



KUMTOR
KUMTOP

centerraGOLD



ENVIRONMENT AND SUSTAINABILITY REPORT **2018**



ABOUT KUMTOR MINE

Kumtor mine is the largest western-operated gold mine in Central Asia. It has been operating since May 1997 and has produced approximately 12 million ounces of gold to December 31, 2018. Kumtor Gold Company CJSC (KGC) is the concession holder for the Kumtor deposit responsible for the entire production cycle.

The Kumtor open pit mine is located approximately 350 kilometers southeast of the capital Bishkek and 60 kilometers north of the border with the People's Republic of China. It is at an altitude of 4,000 meters above sea level in a partially glaciated permafrost zone in the Central Tien Shan Mountains. The current life of the Kumtor mine is until 2026.

About Centerra

Centerra Gold Inc. (Centerra) is the parent company, which owns 100% of Kumtor Gold Company. Centerra is a publicly listed, Canadian-based gold mining company engaged in operating, developing, acquiring, and exploring gold properties in North America, Asia and other emerging markets worldwide. The Company is one of the largest Western-based gold producer in Central Asia and its shares trade on the Toronto Stock Exchange (TSX) under the symbol CG.

Centerra operates two flagship assets, the Kumtor gold mine in the Kyrgyz Republic and the Mount Milligan gold-copper mine in British Columbia, Canada and is

building its next gold mine, the Öksüt Gold Project in Turkey. Centerra also owns late-stage development properties; the Kemess Project in British Columbia, Canada, which includes the Kemess Underground and the Kemess East gold-copper projects, and a 50% interest in the Greenstone Gold Property which includes the Hardrock Gold Project in northwestern Ontario, Canada. Centerra through its acquisition of Thompson Creek Metals Company in 2016, also owns a well-established, fully integrated Molybdenum Business consisting of an operating metallurgical processing facility and two primary molybdenum mines, which are currently on care and maintenance.

The Company also has active exploration joint ventures and exploration properties in Canada, Finland, Mexico, Sweden, Turkey and the United States. Kyrgyzaltyn OJSC, a state-owned entity, is Centerra's largest shareholder, owning 77,401,766 common, approximately 27% of the issued and outstanding shares. Additional information on Centerra is available at SEDAR (www.sedar.com) and on the Company's website (www.centerragold.com).

About this Report

This document is the Kumtor Annual Environment and Sustainability Report for the 2018 financial year (ending December 31, 2018) except where otherwise noted. This report is focused on the Kumtor mine in the Kyrgyz Republic. Performance data include only Kumtor's own operations, unless noted otherwise, although the policies of Centerra and Kumtor apply to both employees and contractors. Financial metrics are reported in US dollars (USD) unless otherwise stated. This report has been prepared in accordance with GRI Standards: Core option. In addition the Report addresses the key reporting requirements centered in Kumtor's Environment Management Action Plan (EMAP). For each specific sector various indicators set in GRI's Mining and Metals Sector Supplement (see www.globalreporting.org) are disclosed. In determining the scope, content, and boundaries of this report, we

considered an importance evaluation process described in the Governance Section of this report. Please note our Cautionary Note regarding the forecast information on the inside back cover. This report will also be available in the Russian and Kyrgyz languages. As we continue to further improve our systems and approaches, we welcome your comments and suggestions on how we can further improve our annual environmental and social reporting and practices. You can find contact details on the back cover of this report.



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MESSAGE FROM THE PRESIDENT



The progress we have achieved, as well as the challenges we faced in 2018, are described in this report.

We have exceeded our operating performance and introduced a technologically advanced dispatching system at the mine site.

Safety remains our top priority, and in 2018 the Work Safe | Home Safe leadership program training continued.



Contribution to the Country Economy

KGC remains an enterprise that makes a significant contribution to the economy of the Kyrgyz Republic. In 2018, our production activity accounted for 18.4% of industrial output and 8.6% of GDP. Payments in the Kyrgyz Republic in 2018 amounted to \$301 million, making the

total of payments since 1994 \$3.7 billion. KGC is the largest taxpayer and largest employer in the private sector of the Kyrgyz Republic. By the end of 2018, the company employed 2,641 Kyrgyz citizens, or 98% of the total number of the full-time workforce.

“ KGC remains an enterprise that makes a significant contribution to the economy of the Kyrgyz Republic ”

Increasing Local Procurement

We believe that a strategic approach to procurement in the local market will not only benefit our company, but also contribute to the development of local communities by creating jobs and developing the economy of the Issyk-Kul region. We continue to promote and support local business and in 2018 our company spent about \$81 million on local procurement.

Interaction with Stakeholders

The Kumtor Ambassadors program, launched in 2015, continues to involve employees and contractors in social projects implemented in the Issyk-Kul region and in other regions of the country. Our employees have volunteered more than 5,000 hours to social work and participated in more than 80 charitable and mentoring events.

The company management on a regular basis conducts a constructive dialogue with representatives of local communities, in the person of the public and youth leaders, local authorities and representatives of small business. At regular meetings, the company reports on plans, listens to requests and makes decisions. The company constantly increases cooperation with all interested parties.

Investing in Communities

In this report, we note some of the activities that we voluntarily initiated, and their results. Moreover, since 2009 the company contributes 1% of gross revenue to the Issyk-Kul Development Fund. In 2018 our contribution to the Fund was \$7.3 million, making the total \$69.9 million since 2009.

Based on the results of activities in 2018, KGC was recognized as the best in the nomination «Community Service» and received the award from the American Chamber of Commerce in the Kyrgyz Republic.

Geotechnical Safety

The Kumtor mine ore body and related infrastructure are located under the moving glaciers or subjected to their impact. Since the approval of the Kumtor project in 1994, plans for the management of ice (necessary for the safe operation of the mine) have become an integral part of the annual mining plans that are subject to approval by the relevant authorities of the Kyrgyz Republic. As further described in the report, we involve leading local and international experts and use advanced technologies for monitoring and assessing geotechnical safety and implementing the activities necessary to ensure the proper level of safety of Kumtor mine.

Health and Safety

We adhere to the policy that no job is so important that safety rules can be neglected. Throughout the year, we implemented the second phase of the WSHS program and successfully trained all employees, contractors and trainees.





Environment and Biodiversity

We consider a responsible approach to environmental management as one of the most important components of our activities. So, in 2018, we spent about \$5.7 million for environmental assessment and protection. This includes the costs of monitoring (both at the mine and in the region) the quality of water, air, biodiversity, soil and sediment, radiation and waste management.

Life of Mine

The total amount of proven and probable gold reserves at the Kumtor mine as of December 31, 2018 is 4 million ounces (447,562 kt at 0.3 g/t). The current mine plan indicates that operations will cease in 2026, however KGC's exploration program is aimed at extending the life of the mine.

Looking Forward

Kumtor successfully implemented various initiatives throughout 2018 for the purpose of continuous improvement. It is important for KGC to meet our production targets, requirements of safety, environmental and social responsibility. Kumtor mine gold production in 2019 is expected to be from 535,000 to 565,000 ounces.

We look forward to your feedback on the report and welcome comments on how we can improve our sustainable development and environmental protection in future.

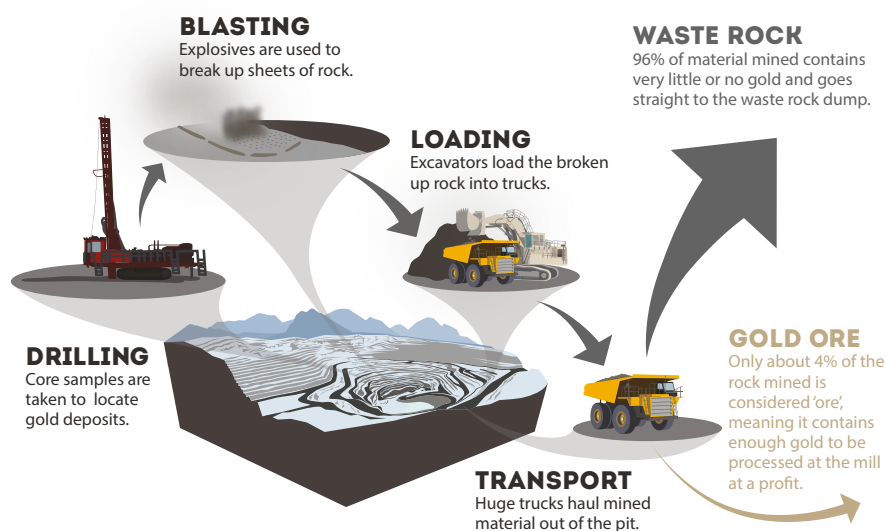
***Daniel Desjardins, President,
Kumtor Gold Company***



OPERATIONS OVERVIEW

MINING PROCESS

Gold is found in the territory of the deposit in the form of finely disseminated pyrite. The development at the Kumtor mine is performed through open-pit mining, that is, with the use of standard methods of drilling, blasting, loading and transportation in the open pit.



The Kumtor mine is equipped with a modern mining fleet. The open pit has 99 Caterpillar trucks with a lifting capacity of from 145 tons to 185 tons, 9 drilling rigs and 14 excavators operating regularly. To maintain the infrastructure in the open pit, there is support equipment: 16 bulldozers and 11 graders. Workers travel to the open pit in KamAz trucks; known colloquially as bus trucks.

DRILLING



Drilling is a very important stage in metal mining, since geologists should accurately determine the average gold grade in the ore before the commencement of the large-scale works at a site. Depending on the results, the further process will determine whether to perform the gold ore production or not. The drilling rigs operating in the open pit are able to drill to a depth of up to 12.5 meters. Nearly 230 holes are drilled in the open pit during one shift.

The drilling process in the mine is not only a part of geological exploration works aimed at determining gold grade but the first stage of blasting in the open pit as well.

BLASTING



Blasting in the open pit breaks apart the topmost rock. After assessing where to blast, the zone is closed off. A network of holes are drilled, and explosives connected to a detonator are placed inside. Meeting safety requirements when firing the charge is of paramount significance for all employees involved

in the works in the open pit. Before the explosion, the mine foreman ensures the withdrawal of employees and heavy vehicles from the open pit to a safe distance.

LOADING



After clearing roads, the excavators drive up to the scene of blast. Two types of excavators operate in the mine. The biggest one is Hitachi EX3600-6. The excavators load the ore onto the mining trucks.

TRANSPORTATION



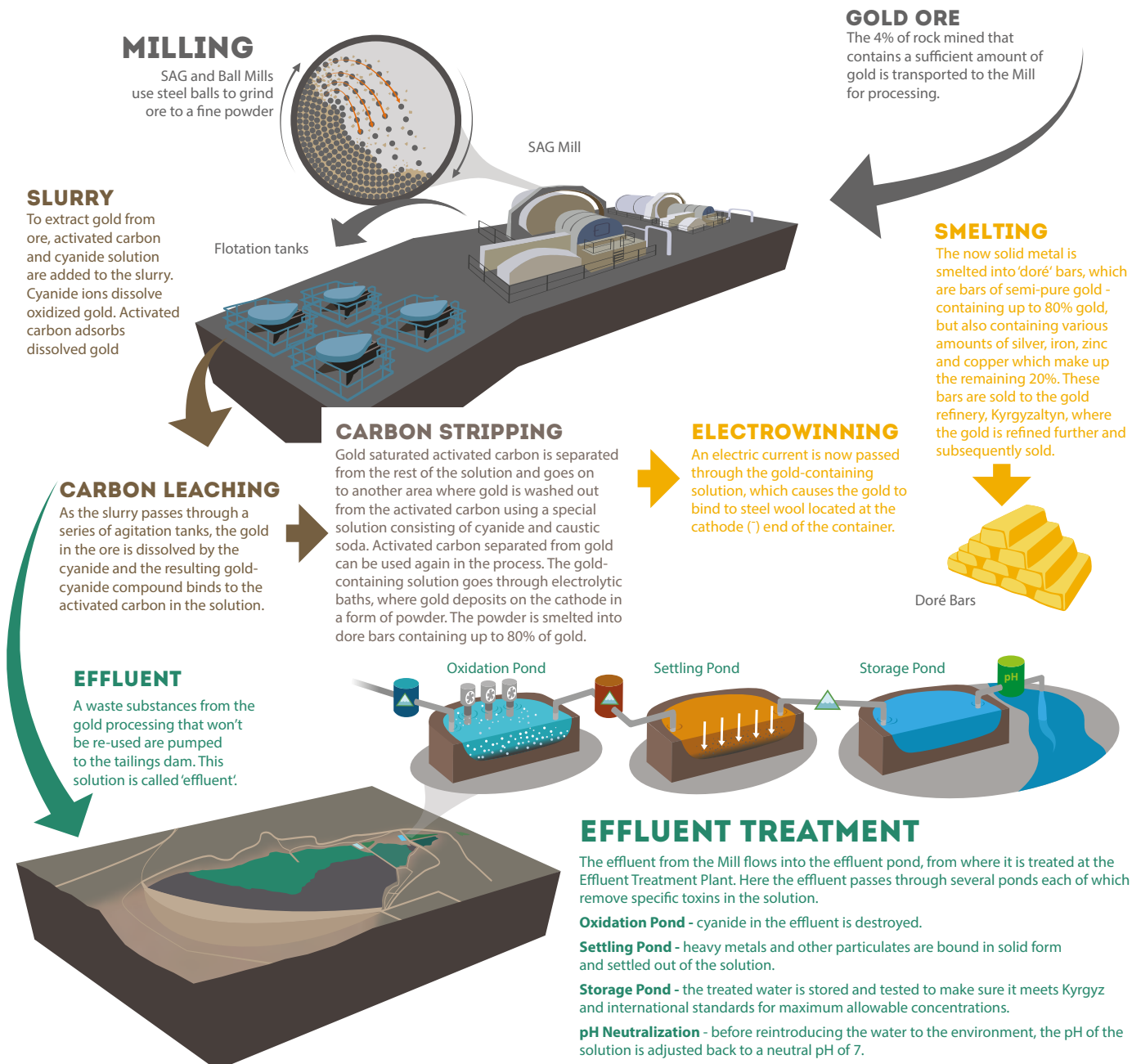
To reach gold bearing ores, it is required to remove the bare rock layer. This process is called stripping. The trucks which transport waste rock unload it on the special dumps. The trucks containing gold bearing ore transport the ore to the large crusher where it is ground to suitable sizes and delivered to the Mill by conveyor.

GOLD EXTRACTION

Gold is extracted from the ore of the processing factory called the 'Mill' using key stages including grinding, carbon leaching (with cyanide), carbon stripping, electro winning, and smelting. Each of these steps is described further in the diagram below.

The Mill's rated throughput is between 17,000 to 19,000 tons of ore per day. The entire production process is automated involving just 16 people per shift to operate the entire Mill. When ore processing is finished, it is smelted into dore bars containing up to 80% gold.

The doré bars produced in the Kumtor mine are purchased by Kyrgyzaltyn OJSC for further processing at Kara-Balta refinery, as stipulated by the Amended and Restated Gold and Silver Sales Agreement concluded by Kumtor Gold Company, Kyrgyzaltyn OJSC and the Government of the Kyrgyz Republic. The exclusive right to sell refined gold and silver both in the Kyrgyz Republic and abroad is held by Kyrgyzaltyn alone.



ENVIRONMENTAL AND SUSTAINABILITY SNAPSHOT

Pillar	2018 Targets
Project Benefits	<ul style="list-style-type: none"> ■ Achieve All-In Sustaining Cost Per Ounce to 733-815 (US\$/oz) ■ Produce 450,000-500,000 oz
Health and Safety	<ul style="list-style-type: none"> ■ Total Reportable Injury Frequency Rate (TRIFR) of 0.21 ■ Implement Work Safe Home Safe (WSHS) Phase II ■ Implement Visible Felt Leadership (VFL) Program for supervisors and higher
Environment	<ul style="list-style-type: none"> ■ No Reportable Spills > Level 2 ■ Progress in achieving ICMI compliance to CNwad discharge limits ■ Progress in MAD compliance to ammonia discharge limits ■ Update Biodiversity Management Strategy and Plan & Contributing to Closure Planning
Community	<ul style="list-style-type: none"> ■ Zero days of material business interruptions ■ Progress in continuing development of protocol between Issyk-Kul Development Fund, regions and KGC for future social and economic projects by the end of Q2 with projects for 2018 approved by the end of Q4 ■ Increase involvement levels in Kumtor Ambassadors Program by 20% (hours) over 2017

Target outcome and Comment on Target

2019 Targets

- All-In Sustaining Cost per Ounce equalled to 695 (US\$/oz)
- 534,563 ounces of gold produced in 2018

- Achieve All-In Sustaining Cost Per Ounce to 666-703 (US\$/oz)
- Produce 535,000 – 565,000 oz

- Actual TRIFR was 0.19
- WSHS Phase II completed
- VFL program implemented for Managers only

- TRIFR of 0.21.
- Implement WSHS Phase III
- Complete VFL training for all KGC supervisors
- Commence implementation of Critical Controls Management Standard for all critical risks

- No Reportable Spills > Level 1
- Undertook some trials in the Mill using a cyanide substitute, also trialled adding glucose into the tailings discharge to encourage biochemical treatment of cyanide in the tailings dam
- The annual average ammonia discharge from the ETP was compliant with MAD discharge limits
- Biodiversity management strategy and plan was updated

- No Reportable Spills > Level 2
- Upgrade treatment systems (ETP & STP)
- Update Conceptual Closure Plan

- Zero days of material business interruptions
- Protocol between Issyk-Kul Development Fund, regions and KGC was developed by the end of Q2 and projects for financing in 2018 were approved by the end of Q4
- About 5 000 hours dedicated for corporate volunteering by KGC employees in 2018

- Zero days of material business interruptions
- Approve Stakeholder Engagement Plan and Community Development Plan

BUILDING A **TEAM-
BASED CULTURE**
OF EXCELLENCE
THAT **RESPONSIBLY
DELIVERS**
SUSTAINABLE VALUE
AND **GROWTH.**

We believe that how we conduct business and how all employees act in fulfilling their job responsibilities are fundamental to achieving our vision **to build a team-based culture of excellence that responsibly delivers sustainable value and growth.**

While Kumtor's ultimate objective is to deliver value to our shareholders, integrity and ethics will be the foundation for everything we do. In endeavouring to achieve our vision we will follow our core values:



BE RESPONSIBLE MINERS

- Meet all government regulations and internal governance standards.
- Ensure we actively and transparently engage our people and the communities around us.
- Minimize the potential for adverse impacts that may arise from our operations to levels as low as reasonably achievable, taking into account social and economic factors.



DELIVER RESULTS

- Strive for operational excellence, safe production and be accountable for our results.
- Be a leading performer among our peers with regard to shareholder value, business ethics, workplace safety, environmental protection and community economic development.



STRIVE FOR CONTINUOUS IMPROVEMENT

- Continually improve the management of our operations so we may respond to the economic, environmental and social expectations of our stakeholders, including our employees, communities, shareholders, governments and the public.
- Challenge the status quo, embrace change and search for new ways to grow our business.



WIN AS A TEAM

- Committed and highly engaged.
- Results focused.
- Recognize contributions and efforts of each team member.

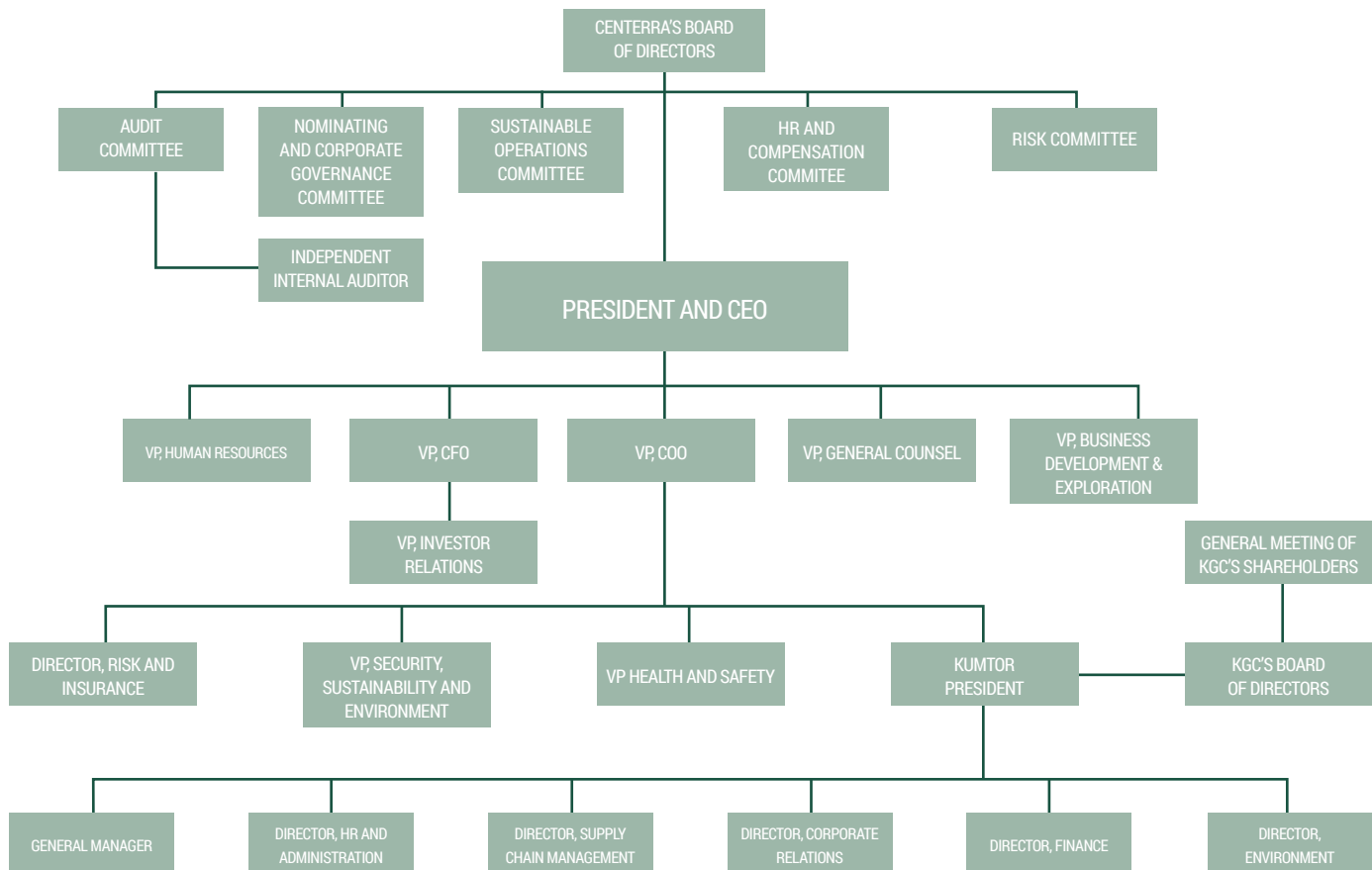
We believe our strong commitment to our vision and these values will continue to make Kumtor the employer of choice and the business partner of choice by governments, state-owned enterprises and special interest groups in the countries we operate in.

As an international company, we respect the different needs and values of people and their cultures and operate with a high level of transparency to ensure stakeholder confidence.

1. GOVERNANCE

1.1 GOVERNANCE MODEL

1.1 Corporate Governance Structure



KGC operates under the governance and standards set by its parent company Centerra Gold Inc. (Centerra), which believes that sound and effective corporate governance is essential for all of its activities. We have adopted practices and procedures to ensure that Centerra's governance principles are followed at KGC. We expect directors, management, officers, and employees to conduct themselves in accordance with the highest ethical standards. These are detailed in three key policies:

1. Code of Ethics for officers and employees;
2. Code of Ethics for directors;
3. International Business Conduct (anti-corruption) Policy for all directors, officers and employees.

KGC develops formal Policies and Procedures for setting performance with internal and external standards, meeting legislative responsibilities and promoting the long-term success of the Company. The policies support KGC values and specifies the framework within which KGC operates in the following areas:

- **Operational Health and Safety:** KGC ensures provisions for safe performance and operation during all states of our activities. KGC recognizes the protection of the health and safety of its employees, contractors, and the public along with responsible environmental management as being its highest corporate priorities. We are committed to the safety motto that **“no job is so important that we cannot take the time to do it safely.”** Key commitments in our policy include:

- Compliance with applicable laws and regulations of the jurisdictions in which we operate, and generally accepted international industry practices;
 - Providing employees and contractors with a working environment free of uncontrolled hazards Identifying and eliminating or controlling potential risks to health and safety of employees, contractors, and the public to levels as low as reasonably achievable, taking social and economic factors into account;
 - Achieving continual awareness of and improvement to our overall Health, Safety, and Environment (HSE) performance.
- **Environmental Management:** KGC is committed to complying with applicable laws, regulations and standards and minimizing potential environmental impacts due to company operations. KGC has established an Environmental Management System (EMS) designed to monitor the effects of operations on the environment and to ensure compliance with permits and other requirements. The system provides for scheduled monitoring, engineering controls, performance requirements in line with good international mining practice and local regulations.
- **Compliance:** KGC has a comprehensive system to ensure compliance with laws, regulations and company policies, which is described further in the section.
- **Transparency and Reporting:** Actual results and company activity is reported regularly through the parent company Centerra Gold Inc. as well as on the company website (www.kumtor.kg). Centerra is a publically traded company with shares listed on the Toronto Stock Exchange. It is subject to rigorous regulations regarding transparency and reporting. Starting in 2017, in compliance with Canadian regulation “Extractive Sector Transparency Measures Act”, Centerra discloses on an annual basis, which regulates extractive sector companies. Centerra is required to disclose on an annual basis payments made to Governments in its operations. Centerra’s filings can be found at its website (<https://www.centerragold.com/responsibility/estma-reports>).
- **Operational Excellence:** KGC has Standard Operating Procedures that describe the activities necessary to complete tasks in accordance with standards and regulations for running the operation. Policies stand as control measures for known or potential risks. However, in today’s changing risk environment, KGC uses an Enterprise Risk Management System to support its business activities and safeguard shareholder value. The risk management systems designed to ensure the risks are systematically identified, rigorously assessed, prioritized consistent with KGC’s risk appetite and effectively managed to eliminate unwanted impacts.

Our external memberships and commitments provide an opportunity to learn from, and align our activities with, good international industry practice. Centerra became a supporting Company of the Extractive Industries Transparency Initiative (EITI) in 2011.

The EITI is a coalition of governments, companies, civil society, investors, and international organizations. It promotes improved governance in resource-rich countries through the verification and publication of all company payments to governments, as well as government-reported revenues from oil, gas, and mining. Centerra has played an active role in promoting the EITI in the Kyrgyz Republic and Mongolia. Our operations were among the first to establish, report, and help improve EITI infrastructure in their respective countries. For more information on Centerra’s submissions, visit eiti.org/Kyrgyz Republic and eiti.org/Mongolia.

Centerra is also a member of the World Gold Council (WGC). The Council’s members regard the management of the local environment and relationships with local communities as paramount considerations during the lifetime of any mine project.

Centerra is a signatory to the International Cyanide Management Code for the Manufacture, Transport, and Use of Cyanide in the Production of Gold (Cyanide Code). This Cyanide Code was developed by a multi-stakeholder steering committee under the guidance of the United Nations Environmental Program and the predecessor of the International Council on Mining and Metals.

The objective of the Cyanide Code is to improve the management of cyanide used in gold mining and assist in the protection of human health and the reduction of environmental impacts.

Compliance

The Compliance and Projects department (C&P) was established by the Company in 2012 to ensure compliance with the requirements of the KR legislation, with international standards of the industrial operation and in order to provide continuous and safe operation of the Kumtor mine. The C&P Department has 10 staff members under the supervision of the Director, who reports directly to the General manager. The C&P department interacts with all KGC structural departments and is guided by acting KR legislation, generally accepted international standards, the Kumtor Amended and Restated Investments Agreement, the Kumtor Amended and Restated Concession Agreement, and Strategic Agreement for the Kumtor project. Specialists of the C&P department monitor changes in the KR legislation and identify the risks that can potentially affect the Company’s activities. in accordance with the KR legislation, the C&P department ensures that all required permits and licenses for all Company activities are obtained in a timely manner and properly maintained.

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In addition, the C&P Department:

- Assists other structural departments of the Company with drafting their respective contracts;
- Obtains all necessary permits for the design and construction of mine site infrastructure facilities;
- Obtains approvals of the design documentation and organizes commissioning of newly constructed facilities upon their completion;
- Assists design companies in obtaining approvals/ expert opinions for Mine Development Plans/ Designs and for the standards of pollutants emissions/discharges and wastes disposal for the mine site and BMY;
- Provides technical assistance during update and/ or introduction of new internal documentation for the Company in accordance with requirements of the KR legislation and international regulations;
- Organizes calibration of measuring equipment used at the mine site or BMY. The C&P Department ensures uninterrupted operations of the mine and BMY facilities through maintaining regular communication with the authorized state bodies in the field of subsoil, natural resource use, construction, sanitary and epidemiological control, technical supervision, as well as with the KR Ministry of Economy, Ministry of Interior, State Communication Agency and the KR Ministry of Emergency.

The C&P Department regularly updates the following permits issued by different KR ministries and agencies:

- Permit to carry out blasting operations in the pits;
- Permit to store explosive materials at the Kumtor mine site;
- Permit to use explosive materials;
- License for production and selling of the explosive materials;
- Permit to carry out mining operations within the Concession Area;
- Permit to store, the weapons used for site security purposes at the Kumtor mine site;
- Permits for transportation and storage of hazardous cargo;
- Certificates for the vehicles and drivers used for transportation of hazardous cargo;
- Permits to transport oversize and heavy cargo;

- Permit to use and store reagents and medical drugs at Kumtor mine site and at the Company's Bishkek Medical Center;
- License for the disposal, storage, burial, destruction of toxic waste materials and substances, including radioactive waste;
- Permit to dispose waste into the environment, including toxic waste;
- Permit for emission of waste products from the stationary sources of pollutant into the atmosphere;
- Permit for the discharge of treated industrial and domestic effluents;
- Permit to operate radio sets, radio frequencies to ensure reliable communication between KGC facilities;
- Permit to use X-Ray devices and equipment with sources of ionizing radiation; and
- Kyrgyz Visas and Work Permits for KGC expatriate personnel to work in the Kyrgyz Republic;

KGC has all permits and approvals required by the KR legislation for the Technical Designs for the Development of the Central, Sarytor and Southwest Areas of the Kumtor mine during the entire life of the mine (LOM), as well as approval of the Environmental Passport and Mine Site Master Plan.

At the end of 2018, all other permits and approvals for 2019 were also obtained:

- Mine Plan for the development of the Central Pit;
- Mine Plan for the development of the pebble deposits at the Lysyi Creek Alluvial Cone;
- Waste disposal into the environment at the Kumtor mine and BMY;
- Emission of waste products from the stationary sources of pollutants into atmosphere at the Kumtor mine and BMY.

Audits, Inspections, Claims

Our Company is subject to regular audits by the KR and international companies and experts. We are also inspected by relevant national authorities and by the audits retained by Centerra and other relevant third parties, which have historically included the European Bank for Reconstruction and Development (EBRD).

Environmental claims

Centerra continues constructive and good faith cooperation with the Government of the Kyrgyz Republic to settle all outstanding matters affecting the Kumtor Project, including the environmental claims initiated by various Kyrgyz regulatory authorities from 2013 to 2016. Some of the claims (initiated by the Prosecutor and the SIETS) were withdrawn in August-September 2017. Other environmental claims (by SIETS) are also expected to be settled as part of agreements reached with the Government of the Kyrgyz Republic by signing the Strategic Agreement on Environmental Protection and Investment Promotion as of September 11, 2017.

