Safety Standards at the Kumtor Gold Mine, March 2012 pages 16-18.

lenders). These site visits, inspections and audits have facilitated competent monitoring and supervision, and have resulted in material operational changes, including those related to monitoring of environmental impacts and significant geotechnical aspects of the operation. Inspections are documented and publically reported in Kumtor's AERs.

We also find that key stakeholders, including the Parliamentary Commission and other KR Commissions, evidently had and continue to have access to the mine site and key data. In addition, monitoring data and other summaries are also included in the AERs which are posted on the Kumtor's website. These are also distributed to a variety of Governmental agencies, local schools/libraries and civil society groups in Kyrgyzstan. The distribution list of Kumtor's Russian-language AERs includes key Government agencies, university libraries and schools, and civil society and other organizations as shown in Table 3. Kumtor has also posted its AER from 2010 and 2011 in both English and Russian languages on its website.

In our opinion, such access, reporting and outcomes do not support assertions that KOC "transparency of activity is not provided". We note that, in addition to generating and distributing voluminous AERs, Centerra and Kumtor are also following best international reporting and disclosure practice though their adoption of the Global Reporting Initiative (GRI) and the Extractive Industry Transparency Initiative (EITI).

This continued singular attention on Kumtor, which already appears to be the only company in the country that transparently discloses its environmental performance, seems to suggest that the Kyrgyz Government is applying requirement and standards to Kumtor which are not being applied to any other mining operation in the country.

Table 3: Distribution of KOC's Annual Environmental Reports (source: KOC)

Key Stakeholders	Recipients of KOC's AERs
Governmental Authorities	State Agency of Env.Protection, Gosgortechnadzor, Ministry of Natural Resources, Ministry of Natural Resources, Issyk-Kul regional Dpt. of SAEP, Issyk-Kul regional Dpt. of SAEP, "Issyk-Kul" biosphere territory (Balykchy), San-Epidem.Supervision Dpt., Issyk-Kul regional San-Epidem.Supervis. Dpt., Issyk-Kul State Administration, Jety-Oguz State Administration, Naryn Oblast State Administration, Naryn Regional Env. Comm., KyrgyzAltyn, "Eco-Service" Design Company
Libraries, Universities & Schools	KR National Library, Library of the KR Nat. Acad. of Sciences, Karakol City Library, Balykchy Town Library, Naryn City Library, Tamga Village Library or School, Tosor Village Library or School, Kichi-Jargylchak Village Library or School, Chon-Jargylchak Village Library or School, Ak-Shyirak Village Library, Barskoon Village library or School, Kyzyl-Suu Village Library, Bokonbaevo Village Library, Karakol University, Institute of Biology
Civil Society & NGOs	ZdravPlus, Karakol, ИППДО Фонд Сороса, "Ai-Symal" NGO, Barskoon, "Jety-Oguz Aiymy" NGO, Kysyl-Su, "Kut-Bilim" NGO (Kara-Koo), NGO "Journalist's House", Karakol, "Yak-Tuor" Company, Karakol Issyk-Kul State Histor.& Cultural Museum, "Kelechek" Ecological NGO, Bishkek, Tree of Life (Kalia Moldogazieva), Natalia Ablova

8.7 Conclusions and recommendations

In our opinion, the continued singular attention on and accusations about Kumtor, which was noted by the 2009 UNECE study to be the only company in the country that transparently discloses its environmental performance, seems to suggest that the Kyrgyz Government and/or its appointed Commissions - is applying requirements and standards to Kumtor which are not being applied to any other mining operation in the country.

In our opinion, the assertions by the PCR pertaining to "falsification" or unreliability of environmental data, including those related to calibration, are misquoted, misleading and immaterial or have been remediated. Importantly, the 'post-calibration' data (data collected since SENES/WESA audits in 2009 and after Kumtor installed additional or new instrumentations or improved its calibration procedures) confirms the overall conclusions of previous monitoring data at Kumtor.

Following interviews with Kumtor's staff, reviewing a variety of facts and documents, including the most recent discussions by SENES and the status update provided by WESA, we find that PCR's assertions and concerns about calibration and data quality contained in SENES's audit omits important context and facts, and disregards their practical implications and improvements made.

Prizma's recommendations regarding data reliability and transparency are provided below:

a) Prizma recommends that Kumtor provides the latest submission by SENES and WESA to relevant Government Commissions and their specialists to ensure they can take this updated information into consideration for any future reviews.
b) We also recommend that Kumtor and Centerra continue with their routine international auditing and improvement programs. These enable the application of 'Plan-Do-Check-Act' concept embodied by the ISO and OSHA-type system used at Kumtor, which supports their commitment to continuous improvement in safety, health and environmental areas that pertain to the Kumtor operation.
c) Kumtor my wish to explore the opportunity of applying (sustainability) reporting assurance approaches to its environmental data management system. This would further boost data integrity, credibility and may also simplify GRI-type reporting which has been adopted by Centerra Gold for all of its operations.
d) Similarly, we also note the apparent lack of suitable SHE benchmarking data and statistics in the mining sector (or any other sector) in the Kyrgyz Republic. Kumtor may wish to consider how the development, disclosure and benchmarking of such data could be encouraged. Such opportunities could be generated through collaboration with international bodies (including UNECE, ILO, IFI and donor community), supporting suitable professional associations, academic research, supporting citizenship programs, etc. through sustained (multi-year) grants and awards.
e) Acknowledging the practical challenges and limitations associated with its remote location and need for related capacity building, we recommend that Kumtor should continue to engage with youth groups, community representatives and NGOs to involve them into Kumtor's environmental monitoring programs. We would expect their involvement to improve the credibility of results of these programs.
f) We also recommend that Kumtor considers financial support (grants, prizes, competitions) for organizations and activities of youth groups, NGOs and academic institutions that aim to introduce or expand broader environmental monitoring, reporting and benchmarking in Kyrgyzstan.