Environmental incidents

Kumtor maintains a system for reporting environmental and safety-related incidents. It is based on a five-tier classification and reporting a system, which allows the Company to classify environmental incidents and spills into reportable and non-reportable. This classification system takes into account the magnitude of environmental impact and the requirements of national laws and other regulations. Senior environmental staff are immediately notified of all incidents; upon receiving such notice, senior environmental staff classify the incident as per the five tiers above. Tier I and Tier II incidents are considered insignificant in terms of scale and severity of impact; therefore, there are

no external reporting requirements. There is no requirement to immediately notify KGC President and Centerra's Board of Directors on such minor significance incidents. Incidents classified as Tiers III through V are reported to the Board of Directors and, in many cases, trigger external reporting requirements to relevant local regulatory agencies. In 2018, 9 non-reportable incidents were recorded. For comparison: 15 non-reportable incidents in 2017 and 15 non-reportable incidents in 2016. These were typically minor spills of fuels that were immediately contained and cleaned up, resulting in no significant or extended impact.

1.2 Environmental incidents and spills

	2016	2017	2018
Non-reportable spills and environmental incidents (Type I)	15	15	9
Non-reportable spills and environmental incidents (Type II)	1	0	0
Reportable spills and incidents (Type III-V)	0	1	0



1.2 SUSTAINABILITY MANAGEMENT

While Centerra's ultimate objective is to deliver value to our shareholders, we remain committed to the principles of sustainable development. In endeavoring to achieve our strategic objectives we aim to:

- Be a leader among our peers with regard to business ethics, workplace safety, environmental protection, socio-economic development of communities, and shareholder value;
- Minimize the adverse impact potential of our operations, taking into account social and economic factors;
- Continually improve the management practices at our operations, so we may respond to the economic, environmental and social expectations of our stakeholders, including our employees, communities, shareholders, government authorities and the public;
- As an international company, respect the different needs and values of people and their cultures, and operate with a high level of transparency to ensure stakeholder confidence. We believe our strong commitment to these principles will continue to make Centerra the employer and the business partner of choice wherever we operate.



1.3 RISK MANAGEMENT AND CONTINUOUS IMPROVEMENT



Kumtor Gold Company (KGC) is committed to enhancing and protecting its tangible (physical or financial) and intangible (employee, stakeholder or organizational) assets through risk management. The Risk Management processes are integrated with the general management of the organization so they are a part of decision-making process. Critical risks and monitoring of their mitigation plan successfully integrated in the day-today activities with the departments managing their own risks identification and monitoring process.

Management discusses risks at a Weekly Leadership Meeting, and more significant risks are followed up on monthly Change Acceleration Process (CAP) Team Meetings. Senior Management discusses risks at weekly Steering Committee Meetings, through a Quarterly Critical Risk Review Meeting, and during Annual Budget preparations. The goal is to use the outcome of risk assessment processes in planning, budgeting and cost control to ensure we focus on proactive rather than reactive management strategies.

The key risk events in 2018 related to workplace injuries, geotechnical conditions of the pit and waste dumps as well as the conclusion of the Strategic Agreement on Environmental Protection and Investment Promotion (hereinafter - the Strategic Agreement) with the Government of the Kyrgyz Republic.

■ **Risk of workplace injury.** Production activity of the Company poses a risk of incidents and injuries. For many years, the Company has continuously focused on safe working conditions and implemented various safety initiatives. The Work Safe | Home Safe Safety Leadership program has been implemented since 2017. The program is aimed at improving safety culture of the Company workforce and ensuring safe working conditions. In 2018, the Work Safe | Home Safe program Phase II strengthened the objectives of the program and, along with the implementation of the critical control process, prevented significant incidents. Implementation of such risk mitigation plans helps the Company reduce the likelihood of workplace injuries.

■ **Geotechnical issues.** Constant ground movement in the pit and dumps is the result of geological and geotechnical ground characteristics, and requires constant vigilance because of the risk it poses to mining operations. It may impact the volume of gold produced, change the sequence of mining operations, increase unloading expenditures, organizing of dewatering, movement or reconstruction of existing infrastructure, reduced slope angles of the central pit and changes in waste rock dump design. Extensive efforts are taken by KGC personnel to impose appropriate measures on adjusting the plan to prevent and anticipate further ground movement. The Company also uses third party geotechnical consultant to review the pit wall, the glacier and waste dump on a quarterly basis.

■ **Completion of the Strategic Agreement.** Conditions precedent to the completion of the Strategic Agreement concluded among Centerra Gold Inc. and Kumtor Gold Company with the Government of the Kyrgyz Republic on September 11, 2017 have not yet been satisfied. The First Completion Date is the date by which all conditions precedent to the completion of the Strategic Agreement shall be satisfied. KGC and Centerra continue to cooperate with the Government of the Kyrgyz Republic to satisfy the remaining conditions precedent to the completion of the Strategic Agreement.

Management of risks clearly demonstrates how risk management processes are linked with continuous improvement activities that became part of our daily operation.

Continuous Improvement is one of the four Corporate core values and it is a vital component of continued success. The purpose is to promote a philosophy of continuous improvement in enabling all employees to systematically drive out inefficiencies and embrace improvement opportunities within the Company.

KGC strives for excellence and quality and takes every opportunity to improve and enhance all aspects of its business and focusing on: safe operation, reduced environmental impact, operational excellence, cost effective operation and positive work environment.

Continuous Improvement tools, namely CAP teams and 3W forms in leading efficient meetings discipline and responsible fulfillment of assigned tasks to relevant teams, have proven to be successful.

In 2018, numerous project teams consisting of operational and administrative departments were initiated to implement various continuous improvement initiatives that are classified in the Company as large and small projects, as well as quick-yielding projects. The most successful initiative was the implementation of a more technologically advanced mine dispatch system.

To improve the fleet dispatch management, Kumtor implemented the "Mine Dispatch System" project that increased the accuracy of data obtained by the system for making operational decisions, while the built-in proximity detection system enhanced the mine operations safety. This led to an increase in the fleet operation time and, accordingly, the gold production.

Additionally, during the year, an operation review team (ORT) session was conducted with the participation of Centerra representative and independent experts. This Continuous Improvement initiative includes brainstorming ideas and best practice sharing to further improve the Company's performance results.



1.4 MATERIALITY ASSESSMENT

In accordance with the GRI Standards, KGC is required to identify and report on material issues – defined as issues that have a significant impact on KGC's business and are important to multiple stakeholder groups. In order to assess which issues are material, we considered a number of various sources. We based materiality assessment on interviews with Senior management:

- Opinions of Senior Management and Departments Heads – via several internal meetings and workshops, and online surveys;
- Opinions of local communities in Issyk-Kul;
- Risks that were rated as High or Extreme as per the KGC Risk Register;
- Relevant legal obligations of the Company;
- Data from the KGC community relations online database, where we document our engagements with key stakeholders in the region to record all concerns and issues raised, as well as record and track grievances and requests from local communities;
- Internal policies, values, goals and targets;
- Incoming correspondence - to identify key issues raised by Stakeholders via official requests;
- Media coverage of the Company.

As shown on Figure 1.3 overleaf, the issues shaded red were considered material.

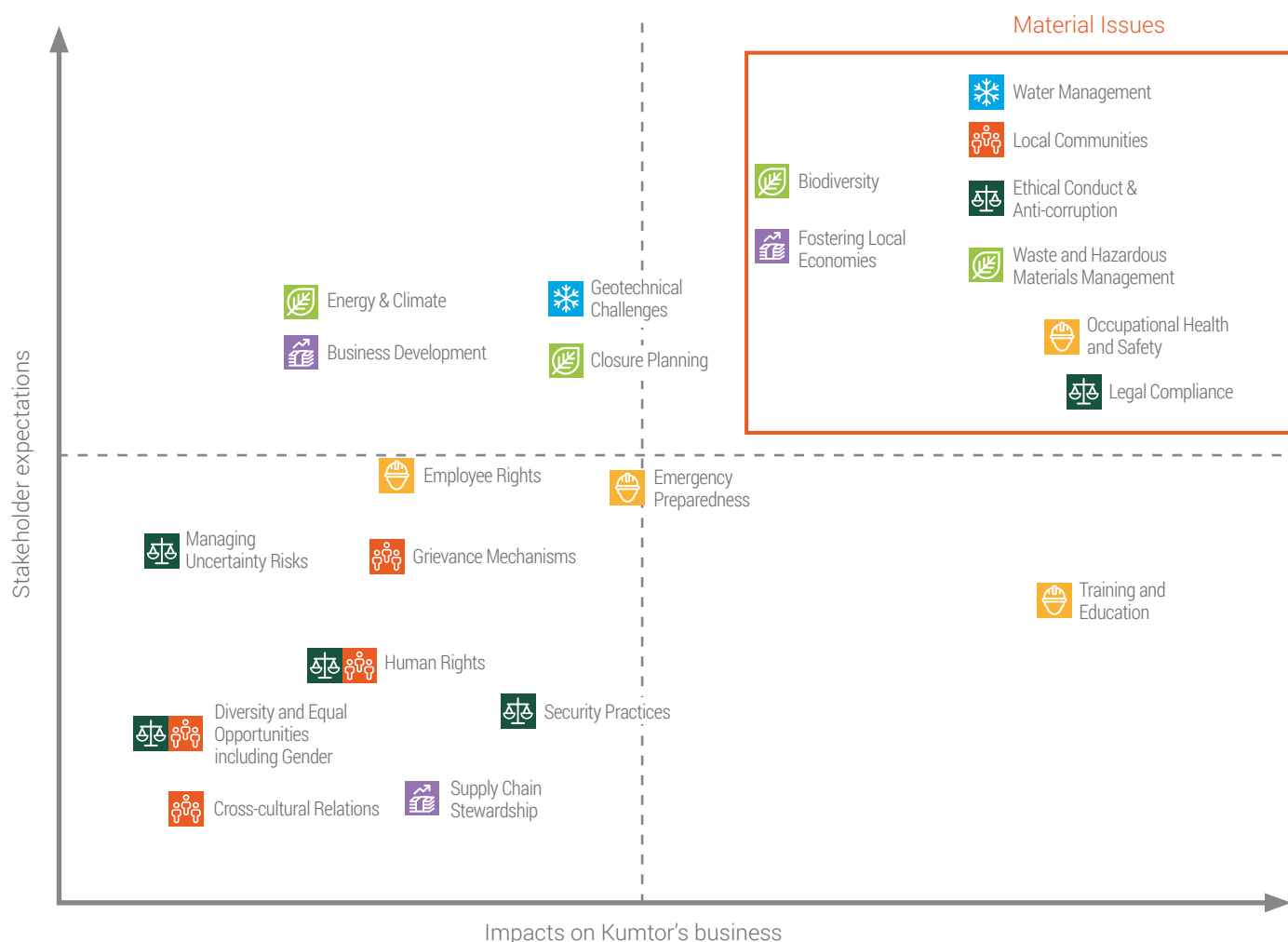


United Nations Sustainable Development Goals

There are 17 Sustainable Development Goals (SDGs) defined by the international community under the leadership of United Nations in 2015 and which will be valid until 2030. In order to achieve these goals, companies are equally accountable as well as NGOs and governments. As a responsible miner, KGC has defined SDGs related to our operations and impacted communities. We will continue to support the following SDGs in our operations:

- Clean Water and Sanitation;
- Responsible Consumption and Production;
- Good Health and Well-being;
- Decent Work and Economic Growth;
- Industry, Innovation and Infrastructure;
- Partnership for the Goals.

1.3 Materiality matrix



Legend: Areas of Impact

- Environmental responsibility
- Health and safety
- Social responsibility
- Economic responsibility
- Governance
- Glaciers and water management



1.4 List of identified material aspects and boundaries

Material aspects	Impact inside organization	Impact outside organization	Relevance outside organization
Water Management	x	x	Minimizing impact of our operations on the environment at the mine site is one of the KGC's main objectives. We comply with the Kyrgyz Republic (KR) and international standards and follow the Good International Industry Practice (GIIP) in our operations.
Biodiversity	x	x	
Waste and Hazardous Materials Management	x	x	
Legal Compliance	x	x	KGC complies with KR legislation and is working closely with the KR Government to resolve number of outstanding matters, including environmental claims and claims made by the General Prosecutor.
Ethical Conduct and Anti-Corruption	x	x	According to the Transparency International Corruption Perception Index the KR is ranked high among the countries most prone to corruption. KGC has a zero tolerance policy for unethical behaviour and has always been committed to fair and transparent operation.
Fostering Local Economies		x	Our economic performance plays significant role in the Kyrgyz economy, providing 8.6% of GDP in 2018, jobs for more than 3,500 people, supporting local producers and investing into local communities.
Local Communities	x	x	Constructive dialogue with the local communities is a key to our successful cooperation and uninterrupted operations.
Occupational Health and Safety	x		Our employees receive regular health checks and support, are provided with high quality personal protective equipment, and receive health and safety training to protect themselves and co-workers. Our motto is "No job is so important that we cannot take time to do it safely".

1.5 BUSINESS ETHICS



Recent high-profile corruption and bribery in the industry and increasing diligence on the part of regulatory agencies means that corruption in many developing countries has increased the risks of non-compliance and the related damage to organizational reputation. According to Transparency International Corruption Perception Index, Kyrgyzstan is ranked high among the countries most prone to corruption.

KGC has a zero-tolerance policy for unethical behavior and has always been committed to fair and transparent operation. Supported by our Code of Conduct, Code of Ethics and International Business Conduct Policy (collectively, the "Policies"). The Code of Conduct provides an ethical framework for employee decisions, actions and behavior. It outlines the principles for appropriate conduct and explains the standard of behavior expected. These Policies regulate KGC's business conduct with Government Officials, interactions with others and include important concepts such as preventing conflicts of interest between parties of the company including engaging in improper activities with suppliers and others that do business with the Company.

These Policies contribute to creating a workplace culture that encourages and supports staff to identify and declare conflicts of interests so that they can

be managed in an open and transparent way. Our employees provide formal acknowledgment of awareness on these Policies, as this subject is an important component of our commitment to conduct business in an ethical and lawful manner.

The Company has also established internal financial and other controls to (a) prevent corrupt payments from being made, (b) detect any such payments that are made, and (c) defend KGC actions if challenged by enforcement authorities. KGC requires accurate documentation from all of our partners. KGC maintains records that accurately reflect all transactions — payments, expense reimbursements, gifts, business entertainment, disbursements, commission payments, fees and other dealings with prospective customers, agents, subsidiaries and other affiliates.

Centerra has established a Compliance Hotline to allow employees and other stakeholders to anonymously submit in good faith allegations of non-compliance with our Policies. The Compliance Hotline is available in English, Russian, Kyrgyz, and the languages of the countries where Centerra operates and can be accessed at www.clearviewconnects.com. The Hotline is confidential and available 24 hours a day and is operated by a third party provider.

Training on International Business Conduct Policy, Code Of Ethics and Anti-Corruption Programs

In 2018, a total of 2 sessions were held (both for expatriates and Nationals in English and Russian) at Kumtor. A total of 32 employees attended training at Kumtor. Our objective is to conduct this training on an annual basis, and to ensure that all employees receive in-person training at least once every 3 years (if not more in high risk areas). In 2018, we also developed an on-line video to provide similar training which will be used in conjunction with in-person training.

The training objective (for in-person or video training) was to raise employee awareness regarding Anti-Corruption legislation and Centerra's Anti-Corruption programs including the International Business Conduct Policy and the Code of Ethics. Topics presented included:

Centerra's Policies on Code of Ethics & International Business Conduct

- Conflict of interest
- Confidentiality
- Compliance with Laws
- Compliance with good disclosure practices
- Anti-bribery & accounting provisions
- Prohibited & allowed payments
- Due diligence in third-party relationship
- Indication of corruption ("Red Flags")

- **Risks and potential impact to the Company, its employees and partners**
- **Compliance Hotline reporting**
- **Annual certification of compliance**



HONESTY & INTEGRITY

HOW WE CONDUCT BUSINESS IS IMPORTANT TO US



As Kumtor employees you agreed to comply with two important policies*, discussed below.

Non-compliance with these policies can result in **disciplinary actions**, including reprimands, demotions, suspensions and **dismissal of employment**.

Non-compliance with these policies may be contrary to applicable laws.

1. CODE OF ETHICS AND GIFT REGISTRY POLICY:

Conflict of Interest

A conflict of interest can occur when an employee has a private interest in the outcome of a business decision.



✓ If there is any doubt whether a conflict of interest exists, talk to your supervisor, any member of management, or submit questions anonymously and confidentially via the Compliance Hotline (see below).

If you have an actual conflict of interest, disclose it in writing to the Vice President, Human Resources.

✗ Don't make any actions or decisions that may create a conflict of interest between you and Kumtor.

Confidentiality

As a Kumtor Company employee, you receive a lot of information about it.



✗ Don't disclose any confidential information about the Company to any member of the public, whether orally or in writing.

Don't speak to the media in the name of Kumtor without permission to do so.

2. INTERNATIONAL BUSINESS CONDUCT POLICY:

Improper Payments

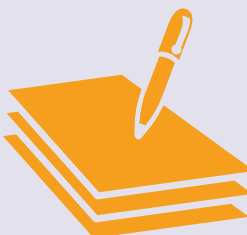
Don't pay, offer, promise any money or thing of value to any Public Official (Government members, employees of any gov. department, ministry/agency, etc., see the full definition in the Policy) in order to obtain/retain contracts, business or any other advantage for Kumtor. This includes money, gifts, entertainment, kickbacks, loans, rewards, the provision of facilities or services at less than full cost, and an advantage or benefit of any kind (whether from corporate funds or assets, or personal or other funds or assets).



✓ Report immediately, if asked to make an Improper Payment. No one will suffer a demotion or penalty for refusing to make an improper payment, even if it results in adverse consequences to Kumtor.

"Books & Records" Provisions

Kumtor is required to make and keep books, records and accounts which accurately and fairly reflect the transactions and dispositions of its assets, and to devise and maintain a system of internal controls.



✓ Record transactions in conformity with accepted methods of financial recording.

Record transactions in ways that permit the preparation of statements in accordance with international financial reporting standards.

✗ Don't misrepresent, conceal or falsify financial books or records.

HOW TO REPORT IF YOU HAVE A CONCERN?

YOUR SUPERVISOR

@ HR DIRECTOR
deon.badenhorst@centerragold.com

@ CENTERRA GOLD (for concerns beyond Kumtor management)
yousef.rehman@centerragold.com



COMPLIANCE HOTLINE

www.clearviewconnects.com

Within North America (toll-free):
1-866-841-8609

Outside North America:
1-647-438-1938



clearview-centerra
(audio only)



ClearView Connects™
P.O. Box 11017
Toronto, Ontario
M1E 1N0
Canada



AUDIT COMMITTEE CHAIR

To Centerra Gold headquarters. In a sealed envelope marked "Private and strictly Confidential - Attention: Chair of the Audit Committee of Centerra Gold Inc."



Our Compliance Hotline is available in English, Kyrgyz (on-line only) and Russian.



ECONOMIC VALUE

2.1 ECONOMIC PERFORMANCE

KGC is the largest private sector employer and taxpayer in the Kyrgyz Republic. In 2018 KGC operations accounted for 8.6 % of GDP and 18.4% of aggregate industrial output.

Payments made within the Kyrgyz Republic in 2018 were \$301 million. Total payments within the Kyrgyz Republic since 1994 have now reached \$3.7 billion. Our strategic community investment programs in 2018, described in the Social Responsibility section, were \$2.2 million.

We continue to contribute 1% of gross revenue to the Issyk-Kul Development Fund for support of social and community projects. The Fund is controlled by the government and is under supervision of local authorities with the aim to develop social infrastructure such as schools, clinics and kindergartens in Issyk-Kul Oblast. In 2018, we paid \$7.3 million to the Fund.

In addition, the Kyrgyz government, through the state owned mining company Kyrgyzaltyn OJSC, remains the largest single shareholder of Centerra Gold, owner of KGC. By the end of 2018, KGC employed 3,491 people, including contractors, with Kyrgyz nationals making up more than 98% of full-time staff, which is detailed further in the People section.

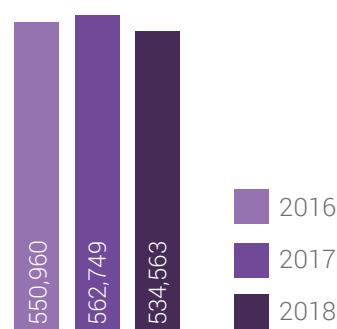
2.1 Kumtor's share of GDP, %*



2.2 Kumtor's Share of Total Industrial Output (%)*



2.3 Gold production (ounces)



* Kumtor's macroeconomic impact in the Kyrgyz Republic
SOURCE | Kyrgyz Republic National Statistics Committee.

2.4 Direct economic value generated and distributed¹

Indicator	2016	2017	2018
Economic value generated			
Revenues from Gold sales	683,327,685	685,163,279	660,058,489
Other income	1,926,887	4,069,740	1,126,089
Economic value distributed			
Operating costs (goods and services) ^{3,5}	190,818,481	206,804,840	222,831,431
Corporate administration costs	-	-	-
Exploration costs			6,090,617
Capital expenditure ⁴	75,778,978	78,745,280	60,429,073
Other operating costs	2,304,654	2,469,333	3,097,024
Employee and contractor wages and benefits	108,861,856	117,237,524	117,800,253
Payments to providers of funds (shareholders)	135,000,000	400,000,000	100,000,000
Taxes and royalties	96,292,724	96,729,304	92,988,345
Community donations and investments	1,176,986	1,035,343	2,603,835
Payments to Cancer Support Fund		7,000,000	
Economic value retained	75,020,894	(220,788,605)	55,344,000

Notes:

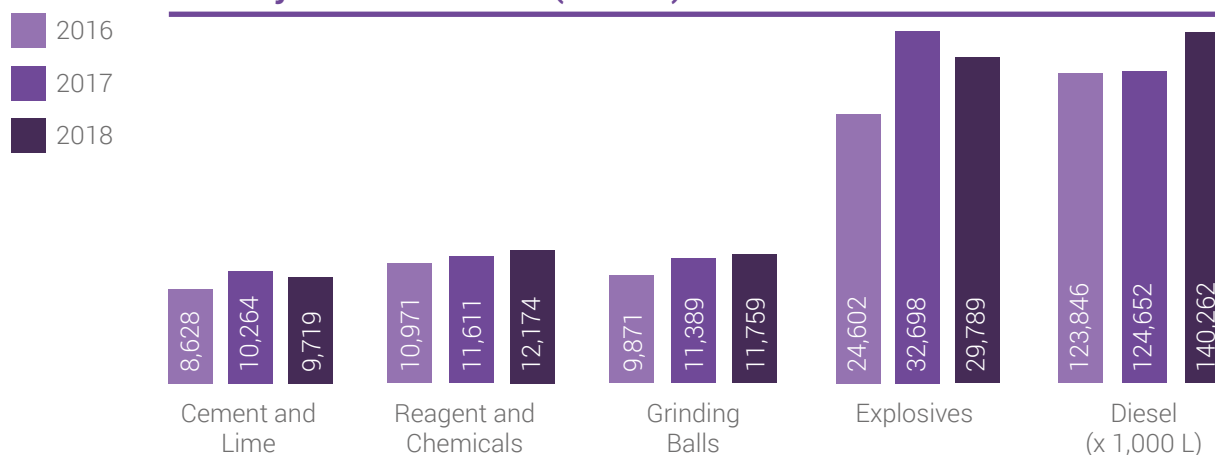
1. Data has been prepared on an accrual basis and non-cash costs have been omitted.
2. Other income includes income from financial investments, sale of assets, and other services.
3. Includes capitalized overburden stripping costs.
4. Excludes capitalized overburden stripping costs.
5. Includes by-product sales (silver).

Consumption of materials

Mines are large consumers of supplies and materials for both the operations and the working community. Efficient use of materials is essential for both economic and environmental reasons. The major raw materials consumed include diesel fuel, explosives, lime, reagents

and chemicals (including cyanide) used in the milling and leaching processes, and grinding balls to crush the ore. We also consume significant quantities of other non-renewable materials such as fuel, lubricants, grease and explosives.

2.5 Major Consumables (tonnes)





2.2 LOCAL PROCUREMENT

One of KGC priorities is to procure goods in the local market. The goods and services should meet strict criteria, which we bear in mind when considering such factors as market stability, quality and price.

We believe that KGC strategy for local procurement creates significant economic benefits for Kyrgyzstan at the local, regional and national levels. Procuring goods and services in the local market results in new jobs and sources of income, acquisition of new skills and technologies and helps in establishing vital local enterprise networks as well. Thus, local procurement provides direct possibilities for creating common benefits for both KGC and the communities where the Company operates. For more detailed information on local procurement strategy, see the company website in the section "Procurement and logistics"

(www.kumtor.kg/en/procurement_logistics/).

To maintain a continuous production, we procure more than 11,000 products supplied by nearly 600 enterprises operating in the territory of the Kyrgyz Republic. Since 2008 100% of food products are procured in the local market. We will discuss our partners - the local producers - below.

Throughout 2018, KGC continuously engages nearly 1,100 employees of various trades and qualifications on a contractual basis, the majority of whom reside in the Issky-Kul province.

Taking into account a relative continuity of the scopes of seasonal works for contracting organizations, and the well-proven processes of recruiting workers and equipment from nearby towns and villages, new potential service providers should be well equipped, have wide experience and be competitive.

We actively inform potential suppliers, disseminate our requirements and advise on the criteria that should be met in order to get a higher chance of entering into partnership with KGC.

2.6 Local procurement in context

	Units	2016	2017	2018
Total Payments for Goods and Services	USD	256,175,620	266,126,258	317,703,765
Local Payments for Goods and Services	USD	58,426,843	60,385,333	81,176,660
Local Payments for Goods and Services as % of Total	%	23	23	26

“ Since 2008, 100% of food products are purchased within the Kyrgyz Republic ”

LOCAL PROCUREMENT

CHALLENGES OF PROCURING GOODS LOCALLY:

Businesses are informal

- not registered
- not paying taxes
- not keeping good records
- not using bank facilities

Poor health and safety practices

- danger of food-borne illnesses
- products do not comply with international standards
- no certification

Small production capacity

- unable to supply large business demand
- no export potential

High production cost

- unable to compete with bigger, more efficient enterprises abroad

Low cash-flow

- unable to survive if they get paid 30 days after invoicing (standard for big businesses)

HOW KUMTOR IS HELPING:

Requires good business practices

- licensing and registration
- paying taxes
- record keeping
- use of bank facilities
- compliance with international health and safety standards & provide training

Helping businesses development

- fostering relationships with other development partners such as EBRD, who can help finance businesses
- helping businesses to harness national resources
- participating in meetings of International Business Council, Association of local businesses JIA, GIZ Office in KR

Pays more for local goods in the short run

- allows small businesses to compete for lucrative contracts
- provides stable revenue for businesses to grow and improve

Flexible Supplier Payment System

- paying faster, sometimes even in advance

EFFECT ON THE LOCAL ECONOMY:

Formalization of business practices

- reduces corruption
- provides government revenue to pay for roads, schools, etc...
- job creation

Implementation of Health and Safety Standards

- lower risk of food borne illnesses
- access to new markets which have similar standards

Bigger production capacity.

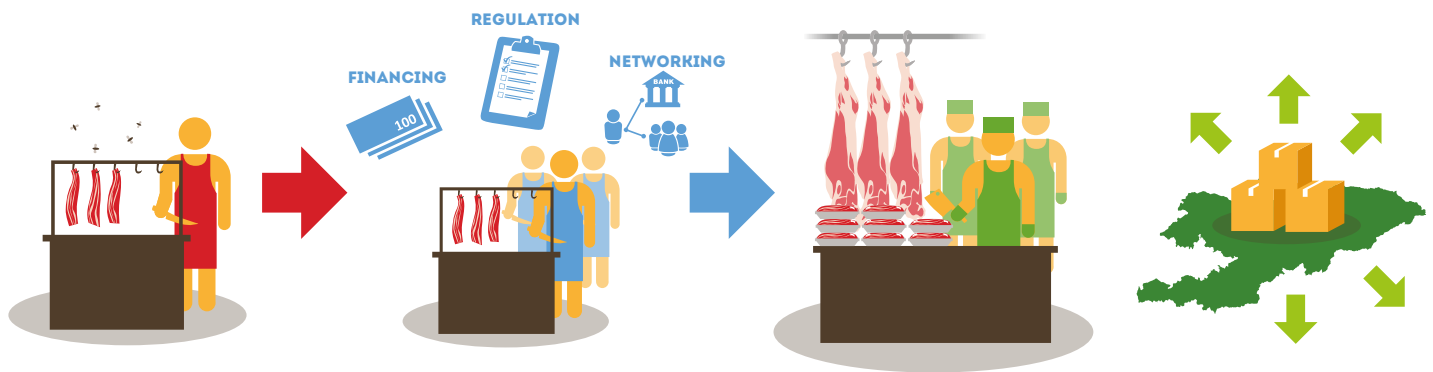
- ability to supply larger companies
- potential to export surplus products
- ability to support themselves after mine closure

Business Growth

- stronger, more self-sustaining economy

Competitiveness

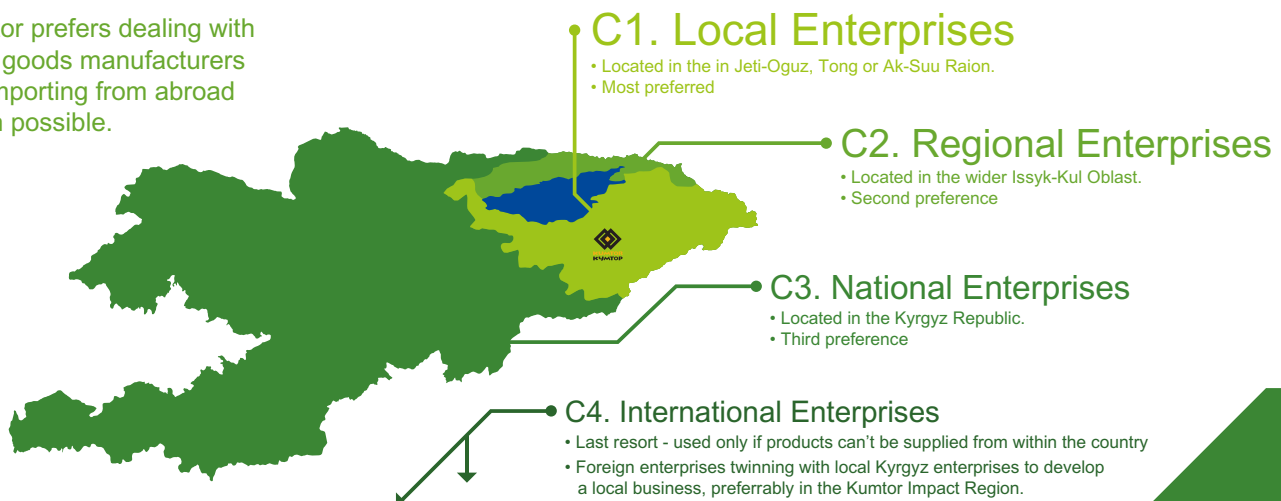
- ability to compete with larger, more affluent enterprises for Kumtor contracts



Who is eligible to be a supplier?

- Businesses who meet Kumtor's health and safety standards;
- Businesses who are licensed by the government and approved by Kumtor;
- Businesses who are not likely to have a conflict of interest, of any kind, with Kumtor.
- Businesses who can provide competitively priced goods and services on a sustainable basis.

Kumtor prefers dealing with local goods manufacturers vs. importing from abroad when possible.



Since the regions have little experience in cooperation with large-scale projects or modern mining enterprises, we face a number of difficulties with supplying goods and rendering services like most international mining companies that operate in them. Nevertheless, we support potential suppliers in the local market that cooperate with us and help them overcome these barriers. Because of Kyrgyzstan's entry into the Eurasian Economic Union, in 2018 a number of goods and services items previously procured in the international markets was replaced with domestic goods. Thus, proportion of goods and services procured in the local market has significantly increased.

We are convinced that making purchases from the local market provides significant benefits not only for the Company but for the local market as well. This is one of the most efficient ways for the Company to retain its social license to operate, strengthen relationships with the Kyrgyz Government and improve the efficiency of the Company's supply chain. The primary objective of KGC Procurement department is to increase volumes and range of goods and services procured by KGC in the local market, which pursues common benefits for both the Company and the country as a whole. We also set a goal for ourselves – to leave a positive legacy, which in future will become a driving force of the extractive sector and related industries.

Despite the constant effort we make to improve the local market, there are still many goods and services that are not produced or not available in the Kyrgyz market. Specialist operational equipment and related services, large dump trucks, spare parts from the manufacturer, tires, main consumables and chemicals may serve as an example. In spite of our being a major consumer of fuels and lubricants, we have to import a major part of them.

Our total expenditures on goods and services in 2018 made up nearly \$318 million. About \$81 million of this sum was spent on procurement in the territory of the Kyrgyz Republic

Leaving a positive legacy

The current estimated life of the Kumtor mine is until 2026. We want our positive impact on the Kyrgyz economy to continue after this. We do everything possible to ensure that the local suppliers use our cooperation to develop their business and diversify their customer base. Many of our suppliers highlight that the contract to supply KGC with products is a mark of quality that makes their production more attractive to other customers. We must be sure

that in 2026 when the mine will close, there will not emerge any socio-economic difficulties, which will force a large number of suppliers to cease their activities. Therefore, we help the entrepreneurs to develop their business and not rely on KGC as their sole client.

We want our suppliers to become more successful and keep creating new jobs and possibilities for the local communities. Realizing their need for current capital, we make quick payment to the suppliers, often within several days, and in certain cases (for example, with supply of the equipment with a long production period) we provide prepayments.

Balykchy marshalling yard

Balykchy Marshalling Yard (BMY) is a central transport hub intended for transit storage of materials, which are delivered by train and trucks. The materials are delivered to the Kumtor mine by KGC trucks and the vehicles of contracting organizations (as required).

- On average, 218 rail cars and 60 haul trucks deliver goods to BMY each month.
- Every day BMY sends approximately 22 haul trucks with goods and materials to the mine. Usually each convoy consists of 11 trucks with fuel, 6 trucks with ammonium nitrate, 1 truck with lime, while the remaining haul trucks transport sectional containers with the equipment and chemicals.
- Our own fleet includes 48 trucks. Moreover, we typically utilize 1-2 trucks per day from contractors.
- The distance from BMY to the mine is 250 km, which means that the total distance the Company's trucks cover each month is 341,000 km. The total volume of fuel transported is about 10 million litres each month.

BMY has a fuel farm with a truck filling station, six tanks with a volume of 12,000 m³, two tanks of 100 m³ to fill the trucks with fuel oil, and one tank with a volume of 200 m³ for gasoline. Moreover, there are warehouses, vehicle repair shops, administrative buildings and one guesthouse as well. 207 people work at BMY. The Company's strategy is to recruit the employees who reside in Balykchy and nearby villages. We procure materials and goods in Balykchy, consume maintenance services and the services required to meet daily production requirements of BMY and guesthouses.



3 PEOPLE

3.1 | WORKPLACE PRACTICES

We value each of our employees and their professionalism, and strive to maximize the development of their abilities, talent, and energy in a working environment that allows them to make a personal contribution to the company objectives.

Employment of personnel

KGC plans staffing requirements and improves the professional level of its employees to ensure effective operation of the enterprise. KGC seeks to hire employees, who meet the established qualification criteria for production expertise, as well as theoretical and practical training.

We continue to increase the percentage of the Kyrgyz Republic citizens among the Company staff, raising it from 95% in 2011 to 98% by the end of 2018.

Labour compensation

The Company establishes a system of labour remuneration that allows attracting and retaining highly qualified personnel, as well as ensuring decent payment for individual and collective labour of employees.

Staff salaries far exceed the average for Kyrgyzstan: in 2018, the minimum wage in the KGC was approximately ten times higher than the minimum wage in Kyrgyzstan. An indication that local employees are satisfied is the desire of many of them to stay in our Company for a long time.

Employee benefits

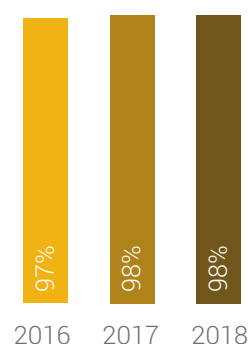
Our employees enjoy the following benefits:

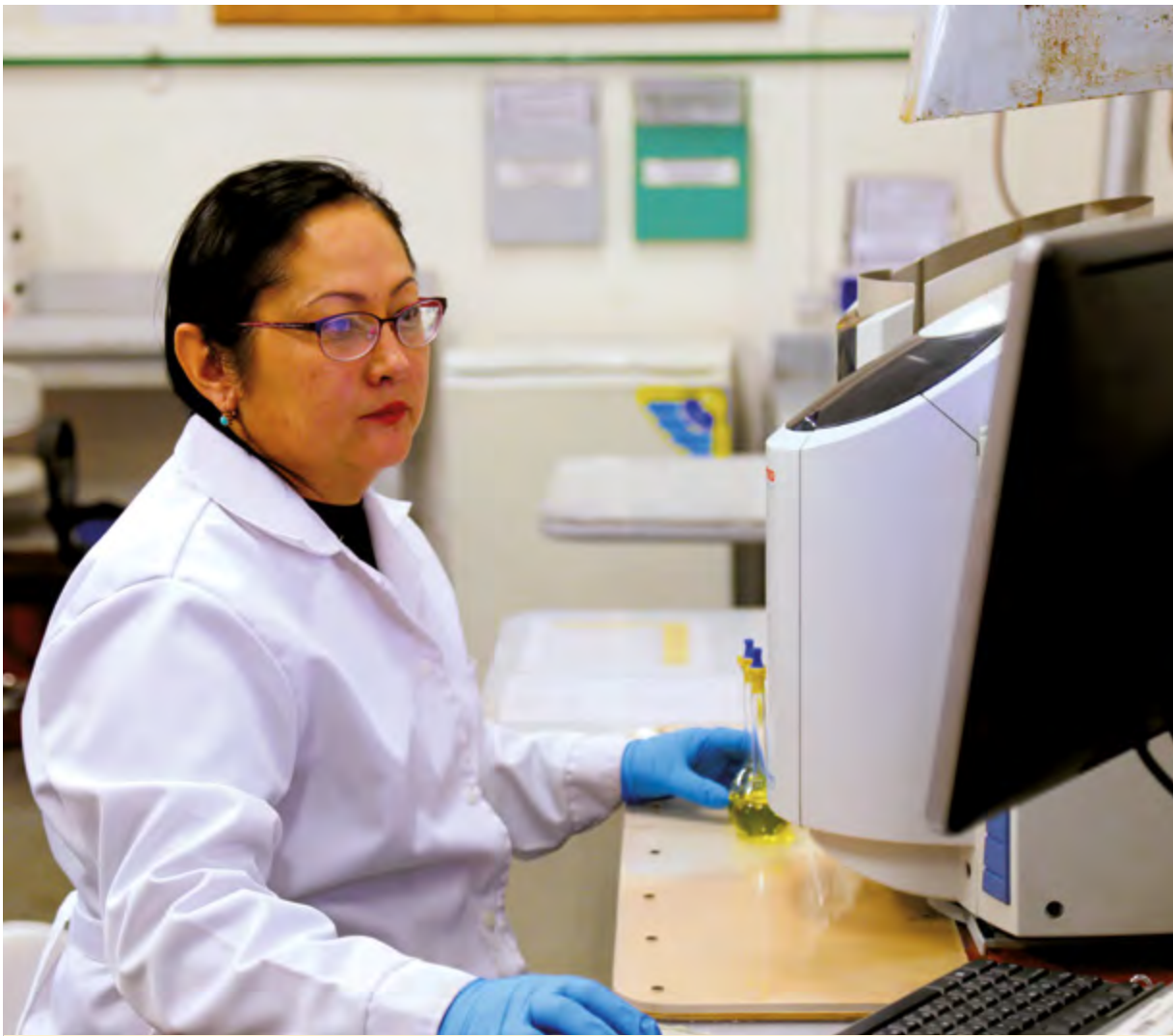
- Funds for health improvement (vouchers to resorts, material assistance for treatment, membership cards to gym halls, etc.);
- Allowances for the celebration of employee anniversaries, in connection with retirement, when entering into the first marriage, at the birth/adoption of the child;
- Home improvement loans;
- Vacation pay for health improvement of employees;
- Funeral allowances and many other benefits.

3.1 Standard National Entry Level Wages and Those Paid by Kumtor

	Units	2016	2017	2018
Kyrgyz minimum wage per hour	KGS	6.33	7.14	10.06
Kumtor entry-level wage per hour	KGS	86.20	94.62	99.35
Kumtor entry-level to Kyrgyz minimum wage ratio		14:1	13:1	10:1

3.2 Proportion of Kyrgyz Citizens as Full-time Staff





Leading from Within Program

One of the core values of Centerra is: “Win as a Team”. To achieve this, we must provide each member of our team the opportunity to contribute to the development of the Company by maximizing employees potential. The program “Leading from within” is the starting point in the journey to unite different, special and valuable personalities. We know that in the mining industry, men represent the majority of the workforce, and that women often face certain difficulties. Therefore, over the next few years we will work together to eliminate these difficulties, regardless of whether they are objective or subjective. The program is a first bold step in this direction.

The program was developed by consulting company Davis Pier. The program is available to all female KGC employees, at all levels, with participation based on a voluntary basis.

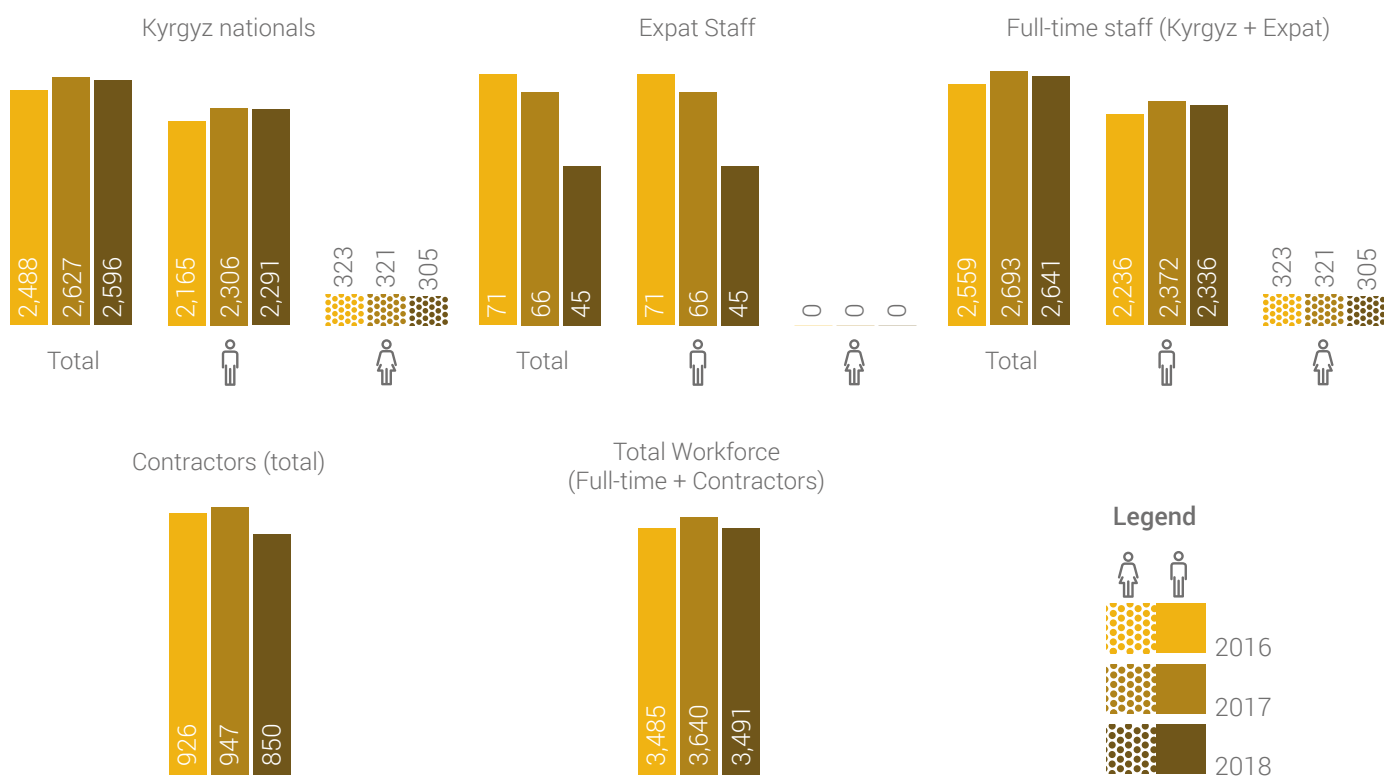
Centerra strives to ensure gender diversity and equal opportunities for all its employees. The management team understands that improving the quality of work, production indicators,

safety, as well as improving the effectiveness of innovation takes place only when each employee feels valued and supported in striving to achieve the best results. That’s what this program was designed for. “Leading from Within” aims to develop the leadership qualities of female staff, which was created with the active assistance of the management and employees of Centerra; especially women.

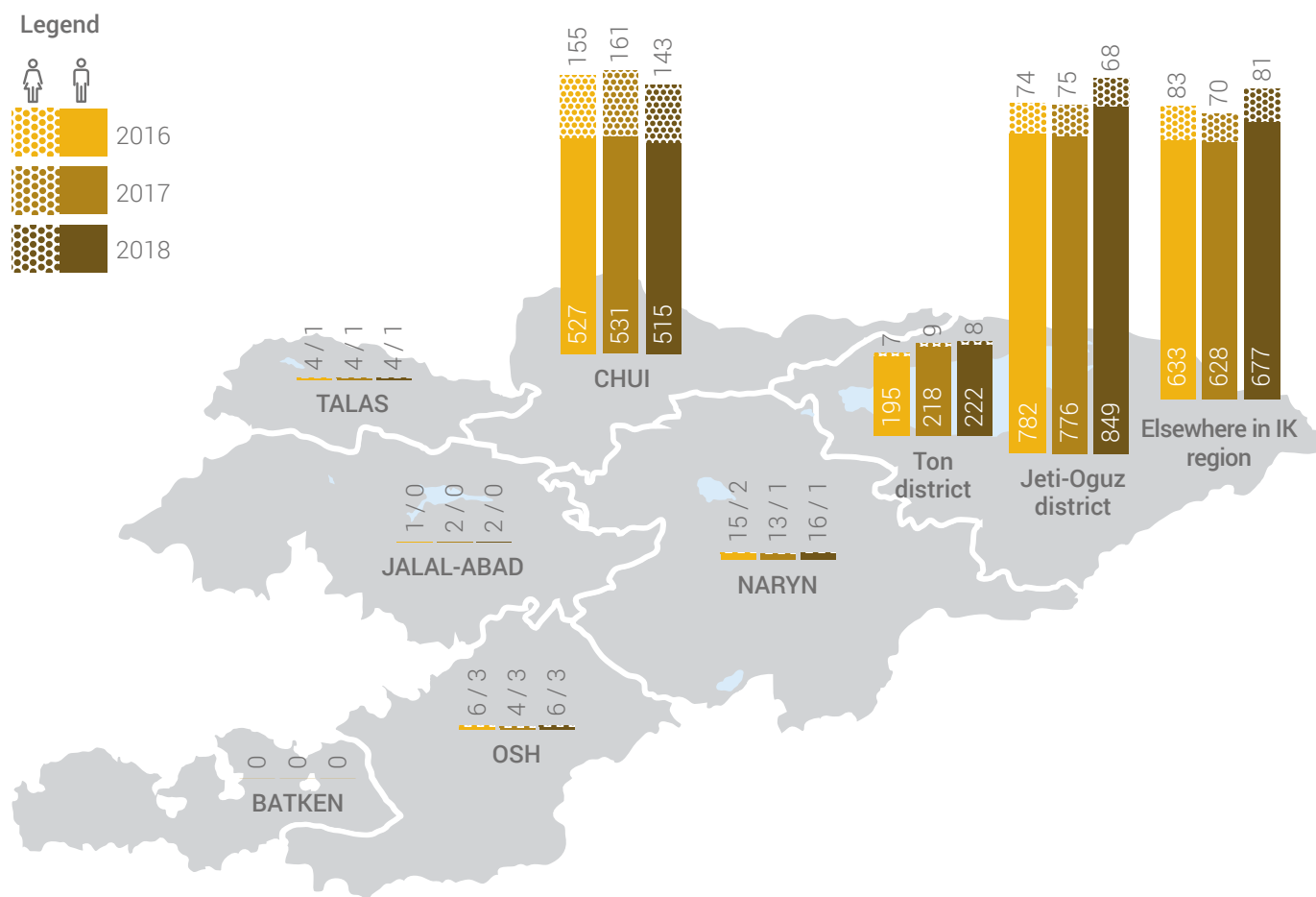
The facilitation of this program is carried out through an internal group of women, called “Regional Champions”. They were taught how to effectively present the material so that recipients can understand and implement it more easily. These women represent the various positions and levels, as well as all the regions in which Centerra operates. They contributed to the development of the program and will act as “champions” in implementing the program within the company.

In 2019, we plan to conduct the program at all KGC locations.

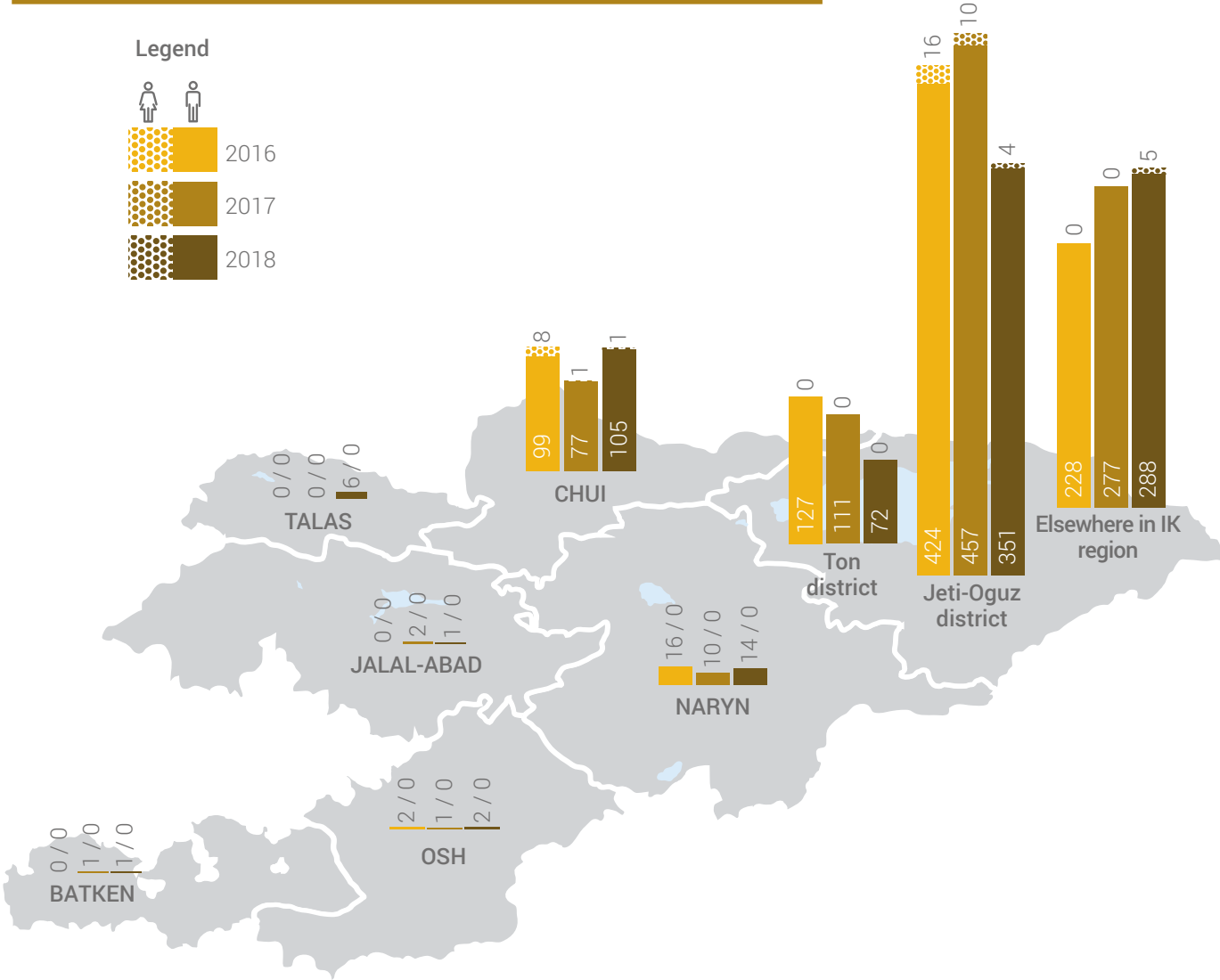
3.3 Employee demographics at KGC



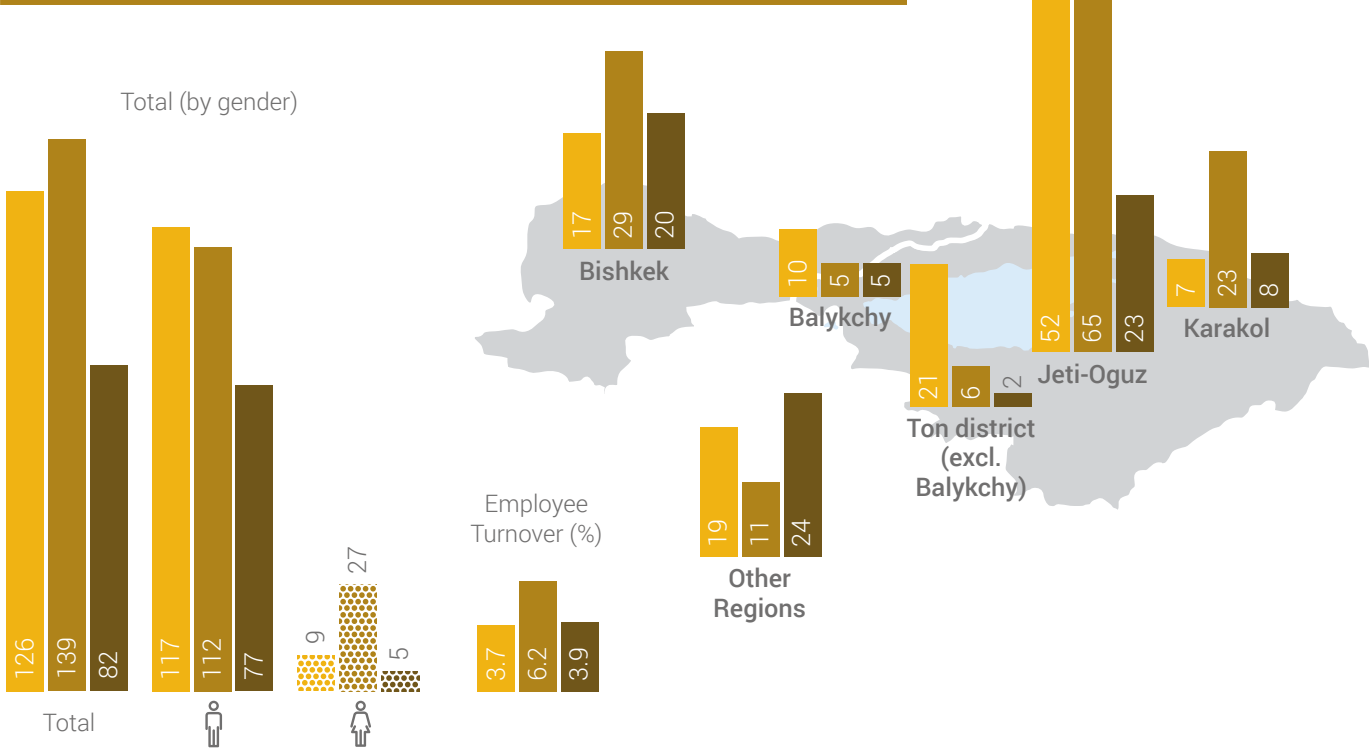
3.4 Total local workforce by region and gender



3.5 Number of contractors by region and gender



3.6 Total number and rates of new employee hires and employee turnover by gender and region



KUMTOR HIRING PROCEDURE

The Company has adopted the following procedure for selecting candidates:

FIND INTERNAL CANDIDATES

We give current employees, who are interested, the chance to apply for an open position first.

WHEN QUALIFIED INTERNAL CANDIDATES CANNOT BE IDENTIFIED, A FORMAL RECRUITMENT CAMPAIGN IS HELD.

EMPLOYMENT OPPORTUNITY ANNOUNCEMENT

Advertising for an open position is done through media (newspaper, TV, web). If necessary, position announcements are distributed in local communities. The Sustainable Development department uses all possible channels to notify the community through local administration.

APPLICATION

Application forms are available at all Company offices - located in Bishkek, Karakol and Balykchy.

Applicants must have the minimum required qualifications, skills, and experience to be considered.

INTERVIEW

The top candidates whose skills, education, and experience best fits the position will get interviewed.

SELECTION

Based on the selection process results, the most suitable candidate's applications are provided to the management for approval.

Before employment, a successful candidate must undergo a medical examination and training on occupational health and safety.



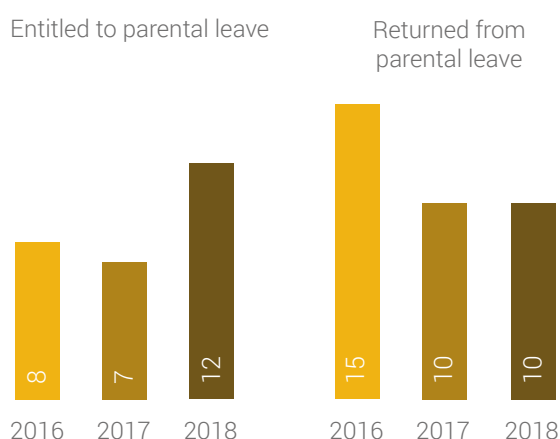
ATTENTION!

Employment at Kumtor is not for sale.

You should not have to pay anyone.

Please contact 0800 223-23-23 or 0312 90-07-07 if you are approached with a job for money offer. Such offers are illegal and go against Kumtor policy.

3.7 return to work and retention rates after parental leave (female employees)



Recruitment process

The Company seeks to ensure consistent and successive staffing of the business through the recruitment of individuals in accordance with the required qualifications, inclusive of education, academic and practical training, working experience, personal qualities, etc.

The selection and hiring of staff for the Company is coordinated and administered by the Human Resources Department, subject to prior approval from the KGC management, in conformance with the principles of efficiency, due diligence, fairness and good corporate ethics. Our recruitment process is covered in the infographic on the previous page.

Employee training

General Safety Induction and Initial Health, Safety and Environment Instruction and First Aid Training is provided to all new KGC employees, students and contract partner employees. In addition to the initial training, refresher training is conducted annually covering topics such as: general workplace safety, first aid, firefighting, emergency response, workplace hazards materials safety, transportation of dangerous goods, defensive driving, forklift truck operation, work permits, radiation hazards, vessels under pressure, working in confined spaces, handling cyanide and other chemicals, hearing protection, frost bite, hypothermia and a variety of other important safety topics.

- Sessions for new employees students and contract partner employees – 18,700 hours;
- Annual Refresher Sessions – 49,129 hours;
- Red Crescent First Aid Certification Training – 22,176 hours;

- Work Safe | Home Safe Phase II Workshops – 15,556 hours.

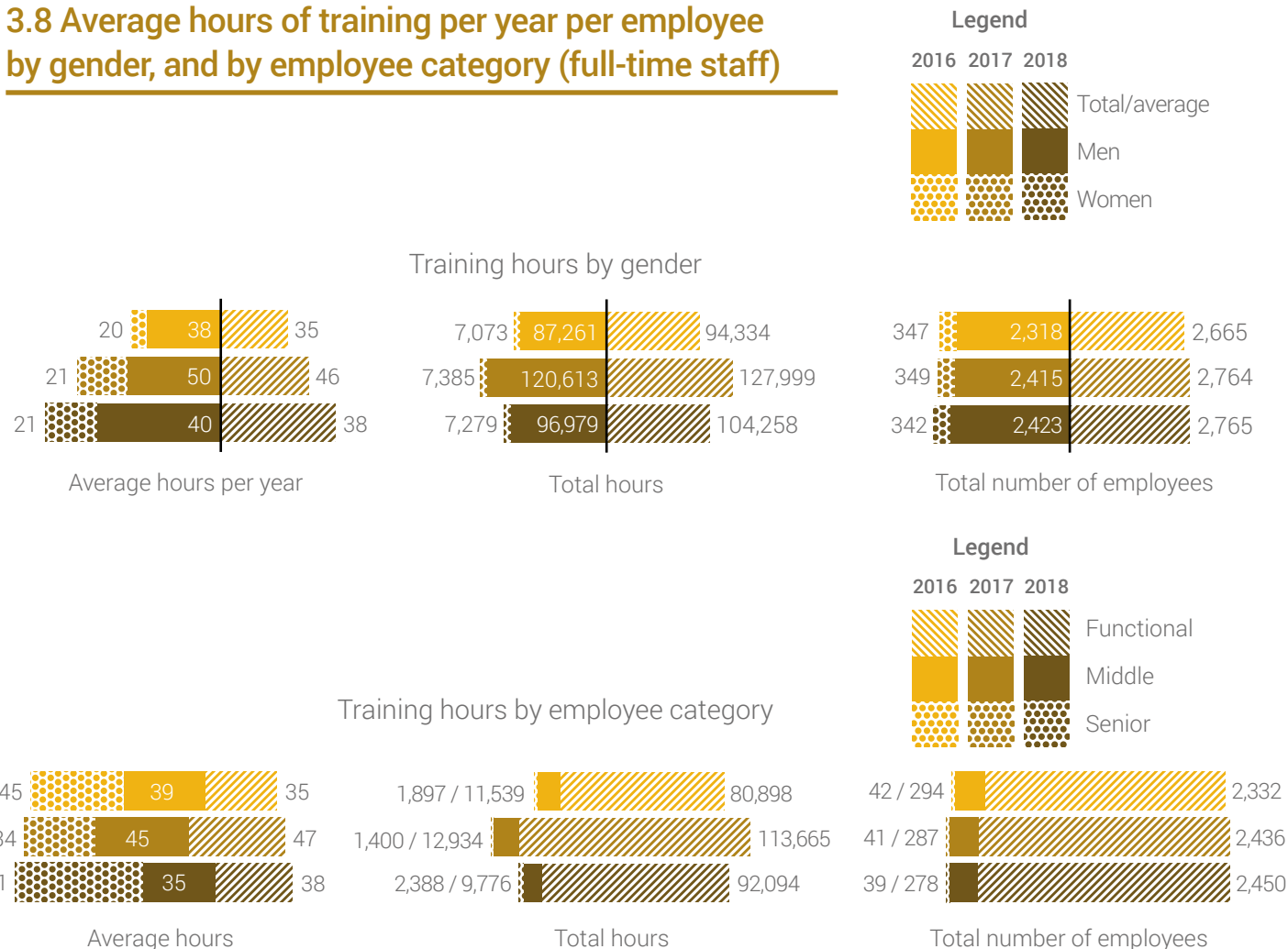
During 2018, KGC invested approximately \$3.0 million for the training of employees, students and contract partner employees. KGC employs 37 full-time dedicated training staff and also utilizes the services of external training providers, such as Red Crescent Society of Kyrgyzstan, Inter-Branch Training Center under the State Committee of Industry, Energy and Subsoil Use, Alfa Leader, Borusan Makina and several other local and international training providers.

The total value of \$3.0 million includes all cost associated with training from all KGC departments and includes all costs incurred with employing training staff, maintaining facilities, contracts with local and international providers etc.

The three training facilities located in Karakol, Balykchy and Bishkek continued their operation in 2018, allowing KGC employees, students and contract partner employees the opportunity to attend any required training during their off-duty time in a location close to their place of residence. This has proved to be cost and time efficient in terms of process optimization as well as being more convenient for the employees.

All KGC leaders, engineers, technicians and many of the workers also attend training programs and receive certification from the Inter-Branch Training Center under the State Committee of Industry, Energy and Subsoil Use of the Kyrgyz Republic, in hazardous operations, in accordance with the law of the Kyrgyz Republic.