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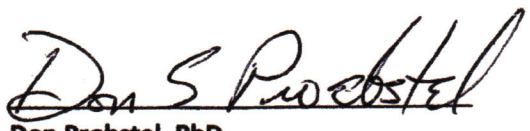
10 Signature Page

This report entitled Independent Assessment of the Parliamentary Commission Report has been prepared for the Kumtor Gold Company by Don Proebstel, PhD, and Mehrdad Nazari, MSc, MBA, LEAD Fellow.

This Final Report is dated 23 September 2012 and respectfully submitted by



Don Probstel, PhD
Senior ESIA & Biodiversity Associate, Prizma LLC

Mehrdad Nazari, MBA, MSc, LEAD Fellow
Senior CSR & ESIA Advisor, Director, Prizma LLC

Appendices

Appendix 1: US EPA facts sheet about Tire-Derived Fuel and its accepted use in portland cement plants and other facilities

United States
Environmental Protection
Agency

April 2005
EPA530-F-05-006
www.epa.gov/osw

Tire-Derived Fuel (TDF)

The Environmental Protection Agency (EPA) supports the highest and best practical use of scrap tires in accordance with the waste management hierarchy, in order of preference: reduce, reuse, recycle, waste-to-energy, and disposal in an appropriate facility. Disposal of scrap tires in tire piles is not an acceptable management practice because of the risks posed by tire fires, and because tire piles can provide habitats for disease vectors, such as mosquitoes.

In 2003, more than 290 million scrap tires were generated in the U.S. Nearly 100 million of these tires were recycled into new products and 130 million were reused as tire-derived fuel (TDF) in various industrial facilities. TDF is one of several viable alternatives to prevent newly generated scrap tires from inappropriate disposal in tire piles, and for reducing or eliminating existing tire stockpiles.

Based on over 15 years of experience with more than 80 individual facilities, EPA recognizes that the use of tire-derived fuels is a viable alternative to the use of fossil fuels. EPA testing shows that TDF has a higher BTU value than coal. The Agency supports the responsible use of tires in portland cement kilns and other industrial facilities, so long as the candidate facilities: (1) have a tire storage and handling plan; (2) have secured a permit for all applicable state and federal environmental programs; and (3) are in compliance with all the requirements of that permit.

More information on the use of TDF in kilns and boilers is available on EPA's scrap tire web site at: <http://www.epa.gov/epaoswer/osw/non-hw/muncpl/tires.htm>. The web site also contains links to other EPA, state, and industry information on the use of TDF.

Appendix 2: Kumtor received its certification demonstrating operations in compliance with International Cyanide Management Code (source Kumtor)

The International Cyanide Management Institute

Hereby presents this certificate in recognition that

Centerra Gold Inc.

Kumtor Operating Company

Has undergone a detailed site inspection and review of its records and documentation by an independent third-party professional auditor meeting the Institute's requirements who has determined that its cyanide management systems, plans and procedures have been developed and are being implemented in compliance with the International Cyanide Management Code for the Manufacture, Transport and Use of Cyanide in the Production of Gold. This certification is effective for three years from the date of this certificate.

President

April 9, 2012

Appendix 3: Senes' August 28, 2012 discussion of calibration finding in its Safety, Health and Environmental Management System Audit of KOC in 2009

Appendix 4: WESA's 2012 Update Report: Industrial Hygiene Assessment and Exposure Monitoring Program Development

SENES Consultants Limited

121 Granton Drive
Unit 12
Richmond Hill, Ontario
Canada L4B3N4

Tel: (905) 764-9380
Fax: (905) 764-9386
E-mail: senes@senes.ca
Web Site: http://www.senes.ca

350614

27 August 2012

Mehrdad Nazari
Senior CR & ESIA Advisor,
Prizma LLC
1972 Woodcrest Circle
Mosinee, WI 54455-8083

Re: Discussion of Calibration Finding in *Kumtor Operating Company: Safety Health and Environmental Management System Audit September, 27 - October 3, 2009*

Dear Mr. Nazari:

This letter report has been provided to provide context to an audit finding related to calibration of environmental and health and safety monitoring equipment identified in the SENES Consultant Limited (SENES) report entitled, *Kumtor Operating Company: Safety Health and Environmental Management System Audit September, 27 - October 3, 2009.* The audit finding in question is reproduced as Attachment A.

This response has been structured through a number of question and answers.

EXECUTIVE SUMMARY COMMENTS

The audit nonconformance related to calibration of safety health and environment (SHE) monitoring equipment was specific and limited to a subset of equipment sampled during the 2009 SHE Audit. Some equipment sampled during this Audit was found to be calibrated on a routine basis. Therefore, this nonconformance cannot be extrapolated and applied to the overall quality of calibration practices for all on-site SHE monitoring equipment.

Overall, SENES concludes that based on its experience, both internally and through our SHE audit experience, the types of equipment identified in the calibration nonconformance finding largely "hold calibration" between calibration intervals. As such, calibrations serve more as a

verification/check of equipment performance rather than as an active act of adjustment to correct for calibration drift. The accuracy of monitoring data based on the use of the equipment indentified in the nonconformance is therefore not expected to be substantively biased either through large over or under measurements of the actual values being measured through calibration drift.

WHAT WAS THE SCOPE AND CONTEXT OF SHE AUDIT FINDINGS?

The purpose of the Kumtor Safety, Health and Environment (SHE) Audit was to:

- gain an understanding of the processes and programmes currently in place for the "implementation" aspects of Safety, Health and Environmental Management System at Kumtor;
- identify gaps between existing in Kumtor systems and the requirements set out in Clause 4.6 and subclause 4.5.1 of the *ISO 14001:2004 Environmental management systems - Requirements with guidance for use* and *OHSAS 18001:2007 Occupational health and safety management systems – Requirements*;
- assess the degree of conformance of established programs and practices implemented in relative to Clause 4.4 and sub-clause 4.5.1 of the ISO 14001:2004 and OHSAS 18001:2007 international standards; and,
- identify any gaps between existing practices and good international practice.