3.8 Average hours of training per year per employee by gender, and by employee category (full-time staff)



In 2018, professional development opportunities for employees included:

- Educational financial assistance and leave is available to employees to obtain higher education degrees at institutes of higher learning, some examples of this are roles requiring technical diplomas, or where a second higher educational would be beneficial for an employee to advance their career in the company;
- Overseas short program learning opportunities in business, management, employee development and other role-specific programs are arranged for employees allowing them to increase skills and to perform more effectively in their roles. This training would normally be a part of the employees' individual development plan and a part of the overall KGC succession plan;
- Overseas technical learning opportunities in skills development specific to operational departments designed to equip employees with the technical skills to keep up with a changing technological environment;
- In 2018, Professional Development training of KGC Supervisors and Managers continued to be a focus for the company to further develop and enhance managerial skills within the leader team.

Several local businesses offering supervisory skills development, effective management techniques and the coaching and mentoring process were utilized.

- Team building and coaching/mentoring sessions for mid-level and senior-level managers providing a venue to build comradery and a sense of working together to achieve the company's business plan. These workshops and sessions are facilitated by a local Professional Development coach under contract with KGC.

Apart from investing in the education and training of current employees, KGC has programs designed for the younger generation – our potential future workers. In agreement with Technical School #27 and Technical School #91, KGC sponsored Red Crescent First Aid Training for Regional Scholarship recipients. After completing the eight-hour training session, each participant is awarded a First Aid Certificates that is valid for 2 years.

The Regional Scholarship Program for students completing high school and keen to pursue a vocational career, has been running since 2000. More information about the Scholarship program is available in the Social Responsibility Section of the Report.



Work Safe | Home Safe Phase II

The implementation and rollout of Centerra's Vision, Values and the Work Safe | Home Safe program (Phase II) was completed in August of 2018 with more than 3,889 KGC employees, students and contract partner employees participating. Work Safe | Home Safe is a Safety Leadership program that establishes and fosters a culture where individuals are responsible to take

ownership of their personal safety and the safety of those working around them to ensure that everyone returns home safely after every shift. One very important tool from the program that all participants have actively embraced is the "STOP Conversation", which is used when someone is seen to be doing something unsafe or in an unsafe situation.



3.2 OCCUPATIONAL HEALTH AND SAFETY

When mining at the high altitude of 4,000 meters, the major challenges are living and working in a cold climate and reduced oxygen levels. Average annual temperature is -8°C with a minimum as low as -38°C.

KGC employees receive regular health checks and support. They are provided with high quality safety clothing, and receive health and safety training to protect themselves and co-workers. We record and analyze incidents and near misses. The Company has an emergency response team that performs regular training exercises. The motto of the Company is: **"No job is so important that we cannot take time to do it safely".**

Medical screening and wellness

Employees of the Company undergo annual medical examinations in various medical institutions of our republic, where they receive an analysis of their health, on the basis of which they are issued a permit to work in the at high altitude. To assist with these examinations, KGC has several contracts with local state hospitals in Bishkek and Issyk-Kul regions. Employees are not allowed to work without the annual medical examination and work permit, which is issued for a period of 12 months. In 2018, 2,633 employees passed annual medical examinations, 162 passed pre-employment screening, 251 employees were referred for special medical examinations and 38 employees were classified as medically unfit to work at the high altitude mine site. The KGC Medical Department conducts partner seminars twice a year with doctors from medical institutions engaged in medical examinations of employees. The purpose of these meetings is to receive feedback, improve the quality of medical examinations, eliminate problems, complaints and seek rational proposals. It is not uncommon for such meetings to invite professionals from the National Center for Cardiology and Therapy to advise regional doctors on the tactics of treating

mountain diseases, as well as diagnosis and therapy of cardiac patients. Thus, by improving the quality of medical examinations, the medical department contributes to the health of employees.

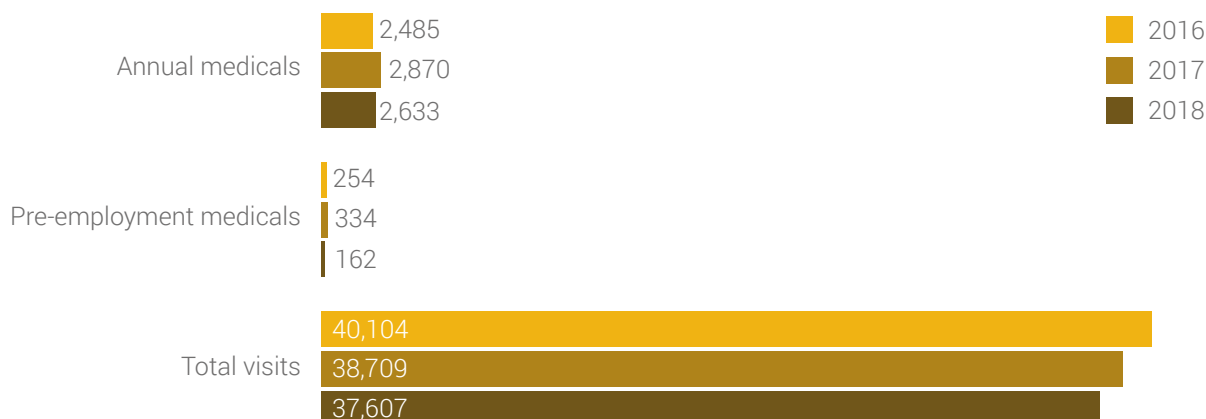
KGC maintains medical clinics in Bishkek, at the Balykchy Marshaling Yard and at the mine site, with trained medical staff. Doctors with high qualifications regularly undergo training both at local and international advanced training courses. They provide medical care not only to the company's employees, but also to contractors, and person who have arrived for short-term visits to the mine site.

All visitors receive medical checks at the Bishkek clinic to verify their fitness to work at the mine. On arrival at site, they receive a further check, and if necessary, treatment is given if any symptoms of acute mountain sickness (AMS) arise.

Our monitoring shows that upper respiratory tract infections remain the principal cause of illness and work absence. Every year, preventive health programs are implemented to motivate our employees to strengthen their health and improve their overall well-being. Thus, as part of the flu prevention vaccination program, in 2018, 500 employees voluntarily underwent influenza vaccination.

Since 2017, a hygienic occupational physician who oversees the hygiene of nutrition and work has been recruited in the staff. For every meal, a wide choice of high quality, freshly prepared food is available, providing for personal and cultural preferences, and entirely sourced from the local companies.

3.9 Medical screening and visits





Work Safe | Home Safe Leadership Program

Over the past few years, Centerra has made significant progress in its vision to become a world leader in safety performance. Centerra has established a corporate culture, in which the value of employees and their contribution to achieving the Company's goals and objectives is recognized, and seeks to ensure that everyone returns home safely after every shift. To do this, all Centerra employees, contractors and other business partners shall take ownership of their personal safety and the safety of those working around them. According to the industrial statistics, Centerra is a leader in the field of safety. However, to our regret, accidents and serious injuries continue to occur. In 2016, after reviewing the feedback and the results of discussions at all levels of the Centerra global operational locations, we concluded that safety leadership had to be transformed. Centerra collected and integrated different points of view and, using the safety consultant's recommendations, Work Safe | Home Safe program was developed which became the Centerra's safety initiative. The recently adopted Centerra concepts and values were also included in the Program, the introduction and

implementation of which started in the 2016 autumn at Kumtor. The program phase I consisted of one- and two-day training sessions. The one-day training session was intended for employees and the two-day session, called Leadership training, was intended for supervisors and managers. Both trainings were developed to provide information in order to change behavior, provide an emotional element for building a commitment to changes, and conduct a series of interactive group exercises that collect data to ensure constant vigilance and feedback from management groups. This data are then analyzed to manage changes, improve safety leadership and culture. Full successful implementation of the Work Safe | Home Safe program Phase I was completed in Q3 2017. Success of the program is confirmed by decrease in the number of incidents and injuries.

In 2018, Centerra introduced the Work Safe | Home Safe program Phase II, aimed at strengthening and improving the results achieved during the program Phase I. All Kumtor employees were trained in the program during 2018.

Accident Reporting

The Company implements a program that identifies, records, assesses and controls accidents, risks, hazards and near misses. When any employee observes or identifies a risk, a hazard or a near miss in an operational area, they are required to complete an industrial hazards or near miss form and submit it to the Occupational Health and Safety Administrator and Coordinator on risk management. Experts assess the degree of risk and take the required measures to eliminate a source of a hazard or a

near miss to reduce the degree of risk and exclude the likelihood of an accident in the future. Our key health and safety statistics are shown in the table 3.10. We have a Joint Occupational Health, Safety, and Environment Protection Committee, which includes representatives from various departments, organizational units, services and contractors employees by various locations of the Company.

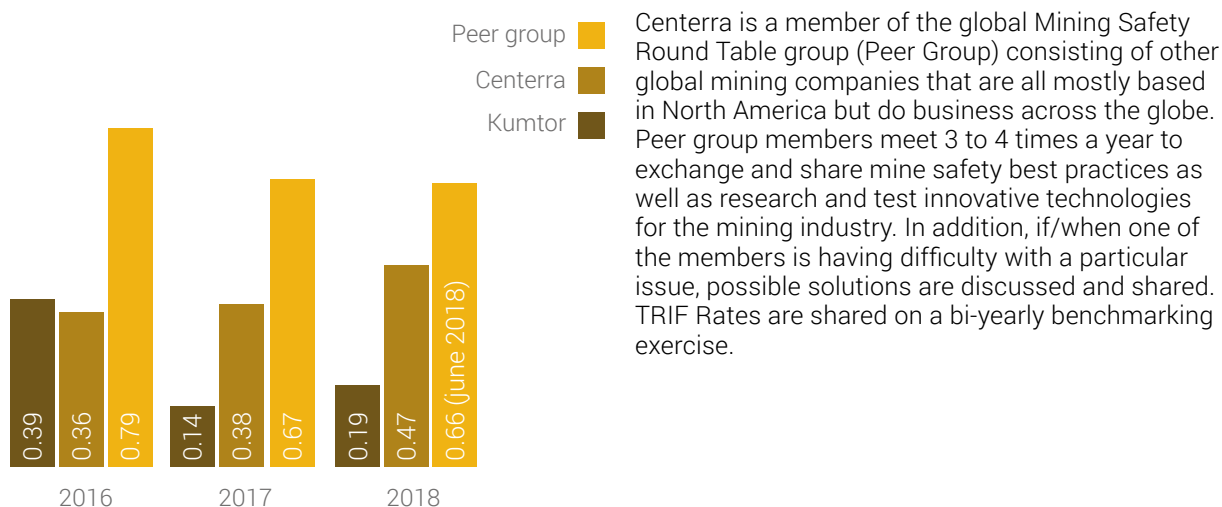
3.10 Key health and safety statistics[#]

	Units	2016	2017	2018
Hours worked	Hours	5,712,626	5,882,917	6,334,208
Lost Time Injuries (LTIs)	Number	9	1	2
Restricted work injuries	Number	1	1	2
Medical aid	Number	2	1	2
First aid	Number	17	13	9
Days lost to injury	Days	6,349	6,026	107
LTI frequency rate	No. of LTIs per 200,000 hours worked	0.33	0.03	0.06
LTI severity rate	Lost time days per 200,000 hours worked	222	205	3.38
Total Reportable Injury Frequency Rate (TRIFR)	No. of Reportable Injuries per 200,000 hours worked	0.39	0.14	0.19
Incidents with Property damage	Number	31	28	16

[#] See Glossary for definitions of key terms .

* The discrepancy in data on the number of lost days due to injuries with lost time incidents (LTI) for 2018 compared to 2017 is due to the fact that no fatal accidents occurred in 2018. In the event of a fatal accident, in accordance with international norms, an automatic calculation of 6,000 lost person-days is implemented.

3.11 Reportable injury frequency rate: KGC/Centerra vs peer group



Centerra is a member of the global Mining Safety Round Table group (Peer Group) consisting of other global mining companies that are all mostly based in North America but do business across the globe. Peer group members meet 3 to 4 times a year to exchange and share mine safety best practices as well as research and test innovative technologies for the mining industry. In addition, if/when one of the members is having difficulty with a particular issue, possible solutions are discussed and shared. TRIF Rates are shared on a bi-yearly benchmarking exercise.



Reducing vehicle incidents

Work at hazardous production facilities represents the risk of incidents and lost time injuries, which can adversely affect the health of employees, reputation, morale and financial results of the Company. To ensure prevention of incidents at KGC, the Work Safe | Home Safe program has been implemented phase by phase. Additional programs and measures were implemented for the critical controls - light vehicles, heavy duty equipment, stored energy, working at heights, ground control, hazardous materials, monitoring at the forefront, incorrect behavior, leading indicator analysis. Safety specialists visit other Centerra mines to exchange experience. Measures are being implemented to increase the involvement of front line employees in labor protection and safe behavior promotion. As part of the "Visible Felt Leadership" training program, the interaction of managers with employees of other departments and at work areas is being implemented.

The idea of safety leadership is being promoted among the line supervisors.

A special focus for employee awareness continues to be on vehicle, as for previous years, on vehicle incidents with collisions and over-turning vehicles in the mine pit which is considered one of the most significant risks to our employees. Our goal is to achieve a zero incident rate. The below table shows the key vehicle accident statistics for the past three years, which we post on information boards around the mine site alongside photographs of recent incidents as a regular reminder of the constant need for care when driving. We also continue to improve driver skills and awareness through job assessments and training. Currently, we are in the process of implementing critical control measures for light vehicles in an effort to reduce the risk of vehicle incidents.

3.12 Vehicle incident reduction program (total number of incidents)

	2016	2017	2018
Overall vehicle accidents	11	14	17
High-potential injury risk - light vehicle accidents	3	1	2
In-pit heavy versus light vehicle collisions	2	0	1
Injuries due to vehicle accidents	1	1	2

Cyanide transport and handling

Cyanide is an essential chemical for gold extraction, which must be transported to site. In 1998, there was a cyanide spillage incident during transportation from the Balykchy Marshalling Yard to the mine site. An independent International Scientific Commission review was carried out shortly afterwards. The report concluded there were no serious or lasting environmental impacts, including no short or long-term damage to Lake Issyk-Kul, and there were no reported deaths that could be attributed to cyanide exposure. The full report can be downloaded from the Kumtor website www.kumtor.kg. In April 2012, Kumtor was initially certified by the International Cyanide Management Institute (ICMI) for transportation of cyanide from the Balykchy Marshalling Yard to the mine site in accordance with the International Cyanide Management Code. The company was re-certified in 2015 and 2018 for transportation of cyanide.

Emergency prevention and response

We have a Joint Environment and Occupational Health and Safety Committee, consisted of 326 representatives from management, employees, and contractors from various locations of the Company. Our voluntary emergency response team consists of three teams at the Kumtor mine and one team at the BMY. The 24-hour mine team includes a medical doctor, is equipped with an ambulance, an emergency car, a fire appliance and extensive emergency response equipment at the mine site. The BMY team consists of a mobile emergency rescue vehicle, an ambulance, and extensive emergency response equipment. We review and update our emergency response plans annually, provide training and conduct periodic drills. Our mine rescue practices and training programs are aligned with best international industry standards.





Emergency team trainings

The emergency response team members from Kumtor mine site go through Emergency prevention training sessions and exercises every Sunday, between 1 p.m. and 6 p.m. (5 hours) and two times per month at the Balykchy Marshaling Yard (3 hours).

In 2018, we conducted 52 training sessions at the mine, and 26 sessions at BMY, totalling 260 and 78 hours respectively, as well as special circumstance sessions at the mine site simulating various types of emergencies: cyanide and chemicals spills and dispersal, vehicle accidents, injuries, fires, etc (six sessions at the mine site and five sessions at the BMY).

Additionally, every year, team members are trained in a specialized Training Center under the Ministry of Emergency Situations of the Kyrgyz Republic where they receive special certificates upon successful completion of the training. Command-post exercises for threats and emergencies are held at the district level with participation of the Kumtor emergency response team every third year. Our team also participates in the republican annual contest of rescuers and always takes prizes.

“ Our voluntary emergency response team consists of three teams at the Kumtor mine and one team at BMY ”



4 ENVIRONMENT

4.1 ENVIRONMENTAL RESPONSIBILITY

We consider responsible environmental management an important part of our business.

Environmental expenditures

We operate a full-time Environment Department of 23 people at the mine site. Total annual expenditure on environmental management (including capital expenditure) was \$5.769 million in 2018 for a range of activities including monitoring, laboratory analyses, external consultants, waste disposal, emissions treatment, water treatment and environmental impact prevention/minimization.

Focused environmental studies and projects

In 2018, we continued a range of focused environmental projects aimed at improving our environmental management practices, as well as our understanding of the natural ecosystem and our impact of operations upon it. These studies involved staff of the KGC Environment Department working with international consultants, scientists from the Kyrgyz National Academy of Sciences, postgraduates and specialists from the Kyrgyz National Agrarian University and other higher educational institutions of the country.

These projects included:

- Continued monitoring of traffic and dust concentrations in the Barskoon Valley in accordance with international standards;
- A variety of fauna surveys and hydro biological researches within the KGC concession area including observations of population of Marco Polo sheep, mountain goats, wolves, and foxes;
- Continued studies into the potential risk of cyanide impacts on biodiversity around the tailings management facility – as part of demonstrating compliance with the International Cyanide Management Code;
- Continued activities to improve biodiversity conservation and management measures in the Sarychat-Eertash State Nature Reserve (SCER);
- Continued research into appropriate rehabilitation techniques for disturbed lands, including expansion of rehabilitation trial plots and development of strategies to increase storage life and viability of stripped topsoil;
- Continued study of wetland facility to reduce concentrations of ammonia and heavy metals in the waste rock dump run-offs and the ETP discharge;
- Continued investigation and implementation opportunities to reduce waste management costs and the amount of waste landfilled at the mine site;
- Monitoring of glaciers and meteorological conditions on the KGC concession area and in the basins of the Arabel and Uchkol Rivers;
- Controlled lowering of the water level in Petrov Lake to prevent a Glacial Lake Outburst Flood (GLOF).



“ Total expenditure on environmental management was nearly \$5.8 million in 2018 ”

4.1 KGC environmental protection expenditures and investments (USD)

	2016	2017	2018
Waste disposal, emissions treatment	3,803,376	4,593,077	3,483,179
Pollution Prevention & Environmental Management Costs	3,018,788	2,633,312	2,285,734
Environmental Capital Projects	105,100	0	0
Overall annual expenditure on environment protection	6,927,264	7,226,389	5,768,913

Process of additional treatment of effluents with the use of cyanohydrin

As reported in the previous annual reports, starting in 2016, Kumtor has been studying the process of biochemical treatment of cyanide containing tails referred to as the "cyanohydrin process". Its main advantage for the Kumtor mine is that, unlike many other cyanide destruction methods, cyanide is destroyed without the formation of ammonia or nitrate. The method uses a certain amount of organic carbon (glucose or fructose) and phosphoric acid necessary for the development of cyanohydrin microbial process.

Based on the 2017 Isolated Pond full-scale trial (and previous research), Kumtor conducted an eight-month full-scale trial of this process at the Mill from the end of February to the beginning of November 2018.

The cyanide destruction level observed in 2018 was within the same range as in previous years, but the formation of ammonia was slightly lower which can be interpreted as the first indication of the cyanohydrin formation process. On the other hand, the expected decrease in the total nitrogen (as ammonia or cyanide) concentration in the Tailings Pond did not have any visible changes.

The 2018 final target concentrations of glucose and phosphorus in the Tailings Pond were not achieved because the volume of water in the pond was significantly higher compared to the previous period. Thus, the results of the full-scale trial are not considered final.







4.2 ENVIRONMENTAL MONITORING

Our monitoring programs follow both national and international standards, and include:

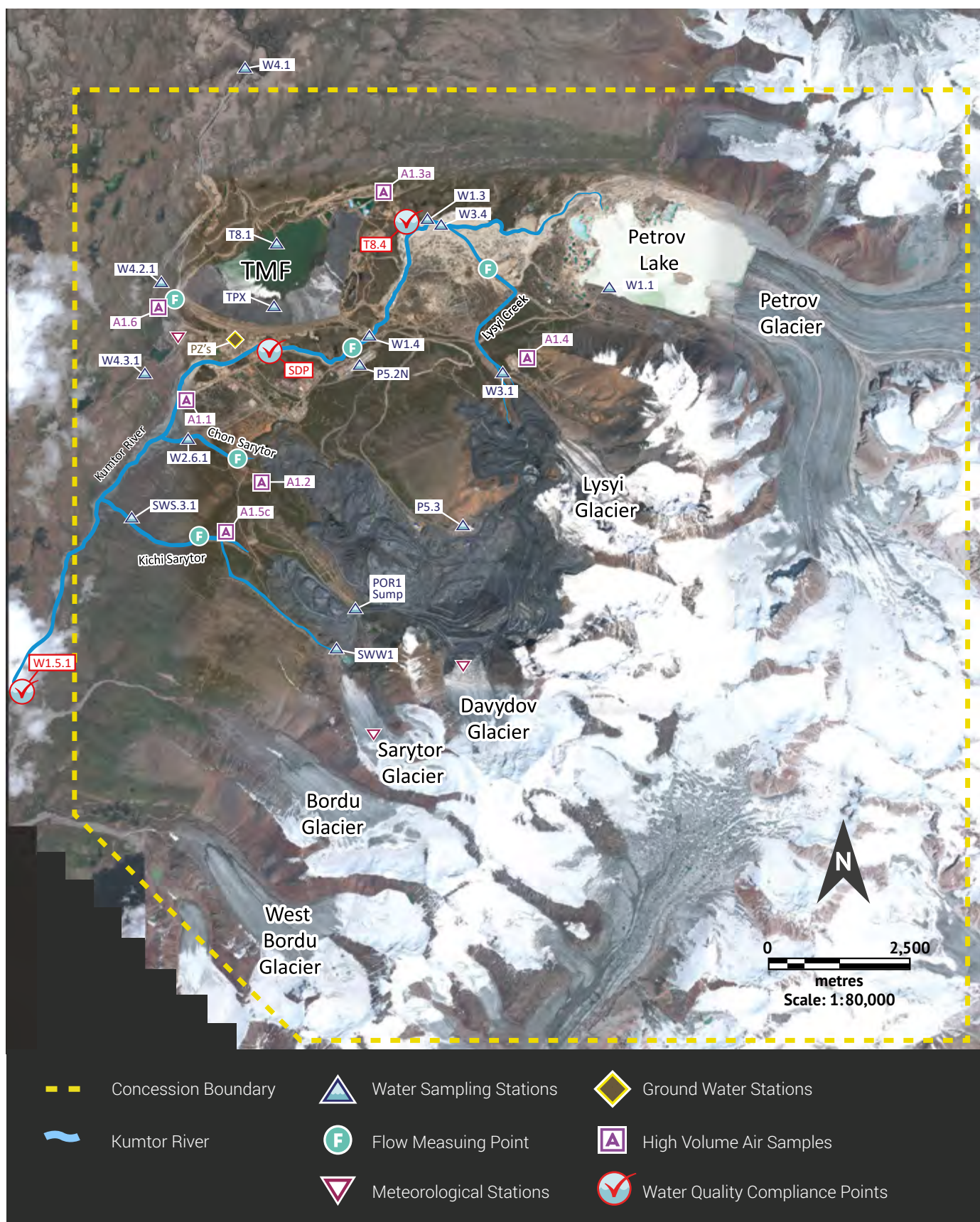
- Water quality and flow;
- Effluent quality and flow;
- Biodiversity;
- Air quality;
- Waste streams;
- Acid rock drainage;
- Meteorology.

Locations of the key monitoring points are detailed on the next page (Fig. 4.3).

4.2 Description of water quality sampling points

Station name	Location description
W1.1	Petrov Lake outflow – Kumtor River Head Waters (alpine glacier fed lake – elevated Al, Fe)
W3.4	Lysyi Creek before joining Kumtor River
W1.3	Kumtor River after confluence of Lysyi Creek and just before ETP discharge
TPX	End of tailings spigot – discharge into Tailings Management Facility (TMF) pond. Discharge point moves along dam wall.
T8.1	Tailings Pond (feed to ETP)
T8.4	ETP discharge point into Kumtor River (MAD limits apply)
W1.4	Between Kumtor bridge and flume 1km downstream from ETP discharge
SDP	Treated sewage discharge point into Kumtor River (MAD limits apply)
W4.1	Head water of Arabel-Suu diversion ditch (background level)
W4.2.1	Lower Diversion Ditch (LDD)
W4.3.1	Discharge of Upper Diversion Ditch (UDD) sediment pond to Kumtor River
W2.6.1	Chon-Sarytor Creek in Central Valley before joining Kumtor River
POR1 Sump	Pit water collection sump before discharge to Kichi-Sarytor Creek
SWS.3.1	Kichi-Sarytor Creek before joining Kumtor River
SWW1	Meltwater from Sarytor glacier
W1.5.1	Kumtor River, just downstream from Kumtor Concession Area (voluntary compliance point)
W6.1	Arabel-Suu River, 6km from Kumtor Concession Area (background level)
W1.6	Kumtor River, 17 km from Kumtor Concession Area (before confluence with Taragay River)
W1.7	Taragay River, 40 km from Kumtor Concession Area (Kumtor + Kashka-Suu + Maitor Rivers)
W1.8	Naryn River in Naryn City, approximately 230km downstream from Kumtor Concession Area
W1.8F	Naryn River just after Naryn City
P5.2N, P5.3	Potable (treated drinking) water - Camp and Mill
PZ's	Piezometers at the Tailings Dam

4.3 Environmental monitoring locations



Meteorological monitoring

We have a mutually beneficial arrangement with the agency of Hydrometeorology under the KR Ministry of Emergency Situations. the Kumtor meteorological station is a part of the national weather network, which provides weather forecasts, important for safe and efficient operation in the extreme climatic conditions on site. this station collects and exports data to MP5 database, in accordance with Canadian Atmospheric Environment Services protocols. The Saskatchewan research Council in Canada is contracted to calibrate sensors and ensure they function correctly.

Hydrological flow monitoring

We track hydrological flows of the main water bodies within the concession area: Kumtor River and its principal tributaries (including Chon-Sarytor, Kichi-Sarytor and Lysyi Creeks), Petrov Lake, and the Upper and Lower Diversion Ditches that divert the Arabel River around the tailings management facility. The Kumtor River flow generally peaks between May and September each year. In 2018, a peak of 21.16 m³/s was recorded on August 18. The total annual flow in the Kumtor River recorded at the flume within the concession area was 102.87 million m³ and the flow at the End of Mixing Zone (also called W1.5.1), the KGC's main water quality compliance point, was estimated to be 146.25 million m³. These variations are not considered significant in the context of normal year-to-year fluctuations (see Fig. 4.4). We also monitor water levels in Petrov Lake, which serves as the fresh water source for Kumtor mine site. The highest recorded level was 3,732.82 m above sea level in August 2018 (compared to 3,733.20 m in 2017) and the lowest was 3,731.305 m in March 2018 (compared to 3,731.39 in 2017). As the Kumtor River flows downstream after leaving the concession area, it receives additional flow from many tributary streams and rivers. At the nearest town Naryn, located approximately 230 km

downstream of the mine, the flow increases to an estimated 2,340 million m³ per year. Our water use at the mine site has no measurable impact on river flows at Naryn since the volume extracted each year from Petrov Lake represents just approximately 0.2% of average annual flow at Naryn. The treated effluents discharged back to the Kumtor River also reduce the net extracted volume (Fig. 4.5).

Water quality monitoring

We follow a comprehensive program of sampling and analyses for water quality based on a network of more than 30 stations. The key stations are listed and described in Table 4.2 in this section, with locations shown on an aerial photograph of the concession area (Fig. 4.3 and 4.5). Water quality results and associated discussion are in a separate section of this report: Water Quality and Compliance.

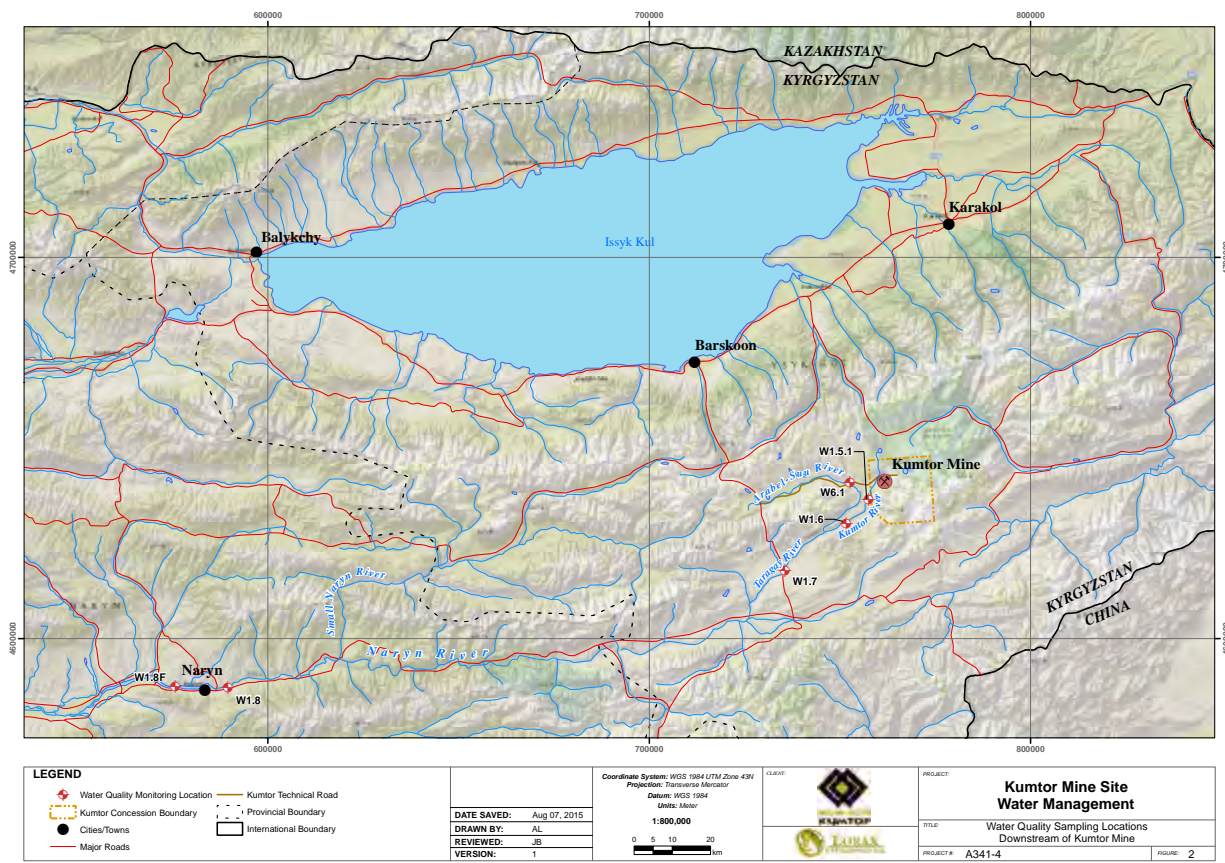
Quality assurance and control

Most of our analyses are contracted to a professional external laboratory, Stewart Assay and Environmental Laboratories LLC (SAEL), part of the international ALS group. SAEL is located in Kara-Balta in the Kyrgyz Republic. We also maintain an on-site laboratory to support operational control. We routinely review our sampling program and processes, updating them as appropriate. Our monitoring program includes a formal Quality Assurance and Quality Control (QA/QC) program for collection and handling of samples. This includes duplicate samples, blind samples, and blank samples, as well as calibration and documentation of instruments and procedures. As part of quality control, samples are sent to expert local and international laboratories including SAEL in Kyrgyz Republic, Saskatchewan Research Council (Canada), and Lakefield Research Laboratories (Canada). Lakefield Research specializes in cyanide chemistry and analysis.

4.4 Kumtor River flow

Monitoring station	Units	2016	2017	2018
Annual Flow in Kumtor River at flume (W1.4)	m ³ /year	107,553,394	118,264,372	102,872,002
Annual Flow in Kumtor River at compliance point (W1.5.1)	m ³ /year	131,030,653	180,911,331	146,251,965
Annual Peak instantaneous flow in Kumtor River at Flume	m ³ /s	16.60	30.67	21.16
Peak daily flow in Kumtor River at Flume (W1.4)	m ³ /day	1,433,376	2,649,888	1,828,224

4.5 Water quality sampling stations downstream of Kumtor mine



Environmental data management system

To minimize the risk of human error and ensure quality control of data, since 2014 we have used a comprehensive and integrated Environmental Data Management system, MP-5. This helped to automate the data collection process as much as possible. Field data is now entered directly using iPads and synchronized later in the office. External laboratory reports are directly imported into the database. Some environmental monitoring instrumentation (river and creek flows, weather, etc.) imports data directly into the MP5 database.

The system helps to analyze and integrate data quickly and accurately, and report on compliance against environmental standards. Warning and compliance levels have been established in the system to ensure any data, which is outside of specified ranges, leads to an alert emailed to responsible employees and management. The majority of environmental data is now entered directly into the system, minimizing the risk of human error and leading to the removal of most paper templates and spreadsheets from use.



4.3 BIODIVERSITY

Our commitment

We are committed to our obligations to preserve natural biodiversity, reduce negative impact of operations on the environment during operation of the mine and cooperate with our partners to increase biodiversity. Further information is available on our website via the link below including our full Biodiversity Management Strategy and Plan (2018) can be downloaded:

www.kumtor.kg/en/environment-protection/biodiversity.

Regional context

The Tien Shan mountain range is one of the longest in Central Asia, stretching approximately 2,800 km through mostly the Kyrgyz Republic and China. The peculiarity of the region is in its unique biodiversity. Moreover, it is home to a number of endangered animals, including snow leopards and the Marco Polo sheep (*Argali*).

The snow leopard is an important cultural symbol in Central and South Asia and features widely in local folklore. Like the snow leopard, an aquatic plant in the Ranunculus family (*Hedysarum kirgizorum*), endemic species of dandelion (*Taraxacum syrtorum*) and a tulip (*Tulipa tetraphylla*) are included in the Kyrgyz Red Data book.

Glacier-fed rivers, including the Kumtor River, which originates from the Petrov Lake, form part of an important ecosystem for a broader range of communities in the Kyrgyz Republic and for the Kumtor mine itself. The Tien Shan region also contains significant grasslands, which provide carbon storage and sequestration services.

Ecosystem services

Ecosystem services are the benefits that people and businesses derive from ecosystems. Kumtor mine is remote, with no villages close to its boundaries that could be impacted by operations at the mine site. The nearest village, Ak-Shyirak, with a population of approximately 120, is located approximately 80 km from the mine in another valley. Agricultural activities for the Ak-Shyirak community, such as crop growing, are very limited due to the harsh high altitude climate. Their livelihoods rely on grazing sheep, goats, and other livestock, in addition to government-funded support. There is also seasonal sheep grazing in the valleys leading to the Kumtor mine site. While there is little scope for KGC's operations to negatively impact ecosystem services of Ak-Shyirak, our support – alongside contributions by other key nature conservation players – for biodiversity conservation (see below) is expected to generate positive benefits for the wider region.



Wildlife monitoring on the Tailings Management Facility

In 2018, the daily wildlife census monitoring program continued on the KGC Tailings Management Facility (TMF). The program was developed to identify and count all avian and mammalian wildlife on the TMF and its immediate surrounds, and confirm that the facility was not having an adverse effect on wildlife. The daily monitoring is undertaken by trained KGC environmental personnel, with regular review and supervision by a recognized expert in the Kyrgyz Republic. The monitoring data is also reviewed by an independent internationally recognized ornithologist. Observations around the TMF were completed on 363 days out of possible 365 days in 2018 – which equates to 99% daily coverage.

Table 4.6 presents a summary of the daily wildlife observations. The information is presented as 'bird-days' and 'mammal-days' which provide a comparative parameter and quantitative measure of the TMF usage or occupancy by wildlife. It is calculated by multiplying the number of animals (birds or mammal) seen by the number of days on which they were seen. This is valuable in the context of the TMF as it presents a broad measure of potential contact of wildlife with the tailings and supernatant water and exposure to their cyanide content.

In 2018, four mammal species were recorded on the TMF (Grey Marmot, Red Fox, Wolf and Argali) and 32 species of birds – predominantly made up of wildfowl and waders. Two bird carcasses were recorded during the year – duck and grey heron (the same number was recorded in 2016). In both cases these are widespread species that died most likely by natural reasons or were attacked by predators. Death of the duck was caused by its poor physical condition aggravated by severe weather conditions, while the weakened Grey Heron became an easy prey for vultures. It is unlikely that exhaustion of birds was caused by the impact of the Tailings Management Facility.

In summary, the extreme weather conditions and low food resources at the high altitude TMF continue to present a low-visitation and unsuitable habitat for birds and other wildlife. For most of the year, the TMF pond remains frozen, preventing wildlife exposure to the supernatant water. Monitoring indicates that the Kumtor TMF system continues to present a relatively low cyanosis risk to avian or other wildlife despite the periodic elevated cyanide concentrations in the tailings. The daily wildlife census monitoring program will continue in 2019.

4.6 Summary of wildlife observations on the TMF

Indicator	2016	2017	2018
No. of days no wildlife was observed	209/365	188/362	199/363
No. of days mammals observed	87/365	85/362	69/363
No. of mammal days	201	196	181
Max. mammal group size seen	12	11	10
No. of days birds observed	105/365	127/362	135/363
No. bird days	1 111	1 499	1444
Max. bird flock size seen	60	150	100

KGC's Support to the Sarychat-Eertash Nature Reserve (SCER)

In 2018, financial support in the amount of 588,800 soms was provided to the Sarychat-Eertash Nature Reserve to create an administrative base and improve working conditions for employees. The allocated funds were used for the following purposes:

1. Fencing of the SCER central administration office.
2. Arrangement of the guest house and auxiliary premises of the Reserve administration office. For many years, the SCER administration has been
3. Financial support in purchasing work clothes for rangers. Since the Reserve is located in a remote and climatically harsh syrt zone, efficient work of rangers who patrol every Reserve sector once a month requires special clothing.

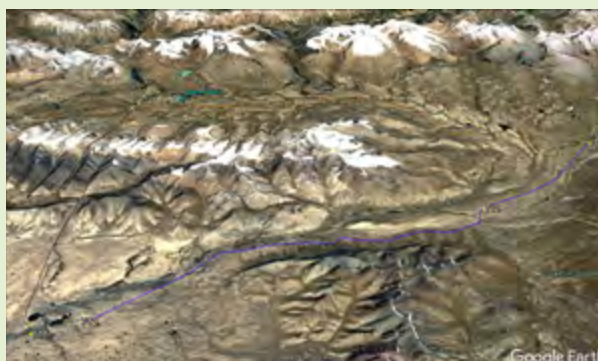
Study of vertebrate animals and birds at the Kumtor mine and adjoining areas



During 2018, a study of vertebrate animals and birds of Kumtor and adjoining areas was completed. Objectives of the study included the following assessment of quantity of animals and birds, identification of species composition of vertebrate animals and birds, distribution by habitats, characteristics of behaviour at the habitat, abundance of species (population density), common species, population trends (natural dynamics), assessment of impact of the mine's activity on vertebrate animals and birds, especially on protected species – rare, endemic, endangered, listed in the Red Book species, identification of especially valuable habitats – areas of mass reproduction of specially protected species, foraging areas, rest areas of migratory species, migration routes, identification of animal species especially sensitive to the mine's operations.

Wildlife census was conducted on the pre-determined transects where the location (start and end of transect) was recorded by the GPS-navigator. 10-zoom binoculars and 60-zoom telescope were used to identify to the species level and count animals.

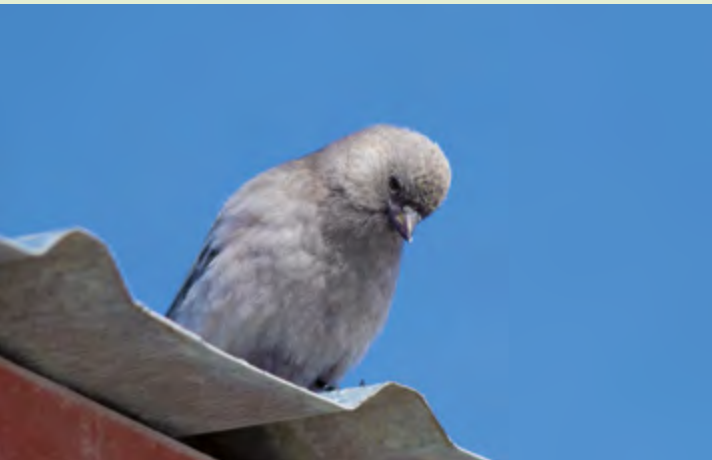
When signs of activity of mammals (burrows, tracks, excrements, etc.) were found, mammals were identified to species level. But in many cases, the presence of mammals on site was visually observed. The presence of individual species of animals was recorded by various signs of their stay – paw prints on the snow or ground, food remnants, flocks or feathers, paths, burrows and lairs, etc. Also, an aerial census was conducted with the use of a quadcopter DJI Inspire 2, X5S. The apparatus flew around the areas of possible wildlife habitats and subsequently made photo and video recordings of the identified habitats.



4.7 Map of census route (transect) within the mine

During the entire period of observations in 2018, 7 species of mammals with 1,270 specimens were recorded at the mine, and 4 species of mammals with 608 individuals were recorded outside the mine.

In 2018, 45 bird species were recorded: 2,561 individuals at the mine and 975 individuals on the adjacent area.



According to the satellite collar records, after the tracking collar was installed, the mountain sheep Aziza travelled 702 km, between 10 to 15 km per day. The main habitat of the sheep is recorded from the Sarytor valley to the Petrov Lake with a short time spent at the Upper Diversion Ditch area. For six months, Aziza did not leave the mine territory. Observations will continue in the future.

Industrial development of the Kumtor deposit is an example of one of the most advanced industries where animals are strictly protected and not exposed to any anthropogenic impact. Despite the fact that heavy equipment constantly operates around the concession area, animals, especially ungulates and predators, are not afraid of the presence of human activity, i.e. animals do not have any disturbance factor. On the contrary, in some cases during the hunting season wild animals move from the nearby hunting farms to the mine's area where they are in safe. This indicates that the Kumtor mine operations does not have any adverse impact on wildlife.

Continuing to study the biology of the mountain sheep, a female mountain sheep was caught on the northern slope of the Ak-Shyirak Ridge, at the Kumtor River headwaters. The sheep was named Aziza and provided with a satellite collar.

Aziza is a female mountain sheep (argali), approximately 5 years and weighing 60-70 kg. Collar frequency is 146.150 MHz. Collar serial number is ID 16675 (Vectronic - Iridium), Iridium, Vectronic Aerospace (Germany).

The collar is registered at the Shinshu University, Mining Institute (Japan) as part of the Kaiberen program.



4.8 Marco Polo sheep called 'Aziza'



4.9 Screenshot of Aziza's collar signals for seven months of movement at the Kumtor Gold Mine and on the adjacent area (12/02/2018).



Hydrobiological studies at the Kumtor mine and on the adjacent area

In 2018, hydrobiological studies were conducted in the water streams and reservoirs at the Kumtor mine area and on the adjacent area, as a result of which the species composition as well as the abundance of zooplankton and zoobenthos were identified.

A total of 27 species, 12 genera, 8 families, 5 orders, 3 classes, 2 types were identified in the Kumtor River during the entire study period (from June to September). Distribution of zoobenthos in sampling stations is extremely uneven. The maximum number of organisms is recorded in headwaters, then the number of invertebrates decreases, which can be explained by the peculiarities of the river bed structure (increased content of suspended solids in water, high flow velocity, low temperature conditions, poor food supply). Chironomid larvae (17 species) prevail in the species composition. A new species of chironomids - *Diamesa angustimentum*, which was not previously encountered, was recorded in the aquatic fauna of the Kumtor mine.

In general, the number of benthic invertebrates in the Kumtor River in 2018 is higher than in 2015 and 2017. Zoobenthos reaches its mass development in August.

25 species of zoobenthos were recorded in the Taragay River, 15 species in the Arabel-Suu River, and 24 species in the Kashka-Suu River.

Among standing water reservoirs, a small lake located not far from the Biodegradable Waste Processing Plant was studied. In this reservoir, 13 species of zooplankton and 9 species of zoobenthos were recorded.

Based on results of the fauna studies in flowing and standing water reservoirs, it can be concluded that the species composition of invertebrates is not rich. This is due to the high mountain extreme conditions.

In 2018, several individuals of *Osman* of Severtsov (juvenile stages) were collected in the Taragay River (June) and in the Arabel-Suu River (August).

On August 27, 2018, another experiment was conducted to determine survival of organisms in water with different concentrations of treated wastewater (the first experiment was conducted in August 2012). In 2018, it was decided to use the following representatives of zooplankton as test objects - daphnia, amphipod, diaptomus, and cyclop. As a result of the experiment, it was confirmed that daphnia and amphipod were sensitive to any toxic effects and changes in the aquatic environment. Thus, the abundance of daphnia and amphipod in natural water reservoirs of the Kumtor deposit and the adjacent area indicates the absence of any toxic effects on standing (non-flowing) water reservoirs.

4.10 Regional Fauna Species with Conservation Status Identified Within the Study Area*

Common Name	Latin Name	Kyrgyz Red Book (2006)	IUCN Red Book	Kumtor Concession	SCER
Mammals					
Stone marten	<i>Martes foina</i>	Lower Risk/least concerned	No	Yes	Yes
Snow leopard	<i>Uncia uncia</i>	Critically Endangered	Endangered	Yes	Yes
Pallas's cat	<i>Otocolobus manul</i>	Near Threatened	Near Threatened	Near	Yes
Eurasian lynx	<i>Lynx lynx</i>	Nearly Threatened	Least Concern	Near	Yes
Brown bear	<i>Ursus arctos</i>	Lower Risk/least concerned	Least Concern	Near	Yes
Mountain sheep	<i>Ovis ammon</i>	Near Threatened	Near Threatened	Yes	Yes
Birds					
Black stork	<i>Ciconia nigra</i>	Near Threatened	Least Concern	Yes	Yes
Whooper swan	<i>Cygnus cygnus</i>	Least Concern	Least Concern	Near	Yes
Golden eagle	<i>Aquila chrysaetos</i>	Near Threatened	Least Concern	Yes	Yes
Eastern imperial eagle	<i>Aquila heliaca</i>	Vulnerable	Vulnerable	M	M
Eurasian black Vulture	<i>Aegypius monachus</i>	Near Threatened	Near Threatened	Yes	Yes
Himalayan griffon	<i>Gyps himalayensis</i>	Least Concern,	Least Concern	Yes	Yes
Lammergeyer	<i>Gypaetus barbatus</i>	Near Threatened	Near Threatened	Near	Yes
Saker falcon	<i>Falco cherrug</i>	Endangered	Endangered	Near	Yes
Eurasian eagle owl	<i>Bubo bubo</i>	Least Concern	Least Concern	Near	Yes
Ibisbill	<i>Ibidorhyncha struthersii</i>	Vulnerable	Least Concern	Near	Yes
Demausel Cranes	<i>Anthropoides virgo</i>	Near Threatened	Least Concern	Yes	Yes

Note: SCER is Sarychat – Eertash Nature Reserve; IUCN is the International Union for Conservation of Nature.

* In 2016, KGC improved the technical equipment of specialists conducting wild animals and birds monitoring near the mine. More powerful optical surveillance equipment was purchased, photo and video equipment updated. Moreover, the frequency and duration of animal observation was increased. This allowed to detect and register six species of animals (rendered in bold) included in the red book and the IUCN list.

M – marked on a span (seasonal migrant).



4.4 ENERGY USE AND CARBON EMISSIONS

Energy consumption

Our large-scale mining operation is a significant consumer of fuel and electricity. Fuel represents over 20 percent of our commodity and service-related purchases. However, wherever feasible, we use electricity. The most energy intensive operation is the Mill, representing approximately 86 percent of our electricity consumption. The Kyrgyz Republic generates more than 85 percent of its electricity through hydropower. In fact, the Kyrgyz Republic is a leading producer and exporter of hydroelectric energy in the Central Asia region, due to its mountainous terrain and abundant water resources. The major source of the power supplied to KGC is from the Toktogul Reservoir located on the Naryn River. This means that our specific GHG footprint generated

from electricity is relatively low. It also means that efforts that reduce or replace our fuel consumption with grid power offers the greatest value in terms of reducing our GHG emissions. We continue to calculate and monitor our greenhouse gas (GHG) emissions, and explore ways to reduce them as part of energy conservation measures. Our calculations include our three main sites: the Kumtor mine, Balykchy Marshalling Yard, and Bishkek head office. However, the mine represents around 98 percent of energy use, and the only site using explosives. We include explosives in our GHG emission calculations as it was determined to be a significant component of the total emissions.

4.11 Electricity, Fuel and Explosive Consumption (Mine site, BMY, Bishkek)



GHG emissions and intensity

Scope 1 (direct) total GHG emissions in 2018 are higher by 12.2% compared to 2017, mainly because we have slightly increased the use of fuel for dump trucks.

Firstly, the increase was connected with carrying ore from the lower ledges of the Central Pit. Secondly, a stepped (hot) change was introduced to increase the ore extraction rates at the open-pit mine, which led to an increase in distance when hauling rock material into dumps using dump trucks.

Scope 2 (indirect) - the total amount of greenhouse gas emissions in 2018 is not significantly lower than in 2017, by 0.19%. Accordingly, the GHG emission intensity (an indicator that normalizes greenhouse gas emissions per ounce of produced gold) at Kumtor, due to an increase in the total amount of GHG emissions, was higher than in previous periods.

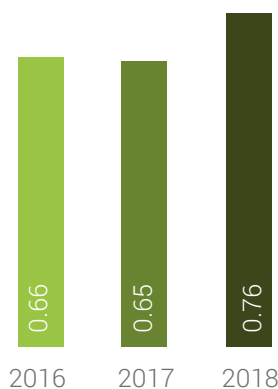
Energy conservation measures

We aim to reduce our GHG intensity by reducing our specific energy consumption and by increasing energy efficiency. We switch from diesel generators to grid electricity, wherever and whenever feasible, for such uses as mine-site lighting, dewatering pumps, and other equipment. This reduces both costs and our GHG footprint. After the Mill, our truck fleet is the largest energy consumer. Our program of reducing vehicular-related fuel consumption has the benefit of reducing use of energy and carbon-intense consumables. For example, we are transitioning to more fuel-efficient engines and have a proactive program to reduce the need for, and occurrence of running engines on parked vehicles. We have also implemented energy conservation measures ranging from the installation of low wattage, high efficiency lighting systems, better insulation in camp buildings, and encouraging behavior changes. However, such activities do not make a material difference to our GHG footprint due to the fact that these energy uses are very small, compared to major operational energy use, and because electricity already has a low GHG intensity. We continue to explore approaches that may help reduce our energy and GHG intensity but because electricity is already mostly from renewable sources, the scope is limited.

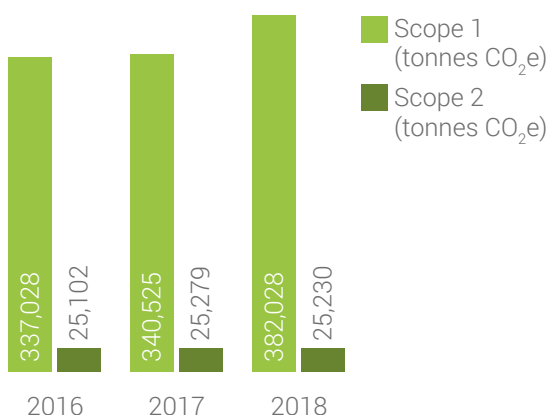
External reporting

As in previous years, KGC's carbon footprint is reported through Centerra's participation in the CDP. This is an independent international not-for-profit organization that tracks and reports corporate information pertaining to climate change. The data for individual companies is publicly available.

4.12 GHG Intensity Ratio (tonnes CO₂/ounce Gold)



4.13 GHG Emissions



“ We take measures to reduce GHG emissions by lower specific energy consumption and higher efficiency of its use ”



4.5 AIR EMISSIONS

Road dust, dispersed by moving cars and trucks, is the main source of observed and measurable air emissions along the access road passing through the Barskoon Valley. Concerns have also been raised about mine dust deposition on nearby glaciers.

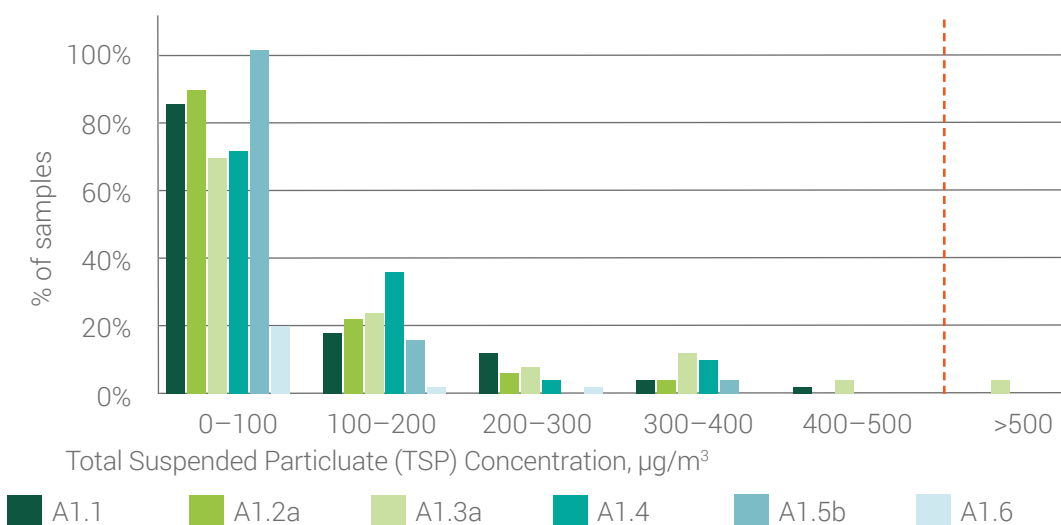
Air quality at the mine

We constantly monitor the air quality at the mine using six large-volume samplers located around the site to measure total suspended particles in the air (TSP). In 2018, the TSP concentration at the monitoring stations was below the Kyrgyz 24-hour limit of $500 \mu\text{g}/\text{m}^3$ for industrial zones, except for two exceedances in autumn. Immediate measures were taken to reduce dust level at this area. Our analysis of the historical data indicates that in spring, the increase in the level of TSP is generally related to commencement of tailing dam works. Selected TSP samples are also analyzed for cyanide, sulphur, arsenic, nickel, selenium, zinc, uranium, radium-226, and strontium-90. Consistent with previous results, the 2018 monitoring data, which are presented in the Appendix, demonstrate that the indicators are below the relevant threshold limit values. KGC has maximum allowable emission (MAE) limits for pollutants emitted into the atmosphere.

Actual emissions are compared against the MAE limits in the table 4.15 and calculated using instrumental measurements of stationary emissions based on a variety of operational data, including:

- Volume of ore mined and deposited at waste rock dumps;
- Annual average consumption of all types of explosives (ANFO, emulsion);
- Total number of days for processing;
- Specific consumption of ANFO and emulsion per 1 m^3 of processed rock;
- Size fraction of rock in the waste rock dumps and ore in the ore stockpiles;
- Average humidity of rock in the pit;
- Number and types of pit machinery and equipment;
- Total volume of consumed diesel fuel and gasoline (lead free), including stationary sources;
- Average operating efficiency of dust-gas collecting units at the Mill, Crusher, Assay Laboratory, Mobile Batch Plant (instrumental measurement data);
- Average concentration of pollutants in emissions from the Mill, Crusher, Emulsion Plant, Assay Laboratory (instrumental measurement data);
- Work hours of emission sources of on-site main and auxiliary facilities;
- List of areas and volumes of dumped mine rock in waste rock dumps and ore stockpiles etc.

4.14 High Volume Sampler Air Quality Results



KR Industrial Zone
Compliance Limit =
 $500 \mu\text{g}/\text{m}^3$

Note: TSP is total suspended particulates. Kyrgyz 24-hour TSP compliance limit for industrial zones is $500 \mu\text{g}/\text{m}^3$. Monitoring station locations change occasionally along with changing footprint of the mine. Annual average results are shown for locations with more than 6 months of data.

According to the composition and the volume of pollutants emitted into the atmosphere, the mine site is classified as the first category of hazard. Emissions of non-stationary sources are calculated according to methodological instructions based on actual data (operational factors) of the previous period. As shown in the table 4.15, in 2018 a total of 900.5 tons of pollutants were released into the atmosphere from the mine sources, including 709.5301 tons from pit operations. The major pollutant is dust (72.7%). Inorganic dust from hauling and loading operations in the Central Pit is a major contributor to the atmospheric air pollution. Maximum ground level concentration of dust emissions

is 10 of the MAE standard within the mine site. Among gaseous pollutants, nitrogen oxide is a major contributor, maximum ground concentration of which is 5 of the MAE standard within the industrial site. The maximum concentration of the remaining pollutants does not exceed 0.3 of the MAE standard.

According to the calculations, the Kumtor mine impact on the atmosphere is estimated as moderately significant. Based on the concentration of pollutants on the ground surface, we can say that outside the concession area, none of the pollutants exceed the MAE limits.

4.15 Comparative emission data at the Kumtor mine and MAE (t/year)

Pollutant	MAE Standard 2018.	Actual 2018.
Dust that contains SiO ₂ 20-70%	783.59380	654.9818
Hydrocyanide	0.0008000	0.00260
Sodium hydroxide	0.0734600	0.05451
Lead and its compounds	0.0015000	0.000565
Calcium oxide dust (lime)	1.9641000	2.41350
Carbon (soot)	1.2327800	2.01890
Sulfur dioxide	6.5267200	10.38329
Welding aerosol	0.3547980	0.50530
Manganese dioxide	0.0479290	0.06880
Hydrofluoride	0.0408970	0.05930
Hydrocarbon	10.008730	15.14807
Nitrogen dioxide	85.028920	133.75458
Carbon oxide	66.031250	55.96210
Tetrafluorosilane (fluorides)	0.0156530	0.02200
Ammonia	0.3433000	1.28340
Silicon compounds	0.0156530	0.02220
Hydrochloride	0.0000770	0.00610
Nitrogen oxide	0.0732900	
Hydrocarbons (as kerosene)	2.3793400	
White Spirit	1.6129000	
Xylol	2.0814000	
Coloured aerosol	0.0294000	
Formaldehyde	0.2589000	0.45630
Benzpyrene	0.0000260	0.0000422
Ammonium nitrate		0.11380
Carbon dioxide		23.24650
Total	961.7	900.5

To reduce this impact, work zones are watered down during mining and other operations at the mine, including hauling and loading operations. the stoping faces are also watered down before and after blasting. Taking into account the fact that the Sarychat-Eertash State reserve is located in the vicinity of the mine site, regular monitoring of air is conducted in the northeastern part of the concession area and in the northwestern part of the reserve.

Dust level in the Barskoon Valley

Transportation of employees to the workplace, as well as delivery of consumables and other materials is carried out on a technological road that passes through the Barskoon Valley and is served by KGC. The route leads to several settlements, including the village of Ak-Shyirak, summer pastures and hunting farms in high-mountain valleys, Sarychat-Eertash nature reserve, various tourist routes. Local residents, researchers, hunters and tourists also use the road.

In order to avoid an increase in the dust level in the Barskoon Valley, we continued watering the road with more than ten water trucks, servicing the road on a daily basis. As in previous years, to determine the total concentration of suspended particles in air (TSP) in the summer of 2018, three large volume samplers were installed. In the Barskoon gorge, there was one

exceedance of the maximum permissible emission limit of $100 \mu\text{g}/\text{m}^3$. To confirm that company vehicles are not responsible for emitting all of the dust in autumn 2014 a sensor was installed in the gorge, which records any vehicles passing at a speed of more than 10 km/h above the speed limit. In addition, along the entire technological route, dust counters, instruments for measuring the dust content in the air, were installed before the mine site, and since 2015, the data have been monitored. The results of the measurements show that the selected air samples meet all international criteria for dust precipitation and sanitary and hygienic indicators.

According to the survey, conducted by G.A. Lazkov, Doctor of Biological Sciences NAS of the KR, it was determined that the KGC activities do not have a significant impact on the vegetation cover of the Barskoon gorge. Uncontrolled grazing and recreational loads have a much greater impact.

Residents of some villages in the Issyk-Kul region suggest that dust and other emissions occurring at the mine have a negative impact on them. However, the mine site is separated from these villages by a mountain range, and the distance to them exceeds several tens of kilometers. Burning of rubbish and other uncontrolled air emissions are known to be commonplace in these village areas, and therefore, a much more likely source of emissions.

4.16 Dust monitoring in the Barskoon Valley, $\mu\text{g}/\text{m}^3$

Sampling Points (Stations)	Jul 2016	Aug 2016	Jul 2017	Aug 2017	Jul 2018	Aug 2018
Nº 1	30	41	31	41	47	77
Nº 2	37	89	20	89	39	113
Nº 3	50	59	12	59	24	39
Recommended MAC*	100	100	100	100	100	100

Note: #1 sampler was located 50 m to the south of the road upstream of the Kamaz truck monument; #2 sampler was located 100 m to the north of the road, towards the Barskoon River; #3 sampler was located 50 m to the north of the road, opposite to Kamaz truck monument, towards Barskoon River.

* Recommended KR maximum admissible concentration (MAC) standard for populated areas





Kumtor Gold Company continues to strengthen efforts to reduce dust effects of technological road in Barskoon Gorge.

In March 2018, 750 seedlings of birch, weeping willow and common willow were planted in Barskoon gorge, Jety-Oguz region of Issyk-Kul oblast. The trees were planted on the 15th km of the technological road leading to the Kumtor mine, as part of the measures to reduce dust effects of the technological road, implemented upon the AMEC recommendations.

The company allocated about KGS 210,000 for the purchase of seedlings, black soil and tools, as well as for the manufacture and transportation of a domestic animal-proof fence. The fence was made by the locals from the wood waste generated at the Kumtor mine. More than 30 employees of the company took part in the charity activities called 'Kumtor's Ambassadors.' Employees came from different settlements of Issyk-Kul oblast and Bishkek on their day off and during their rotational leave.

In addition to Kumtor employees, about 40 local residents took part in the tree planting, including the Akim of Jety-Oguz region, the head of the Barskoon rural council, representatives of the regional forestry administration, the local youth association, members of the local women's council and deputies of the rural council. The contracting organization 'Jolchu' and local residents also supported the event by cooking a lunch for all the participants.

Local authorities and residents expressed their gratitude to Kumtor Gold Company for the project implementation and committed themselves to ensure its sustainability, having undertaken obligations on watering, maintenance and protection of seedlings from the bovine cattle.

KGC plans to continue planting the green strip along the technological road as part of the AMEC recommendations.



4.6 WASTE MANAGEMENT

KGC understands the importance of minimization of negative impact of waste on the environment and operates in compliance with Good International Industry Practice. We are committed to the ongoing improvement of our waste management strategy.

Waste Management Strategy

In 2013, KGC developed an integrated waste management strategy with input from international consultants. This strategy includes principles such as minimizing the negative impact of waste on the environment and effective use of financial resources spent on labour and purchase of equipment. KGC achieved the previously set objectives for waste management, namely:

- 100% recycling of industrial waste;
- Reduction of the volume of solid domestic waste to be landfilled;
- 100% composting of food waste from the camp kitchen on site.

Major waste streams

Three major types of waste (not including waste rock and tailings) result from the mine operation: solid domestic waste, industrial and hazardous waste. Solid domestic waste includes food waste, various types of packaging, as well as other out-of-service household items. Industrial waste includes scrap metal, waste tires, plastic, waste oil and fluids, and other low hazard waste, generated in large volumes and subject to recycling and further use as a secondary raw material. Hazardous waste includes packaging materials, polypropylene bags and wooden boxes used for transportation of toxic agents, batteries, mercury lamps, medical waste and expired reagents. An important part of effective waste management is the accurate recording of waste generation.