The SHE Audit included over 150 separate *audit criteria* (set of policies, procedures or requirements used as a reference against which audit evidence is compared) addressing Clause 4.4 and Sub-clause 4.5.1 of *ISO 14001* and *OHSAS 18001*.

WHAT INFERENCE CAN BE MADE REGARDING SITE-WIDE SHE CALIBRATION PRACTICES FROM THE AUDIT FINDING?

For this SHE audit, hundreds of pieces of *audit evidence* (records, statements of fact or other information) were collected and assessed for conformance to the *audit criteria*. Given the large amount of audit evidence collected, as per typical SENES practice, the Kumtor SHE audit report focused on those few areas requiring improvement rather than on the numerous areas where site performance conform to the audit criteria.

The scope and breadth of the Kumtor SHE Management Systems, the number of criteria assessed and the finite period of time and finite resources available for the audit necessitated the reliance

on standard audit sampling techniques. As such, conclusions were not, nor should they be, drawn about the degree of conformance for activities not audited.

In particular, it would be incorrect to infer that the reported non-conformances in calibration practices imply that ALL calibration practices at the site were not being properly completed. In fact, audit evidence proves the falseness of this assumption. Given the focus of the audit report on areas on non-conformance, calibration practices verified during the audit as being completed (e.g., pH meters and meteorological station as examples) were not documented in the audit report.

In short, based on audit evidence, one cannot and should not conclude that Kumtor was deficient in all SHE calibration requirements.

HOW PREVELANT ARE CALIBRATION FINDINGS IN SHE AUDITS?

SENES has completed hundreds of SHE compliance and management system audits covering a broad cross section of industrial and mining operations, mainly in Canada and the United States but also around the world. When calibration practices were included within the scope of these audits, it was not unusual to find isolated non-conformances related to the frequency, methods or records of calibrations. In this respect, the identification of calibration issues at Kumtor is not unusual.

SENES cannot, however, provide a definitive statement related to the prevalence of calibration issues identified at Kumtor relative to other sites audited. Monitoring and measurement, of which calibration plays an important role, was one of the focus areas of the Kumtor SHE audit. For most SHE compliance and management system audits, particularly management system audits, monitoring and measuring would be only one of the many diverse elements of the management system audited. As a result, only one or two calibration activities would typically be sampled within a given audit. Many more calibration activities than normal were included within audit sampling completed at Kumtor.

WHAT ARE THE *POTENTIAL* IMPACTS OF THE CALIBRATION FINDING?

The Kumtor SHE audit only identified the presence/absence of calibration practices relative to established practices and procedures and good international practice.

In accordance with standard Centerra audit practices, the *potential* impacts of the calibration non-conformance were provided. These potential impacts are intended to place the findings in

context to assist the audited operation in developing and prioritizing corrective actions. The identified impacts represent potential and not necessarily actual risks. The scope and mandate of the audit did not include an assessment of the significance of potential impacts of this nonconformance on the integrity of the monitoring program. To assess actual risks, the ability of monitoring instruments to "hold their calibration" and the potential impacts of calibration drift and monitoring results versus monitoring standards must be assessed.

In reviewing the business impacts of all audit findings, SENES considers the potential impacts of the calibration non-conformance to be one of the more significant of the *potential* risks identified during the audit. It is our understanding that Kumtor has responded to these *potential* risks through major efforts to improve monitoring programs in general, and the Industrial Hygiene (IH) program in particular. It is our understanding that Kumtor retained WESA to assist in a detailed assessment and refinement of the IH Program, including a determination of equipment needs and associated calibration requirements, redesign of monitoring documentation, and training on Kumtor staff on two occasions in December 2009 and November 2010.

HOW LIKELY IS CALIBRATION DRIFT FOR EQUIPMENT IDENTIFIED IN THE CALIBRATION NONCONFORMANCE?

Calibration Drift is the difference between the instrument response and a reference value after a period of operation without recalibration. Actual business risks associated with the absence of appropriate fully implemented calibration programs for SHE monitoring equipment largely depends on how well equipment "holds it calibration" through its calibration interval. If equipment "holds it calibration" (i.e., little calibration drift) between calibration intervals, calibrations serve primarily to confirm the continued satisfactory operation of the equipment. In this case, the instrument response would provide an accurate (i.e., high degree of agreement between individual measurements and the true value) indication of the monitored value within the tolerances of the equipment.

SENES offers the following comments on the likelihood of calibration drift for the monitoring equipment identified in the calibration nonconformance. These comments are based primarily on our experience with SENES-owned equipment, but also on audit experience in reviewing calibration records at audited sites. These comments are based on the assumption that equipment is maintained in good working order and has not been subject to damage (e.g., by dropping).

Gamma meters: are typically calibrated annually. Through a review of annual calibration records, it is SENES' experience that gamma meters "hold calibration" between calibration intervals. This was established by: (1) comparing "after calibration" data from the prior year

with "before calibration" data for the following year; and (2) comparing "before calibration" data for each year with "after calibration" data for the same year. These comparisons over a number instruments indicated that gamma meters "hold calibration" between calibration intervals since little to no adjustment was made in equipment during calibration (i.e., before and after calibration points were identical) and that calibration point values were similar for each piece of equipment between each successive calibration interval.

Gilibrator 2 Calibration System: is a primary standard, certified for accuracy and traceable to (National Institute of Science and Technology (NIST), used to check air sampling pumps for proper air flow function before deployment. Primary Standards are defined as direct measurements of volume based on the physical dimensions of enclosed spaces. These measurements are not altered by changes in temperature or atmospheric pressures. Secondary standards, which base their calibration upon primary standards, may be affected by temperature or atmospheric change and by mishandling. Secondary standards must be recalibrated periodically in order to assure valid reference measurements.

The accuracy of the Gilibrator 2 System is based on the physical dimensions of the unit, which do not change, and on the stability of the crystal controlled microprocessor Control Unit. Despite being a primary standard, Sensidyne, the manufacturer of the calibrator, *recommends* calibration of the Gilibrator 2 System at least once a year.

SENES and its affiliates experience with electronic primary standards for checking flow rates on air sampling pumps is that the electronic primary standards have little to no calibration drift. Periodic checks of in-house electronic primary standards against a bubble tube (another primary standard) demonstrate the long term stability of the electronic primary standard.

This experience is supported by the experience at Kumtor. It is our understanding that as part of the December 2009 and November 2010 Industrial Hygiene training conducted by WESA, the consultant's electronic primary standard was used side-by-side with Kumtor's Gilibrator 2 System with no discernible difference in calibration outcomes. This side-by-side use of instrumentation suggests that Kumtor's Gilibrator 2 System continued to operate properly.

Hi-Vol Air Samplers: are typically calibrated upon installation or movement, following any maintenance activities (i.e., motor brush replacement, motor replacement), and at least annually (typically quarterly). Our experience is that calibration requirements often driven by motor or motor brush replacements. During such recalibrations, SENES has found no significant variation in the sampler air flow rate (typically +/- 10%. Note that the acceptable range of high-volume samples is 40-60 ft^3/min of air) provided that the voltage variator is not adjusted. SENES has

identified similar performance for hi-vol air samplers included within the scope of SHE audits at client sites.

Noise (Sound Level) meters: are typically calibrated annually and checked with a sound level calibrator (or acoustic calibrator) before use to verify the general performance of the meter. Of the approximately 40 annual calibrations completed on a variety of SENES sound level meters and microphones over the 2007 to 2012 period, only one (1) microphone was ever found to be out of calibration, with calibration drift occurring only at the higher frequency range for low sound levels.

It is our understanding that during industrial hygiene training of Kumtor staff completed by WESA, the consultants sound level meter and calibrator was used in side-by-side measurements to verify the function and accuracy of Kumtor measurements.

Our experience in reviewing sound level meters during audits is similar, with sound level meters tending to hold calibration. SENES experience with the use of in-field sound level calibrators is that the accuracy of the instrument relative to the calibrator has typically been +/- 0.1 dBA. It is therefore SENES' experience that noise meters "hold calibration" between calibration intervals.

Light (Lux) meters: are used to measure illumination (light) levels. Usually light meters are initially calibrated/standardized under a standard light tungsten source of 2856 K. If used under different types of light source, correction factors are required to the measured value. It is our understanding that the use or misuse of these correction factors (or for equipment different with the ability to compensate for colors of tungsten, florescent, mercury and sodium lights, not selecting the correct setting) is responsible for the largest error in light meter readings. Given the cost of a light meter versus the cost of calibration, even in North America, it is usually cheaper to purchase a new light meter than to calibrate an existing meter.

Summary comment: Overall, SENES concludes that based on its experience, both internally and through our SHE audit experience, the types of equipment identified in the calibration nonconformance finding largely "hold calibration" between calibration intervals. As such, calibrations serve more as a verification/check of equipment performance rather than as an active act of adjustment to correct for calibration drift.

IF MEASUREMENTS WERE TO BE IN ERROR DUE TO CALIBRATION ISSUES, HOW DOES THIS AFFECT COMPLIANCE STATUS?

Another way to assess the potential impacts of monitoring equipment being "out of calibration" is to assess monitoring data and determine how close monitoring data are to relevant criteria. The closer measured data are to the criterion or standard, the greater the risk that out of calibration equipment may lead to non-compliance due to inaccurate measurement.

Environmental monitoring data were available to SENES through the 2010 and 2011 Environmental Reports for the operation. The following comments are provided on gamma radiation and total suspended particulate matter measurements.

Gamma Meter - Radiation: The Kumtor 2010 and 2011 annual reports indicate that: *[The] average radiation level for the site is 0.16μSv/hr, which is unchanged since the monitoring program was implemented in 1996. Gamma radiation levels at Kumtor are approximately half of the average background value of the KR (0.255 μSv/hr or 25.5 microR/hr). The average for the site is 0.16μSv/hr, which is unchanged since the monitoring program was implemented in 1996. In 2010, the highest value recorded at Kumtor was in the Pit (0.22 μSv/hr or 22 microR/hr) and the lowest was recorded inside the underground mining area № 1 (0.10 μSv/hr or 10 microR/hr) .In 2010 regardless of altitude, location and time of year, the gamma readings were low and consistent at individual stations.*

Given that the average site radiation level is approximately one-half of the average Kyrgyz Republic background level, and that all locations are below the background level, any minor calibration errors / calibration drift would not be expected to result in a non-compliant situation or to place workers at risk of elevated exposure to radiation.

Hi-Volume Air Sampler - Total Suspended Particulate (TSP): The Kyrgyz 24-hour limit for TSP is 500 $\mu g/m^3$. The Kumtor 2010 and 2011 annual reports indicate that "at all stations, the TSP annual average concentration has been under 100 $\mu g/m^3$ for the past five years [i.e., back to 2006]," with isolated exceedances (e.g., two in 2010 and one in 2011) above the TSP limit reported. Given how far below (a factor of five) the annual average TSP levels are from the Kyrgyz 24-hour limit, any minor calibration errors / calibration drift would not be expected to result in a non-compliant situation, provided that hi-volume air samplers were operating within acceptable air flow rates.