Improvement of waste handling practices

Reducing the negative impact on the environment and the effective use of financial resources related to waste management are the key priorities in improving our waste management strategy. As part of the implementation of the strategy objectives, KGC seeks for partners who are able to provide waste processing/recycling services, contributing to reduction in waste volumes disposed at site landfills.

Since 2014, not a single kilogram of industrial waste has been disposed on site. Scrap metal, plastic, rubber, wood, paper, waste oil and other waste are removed from the mine and delivered to our local partners to reuse and recycle. The re-use of scrap metal in the production of grinding balls is of particular note. The local company "Vulkan Plus" produces different size steel balls used for ore grinding at the Mill.

Domestic and hazardous waste are disposed at two landfills commissioned in 2015. These landfills were designed and constructed in full compliance with all engineering and environmental requirements. When designing and constructing the landfills, the following factors were taken into account: prevention of negative impact on ground and surface water, minimization of pollutant emissions into the atmosphere, preservation of pasturelands, effect of runoff and melt water on generation of leachate products and their safe utilization, and prevention of negative impact on local fauna. The landfills are operated in full compliance with the approved design and required environmental, sanitary and technical standards. Operation of the landfills involves placing and compacting the waste in batches, followed by covering the waste with a 20-30 cm soil layer to prevent access by wild animals. According to the mine closure plan, the landfills will be reclaimed with the rest of the areas onsite.

Waste management

In compliance with KR environmental legislation, as well as high regulations and standards of environmental responsibility, KGC, as the owner of waste, is committed to ensure safe recycling or utilization of its waste, as well as continuous improvement of its waste management systems/processes/practices in order to minimize negative impact on the environment.

In 2018, the mine produced 6,751 tonnes of industrial waste, but for the fourth year in row, KGC recycled 100% of this. Separate collection of all industrial waste at all key locations on site and at BMY made it possible to eliminate the need for the temporary industrial waste sorting area, which, in turn, resulted in a significant cost-saving due to reduction in labour and equipment previously involved in these areas. Currently, all industrial waste is collected separately into corresponding containers and tanks, which as soon as filled, are removed from the mine avoiding unnecessary loading/unloading and sorting operations.

In 2018, the mine produced 855.6 tonnes of solid domestic waste. KGC committed to reduce volume of solid domestic waste to be buried in the Kumtor mine landfill by 50%, which is currently being implemented. The main purpose of the program is to reduce negative impact of waste on the environment and extend the life of the Solid Domestic Landfill. Such reduction in volumes of solid domestic waste has become possible through introduction of separate collection and further recycling of this waste.

Domestic waste can be segregated into three main categories: 1) Biodegradable waste – food; 2) Recyclable items – plastic, paper, glass, metal; 3) Non-recyclable items – multilayer packaging, domestic waste, etc. At the same time, biodegradable and recyclable waste can be relatively easily recycled and reused. Thus, taking into account composition of solid domestic waste, it is easy to see that if separate collection of waste is organized, about 75% of waste volume can be recycled and reused, and only 25% can not be recycled. It means that volume of solid domestic waste to be landfilled can be reduced 3-4 times.

As part of implementation of the strategy to optimize waste management system, as well as to reduce volume of waste to be buried at the Kumtor mine, in 2017, KGC introduced a partial separate collection and recycling of solid domestic waste in the camp. In particular, a four-component separate collection of waste was introduced in the camp kitchen. Waste was divided into: 1) food waste, 2) recyclable packaging (plastic, cardboard, glass, metal), 3) used vegetable oil, 4) non-recyclable waste. About 2 tonnes of solid domestic waste are generated in the camp kitchen per day, of which only one third is waste that cannot be recycled easily, two thirds can be recycled without the need for burial of waste in the site landfill.

In 2017, a biodegradable waste processing station, or compost unit, was designed and constructed. In this station, food waste is processed by aerobic decomposition producing compost – an organic fertilizer that will be used for restoration of fertile properties of top soil, reclamation of disturbed fertile soil areas. Laboratory tests confirmed that the chemical-biological composition of the final product – compost – fully complies with the properties of organic fertilizers. In this way, about 1 ton of food waste is processed per day. The recyclable types of waste are still sent to processors of plastic, paper and metal what made it possible to significantly reduce the amount of waste to be buried on site and, therefore, extend life of the waste landfills, reduce negative impact on the environment, reduce expenses for maintenance of landfills and partially solve the problems with wild animals feeding on food waste.

The biodegradable waste processing station underwent all stages of designs, state expertise and obtained a construction permit. It should be noted that this is the first such project in Kyrgyzstan demonstrating a high level of environmental responsibility at KGC.

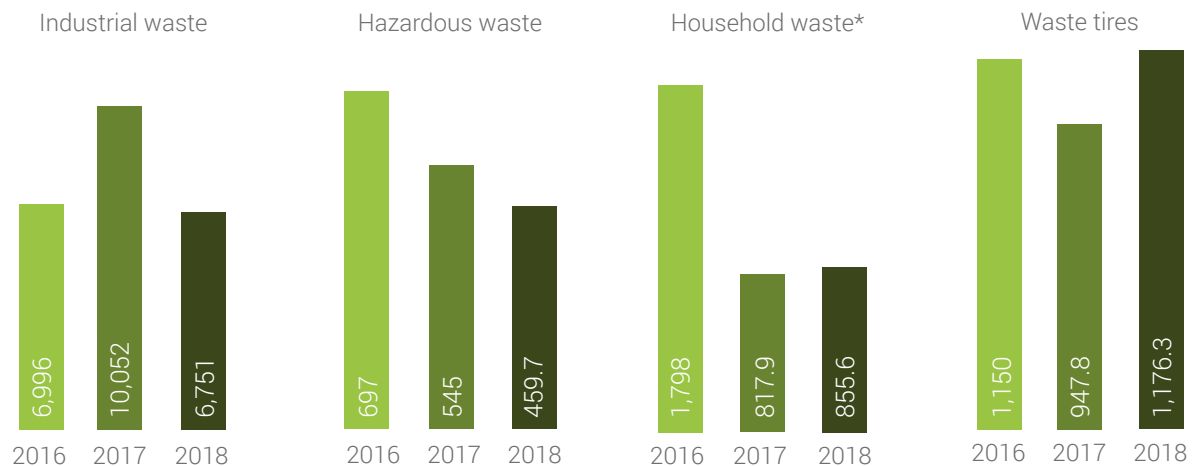
In 2018, the mine produced 459.7 tons of hazardous waste, of which 19.5 tons were shipped off site for recycling by a specialized company. The volume of hazardous waste shipped off for recycling was significantly lower than the 2017 volume because oily rags were classified as a lower hazard class and its volume was included in the total volume of industrial waste. Hazardous waste includes various packaging materials, used for transportation and storage of toxic chemicals, car batteries and other types of batteries, mercury-containing lamps, as well as ground contaminated with hazardous materials. Chemicals packaging materials are buried on site in the authorized Hazardous Waste Landfill, commissioned in 2015. Car batteries are collected separately and shipped off site for recycling, which was done in 2018. In addition, collection of other types of batteries was started – AA batteries, typically used in communications and computer equipment. As this type of hazardous waste accumulates, it is shipped off site to Bishkek for safe disposal by a specialized company. In 2017, with assistance of local companies, KGC started the process of utilization of oily rags and big bags and these works were continued in 2018. In general, KGC significantly improved its waste management practices, adhering to the main priorities for reduction of negative impact on the environment, effective use of financial resources and introduction of the best waste management practices.

4.17 Waste generation 2018 (tonnes)

	Generated tonnes	Disposal method
Industrial waste		
Metal	4,138.5	100% Recycled
Paper	109.6	100% Recycled
Wood	404.8	100% recycled and donated to local communities
Plastic	292.6	100% Recycled
Rubber products	95.2	100% Recycled
Oily rags	85.6	100% Recycled
Used oil and blends	1,624.6	100% Recycled
Total	6,751.1	
Hazaradous waste		
Packaging	439.4	Landfilled
Batteries	19.5	100% Recycled*
Mercury lamps	0.6	Temporarily stored
Total	459.7	
Tires		
Waste tires	1,176.3	57 % recycled/ temporarily stored

Note: An additional 8.8 tonnes of batteries were recycled from temporary storage areas.
In 2018, 1,176.3 tons of used tires were generated, 666.3 tons were transferred for recycling, 510 tons were temporarily stored at the mine.

4.18 Waste produced at Kumtor Mine Site (tonnes)



* In 2018, volume of produced domestic waste increased due to the increased number of employees (Fig. 3.5).

4.7 UNPROCESSED WASTE ROCK



As typical for most open pit mining projects, KGC has to remove large volumes of unprocessed (waste) rock and other materials in order to safely access the ore.

The waste rock is deposited in agreed designated locations and is routinely monitored for its impact on the environment.

Waste rock dumps

In accordance with the KR Law on Subsoil Protection, as well as industrial safety standards, waste rock dumps shall have sufficient storage capacity, and be located at a minimum distance from a mining cutback. Mined waste rock shall not be placed in areas with mineralization, hinder mining operations in the pit and shall be formed according to the safety requirements. In addition, dumping methods and equipment shall ensure uninterrupted waste rock dumping in the required volume per time unit, and comply with limitations on dump capacity whilst maintaining dumping costs at the lowest level and labour/equipment productivities at the highest level. Modeling and assessment of waste dump stability are performed by specialists of the Science and Design Laboratory LLC of Geotechnical Stability based on KGC's monitoring data.



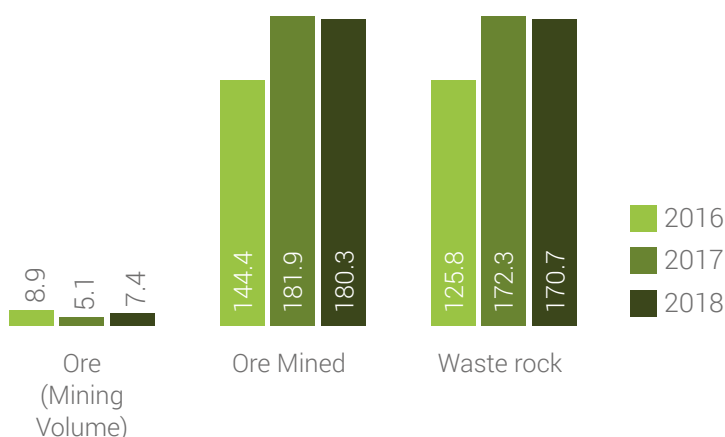
Waste rock movement

KGC continues to monitor potential deformations of soil and ice throughout the mine, as well as work on handling ice and dumps of rock and waste rock to ensure safe mining operations and timely relocation of the affected infrastructure. In 2018, the company continued to implement special measures aimed at reducing the rate of dump deformations and associated risks, in particular: the reduction of amount/volumes of waste rock placed in the Chon-Sarytor valley through a more even distribution of loads, construction of water drainage systems, and introduction of an automatic monitoring system.

Acid rock drainage analysis

Acid rock drainage (ARD) describes contaminated water that can be generated from water contacting the sulfur containing waste rock. The issue of acid formation is directly related to both mining and post closure period. KGC has routinely monitored for ARD risk since the initial environmental impact assessment, taking into account the ore body, waste rock and tailings. A number of independent assessments by international consultants concluded the ARD risk from KGC is low due to the high carbonate content in dumps, which neutralizes acidity. A long-term ARD assessment is a part of the mine closure planning.

4.19 Key production statistics of Mine Operations, million tonnes





4.8 TAILINGS MANAGEMENT

Tailings are liquid and solid materials, also called slurry, that remain after extraction of economically beneficial metals and minerals from crushed and processed ore.

Tailings of the Kumtor mine are transported through a 6.7-kilometer slurry pipeline from the Mill to the tailing management facility (TMF), where they are deposited, settled, and stored. The liquid component is treated before discharge and the solid component retained in the tailing pond until further reclamation and mine closure activities. The Kumtor TMF consists of two slurry pipelines (main tailings line and a spare one), a tailings dam supported by a buttress and a shear key, monitoring equipment and instruments, an effluent treatment plant, and two diversion ditches to direct surface water around the TMF. In addition to general tailings management, two important aspects are monitored and controlled: (i) cyanide containing solutions, which are securely contained within the TMF, and (ii) dam stability. These issues are discussed below.

Cyanide residue management

The concentration of cyanide in the TMF is routinely monitored. In the tailings pond there is a natural disintegration of the chemical, or its decomposition, as a result of a chemical reaction and exposure to ultraviolet radiation. The liquid component is pumped and treated by the effluent treatment plant (ETP) to reduce cyanide and metals for safe discharge to the environment. More discussion of the cyanide concentrations discharged to the external environment is provided in the Water Quality and Compliance section.

Geotechnical monitoring and stabilization

The dam is constructed and managed to safely retain tailings. The dam is 3,050 meters long with a maximum height under its crest of 40.5 meters at an elevation of 3,670.5 meters above sea level. The dam is constructed primarily of dense granular fill made of the local ground. The dam surface is covered with an HDPE liner (a strong impermeable synthetic material) from the upstream slope to the toe of the dam, and then 100 meters into the tailings pond. This liner extends into the permafrost to minimize seepage through the dam. The height of the dam is increased

over time to ensure sufficient volume for tailings storage. Along with the increase of the pond volume, the existing buttress downstream of the dam is also expanded, which helps to increase the strength and stability of the structure. Some movement of the KGC dam was first observed in 1999, and since then, Kyrgyz specialist organizations and international engineering experts have been consulted on management and mitigation. In response, a shear key and buttress were constructed along the downstream toe to reduce, and eventually eliminate, the movement of the dam. Since 2006, a tendency of horizontal displacement velocity reduction has been observed. A branched network of sensitive instrumentation is installed to detect and record any movements in the dam structure. In 2018, operations on the shear key expansion were carried out at the dam lower edge for further expansion of the dam from the downstream toe. Compliance with timelines for periodic topping of the tailings dam, construction of the shear key and the buttress will ensure increase of the dam overall stability. To implement the planned activities ensuring the dam stability at 3,674.0 m crest level, a sequence of construction operations has been developed, starting from 2017 to 2020. Dam construction operations and the technological process of tailings impounding are carried out in accordance with ecological, economic and technical standards and fulfillment of safety conditions.

Tailings balance

Accurate knowledge of what enters and leaves the TMF and the volumes of liquid and solids it contains, are an important part of safe management. We survey the extent and depth of the pond, and track the volume of tailings entering the TMF and volume of water leaving it after treatment at the ETP and by evaporation from the pond surface. Tailings slurry, 49% consisting of solids, is continuously added to the TMF throughout Mill operations (most of the year). Water treatment and removal (via the ETP) occurs only during summer months when the pond and Kumtor River is not frozen - usually May to October. Therefore, TMF water volume peaks in spring and reaches its lowest level at the start of winter.

4.20 Tailings dam monitoring instrumentation (number of instruments)

Type	Purpose	2016	2017	2018
Inclinometers	Measure horizontal displacement	45	50	50
Settling plates	Identify dam base settlement	26	32	37
Piezometers	Measure water levels in dam body and base	32	33	38
Thermistors	Dam body and base temperature	47	48	53

4.21 Key Characteristics of Kumtor's Tailings Management Facility (TMF)

	Units	2016	2017	2018
Tailings discharged to Tailings Pond	mil. m ³	8.30	8.36	8.68
Net tailings remaining in Tailings Pond per year	mil. m ³	6.04	4.98	4.99
Total cumulative tailings in Tailings Pond at year end	mil. m ³	78.31	83.29	88.28
Total free water in Tailings Pond at year end	mil. m ³	5.73	6.55	7.32
Elevation of Tailings Dam Wall crest	masl	3,670.5	3,670.5	3,670.5
Peak water level in Tailings Pond during year	masl	3,663.68	3,664.86	3,665.95
Minimum water freeboard (dam crest level - peak water level)	m	6.82	5.66	4.55

Note: masl = metres above mean sea level

4.22 Water balance in TMF, m³

	2016	2017	2018
Free water at start of year (January 1)	3,890,450	5,730,850	6,546,038
Water added in tailings	6,086,506	6,174,299	6,465,724
Net precipitation/runoff less evaporation	1,308,441	470,340	816,738
Water remaining in tailings voids	-1,878,304	-1,861,268	-1,884,923
Water discharged from Tailings Pond to Effluent Treatment Plant	-4,028,844	-5,026,168	-4,622,464
Adjustment based on bathymetric survey	352,600	1,057,985	0
Free water at the end of year (December 31)	5,730,850	6,546,038	7,321,113



Conclusions of external experts

Geotechnical monitoring data is analyzed by the Institute of Geomechanics and Subsoil Development of the NAS KR. Overall tailings dam condition is assessed as suitable for operation. The international engineering company, Golder Associates Ltd., conducted inspection of the condition and safety of the TMF dam, providing recommendations for changes and improvement where appropriate. In the report for October 2018, the company specialists concluded: "The visual inspection of the tailings dam and appurtenances of the Kumtor site generally

indicated that the structures were in good condition and were functioning as required. It is recommended to continue with annual TMF inspections by external technical consultants, in view of continuous construction process of the tailings dam. KGC is doing an effective job of carrying out comprehensive inspections, preparing monitoring reports, collecting data from monitoring equipment and instruments, as well as implementing the necessary measures to operate the facility in a safe manner".

“ The visual inspection of the tailings dam and appurtenances of the Kumtor site generally indicated that the structures were in good condition and were functioning as required ”



Conceptual closure plan

The current mine plan indicates that gold production of KGC will cease in 2026. As agreed with Kyrgyz authorities and outlined in the Environmental Management Action Plan (EMAP), KGC is required to update the Conceptual Closure Plan (CCP) for the operation every three years, and complete a Final Closure Plan (FCP) two years prior to closure. This approach allows for a period for testing and monitoring of several years to evaluate the various options provided by the CCP, and time to consider any changes to the environmental, regulatory and social environment that may have occurred over the life of the mine. KGC has prepared CCP's in 1999, 2004, 2008, 2011, 2013 and most recently in 2016. The latest CCP covers the existing components of the Kumtor operations including the open pits, waste rock dumps, tailings management facility and related water treatment facilities, and the Mill complex and associated mine infrastructure. Closure and land use objectives of KGC:

- materially comply with regulatory requirements;
- minimize residual environmental impacts;
- ensure mine site features are geotechnically stable;
- ensure the protection of public health and safety;
- return the land to suitable post-mining land use;
- identify and mitigate social risks/impacts on the community, the business and the overall success of the closure process.

All CCPs have been previously submitted to the relevant Kyrgyz regulatory agencies for their information.

CCP update

The 2016 update to the CCP is based on the 2013 CCP, and incorporates new data and information, changes to the life-of-mine (LOM) plan, an analysis of closure risks, and changes to the environmental and social sphere of the project. The primary closure consideration will be the long-term stability of the TMF and the waste rock dumps. Key changes to this CCP update include the following:

- TMF design event – The Probable Maximum Flood (PMF) has been calculated for the tailings management facility (TMF) and is used as the design event for the closure of the TMF.

- TMF cover – The TMF cover has been modified to a single layer of inert waste rock crushed in the Mill circuit to a size less than 5 mm diameter.
- Waste Rock Dump configuration – It is assumed that the final dump configurations will comply with predictions by the Institute of Geomechanics and Subsoil Use (IGSU) under the KR NAS (2013).
- New facilities (admin, camp, landfill) – Closure actions for several new facilities constructed since the 2013 CCP have been incorporated, including new camp and administration buildings and a new landfill.
- Post-closure land use – An analysis of sustainable post-closure land uses for each area and facility of the site has been included.
- Social closure considerations – This CCP considers the social and socio-economic context of closure of the Kumtor mine.
- Closure Cost Estimate – The cost estimating methodology used in this update is based on first engineering and cost principles. In preparation of the reclamation and closure cost estimate the standardized reclamation cost estimator (SRCE) developed for mining industry in the USA and approved by the US state and federal regulatory authorities was used. During the development of this plan, additional data collected since 2013 was evaluated to update and confirm conclusions and closure actions presented in the 2013 CCP. In particular, KGC reviewed the available hydrological, hydrogeological and geochemical data, and pit and dump configurations. This review confirmed the general closure actions identified in the 2013 CCP are appropriate and resulted in only minor changes to the pit lake refilling curves and pit overflow channel alignments that do not affect the actions required for, or schedule or cost of closure.

In 2018, Kumtor continued to implement the scientific program to research and develop the most effective methods for land reclamation. The program includes collecting native plant seeds and establishing trial plots with disturbed topsoil to test proposed seed species, topsoil addition rate, seeding rate and requirements to fertilizers. The studies are conducted by the Kyrgyz National Agrarian University named after K. I. Skryabin.

In 2019, the CCP will be updated as per the agreement with Kyrgyz Authorities.



Funding closure liabilities

As outlined in the 2016 CCP, the uninflated life of mine closure cost is estimated at \$56.7 million. Kumtor is required to re-calculate closure liability on an annual basis, in accordance with International Financial Reporting Standards to take account of future discount and inflation rates.

In 1995, Kumtor established a reclamation trust fund to accrue cash funds for mine closure liabilities. This is funded by sales revenue, annually in arrears. As of December 31, 2018, the balance in the fund was \$30.8 million, with the remaining cost to be funded until the Life of Mine end.

“ In 2019, the CCP will be updated as planned by the Restated Investment agreement for the Kumtor project ”

Program of soil and vegetation studies

KGC is carrying out a program of soil and vegetation studies at the Kumtor mine with the purpose of further reclamation of disturbed lands. The program includes field expeditions to both the mine site and adjoining areas, as well to high-mountain valleys of the Kyrgyz Republic. The aim of the expeditions is to identify plant species suitable for reclamation works at the mine site. Studies, field expeditions, analyses of soil and vegetation at the mine are conducted by KGC Environment Department employees in cooperation with representatives from the Kyrgyz National Agrarian University named after

K. I. Skryabin, national experts in the sphere of agronomy and soil science are also involved. Representatives of the University have been conducting studies at the mine since 2012. The scientific program on the most effective reclamation methods includes collection of local plants and seeds, as well as establishment of trial plots with different soils and conditions.

The program of soil and vegetation studies is a set of measures aimed at improving environmental conditions and restoring lands, suitable for land use in post-closure period.





5 GLACIERS AND WATER MANAGEMENT

5.1 WATER USE AND TREATMENT

We use water for operational activities (mostly in the Mill), as well as for domestic use (drinking and sanitation) in the mine camp, offices, and workshops. Water is removed from the mine pit in order to ensure safe and stable operations.

Our main water management responsibilities are:

- Providing safe drinking water for our employees;
- Removing water and moving ice from the open pit to ensure safe access to ore, and stable and safe working conditions;
- Ensuring water returned to the natural environment is safe and meets specified quality criteria;
- Managing run-off to reduce sediment load entering local creeks and rivers.

An information brochure describing Water Management at KGC can be downloaded from our website at: www.kumtor.kg/en/environment-protection/water-management.

Water sources

We have two primary sources of water at the mine site. Most of the water we use is extracted from Petrov Lake. We also pump large volumes of water from the open mine pit, some of which we use at the Mill, thus reducing our demand from Petrov Lake. In 2018, we extracted approximately 5.17 million m³ of water from Petrov Lake, which was very similar to the previous year (5.21 million m³). In 2018, we pumped a total of 27.45 million m³ of water from the pit, including groundwater and glacier melt water. Of this, 1.54 million m³ was used in the mill, 0.75 million m³ for watering the pit roads and the remaining volume (25.17 million m³) discharged to the environment.

Operational water use

Our main use of water is as process water in the Mill, for crushing the ore and processing it to produce gold. In 2018, the Mill used 4.91 million m³ from Petrov Lake, 1.54 million m³ collected from the mine pit and 8.06 million m³ of reached recycled water. The use of pit water, which reduces our demand on water from Petrov Lake, has increased from zero in 2011 to 1.54 million m³ in 2018. The total amount of water used at the Mill increased by approximately 291.425 m³ in 2018, but this was all sourced from the Pit, so the amount of raw water sourced from Petrov Lake actually decreased in 2018 compared to 2017.

Drinking water

We also use treated water from Petrov Lake for domestic uses (drinking and sanitary) in the mine camp, the Mill, and other facilities. Domestic water use in 2018 was about 0.16 million m³, representing just 3.09 % of the freshwater we collect from Petrov Lake. Drinking water quality is monitored to ensure its safety and compliance.

Pit dewatering

We collect and discharge large quantities of water as a necessary part of our pit-dewatering program to keep the pit stable and safe. Some dewatering occurs throughout the year, but most occurs during the summer period when large quantities of glacial melt water collects in the open pit. The majority of the pit water is discharged to the environment.

Petrov Lake

Formed by the meltwater of Petrov Glacier, the lake is the source of drinking water at the mine and also supplies most of the water used for gold processing at the Mill.

5.1 Water Flows at Kumtor Mine, mil m³*

Pit

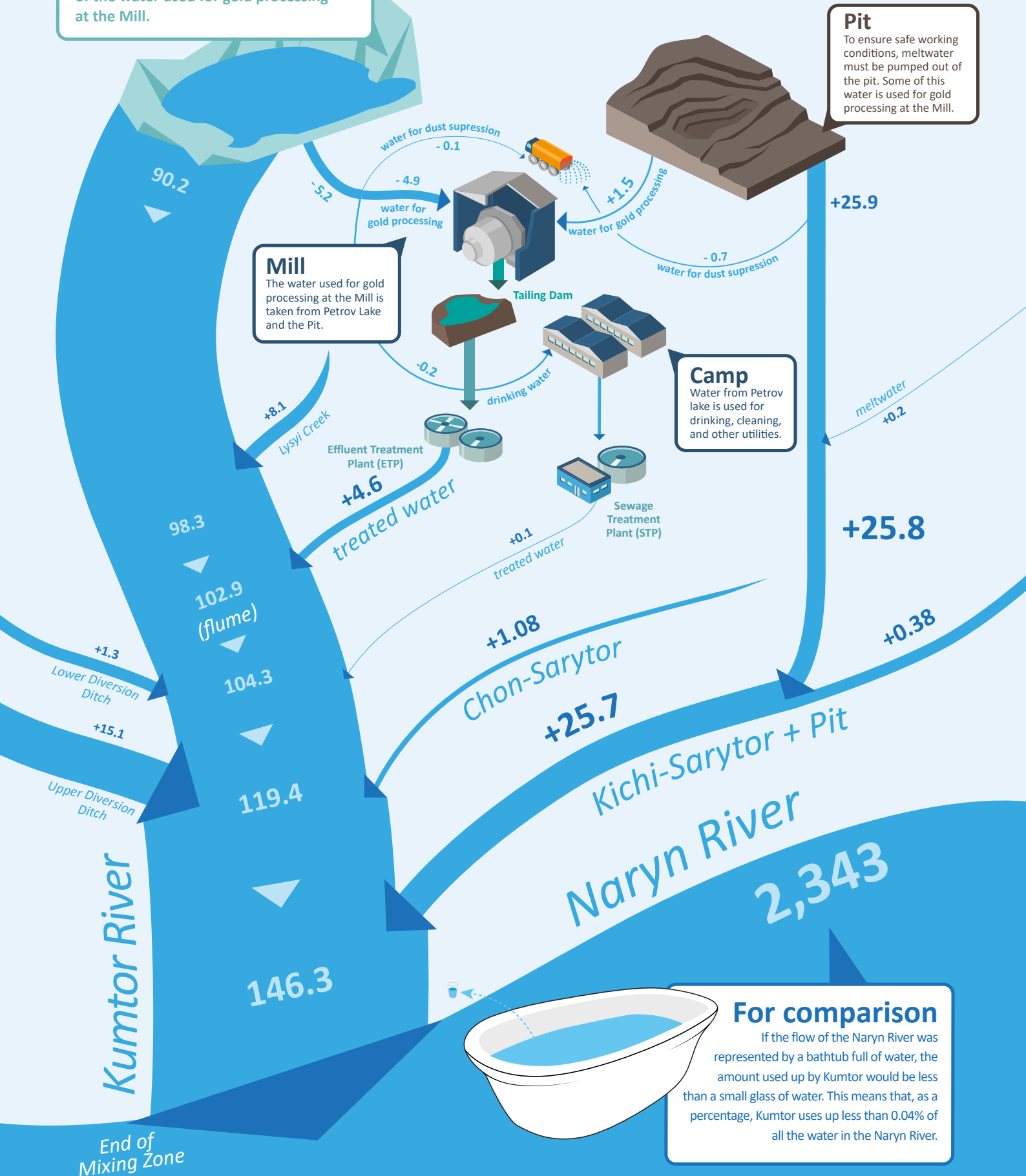
To ensure safe working conditions, meltwater must be pumped out of the pit. Some of this water is used for gold processing at the Mill.

Mill

The water used for gold processing at the Mill is taken from Petrov Lake and the Pit.

Camp

Water from Petrov lake is used for drinking, cleaning, and other utilities.



For comparison

If the flow of the Naryn River was represented by a bathtub full of water, the amount used up by Kumtor would be less than a small glass of water. This means that, as a percentage, Kumtor uses up less than 0.04% of all the water in the Naryn River.

* These flows are indicative only and will vary year to year



5.2 Water usage at Kumtor Mine Site

	Units	2016	2017	2018
Sources of Water				
Total Water Extracted from Petrov Lake	mil. m ³	5.25	5.21	5.17
Pit water pumped to the Mill	mil. m ³	1.01	1.14	1.54
Pit water pumped to the environment	mil. m ³	12.75	29.24	25.17
Water used for Domestic Purposes				
Water Used for camp domestic purposes	mil. m ³	0.13	0.13	0.14
Water Used for Mill domestic purposes	mil. m ³	0.02	0.02	0.02
Water used for Process/Mill				
Raw water used at Mill (from Petrov Lake)	mil. m ³	5.06	5.03	4.91
Total water used at Mill (Petrov Lake + Pit water)	mil. m ³	6.07	6.17	6.45
Water internally recycled at Mill	mil. m ³	6.50	6.19	8.06
Ore Feed to Mill	tonnes	6.3	6.2	6.3
Raw Water Intensity Ratio	litres/tonne Mill Feed	1,074	805	776
Water used for Dust Suppression				
Water used for dust suppression (from Petrov Lake)	mil. m ³	0.04	0.05	0.10
Water used for dust suppression (from Pit water)	mil. m ³	-	0.77	0.75
Wastewater Discharged to Environment				
Treated wastewater discharged from ETP	mil. m ³	4.14	4.75	4.58
Treated wastewater discharged from STP	mil. m ³	0.10	0.10	0.13
Net water usage	mil. m ³	1.01	0.36	0.46

Sewage treatment

Sewage wastewater is treated at the sewage treatment plant (STP) before discharge to the environment. This uses standard processes of biological treatment and disinfection (chlorination). The biological treatment improves the water quality by removing the 'oxygen demand' of organic matters, which would otherwise use up oxygen in the river and reduce its quality. Chlorination eliminates potentially harmful bacteria. Although challenging to operate in extreme conditions - high altitude with low oxygen and harsh weather conditions, treatment is achieved successfully through careful calculations and management. During freezing winter conditions, treated sewage is stored in a holding pond prior to gradual discharge during summer. In 2018, approximately 0.13 million m³ of sewage was treated and discharged.

Industrial wastewater treatment

Industrial wastewater containing residual cyanide is a component of tailings slurry discharged by gravity flow from the Mill to the tailings management facility (TMF).

The liquid component of tailings (approximately 51% of the slurry by weight) is pumped to and treated at the Effluent Treatment Plant (ETP), for compliance with the established standards – Maximum Allowable Discharge (MAD), before discharge to Kumtor River. Due to the freezing winter conditions, the treatment and discharge of wastewater is restricted only to the warmer season, typically from May to October.

The main concerns of community regarding wastewater from the Kumtor mine are related to cyanide, a highly chemical used routinely in the processing of ore to recover gold.

In 2018, 8.7 million m³ of tailings were produced and discharged into the tailings pond. The solid component is retained in the TMF, while the majority of liquid component is pumped to and treated at the ETP to reduce concentrations or remove elevated contaminants. We use the patented INCO treatment process, and operate one of the largest cyanide treatment plants outside of North America.