CLOSURE

We trust that this letter report provides the required clarification on the calibration nonconformance included in the *Kumtor Operating Company: Safety Health and Environmental Management System Audit September, 27 - October 3, 2009.*

Yours Very Truly,
SENES Consultants Limited

John Peters, M.Eng., P.Eng. , EP(CEA), EP(EMSLA)
Principal and Director Audit/EHS Group

ATTACHMENT A: AUDIT REPORT EXCERPT

CALIBRATION OF EHS MONITORING EQUIPMENT

Subclauses 4.5.1 of ISO 14001 and OHSAS 18001 require an organization to ensure that calibrated or verified monitoring and measurement equipment is used and maintained and that associated records are kept. Section 20.8 of *EMS Section 20 –Measuring and Monitoring*, and section 18.8 of *HSMS Section 18 - Performance Measuring and Monitoring* also require KOC to ensure that monitoring equipment is calibrated and maintained and records of this process retained.

There was neither objective nor anecdotal evidence that the following monitoring equipment was subject to routine calibration:

- High volume air sampling equipment (hi-vols) used for ambient air environmental dust sampling. The normal calibration schedule for hi-vols is upon installation or movement, following any maintenance activities (i.e., motor brush replacement, motor replacement), and at least annually (typically quarterly);
- Gamma survey meters. Gamma meters are typically calibrated annually with a check source used prior to each sampling campaign;
- Gilibrator 2 Calibration System used to calibrate industrial hygiene personal sampling pumps. The last calibration sticker on the unit indicates calibration in 2004. The manufacturer recommends an annual calibration of the unit;
- Noise meter. Noise meters are typically calibrated annually, with a sound level calibrator (or acoustic calibrator) used to check the general performance of the meter before use. Note that an acoustic calibrator is not available at the mine site; and,
- Sper Scientific Lux Light Meter (840006). Under average use conditions, the manufacture recommends annual calibration.

For some equipment, KOC personnel indicated that periodic comparative checks were made with other equipment (e.g., noise monitor) when third party equipment was on site. KOC personnel also indicated that the calibration for some equipment (e.g., gamma, light and noise meter) was difficult due to the absence of available in-country calibration services. This assertion was not verified during the audit

Business Impact

The use of uncalibrated monitoring equipment has the potential to result in the collection and reporting of erroneous data and may result in the accuracy of monitoring data being questioned leading to public perception risk. Use of uncalibrated equipment also increases the risk of

unacceptable employee exposures (if equipment measurements are biased low) or unnecessary costs for administrative, engineering controls or personal protective controls (if equipment measurements are biased high). Erroneous data may also result in compliance issues resulting from unreported or improperly reported regulatory data.

Recommendation(s)

Review SHE monitoring equipment to determine required/recommended calibrations for proper functioning of the equipment. Where on-site or in-country calibration services exist, implement calibration programs and retain records of calibration. Where on-site or in-country calibration services do not exist, discuss with Corporate SHE to establish acceptable risk mitigation strategies.

Source: *Centerra Gold, Kumtor Operating Company: Safety Health and Environmental Management System Audit September, 27 - October 3, 2009*. SENES Consultants Limited, 28 October 2009.

August 28, 2012
Project No. CB7166-00-06

Kumtor Operating Company
24 Ibraimov Street
Bishkek, Kyrgyz Republic 720031

Attn: Rodney Stuparyk,
Vice-President, Operations

EXECUTIVE SUMMARY:

WESA Inc. (WESA) has provided industrial hygiene services for the Kumtor Operating Company (KOC) mine facility in Kyrgyzstan since 2008. A first site visit August 29 – September 5, 2008 by WESA Director, Occupational Hygiene and Safety, Lydia Renton was carried out to:

- Determine the current status of Industrial Hygiene exposure monitoring and assessments,
- Conduct a gap analysis to evaluate current IH practices, and
- Develop a documented Industrial Hygiene Program.

The second component of the project was the training of the KOC Safety Department staff, and IH exposure sampling of potential airborne contaminants, of which specifics were determined during the initial site visit and evaluation. A four-day (4 day) training course was developed and delivered to meet the needs of the Kumtor staff. This training was initially carried out from December 1 – 4, 2009 and repeated as a refresher training November 22-26, 2010.

During the on-site training, KOC course participants collected actual air samples (representative of full-shift, wherever possible) and conducted monitoring in the mine, mill and maintenance workplace areas. The Quarterly monitoring plan was updated and used to select the sample types and locations.

A review of the Industrial Hygiene database for results of air sampling was carried out and improvements were made to the database input criteria in 2010 to facilitate quality control, as well as compare exposure results to Kyrgyz Republic regulatory limits and ACGIH TLV's.

As a result of the above support activities, the Kumtor Industrial Hygiene Quarterly Monitoring Plan has been diligently adhered to for over a 4-year period, consistent with good industrial hygiene practice. There is sufficient data to give the site documentary evidence of worker exposures to various contaminants in order to determine appropriate and adequate controls

(engineering, ventilation, isolation, enclosures, personal protective equipment, ongoing monitoring) are in place for the protection of workers and to minimise exposures. The monitoring results for the last 4 years should now be reviewed and scrutinized (preferably by a Certified Industrial Hygienist) to determine appropriate recommendations for improvements and changes to the plan, for example removing parameters that are no longer relevant to employee exposure monitoring.

It is also recommended that the draft "Kumtor Industrial Hygiene Policy and Program document", provided to Kumtor in 2008 be reviewed, updated and issued as a final document.

2012 FINAL REPORT:
Update on KOC Industrial Hygiene Assessment and Exposure Monitoring Program Development

WESA Inc. has been retained directly by Kumtor Operating Company (KOC) since 2008 to provide industrial hygiene services for their mine facility in Kyrgyzstan. This report provides an overview and update of the services provided and improvements that have occurred since 2008 and previously described in WESA's *Preliminary Report: Industrial Hygiene Assessment (Gap Analysis) and Sampling Program Development* issued in December 2008.

Initially, an independent assessment of the current status of the Industrial Hygiene exposure monitoring program was carried out by WESA by conducting a gap analysis to evaluate current Industrial Hygiene practices and assist in the development of a documented Industrial Hygiene Program. The WESA scope of work included the following tasks, some of which (items 1., 2., and 3.) were completed during the first site visit/evaluation conducted August 29 – September 5, 2008 by WESA Director, Occupational Hygiene and Safety, Lydia Renton, B.Sc., CIH, ROH (see brief biosketch, Attachment A):

1. Determine the current status of Industrial Hygiene exposure monitoring and assessments:
   - Technical review of existing IH exposure monitoring reports/ surveys and data for the years 2005-2008, including exposure (personal and area) monitoring, noise monitoring, toxic gas(es) monitoring, radiation survey/ monitoring, and light measurements,
   - Review occupational health/medical surveillance reports,
   - Evaluate current IH exposure monitoring practices; observe staff conducting exposure monitoring onsite,
   - Review exposure sampling methodologies, equipment and calibration procedures,
   - Review personal protective equipment and respiratory protection.

2. Conduct a gap analysis to evaluate current IH practices:
   - Review and examine mine areas where IH exposure monitoring has been conducted,
   - Conduct a thorough walkthrough of all mining work areas,
   - Conduct a thorough risk assessment of potential worker IH exposures in all mining work areas (including pit and underground, mill, camp and administration, water treatment plant, effluent area, sewage treatment plant and security operations).

3. Develop a documented Industrial Hygiene Program:
   - Document the risk assessment conducted during the gap analysis,
   - Develop a written 1-year sampling strategy, based on existing and proposed exposure monitoring surveys; prioritize the sampling based on risk,
   - Develop a written occupational health/medical surveillance program to support the exposure assessments,
   - Report on current status and future requirements, including integration of hygiene, medical/health and training programs, as required.

4. Training:
   - Provide overview and refresher training for KOC Staff in IH sampling techniques for existing Kumtor monitoring equipment,
   - Hands-on exposure monitoring for quality control and verification of methodology and techniques,
   - Provide on-site mentoring/ training, as required.

The gap analysis and site visit were conducted from August 29 – September 5, 2008. A *Preliminary Report: Industrial Hygiene Assessment (Gap Analysis) and Sampling Program Development* (dated December 2008) was issued that detailed the following:

- Scope of Work
- Trip Report
- Observations
- Report of Air Sampling Conducted
- Industrial Hygiene Monitoring Program and Strategy
- Overall Recommendations

Each of the recommendations was addressed during the subsequent training sessions and/ or work practices carried out.

The second component of the project was the training of the KOC Safety Department staff, and IH exposure sampling of potential airborne contaminants, of which specifics were determined during the initial site visit and evaluation. A four-day (4 day) training course was developed and

delivered to meet the needs of the Kumtor staff. This was carried out from December 1 – 4, 2009 and consisted of the following:

- Customize the industrial hygiene sampling training program for Kumtor
- Provide overview and refresher training for KOC Staff (8 Safety department staff) in IH exposure sampling (NIOSH methods) and calibration techniques for existing Kumtor monitoring equipment.
- Training for and actual air monitoring/sampling in appropriate areas of the mine site for the following contaminants of concern: respirable dust, silica, total dust/particulate, lead, cyanide, sulphuric acid, hydrochloric acid, sodium hydroxide (caustic), welding fumes.
- Bring extra sampling pumps and appropriate sampling media for the types of contaminants to be monitored (personal and area).
- Provide all training slides, videos and materials in English; WESA staff also provided simultaneous translation in Russian, as required.
- Hands-on exposure monitoring for quality control and verification of methodology and techniques; observe and coach staff conducting monitoring onsite.
- Provide on-site mentoring/ training.
- Provide a practical evaluation and written test.

As best practices in the global profession of occupational/ industrial hygiene, WESA uses and recommends:

- only AIHA-accredited laboratories for the sample analyses,
- only sampling methods that are recognized and approved by regulatory bodies, NIOSH and/or OSHA.

As outlined in the recommendations in the Preliminary Report (2008), all of the requirements below were addressed during the industrial hygiene monitoring training (as outlined in the December 2009 course handout, and again in the November 2010 refresher course (described on the next page) handout:

- Review of high flow pumps, 'sampling train' and calibration setups
- Calibration of low-flow pumps (pump adjustments)
- Calibration using cyclones (respirable dust and respirable silica)
- Use of Draeger Accura pump and instantaneous direct-reading tubes
- Demo/explanation of various sampling methods and media (filters - 5 μm PVC, 0.8 μm MCE filters, 1 μm PTFE, - single filters, matched-weight filters; cyclones; tubes)
- Compare MSA ToxiGuard sensors and Draeger tubes for air concentrations of hydrogen cyanide
- Use of sound level meter; how to calibrate/ use instrumentation and carry out site mapping/survey

- Use of light meter; how to calibrate/ use instrumentation and carry out a survey
- Chain of Custody Record(s)
- Use of ACGIH TLV- TWAs, STELs and CEVs and Kyrgyz Republic Regulatory exposure values

During the on-site training, much of the time was practical-based and hands-on training, whereby the course participants collected actual air samples (representative of full-shift, wherever possible) and conducted monitoring in the mine, mill and maintenance workplace areas. The Quarterly monitoring plan was used to select the sample types and locations. These were documented in Sampling Data forms (Russian/English), and included information on sample number, type, date and time, area, job location and calibration data (before and after). Chain of custody records were used in every instance to transfer samples to the laboratory, with one copy retained by Kumtor. Duplicate and (travel) blank (media quality control) samples were taken so that comparison could be made on the results from three laboratories, namely Alex Stewart Assay and Environmental Labs (ASA in Bishkek), Saskatchewan Research Centre (SRS in Saskatoon, Canada) and Galson Laboratories (in Syracuse, New York U.S.A.). The rationale was to evaluate whether the current laboratories used provide acceptable analytical results based on recognized industrial hygiene sampling and analytical methods (NIOSH Methods) and are accredited to perform such services. Since this training, Kumtor predominantly uses Galson Laboratories (AIHA-accredited) for industrial hygiene sample analysis.