In 2018, approximately 4.578 million m³ of industrial wastewater from the tailings ponds was treated and discharged, which is 0.176 million m³ less than in 2017.

Water use intensity

Extraction of water from Petrov Lake for the mine's needs has no measurable impact on average annual lake water level.

Total water extraction from Petrov Lake of 5.17 million m³ in 2018 represents approximately 5.4% of its natural outflow to Kumtor River. We then returned 4.7 million m³ as treated wastewater (STP plus ETP), thus making the net impact on Kumtor river flow near neutral.

The gold recovery technology used at the Kumtor mine and severe climatic conditions limit our ability to increase our water use intensity by recycling effluents from our tailings pond. Studies have shown that even low levels of cyanide in the tailings pond would adversely affect our gold recovery process. All year round operation of the Effluent Treatment Plant is impossible because of climatic conditions. Since July 2012, we have been using water from pit dewatering in the Mill. As a result, we are seeing a decreasing trend in the water use intensity of our operation, reflecting the positive impact of in-mill recycling and using an increasing proportion of water from pit dewatering.

Managing run-off

We continue to improve the management of surface run-off (precipitation and ice melt) to reduce the risk and prevent possible contamination. Pumps are installed at the toes of Davydov, Lysiy and Sarytor glaciers and pipeline system was constructed around the waste rock dumps. Melt water is diverted to Kichi-Sarytor and Lysiy Creeks. We also constructed a number of settlement ponds in Lysiy and Chon-Sarytor Creek beds for settlement of solid particles. Flume stations with automatic calculation of water flow and data import directly to the MP-5 database were constructed at the Kumtor River and Lysiy Creek.



5.2 | WATER QUALITY AND COMPLIANCE

Drinking water

The water we use at the mine site for standard domestic use (for drinking, food preparation, personal hygiene and general cleaning of the mine camp and offices) is regularly tested against Kyrgyz, Canadian and World Health Organization (WHO) drinking water standards. The key parameters of our drinking water are compliant with these standards, and therefore safe for all relevant uses.

End of mixing zone

We sample and test water quality at over 30 points across the Concession area, which are listed and shown in the Environmental Monitoring Section. Sampling points are selected from a combination of legal obligations and additional commitments related to our environmental management responsibilities and programs. Our main compliance point is where surface water converges downstream of our operations, below where treated water is discharged to the river and shortly after leaving the concession area (as shown in Fig. 4.3). This point, designated as W1.5.1, and referred to as 'End of Mixing Zone', was selected by KGC to be protective of the intent of the Environmental Management Action Plan (EMAP) and the water quality in the Kumtor River. Any exceedance of water quality criteria at W1.5.1 triggers us to examine the data at W1.8, the monitoring point 1 km upstream of Naryn City, which is the nearest to the mine downstream community consuming the water. Results for 2018 are presented in the bar chart (Fig. 5.3), which includes the Kyrgyz maximum allowable concentration (MAC) limits recommended for water bodies providing public water supply.

Overall, the glacial origin of surface water sources in the Kumtor project area results in them having elevated sediment loading (suspended solids), visible in the generally milky appearance of the water. This sediment loading influences the total concentration of metals (aluminum, copper, iron, zinc). This naturally elevated background condition was documented in baseline monitoring prior to the start of KGC mining operations.

Elevated background concentrations are also reflected in water quality results from Petrov Lake, the source of Kumtor River located upstream of the mine. The presence of sediments and associated metals is not indicative of poor environmental performance of Kumtor mine. Kyrgyz water quality standards refer to total metal concentrations, whereas international environmental water quality standards are more commonly based on dissolved metals, which is more indicative of environmental impact and associated risks. We consider these aspects when evaluating water quality at KGC.

A review of results from 2018 shows the average total aluminum and iron concentrations exceeded the MAC standards. However, they remained consistent with the naturally high background concentrations in the region, which can be of the same order or higher. These results do not represent a significant risk to human health or the environment, as iron effects are mainly aesthetic (taste, visual appearance). These are some of the most abundant metals in the Earth's crust, and therefore not unusual to see at these concentrations.

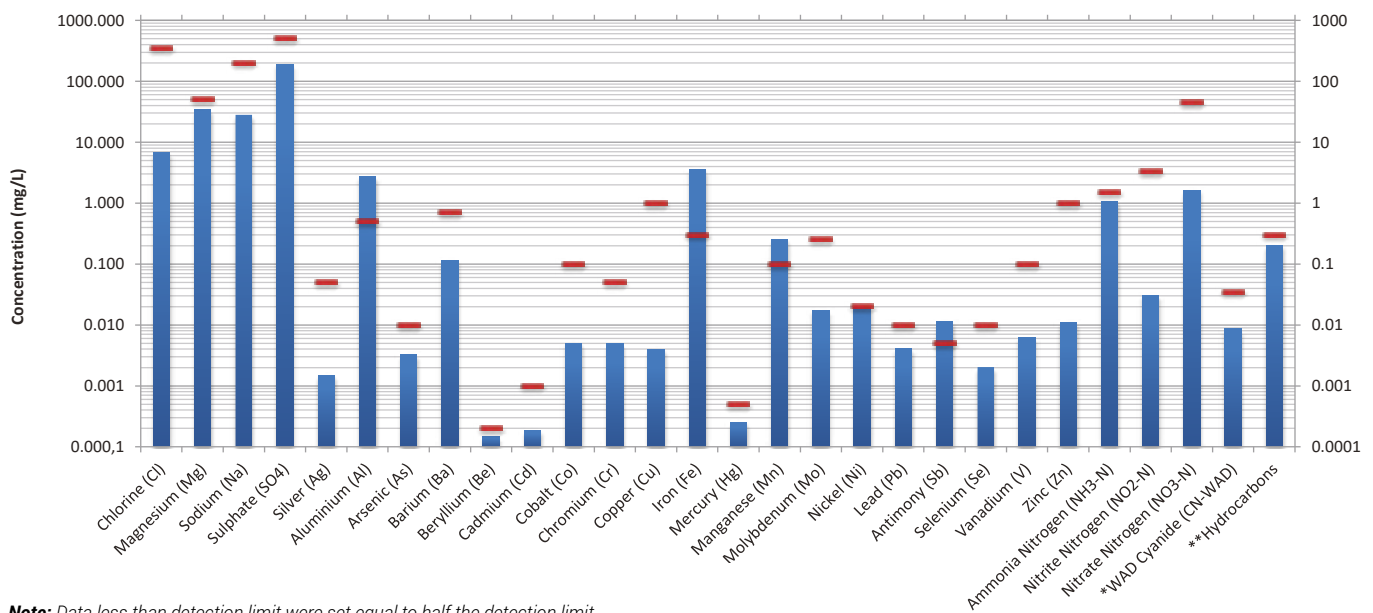
The average total manganese concentration (0.24 mg/L) at the End of Mixing Zone is above its MAC Communal Use standard (0.1 mg/L) in 2018, but lower than 2017 values. It should be noted that manganese occurs naturally in the environment, produced by erosion and weathering of rocks and minerals. The concentrations observed do not represent a significant risk to human health or the environment, as manganese effects are primarily aesthetic in humans and livestock.

According to the EMAP, KGC is required to consider international guidelines when processing water quality data. In particular, the current Canadian water quality guidelines do not provide for maximum concentrations of manganese allowable for livestock. There is a Canadian aesthetic guideline of 0.05 mg/L for distribution systems, which is not based on toxicity but rather potential problems in restricted flow devices in water lines (Olkowski, 2009). Ministry of Health Canada also assigns an aesthetic objective for human drinking water at 0.05 mg/L based on taste, staining of laundry, as well as quality of plumbing fixtures (Health Canada, 2014). There are no Canadian Environmental Quality Guidelines or United States Environmental Protection Agency (US EPA) guidelines for the protection of aquatic life or livestock (CCME, 1999). In Canada, the province of British Columbia has a chronic guideline for protection of freshwater aquatic life of 0.7 mg/L in soft water (mg/L as CaCO_3) and higher guidelines in higher hardness water (Nagpal, 2001). The average manganese levels in 2016 were well below the British Columbia guideline for protection of aquatic life from long-term exposure.

In 2018, the antimony concentration (average of 0.01 mg/L) exceeded the relevant MAC limit (0.005 mg/L). In light of this, Kumtor retained CanNorth consultants from Saskatoon, Canada, to complete a risk assessment for potential environmental and human exposure to antimony downstream of the Kumtor mine. It was concluded that this antimony level was "well below levels associated with potential effects on aquatic receptors and thus are not a concern for the health of the aquatic environment". The antimony concentration in 2018 is below the threshold reference value (TRV) for mammals, suggesting that

“ Our drinking water is safe and compliant.
All our wastewater is treated and is
environmentally safe before discharge ”

5.3 2018 Water Quality Data in the Kumtor River at the End of the Mixing Zone and Kumtor Concession Area (location W1.5.1)



Note: Data less than detection limit were set equal to half the detection limit.

* MAC is for Free Cyanide (CN_F). Measuring CN_{WAD} is conservative as CN_F is always less than or equal to CN_{WAD}.

** Hydrocarbon fractions F1 (C6-C10) to F4 (C34-C50) were analyzed individually and all measured at less than laboratory method detection limit. The value reported above (0.1 mg/L) represents half of the highest detection limit (0.2 mg/L for F3 and F). Other fractions had lower detection limits.

Maximum Allowable Concentration (MAC)

this antimony concentration is not toxic to them. Unfortunately, a quantitative assessment is not possible for birds due to a general lack of available toxicity data for birds exposed to antimony.

With respect to human health, the Kyrgyz Republic does not have a drinking water guideline for antimony. However, CanNorth (2017) notes that the World Health Organization (WHO, 2011) has derived an antimony drinking water guideline of 0.020 mg/L for the protection of human health. Despite the fact that in 2018, the concentration limits noted in the WHO drinking water guidelines are not exceeded, CanNorth also considered other pathways of exposure (e.g., consumption of fish) through the comparison of an intake to a TRV. The TRV for antimony was selected from the United States Environmental Protection Agency (US

EPA) Integrated Risk Information System (IRIS) database. Exposures were then calculated for adults, children and toddlers that were assumed to be potentially influenced as part of a shepherd family living seasonally downstream of Kumtor near the Taragay River. The calculated intakes were “well below TRV levels” indicating that antimony concentrations “do not represent a cause for concern from a human health perspective” (CanNorth, 2017). Notwithstanding the conclusions above, Kumtor is committed to identifying and mitigating the source of antimony released to the Kumtor River.

Effluent treatment plant discharge

Given the extreme climate conditions at the mine site, KGC's effluent treatment plant (ETP), which treats the effluents contained in the tailings management facility (TMF), generally operates between May and October each year (when water is not frozen).

During the water treatment season, the Kumtor river, which receives treated discharge from the ETP, is not frozen and exhibits significant flow volumes.

The ETP treated water quality results for 2018 are presented in the bar chart (Fig. 5.4). The results are compared to the MAD standards and discussed below.

The results show that concentrations of cyanide in the treated effluent discharge, as well as certain other key parameters met their respective MAD standards, including the average total ammonia (as N) concentration (23.32 mg/L). However, there were one-time exceedances of total ammonia (as N), which do not represent any significant risks to the environment.

Sewage treatment plant discharge

In 2018, the average generation of sewage water was approximately 356 m³/day. The quality of treated water discharged from the STP met all required MAD standards, except for the total ammonia value (2.7 mg/L) which slightly exceeded its approved MAD standard (2.03 mg/L) (Table 5.5).

External water quality testing

Our operations are routinely subject to inspections by local government agencies, who notify us of any concerns identified. We then respond and address these concerns accordingly.



Monthly and historic results

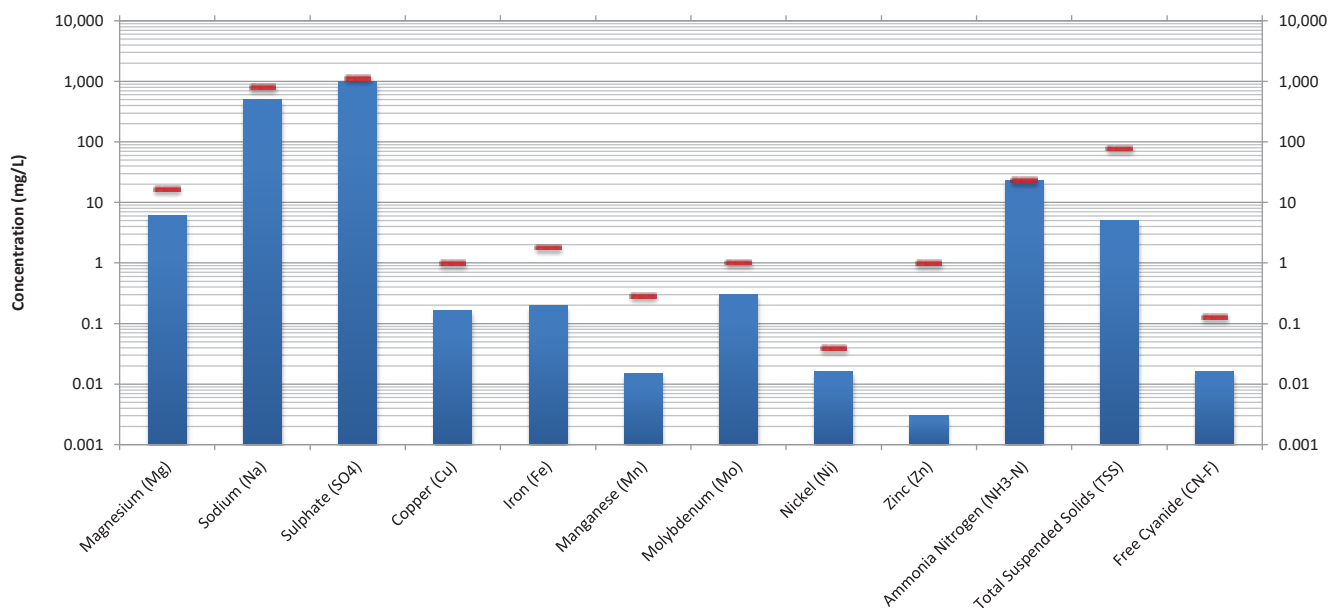
Average monthly monitoring results are presented in the appendix to this report. Monitoring results from previous years are presented in the past annual environment reports, which are also available on the website www.kumtor.kg.

References:

Canadian Council of Ministers of the Environment (CCME), 2008. Canadian Water Quality Guidelines (CWQG). Accessed at: https://www.ccme.ca/files/Resources/supporting_scientific_documents/cwqg_pn_1040.pdf; United States Environmental Protection Agency (US EPA), 1995. 1995 Updates: Water Quality Criteria Documents for the Protection of Aquatic Life in Ambient Water. Accessed at: <https://nepis.epa.gov/Exe/ZyPDF.cgi/20002924.PDF?Dockey=20002924.PDF>; The key parameters of our drinking water are compliant with these standards, and therefore safe for all relevant uses.



5.4 2018 Water Quality Data at the Discharge Point of the Effluent Treatment Plant (location T8.4)

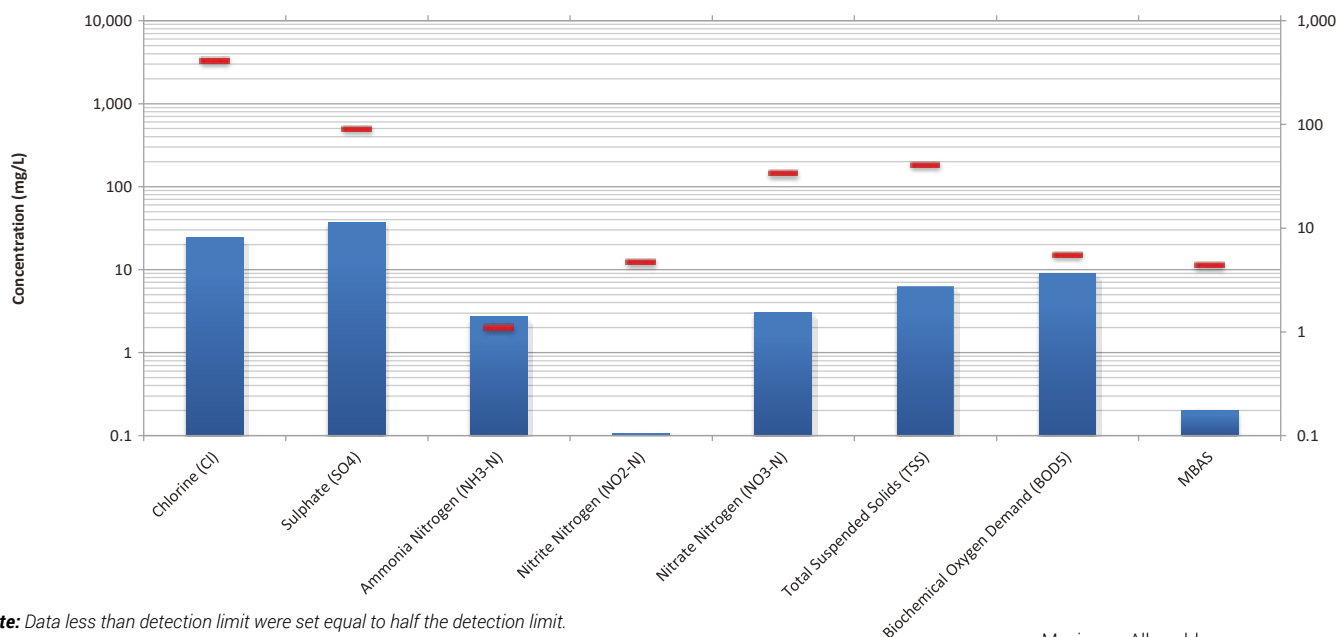


Note: Data less than detection limit were set equal to half the detection limit.

** MAC is for Free Cyanide (CN_F). Measuring CN_{WAD} is conservative as CN_F is always less than or equal to CN_{WAD}.

— Maximum Allowable Discharge (MAD)

5.5 2018 Water Quality Data at the Discharge Point of the Sewage Treatment Plant (location SDP)



Note: Data less than detection limit were set equal to half the detection limit.

** MAC is for Free Cyanide (CN_F). Measuring CN_{WAD} is conservative as CN_F is always less than or equal to CN_{WAD}.

— Maximum Allowable Discharge (MAD)



5.3 | GLACIER MANAGEMENT

Kumtor's high altitude mining operation is in close proximity to active glaciers, with part of the ore deposit and associated infrastructure extending beneath or affected by moving glaciers.

Ice removal is required to provide safe access to ore and has been an approved part of mining since 1994. Glaciological studies have shown that, compared to the natural melting caused by climatic changes, the removal and relocation of glacier ice to ice fields (practically at the same elevations) protects the relocated ice from excessive melting, significantly reducing their loss.

In response to stakeholder concerns, and taking into account changes in the legislation of the Kyrgyz Republic prohibiting activities that result in the acceleration of glacier melting, or activities that may affect the condition of glaciers, KGC describes relevant information on mining operations.

Ice unloading

As visible on the map in the Environmental Monitoring section of this report (Figure 4.3 - Key Environmental Monitoring Locations), parts of five active glaciers are located within the Kumtor Concession area (Davydov, Lysyi, Sarytor, Petrov, Bordu). Ice is also present in extensive ice fields in the southern and eastern parts of the Concession area. The continuation of mining at Kumtor depends on our ability to minimize the impact on glaciers and remove the ice only in the vicinity of the open pit and other infrastructure throughout the life of the mine. Over the years, KGC has found the best mining options, adapting to the current situation. Taking into account the opinion of stakeholders, KGC no longer deposits waste rock on the part of the glacier surface and now segregates waste rock and ice, avoiding co-disposal. The ice removed by Kumtor as part of its mining process is deposited back on other ice fields. In 2018, approximately 2.27 million tonnes of ice was removed and placed subsequently in the isolated

areas. Ice removal will need to continue in the future to provide ongoing safe access to the ore body as mining progresses.

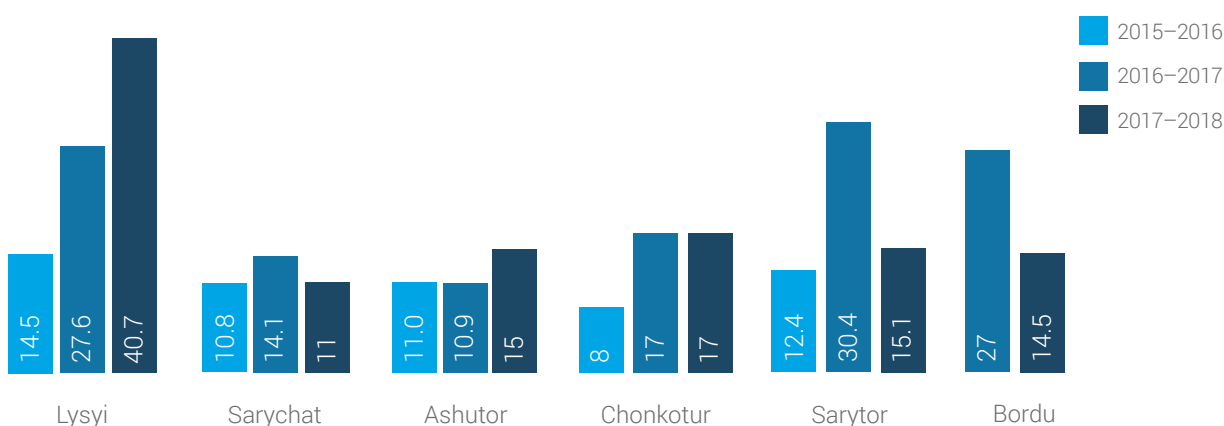
Environmental aspect

The impact of climate change has been observed in Central Asia, as well as around the world, over the past century. According to the United Nations Development Programme (UNDP), nearly 1/3 of the glacial area of Central Asia has disappeared since 1930, including the glaciers of the Kyrgyz Republic. In 2003–2013, the Ak-Shyirak massif glaciation reduced by 21.9 km² or 0.59% per year, and, in 2013–2018, by 15 km² or 0.93% per year. This reduction was accompanied by the retreat of glaciers, which constituted 11 m/year in 2003–2013, and 19 m/year in 2013–2018 on average for all glaciers of the massif. Both the rates of reduction of the Ak-Shyirak massif glaciers and the rates of retreat of the glaciers tongues have significantly increased in the recent years. This is due to the rapid increase in air temperature in the warm period (May - September). Thus, if in 1930–1977 the temperature increase was +1.7 °C, then in 1977–2003 it was already +2.4 °C, in 2003–2013 it was +3.0 °C, and in 2013–2018 +3.2 °C. The greatest reduction was experienced by the glaciers of the Tez, Aktash and Kurga-Tepchi basins, and the smallest - by Kumtor and Karasai (Petrakov, 2018).

The area of the Ak-Shyirak massif glaciation, determined by decoding multi-temporal space images, taking into account the glaciers that are not included in the Glacier Catalogue of the USSR, is as follows:

- in 2003 - 373.2 ± 11.2 km²
- in 2013 - 351.2 ± 5.6 km²
- in 2018 - 335.1 ± 9.0 km²

5.6 Retreat of the observed glaciers, m/year



Research experts from the Moscow State University named after M. V. Lomonosov (MSU) did not identify any relationship between the rate of glacier area reduction and the distance to technogenic impact area. In 2013-2018, the reduction of the Lysyi, Sarytor and Davydov glaciers was slower than the reduction of the entire Ak-Shyrak massif glaciation.

Glacier monitoring

The nature of all glaciers is for them to move steadily downhill, much like a very slow-moving river. The movement of the Davydov and Lysyi glaciers has been monitored since 1995, before mining started, with Sarytor and Bordu glaciers included in recent years. Flow rates of the glaciers, like any other glaciers, follow a seasonal pattern, being faster in warmer months and slower in winter. The retreat of the observed glaciers for 2014-2018 is shown in Fig. 5.6.

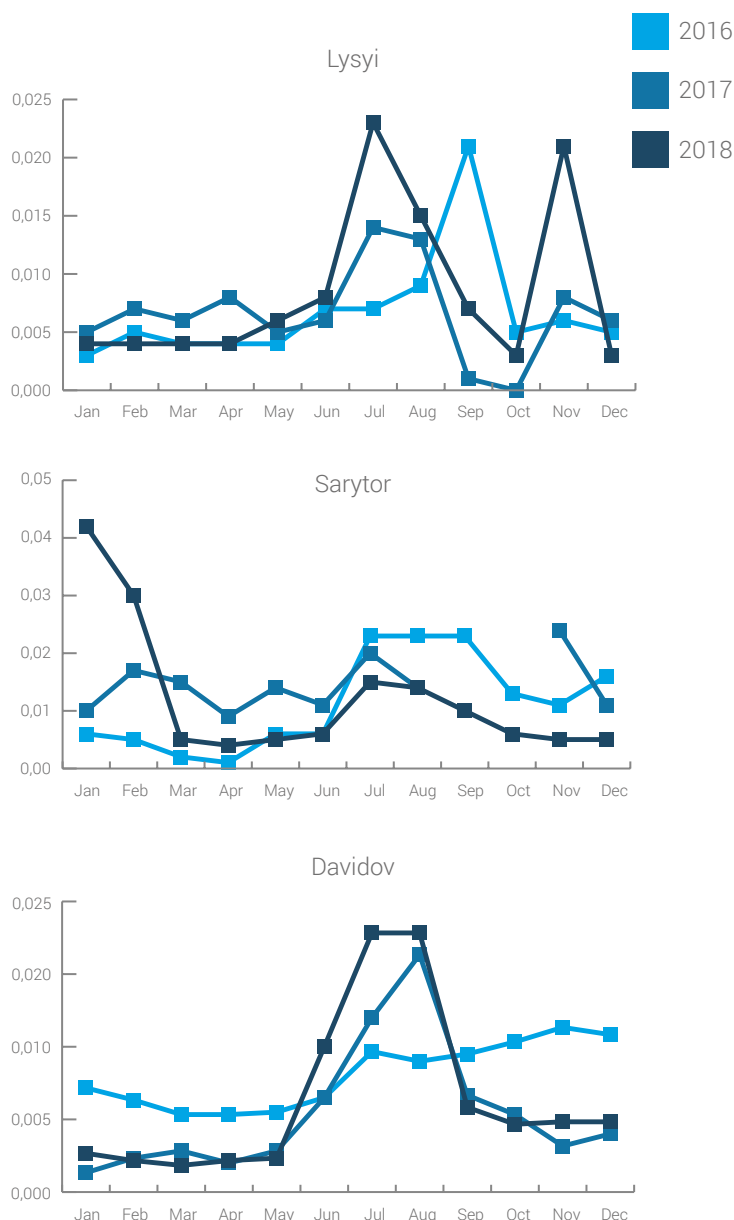
In 2014, Kumtor constructed an in-pit retaining buttress to reduce the movement rate of the south arm of the Davydov Glacier. Regular monitoring has shown this has been an effective engineering solution, and has reduced the quantity of ice that needs to be removed to ensure pit safety. In 2014, we commenced a long-term (2014-2018) glacier and hydro-meteorological monitoring program covering KGC concession area and basins of Arabel and Uchkol rivers.

The studies are conducted by the Institute of Water Problems and Hydropower under KR NAS with involvement of experts from MGU (Moscow State University, Russia). The monitoring program aims to assess the status of glaciers and trace the dynamics of their change (movement rate, linear retreat, and surface depression) and reflective properties of their surfaces (albedo) within the area of immediate anthropogenic impact by KGC and comparison of obtained data with similar observations undertaken on glaciers located at significant distances from the mine. Further information is contained in the case study in this chapter.

Regulatory aspects

Measures to move glaciers and ice have been a feature of mining operations at Kumtor starting from 1994. These measures are the subject of frequent inspections and considered when the KR supervisory and regulatory authorities issue permits and approvals to KGC for any activity, and are also studied by international technical and environmental experts. In November 2017, amendments regulating the operations on Davydov and Lysyi Glaciers were introduced by the KR Parliament into the KR Water Code.

5.7 Retreat of the observed glaciers, m/day



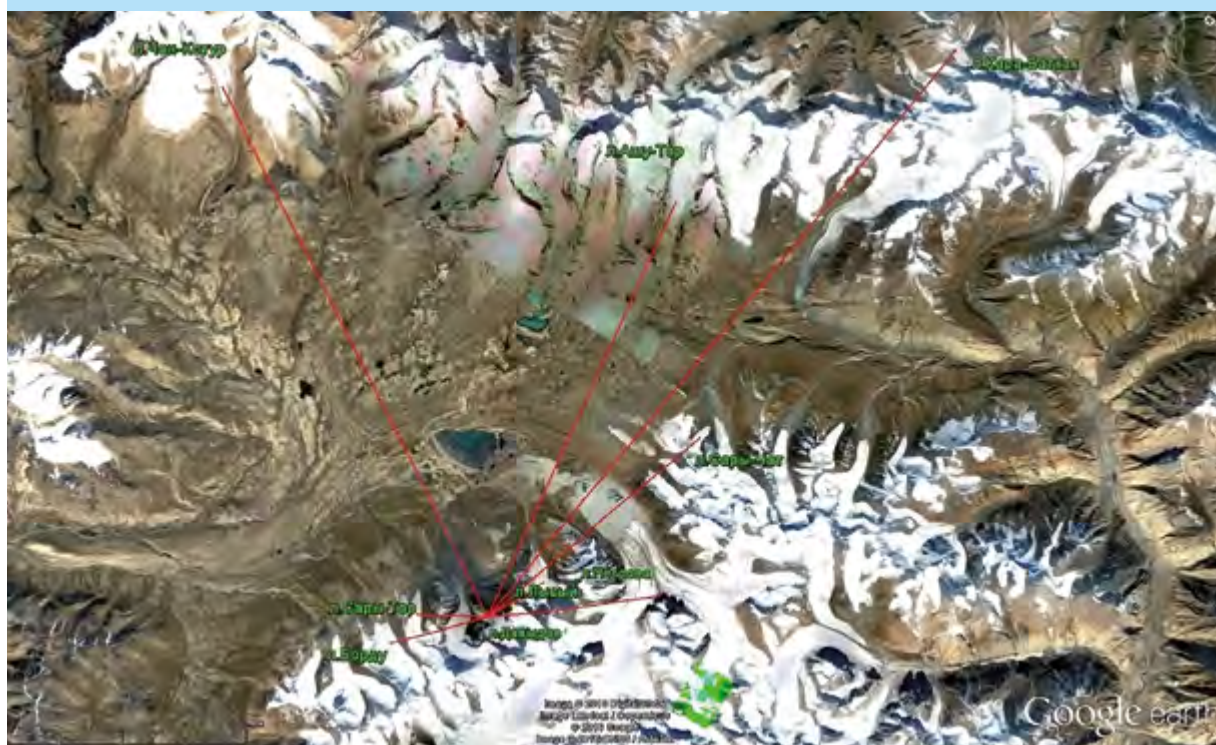
5.8 Retreating glaciers in Kyrgyzstan

	mil t/year
Annual average climate-change-induced ice loss on the Ak-Shyirak mountain massif (on which Kumtor is located)	200
Kumtor Ice Unloading in 2016	9.7
Kumtor Ice Unloading in 2017	4.4
Kumtor Ice Unloading in 2018	2.3

Glacier research and assessment of technogenic impacts on Ak-Shyirak Massif Glaciers

Studies of the Ak-Shyirak massif glaciers have been conducted for more than 140 years. As a result of the studies, it was found that the area of glaciation of the Ak-Shyirak massif in the late 1950s - early 1960s was 436 km² (Katalog lednikov SSSR [Glacier Catalogue of the USSR] 1969, 1970). In 2018, KGC continued funding the glacier research covering the glaciers within and outside the KGC concession area. The study was conducted by two research groups. One group was represented by the Kyrgyz Institute of Water Problems and Hydropower (IWPH) of the KR National Academy of Sciences and the second group was represented by the research

experts from the Moscow State University named after M.V. Lomonosov (MSU) and the Institute of Geography, Russian Academy of Sciences (IG RAS). Studies conducted by IWPH scientific team in 2018 continued research from previous years 2014-2017 and based on the approved by both parties expanded glacier and hydro-meteorological monitoring program covering KGC concession area. The monitoring program aims to assess natural (due to global warming) and technogenic (caused by the Kumtor mine activities) factors affecting the shrinkage of glaciers in KGC concession area.