Direct-reading instruments were also used for comparison purposes, in particular, for hydrogen cyanide, and for confined spaces air testing. All equipment requiring calibration with known gas mixtures is undertaken, either on a weekly or monthly basis. The appropriate gas mixtures and logs are maintained. The gas mixture certificates of analysis were reviewed and were found to be appropriate. The expiry date of all gas cylinders was verified and noted to be current. The calibration records were verified and appeared complete.

WESA provided refresher and updated industrial hygiene training for the KOC Safety Department staff from November 22-26, 2010. The training materials and handouts from the December 2009 session were updated and provided in English with Russian notes translation. A copy of the *Industrial Hygiene: Air Sampling Basics (for Kumtor), 22-26 November 2010* (course handout, in English with notes in Russian) is available on request. In addition to using the existing 4 air sampling pumps and Gilibrator 2 calibrator, Kumtor purchased five new GilAir air sampling pumps and a Bios DryCal Defender 510 calibrator. Both the existing Gilibrator Air Flow Calibrator and the Bios Dry Cal Defender Air Flow Calibrator are approved primary standard flow calibration systems, traceable to the U. S. Department of Commerce National Institute of Science and Technology (NIST). As such, they each have a Certification of NIST (NBS) Traceability, which indicates each is a 'true' primary flow standard, and that calibration of that

unit is neither required or possible, as accuracy is dependent upon the dimensions of the flow measuring cell and the accuracy of the internal computer's crystal clock. Based on the dimensional stability and precision of its components and controlled manufacturing procedures the unit either does or does not work properly.

Annual recalibration is not possible or necessary. aceability depends upon verification of these dimensions. A manufacturer may offer the service of an elective re-certification, upgrade and performance test program, in the instance that the instrument has been damaged or a company requires it for ISO QA/QC purposes. The determining factors are whether the unit passes the internal leak test, and the conditions in which the unit is used. If calibrations are carried out in a lab or office environment, then a 3-year quality assurance may be considered 'normal'.

A Kumtor program for quarterly sound level measurements exists. In 2008, the sound level meter was operational; there was no calibrator available. A new sound level meter (SLM) was purchased. During training, WESA brought a Type 2 SLM and calibrator, and it was used in side-by-side measurements to verify the function and accuracy of the Kumtor measurements. Such instruments do not typically drift in their calibration. However, it is good practice to verify, with every use, the accuracy of the instrument. Such calibrators typically are set at a specific frequency, and, when placed over the SLM microphone, verify accuracy and range of the instrument. This is a universally acceptable method for on-site SLM calibration. When the SLM can not readily hold a calibration, the instrument is required to return to the manufacturer for repair.

A review of the Industrial Hygiene database for results of air sampling was carried out on several occasions. The report format (tables) is excellent and delineates the types of air sampling as well as the location/areas and provides exposure values for air concentrations of the parameter sampled. In 2008, the input of sample data and laboratory analysis results were always recorded, and it was noted in our report that there was occasional mixup of units (milligrams vs grams, litres vs m^3, etc.). As a result of this observation, WESA provided training to several Safety

Department senior staff for the accurate and appropriate transfer of data from the sampling forms and laboratory reports to the database. In 2010 and 2011, WESA updated the database so that data input criteria would be clear, and that embedded calculations would permit Kumtor staff to do a verification of quality control, as well as compare exposure results to Kyrgyz Republic regulatory limits and ACGIH TLV's. Kumtor Safety Department staff now uses this database and has validated previous data.

Kumtor currently only carries out industrial hygiene exposure sampling using validated and globally accepted NIOSH Methods (hardcopies provided during training sessions), and queried at http://www.cdc.gov/niosh/nmam/ with sample analysis using an AIHA-accredited laboratory. Kumtor carries out their quarterly monitoring program, and sends samples monthly to Galson Laboratories. Kumtor is provided with 'fresh' sampling media, as required, from Galson. WESA has assisted Kumtor in ensuring expired sampling consumables are removed from use. Kumtor includes sample 'travel blanks' with every shipment. WESA is copied on the email from Galson to Kumtor which provides the Laboratory Reports (analytical results) on a monthly basis. The signed Chain of Custody record is included.

The Industrial Hygiene Quarterly Monitoring Plan has been diligently adhered to for over a 4-year period. There is sufficient data to give the site evidence of worker exposures to various contaminants in order to determine appropriate and adequate controls (engineering, ventilation, isolation, enclosures, personal protective equipment, ongoing monitoring) are in place for the protection of workers and to minimise exposures. To determine improvements, the monitoring results for the last 4 years should be reviewed and scrutinized (by a WESA Certified Industrial Hygienist). The Quarterly Monitoring Plan should be re-evaluated to determine and adjust the sampling criteria. For example, there is evidence that a particular contaminant has never been detected in any samples (specific metals in welding fumes); that parameter analysis can be eliminated.

An evaluation of each of the training course participants was provided to Kumtor, and included their mark on the written exam, a subjective assessment of their participation in practical aspects of the course, and suggestions for improvement. Certificates of Course completion were issued to each participant.

Professional Opinion:

It is my opinion, based on the recommendations provided in WESA's *Preliminary Report: Industrial Hygiene Assessment (Gap Analysis) and Sampling Program Development* issued in December 2008, that Kumtor has made significant progress in their Industrial Hygiene exposure monitoring programs over the last four years. The participants of the two training sessions (December 2009 and November 2010) have shown good knowledge in the application of both the theoretical and practical aspects of exposure monitoring during air sampling and noise measurements. They continue to collect air samples and submit monthly for analysis at an AIHA-accredited laboratory. The Kumtor Industrial Hygiene Quarterly Monitoring Plan and Industrial Hygiene Program provides a good foundation to build on, and with the implementation of Current Recommendations (provided below), should achieve a level of good international industrial hygiene practice.

Current Recommendations:

1. After four years, and accumulation of significant amounts of data for the various workplaces at the Kumtor mine site, the Industrial Hygiene Quarterly Monitoring Plan should be re-evaluated to determine and adjust the sampling criteria. For example, there is evidence that a particular contaminant has never been detected in any samples (specific metals in welding fumes); that sampling parameter and lab analysis can be eliminated. Focus of continued air monitoring can be adjusted accordingly.

2. The draft Kumtor Industrial Hygiene Policy and Program document, provided to Kumtor in 2008 should be reviewed, updated and issued as a final document.

CLOSING

The conclusions presented in this report represent our professional opinion and are based upon the work described in this report and any limiting conditions in the terms of reference, scope of work, or conditions noted herein.

The findings presented in this report are based on conditions observed at the specified dates and locations, the analysis of samples for the specified parameters, and information obtained for this project. Unless otherwise stated, the findings cannot be extended to previous or future site conditions, locations that were not investigated directly, or types of analysis not performed.

WESA makes no warranty as to the accuracy or completeness of the information provided by others, or of conclusions and recommendations predicated on the accuracy of that information.

Nothing in this report is intended to constitute or provide a legal opinion. WESA makes no representation as to compliance with occupational health and safety laws, rules, regulations or policies established by regulatory agencies.

This report has been prepared for Kumtor Operating Company. Any use a third party makes of this report, any reliance on the report, or decisions based upon the report, are the responsibility of those third parties unless authorization is received from WESA in writing. WESA accepts no responsibility for any loss or damages suffered by any unauthorized third party as a result of decisions made or actions taken based on this report.

Should you have any questions regarding this report or require further information or details, please do not hesitate to contact the undersigned at (613) 839-3053 ext 257.

Respectfully submitted,

WESA Inc.

Lydia N. Renton B.Sc., CIH, ROH
Principal;
Director, Occupational Hygiene & Safety

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ATTACHMENT A

Biosketches: Lydia Renton, B.Sc., CIH, ROH
Kateryna Zhylenko, M.Sc.(A)

WESA Inc. has a strong industrial hygiene and occupational health and safety team. A biosketch for Lydia Renton is provided below (a complete resume can be provided at your request). Ms. Kateryna Zhylenko (Occupational Hygienist) provided training and translation (Russian) support during the training and practical aspects of the industrial hygiene monitoring and evaluations at Kumtor (December 2009 and November 2010).

Lydia N. Renton, B.Sc., CIH, ROH, is a Partner in WESA Group Inc. She is Director, Occupational Hygiene and Safety and Sr. Industrial Hygienist with WESA Group Inc. Ms. Renton received her Bachelor of Science degree in Chemistry from the University of Ottawa and is a Certified Industrial Hygienist (CIH - ABIH) and a Registered Occupational Hygienist (ROH - CRBOH).
Ms. Renton is very familiar with the practical application of the various regulations related to health and safety in Canada and Ontario, having worked for the federal departments of Labour Canada (now HRDC), Health Canada, and the Ontario Ministry of Labour. She joined Bell-Northern Research in 1989 as corporate hygienist and held several roles, including Manager of Environment, Health and Safety at Nortel Networks. She developed the Industrial Hygiene consulting service within WESA over the last 13 years.

She has guided, advised, trained and consulted to government and industry, to senior management, Health and Safety Committees and employees on a wide variety of projects by actively developing, delivering and participating in loss control, industrial hygiene, health, safety and environment programs. She has lead EHS audits in North America, Mexico and Central Asia, and is familiar with ICMI, ISO 9001, ISO 14,001, OHSAS 18001 and CSA Z1000 auditing processes. She has been recognized in North America as the 2008 Hugh Nelson Award recipient by OHAO (Occupational Hygiene Association of Ontario) and is often called for advice and to share expertise in health, hygiene and safety programs.

Ms. Renton is currently the Chair, American Board of Industrial Hygiene (ABIH) and a member of the Board of Directors since 2009. She is a Board of Directors member of WESA Group Inc. She is the past-President and Board of Directors for ICRBOH (Canadian Registration Board of Occupational Hygienists); past-Director of the AIHA (American Industrial Hygiene Association) ConsultSIG; is a founder of the HTIG (High-Tech Industry Group - IAPA); is a member of the Program Committee for OHAO (Occupational Hygiene Association of Ontario); and is a co-founder and co-chair of SHEPN (Safety, Health and Environmental Professionals Network).

Ms. Renton has 35 years' experience in the areas of comprehensive industrial/occupational hygiene and risk assessment and management.

Ms. Kateryna Zhylenko, M.Sc.(A) is an Occupational Hygienist with WESA Inc. Ms. Zhylenko completed the Masters degree program in Occupational Health at McGill University. Her experience includes a wide spectrum of occupational hygiene knowledge and theory to complement her practical skills. Experience as an occupational hygienist includes mould assessments, air monitoring (including bio-aerosols) and exposure assessments. Ms. Zhylenko assisted Ms. Renton in the industrial hygiene training and exposure monitoring carried out at the Boroo Mine in December 2008 and the Kumtor Mine in December 2009 and in November 2010. She is fluent in English, French and Russian.