The main conclusions from the observations in 2018

In 2018, from all observed glaciers of a northern macroslope of the Ak-Shyirak ridge (Sarytor, Lysyi, Sarychat, Bordu) the Lysyi glacier underwent the greatest ablation. For the period 2014-2018, all the observed glaciers underwent a persistent retreat of the front tongue sections. This can be most associated with such natural causes as the apparent global warming. In 2014-2018, the highest movement rate was recorded at glaciers Lysyi and Sarychat (40.7 m/year and 17.0 m/year, respectively).

In general, according to the calculations of the air temperatures adjusted in one line made by the Tian-Shan- Kumtor Weather Station, the average annual air temperature increase trend made up 1.2 °C for 1930-2018.

Research of glaciers surrounding the Kumtor mine will be continued in 2019.

Evaluation of the Kumtor mine development impact on the pollution of the Ak-Shyirak massif glaciers based on monitoring of the glacier area and surface albedo

Loss of the glacier area due to direct technogenic impact in 2013-2018 decreased compared to 2003–2013. In 2003–2013, the loss was 1.5 km², in 2013–2018 - 0.36 km², i.e. the loss decreased as much as four times. In 2013–2018, the loss caused by direct technogenic impact was only 0.1% of the total glaciation area of the Ak-Shyirak massif, i.e. 2.4% of the climate-induced ice loss. In 2013-2018, the ice mass loss was 4% of the climate-induced glacier mass loss. The removed ice was not lost, but became part of the rapidly growing technogenic rock glaciers located in the Lysyi and Davydov glacier valleys. In 2013–2018, the area of these glaciers increased by 1.4 km², which is significantly more than the reduction in the area of the Lysyi and Davydov glaciers and is 40% less than the reduction in the area of the Kumtor River basin glaciation. It should be noted that ice is

protected from melting much better in rock glaciers than on the surface of glaciers.

The contribution of direct technogenic impact to the loss of glacier area and mass is less than 4%, but these losses are offset by the growth of technogenic rock glaciers. The contribution of technogenic impact to the glacier surface dusting is not visible. The 2013-2018 reduction in the massif glaciers (with the exception of the Davydov glacier) is due to the continuing regional climate changes (Petrakov, 2018).

Thus, the 2013-2018 ice loss caused by technogenic impact was only 2.4% of all ice losses caused by the growth of annual average and especially average summer air temperature in the glacier zone.

5.4 PETROV LAKE WATER BALANCE

Water balance of the Petrov Lake was estimated based on data of water flow in the river, as well as water consumption and discharge to determine the total volume of water used at the Mill in 2018.

To determine the impact of water intake by the Kumtor mine on the Petrov Lake water balance, the Company took measurements at points of water outflow from the lake. We used readings from sensors installed at the Petrov Lake for measurement of water level fluctuations, water meters at the water supply pipeline to the Mill, data taken from the Kumtor River flume, as well as measurements of precipitation and evaporation.

Volume of water flow measured at the Kumtor River flume is determined by:

- Volume of treated effluents discharged from Effluent Treatment Plant (ETP);
- Inflow of water from the Lysyi Creek;
- Volume of precipitation;
- Inflow of glacial melt water into the Petrov Lake;
- Inflow of spring meltwaters or surface waters into the Petrov Lake.

Total inflow into the Petrov Lake is calculated using the following formula:

$$V_{\text{Inflow}} = V_{\text{Water according to Kumtor River flume}} - V_{\text{Water discharged from ETP}} - V_{\text{Lysyi Creek Flow}} + V_{\text{Water consumption by the Mine}} - P_{\text{Precipitation}} + E_{\text{Evaporations from the Lake}} \pm V_{\text{Lake water volume fluctuations.}}$$

Outflow calculation

Kumtor River. Volume of inflow into the Kumtor River is obtained by summing outflow from the Petrov Lake, discharge from ETP, and Lysyi Creek flow. Kumtor River flow in 2018, according to measurements at the flume comprised 102.87 million m³ for the period from May to October.

Effluent Treatment Plant. Volume of water discharged from ETP is obtained by summing up readings of flowmeters installed at the pump station #3. Total volume comprised 4.58 million m³ (for the period from May to October).

Lysyi Creek. Lysyi Creek flows into the Kumtor River upstream of the flume. Total flow of the Lysyi Creek throughout the season comprised 8.09 million m³.

Consumption of water at the Mill, Camp and other facilities. The total water consumption by the Mill and the camp was measured by flow meters at the pump station on the Petrov Lake and the Potable Water Treatment Plant (WTP). In 2018, the total volume of water consumed by all facilities at the Mine was 5.17 million m³.

Precipitation. Volume of water evaporated from the surface of the Petrov Lake was calculated according to Meyer's equation (equation for determination of evaporation from water surface). Evaporation from the surface of the Petrov Lake throughout May to September comprised 121.21 mm or 0.486 million m³. This value does not contradict the data of A. M. Molchanov, who notes that evaporation from the surface of mountain lakes in the area of the Petrov Lake is below 400 mm/year (A. M. Molchanov, "Central Asian Lakes", Gidrometizdat, Leningrad, 1987).

With precipitation of 338.52 mm, the volume of water in the Petrov Lake increased by 1.45 million m³.

Changes in volume of accumulated water. When comparing the start and end of the year, the level of water in the Petrov Lake increased by 0.125 m – from 3731.396 to 3731.521 m.

Final Calculations. Using the above formula, the total calculated inflow into the Petrov Lake in 2018 was 94.97 million m³.

Conclusion. The volume of water consumed by the KGC operations in 2018 comprised 5.4% of total water inflow into the lake. The above calculations of the water balance demonstrate that the volume of water consumed from the Petrov Lake by the mine facilities for production, domestic use and other needs is negligible. General data on water consumption and diversion, including wastewater treatment, are presented in the Table 5.2.



Risk of Petrov Lake outburst and preventive activities conducted by the Company

Understanding the concerns of state and regulatory authorities, as well as the public, KGC carries out continuous monitoring of water level in the Petrov Lake, water flow in the Kumtor River and readings of thermistors installed at three different points in the natural moraine dam. In addition, prior to development of an engineering design on the controlled lowering of water level in the Petrov Lake and its implementation, the Canadian consulting company "BGC", commissioned by KGC, developed an early warning system for the potential outburst of the Petrov Lake moraine dam, which was successfully introduced. KGC is currently conducting continuous monitoring of this warning system data. The basis of this system is a regular comparison of water flow in the Kumtor River Q_{act} with water flow calculated by the developed mathematical model of dependence between water level in the Petrov Lake and water flow in the Kumtor River Q_{mod} . If the difference between Q_{act} and Q_{mod} exceeds a specified value, it means

the extra flow in the Kumtor River is caused by infiltration or seepage through the natural dam body.

In 2015, commissioned by KGC, the head of the research and design laboratory "Stability of geotechnical objects" Ph.D. Chukin B.A. developed recommendations for a system of instrumental monitoring of the condition of the Petrov Lake natural dam. KGC is currently conducting monitoring in accordance with these recommendations.

KGC has repeatedly taken steps to develop design solutions for lowering water level in the Petrov Lake. In 2017, commissioned by KGC, JSC "Kyrgyzsuudolboor" developed a design for a stage-by-stage lowering of water level in the Petrov Lake. At the time of writing this report, the design has obtained the expert opinions and approvals in the relevant state authorities, as required by the KR legislation.



6 SOCIAL RESPONSIBILITY

6.1 STAKEHOLDER ENGAGEMENT

Effective stakeholder engagement is essential for us to manage our social responsibility. We have established structured processes to effectively listen to and communicate with our stakeholders, including regulators, shareholders, employees, local communities, small businesses, and the general public.

The process also includes bringing stakeholders together. Many of the projects described in this section have brought together communities, other supporting partners, the international aid community (see case study boxes), and government representatives.

Engagement context

Our approach to engagement reflects our desire for respectful and meaningful dialogue within the complex social and political context of the Kyrgyz Republic. This context means that public and media interest in the KGC activities remains high.

Structured dialogue

Our local engagement is maintained through our four Regional Information Centres, which have been established in the Jeti-Oguz and Ton districts, and in Balykchy town. The main objective of the Centres is to provide information about KGC to local residents. This includes information related to our hiring procedures, human-resources policies and job vacancy information. Community relations officers attend local community events, monitor the implementation of development projects funded by KGC, and act as a point of first contact for members of local communities.

In addition to these structured activities, other types of formal and informal engagements occur on a regular basis across our host communities, with a range of other stakeholders such as community leaders, community organizations, local small businesses, and farmers. To ensure partnerships based on consensus we initiated an establishment of Regional Committees in Jeti-Oguz, Ton and Balykchy. Committee members are local authorities, heads of village councils, representatives of civil society organizations, members of different unions. In these meetings, KGC management raises issues about

operations and defines plans of investment projects in liaison with local communities. Decisions are made together with the representatives of each Committee so that KGC's investments meet expectations and needs of communities. Regional Committee meetings take place every quarter.

Public communication

Adhering to the information transparency policy and main principles of the Extracting Industries Transparency Initiative (EITI), KGC recognizes the importance of providing accurate and objective information on the Company and satisfying the information needs of all stakeholders. Effective engagement with all stakeholders is highly important for us in terms of social responsibility management.

In recognition of the increased interest in KGC's activities, we update our corporate website (www.kumtor.kg), in three languages (English, Russian, and Kyrgyz) on a regular basis. On the website, we post news releases, downloadable reports, and media articles that feature KGC. Stakeholders can also have an access to the information describing our business, and our environmental and social responsibility activities. We commission films about our activities that we post on our website and through social media channels, such as Youtube and Facebook (as **Kumtor Gold Company**). On a regular basis, we produce a corporate newsletter, In Touch, and occasional brochures on specific issues, such as environmental and operational safety (all of them are available on our website). We have a free telephone number to allow members of the public to contact us, in order to express a concern or request information, and we also have an email address for this purpose, or can be contacted via our website. On a quarterly basis, we produce special issues of regional newspapers in Kyrgyz and Russian languages about our activities and distribute them in focus areas.

“ As part of the Kumtor Ambassadors Program, KGC staff also assists the Sustainable Development Department in capacity building of local communities ”



Kumtor Ambassadors Program

In 2018, Kumtor Ambassadors Corporate Volunteering Program continued to unite the Company employees from all the company departments and introduced them to local communities in the region where the Company conducts its operations. In 2018, employees put their collective efforts and volunteered more than 5,000 hours to various charity activities. The Program was of particular importance for the regular company partners, since a court decision of the Kyrgyz Republic effectively banned most social responsibility programs.

On a regular basis, we organize mine site visits for stakeholders, including representatives of state bodies, Government, local authorities, partner organizations, as well as teachers and students from various educational institutions. The Program for such groups usually includes a visit to the main work areas: Camp, Mill, Open Pit, Petrov Lake, Tailings Management Facility and Water Treatment Stations. Department Managers accompany the groups to the relevant sites and discuss the emerging issues on the spot. We will continue organizing such mine site visits for all stakeholders.

As part of the Kumtor Ambassadors Program, KGC staff also assists the Sustainable Development Department in capacity building of local community representatives involved in community investment projects implemented in the Region. On a quarterly basis, we continued to hold meetings of the Supervisory Board of microcredit agencies where KGC managers act as Board members and have experience in the areas of sustainability, finance, and risk. They help to maintain proper functioning and monitor the implementation of agreed programs in order to improve the performance of all three microcredit agencies.

We continue our cooperation with the International Business Council (IBC) and took part in all meetings of its Board. IBC is the largest multisector organization that unites the leading mining companies. We took an active part in the events of the KR Chamber of Commerce and Industry, as well as the American Chamber of Commerce, where the company was recognized the best in the nomination «Community Service».

102-42
102-43
103-2
413-1

Issyk-Kul Reginal Development Fund

KGC contributes 1% of gross annual revenues to the Issyk-Kul Development Fund (the "Fund"). This fund is governed by an oversight and steering committee (independent of KGC), which includes local government representatives and NGOs. The fund is designed to develop the socioeconomic infrastructure of the Issyk-Kul Region in accordance to local and regional government priorities. Since the creation of the fund in 2009, KGC has invested more than \$69.9 million into projects as diverse as kindergartens, schools, sports clubs, and irrigation infrastructure across the Issyk-Kul region. We understand that the Fund continues to be criticized for lack of transparency and that some stakeholders are expressing concerns about selection of projects and application of the IKDF resources. We are aware of these concerns and continue to encourage the fund to be more transparent.

KGS intends to assist the authorities of the Issyk-Kul region who have been raising concern of the future of IKDF and jointly are developing a new mechanisms that permit saving a portion of deducted funds to a post-closure period and divert funds to a more sustainable and profit-oriented projects. Over the year we have been working on development of a mechanism that will improve the IKDF's work with a purpose to warrant that the projects meet the following criteria:

- comply with the transparency principles (rational and efficient use of funds);
- be sustainable (use funds with account of Mine Closure);
- be targeted at improving the quality of life (include more profit-generating projects and have sustainable social infrastructure).

6.1 Annual Contribution to Issyk-Kul Region Development Fund

Units	2016	2017	2018
Million US\$	6.2	6.4	7.3

KGC has a seat at the IKDF Supervisory Board and has a right to coordinate 50% of overall funds to ensure a transparent and fair spending of the selected projects in the interests of social and economic development of the Issyk-Kul region, especially of communities located on the southern coast of Lake Issyk-Kul, including Balykchy town.

Impact assessment

Apart from regular monitoring and evaluation processes embedded in each project and donation supported by the company, we regularly conduct impact assessments and perception studies in our focus areas – Jeti-Oguz, Ton and Balykchy. Our Stakeholder Engagement Strategy and Plan are based on these studies and quarterly review of major stakeholders and their concerns, documented in internal online Kumtor-Connect software system, updated by regional community relations officers, and members of other departments dealing with publicity. Based on analysis and studies we have formulated a summary of stakeholder concerns (see Fig. 6.2).

KGC Grievance Mechanism

As the major company operating in the Kyrgyz Republic, KGC receives complaints and requests ranging from dust burden because of KGC trucks movement to job requests and hospital or road construction requests. We maintain an open dialogue with all stakeholders and listen to rational ideas. The measures taken by the company with regard to the dust on the technological road are described in the Environmental Monitoring Section. KGC also experienced temporary road blocks in 2012 and 2013, but none in 2014-2018. Protests typically involved demands for a greater distribution of the mine's profits and benefits. Negotiations between Centerra and KR Government actively continued in 2018.

Grievances on sustainability issues are dealt in accordance with the accepted grievance acceptance mechanisms. In 2018 KGC received 9 grievances and resolved all of them during the year. We understand the importance of raised concerns and their timely resolution. The Company will continue to dedicate its efforts to mitigate related risks.

KGC's Sustainable Development Department has four information centres in the Issyk-Kul region, and community representatives and local authorities contact our specialists for any information. In their turn, they report all issues raised by communities to the Sustainable Development Director.

We have a free phone line available for submitting grievances, our grievance acceptance

mechanisms are available in all regional information centres. We try to resolve each raised issue and concern, and provide requested information for every stakeholder group. All environment-related issues can be directly sent to the Environment Director via KGC.environment@centerragold.com. All grievances and issues raised are also reported directly to the KGC senior management.

6.2 Summary of stakeholder concerns

Stakeholders	Topic	Report section where discussed
Kyrgyz Republic Government and Parliament	<ul style="list-style-type: none"> ■ Project benefits ■ Changing legal agreements ■ Claims and changes to the legislation (glaciers, Water Code) ■ Project benefits ■ Waste Management and permits for new waste dump 	<ul style="list-style-type: none"> ■ President's Message ■ Economic Responsibility ■ Waste Rock and Ice ■ Social Responsibility
Various Commissions, Government Agencies and Local Communities	<ul style="list-style-type: none"> ■ Economic benefits ■ Environmental impacts ■ Waste rock management ■ Tailings dam displacement ■ Impacts on glaciers ■ Glacial lake outburst flood ■ Mine closure and its funding 	<ul style="list-style-type: none"> ■ President's Message ■ Economic Responsibility ■ Social Responsibility ■ Environmental Sections ■ Case Studies ■ Tailings Management ■ Waste Rock and Ice ■ Mine Closure
Local Communities, Youth, Vulnerable Groups	<ul style="list-style-type: none"> ■ Employment opportunities ■ Environmental impacts ■ Community support, projects and donations ■ Water resources 	<ul style="list-style-type: none"> ■ President's Message ■ Social Responsibility ■ Local Procurement ■ Water Use and Treatment
Local Businesses	<ul style="list-style-type: none"> ■ Supplying goods and services 	<ul style="list-style-type: none"> ■ President's Message ■ Economic Responsibility ■ Local Procurement ■ Social Responsibility
Employees and Contractors	<ul style="list-style-type: none"> ■ Employment conditions ■ Benefits ■ Health, safety and well-being 	<ul style="list-style-type: none"> ■ President's Message ■ People ■ Occupational Health & Safety
Conservation NGOs	<ul style="list-style-type: none"> ■ Environmental impacts ■ Biodiversity strategy ■ Mine closure 	<ul style="list-style-type: none"> ■ President's Message ■ Environment sections ■ Mine Closure



6.2 COMMUNITY INVESTMENT PROJECTS

We believe in importance of providing assistance to local communities in reaching their goals to develop local economy and well-being of Issyk-Kul citizens.

Taking into account that the mine closure will have a direct impact on region's economy, we consider that our high-priority task is to have a structured and well-planned approach in community development projects, which is therefore a vital component in maintaining our social license to operate.

The current life of the Kumtor mine is expected to end in 2026. Given its role as a major employer, taxpayer, and purchaser, mine closure is expected to bring with it a negative economic impact in the Issyk-Kul region and across the country.

In order to reduce this impact, the strategy of our community investments is to promote and develop a more diverse economy which will not be over-reliant on KGC. We work in partnership with a number of international and local organizations to maximize the impact of our community investments. The partnerships focus mainly on the southern shore of Issyk-Kul Lake. Projects are developed taking into account stakeholder input, community needs, company risks, and availability of an experienced partner that can deliver against expected outcomes. Within the framework of implementing its programs in the region, the Company strictly follows the

Sustainable Development Strategy of the Issyk-Kul Region that includes four main areas:

1. Support business growth and diversification (especially small businesses and entrepreneurs).
2. Support to development of the agricultural sector.
3. Youth and educational projects.
4. Environmental protection projects.

A key criterion for project selection is the principle of sustainability, which refers to the lasting effects of the project beyond the end of KGC's funding. If a project cannot be deemed to be sustainable and able to continue - or continue to generate benefits - beyond our funding period, then it will not be selected for implementation.

6.3 Sponsorships & Sustainable Development Projects

Units	2016	2017	2018
Million US\$	0.7	0.9	2.2

Note: From June 2016 until October 2017, KGC was unable to finance development projects because of the decision of the interdistrict court to prohibit the transfer of assets to third parties.



Kumtor Gold Company sponsored the Third World Nomad Games

In September 2018, the 3rd World Nomad Games were held in Issyk-Kul. Kumtor Gold Company was the general sponsor of the event, which brought together about 3,000 athletes from 70 countries of the world. The games attracted thousands of tourists and fans of 37 traditional sports of nomads, included in the competition program.

During the Games, two thousand volunteers were involved, 600 representatives of international media from 56 countries of the world covered the event. In 2020, Turkey will take the baton of the World Nomad Games. KGC allocated about US\$750,000 to support the event.



Regional Scholarship Program

The Kumtor Regional Scholarship Program provides students completing high school and wishing to pursue a vocational career the opportunity to apply for one of 18 Scholarships. The successful applicants are under full scholarship that includes tuition, accommodation, meals and a monthly stipend while they attend Technical Vocational School #27 or Technical School #91 in Bishkek.

In 2018, full scholarships were awarded to 11 students to study at Technical School #91 where they graduate with the profession of Cook/Baker.

Technical School #27 has worked closely with KGC to establish a program that incorporates school based instruction with practical training in the Heavy Duty workshop or the Mill Maintenance area at the Kumtor mine site.

Currently, KGC is sponsoring 22 students at Technical School #27, with 6 in the first year, 8 in the second year and 8 in the third year. The program takes 3 years to complete with graduating students qualifying as automechanics.



Supporting businesses

We support the development of local businesses in a number of ways. The most important one is based on our policy of supporting local procurement and encouraging new local suppliers to supply goods and services, as described in the Local Procurement section. However, we are aware of the risk for individual suppliers to become overly reliant on business with KGC. Therefore, we work with suppliers to support them in improving business processes (such as quality management systems) and encourage them to seek additional customers apart from KGC. Another important initiative is our micro-financing and credit program, which supports and enables local microcredit agencies in Jeti-Oguz, Ton, and Balykchy to offer favorable lending rates for small enterprises and farming businesses. The interest rates of these programs are the lowest in Kyrgyzstan.

Donations and charitable support

In addition to our sustainable community development programs, we provide one-off donations, usually in form of in kind equipment or services. We receive many requests for support from across the country. Donation requests and proposals are reviewed on a monthly basis by our donations committee consisting of the company management representatives under the chairmanship of the KGC president. All donation applications are reviewed to approve they meet the selection criteria specified by our Corporate Donations and Sponsorship Policy and Company procedures. KGC conducts follow up monitoring visits on a regular basis to ensure that the donations are used for the intended purposes.

See the infographics on next page for the applications review mechanism, which is also available online in our web-site.

DONATIONS PROCEDURE

As a socially responsible company, KGC annually allocates funds to help local communities in need. KGC strictly adheres to the Corporate Donations and Sponsorship Policy aimed at poverty alleviation, increasing living standards of local population, and improvement of social and economic situation in Issyk-Kul region and the country in general. The help rendered by KGC serves to contribute to the development of local communities and provide support to vulnerable groups.

1. FILING A REQUEST

To ensure timely and fair request processing the requester of charitable and sponsorship support should follow set standards.



REQUESTS SHOULD INCLUDE THE FOLLOWING INFORMATION:

- Name, address and contact phone numbers of the organization;
- Organization registration number;
- Aims and goals of the organization;
- Purpose of the event or activity for which the financial support is being requested;
- Expected results and estimated benefits for the company;
- Type and amount of requested support;
- Description of the way how the support is going to be used.

Donation is provided as a property, defrayal of expenses for works and services, and in very rare cases transfer of money assets.

During the review process priority is given to requests from Issyk-Kul region.



2. SUBMITTING A REQUEST

The letter of request shall be filed on official letterhead of organization or local government body signed and stamped by the head.



3. REGISTRATION AND NOTIFICATION

Document Control Department (DCD) of the Company registers an application and assigns it an internal number. The applicant may contact DCD to query the application status.



4. VERIFICATION

Sustainable Development specialists evaluate the applications for the possibility to include them into the protocol of the Donations Committee. Applications that fail to comply with the Company policies and go against its principles will be screened and not submitted for review of the Committee. Such applicants will be sent official letters of regret.

Applications that passed preliminary assessment go through additional verification that may require several initial meetings at site to have an insight into the applicant's activities.



A LETTER OF REQUEST IS ACCEPTED:

- **In regional info-centers of the Company** (Kyzyl-Suu village, building of the State District Administration; Bokonbaev village, building of the State District Administration; Balykchy town, 374A Frunze Str.);
- **In offices of the Company** (Bishkek city, 24 Ibraimov Str., Floor 10; Karakol town, 150 Elebaev Str.; Balykchy, 9 Naryn roadway);
- **Via postal address:** Kumtor Gold Company, 24 Ibraimov Street, 10th floor, Bishkek, 720031;
- **Fax:** 0 (312) 59-15-26
- **E-mail:** info@kumtor.com



5. DONATION COMMITTEE MEETINGS

Every month the Company holds a meeting of the Donation Committee, comprised of senior management and chaired by the KGC President to decide on allocation of funds to applicants.



6. RESPONSE

As per the Donations Committee decision, all applicants receive notification letter.



KGC DOES NOT PROVIDE DONATIONS TO:

- Individuals or companies, other than local community organizations and groups;
- Compensate travel and medical costs;
- Finance private business;
- Support religious or political goals;
- Finance corporate advertising of organizations requesting for help;
- Covering membership fees in any organization.



NEGATIVE RESPONSE

In case of negative decision, the applicant is suggested other possible sources of funding.



POSITIVE RESPONSE

In case of positive decision, shortly after the notification letter, the Company gets into contact with the applicant to clarify the details.



IMPLEMENTATION

Our donations are not made in cash but rather through goods or equipment procured by Kumtor and provided to the recipients.



MONITORING

At any given time, KGC is eligible to monitor the designated use of funds. Upon revealing any violations, KGC will assume measures according to Company policy.

GLOSSARY AND ABBREVIATIONS

Albedo - is the coefficient of spectral whiteness (reflection) of surface used as a key parameter in climate surveys to estimate the Earth's energy budget, radiation transfer in earth-atmosphere system and glacier balance.

ARD - Acid rock drainage is a term used to describe the outflow of mine waters that have been acidified by contact and exposure to rocks, reducing the pH levels which, in turn, can release and mobilize metals into the environment.

Biodiversity - Short for "biological diversity," the variability among living organisms and the ecosystems of which they are part. This includes diversity within species, between species, and within ecosystems.

BMV - Balykchy Marshalling Yard.

CAP - Change Acceleration Process.

Capacity Building - Activities and initiatives that strengthen the knowledge and skills of individuals and improve structure and processes such that communities can grow and develop in a sustainable way.

CCP or MCP - Conceptual Closure Plan (see also Closure Plan).

CG - Centerra Gold Inc.

CJSC - Closed Joint Stock Company.

Closure Plan - A plan designed to ensure public safety and restore the physical, chemical, and biological quality of the area disturbed by mining to an acceptable level. It must aim at leaving the area in such a way that the rehabilitated property does not become a burden to society after the mining operation is over.

Code of Ethics - A policy that sets out Centerra's dedication to upholding high moral and ethical standards and specifies basic business conduct and behaviour.

Collective Bargaining Agreement - An agreement between a company and one or more workers' organizations or, in absence of such organizations, the representatives of the workers duly elected and authorized by them in accordance with national laws and regulations.

Corporate Responsibility - A form of corporate self-regulation integrated into a business model where companies embrace the responsibility forth impact of their activities on the environment, consumers, employees, communities, and stakeholders.

Currencies - Kyrgyz som (KGS): 2018 average exchange rate 1 USD = 69.84 KGS.

Cyanide - A chemical compound containing carbon and nitrogen used to dissolve gold from ore.

Derived Air Concentration (DAC) - A derived limit on the activity concentration in air (in Bq/m³) of a specified radionuclide - calculated such that a typical worker, breathing air with constant contamination at the DAC while performing light physical activity for a working year, would receive the annual limit on intake for the radionuclide in question.

EBRD - European Bank for Reconstruction and Development.

Economic Value Retained - Component of GRI Economic Indicator EC1 and calculated as economic value generated less economic value distributed (see also www.globalreporting.org for further details).

EITI - Extractive Industries Transparency Initiative.

EMAP - Environmental Management Action Plan.

Engagement - A process of contact, dialogue, and interaction that ensures all parties of interest are informed and participate in decisions that affect their future.

Environmental Assessment - The process of identifying, predicting, evaluating, and mitigating the biophysical, social, and other relevant effects of development proposals prior to making major decisions and commitments.

Environmental Incident - An event that has caused or could cause environmental harm. Ranges in scale and severity from Type I (Insignificant) to Type V (Catastrophic).

Environmental Management System (EMS) - A framework developed by an organization to help improve its environmental performance by taking environmental considerations into account when making decisions and managing risks.

ETP - Effluent treatment plant.

First Aid Injury (FA) - A work related injury that requires first aid treatment.

GDP - Gross Domestic Product.

GHG - Greenhouse gas - Emissions commonly reported as CO₂ equivalents (CO₂e).

GIIP - Good International Industry Practice. Defined in the International Finance Corporation Environmental, Health and Safety Guidelines for Mining as "the exercise of professional skill, diligence, prudence and foresight that would be reasonably expected from skilled and experienced professionals engaged in the same type of undertaking under the same or similar circumstances globally. The circumstances

that skilled and experienced professionals may find when evaluating the range of pollution prevention and control techniques available to a project may include, but are not limited to, varying levels of environmental degradation and environmental assimilative capacity as well as varying levels of financial and technical feasibility.”

Global Reporting Initiative (GRI) - A global network based organization that has developed a widely used sustainability reporting framework consisting of principles and indicators to measure and report on an organization’s economic, environmental, and social performance (see also www.globalreporting.org for further details and definitions of the GRI framework and indicators).

Governance - A set of processes, customs, policies, laws, and institutions affecting the way a company is directed, administered, or controlled.

Hazard - A source of potential damage, harm, or adverse effects on something or someone under certain conditions at work.

HSE - Health, Safety and Environment.

ICMI - International Cyanide Management Institute.

IFC - International Finance Corporation, a member of the World Bank Group.

ISO - International Organization for Standardization, the world’s largest developer of voluntary International Standards.

ISO 31000 standard - Standard developed by ISO Technical Management Board Working Group.

IWP & HP - Institute of Water Problems and Hydropower.

IUCN - International Union for Conservation of Nature.

JSC - Joint Stock Company.

KR NAS - Kyrgyz National Academy of Sciences.

KGC - Kumtor Gold Company.

Local Suppliers - Suppliers based in the same country as the operation that they supply.

Lost Time Injury (LTI) - A work related injury resulting in the employee being unable to attend work on the next calendar day after the day of the injury. If a suitably qualified company medical professional advises that the injured person is unable to attend work on the next calendar day after the injury, regardless of the injured person’s next rostered shift, a lost time injury is deemed to have occurred. Site and company medical advisors will determine when a lost time injury is no longer recorded as a lost time injury. This includes fatalities.

LTI Frequency Rate - Number of LTIs x200,000/hours worked.

LTI Severity Rate - Number of days lost to injury x200,000/hours worked.

MAC - Maximum allowable concentration standards which apply at KGC’s surface water quality compliance point (referred to as W.1.5.1) downstream of the Kumtor mine.

MAD - Maximum allowable discharge standards which apply to treated effluent discharges from the effluent treatment plant and the sewage treatment plant.

MAE - Maximum allowable emission standards which apply to airborne emissions from Kumtor.

Materiality - The threshold at which an economic, environmental or social issue or indicator becomes sufficiently important that it warrants disclosure in the corporate responsibility report.

Medical Aid (MA) - A work related injury or illness that requires medical treatment administered by an off-site physician or by a registered medical personnel. Site and company medical advisors are to be consulted and a final decision as to how a medical aid injury is to be managed will be determined by the company medical team in consultation with senior site management.

Millimeter/Millimetre (mm) - International System unit of length, 1000th of a metre.

NGO - Non-Governmental Organization, a not-for-profit group largely funded by private contributions and operating outside of institutionalized government or political structures. NGOs focus on environmental, social, and economic issues at local, regional, national and international levels.

Near Miss - An event not causing harm, but has the potential to cause injury.

Oblast - Administrative division, which in English translates as province or region.

OJSC - Open Joint Stock Company.

Open Pit - A mine where the minerals are mined entirely from the surface.

Ore - A naturally occurring solid material (usually rock) from which a metal or valuable mineral can be extracted profitably.

QA/QC - Quality assurance and quality control program for collection, handling, and analysis of samples to ensure a consistent approach and accurate results.

Reclamation - The restoration of a site after the completion of mining or exploration activity.

Reportable Injury - The sum of the number of Medical Aid Injuries and Lost Time Injuries in a given period.

Reportable Injury Frequency Rate (RIFR) - Number of Reportable Injuries per 200,000/Hours Worked

Responsible Mining - A comprehensive and transparent minerals activity that respects the rights of all stakeholders, especially those of local people, operates safely, protects the environment, minimizes the impact on human health, embraces the best international practices, and upholds the rule of law while generating benefits for host countries (see also Corporate Responsibility).

Restricted work injury - Temporary transfer to lighter work.

SAEL - Stewart Assay and Environmental Laboratories LLC (part of the ALS international group of laboratories), located in Kara-Balta, Kyrgyz Republic.

SAEPF - State Agency of Environment Protection and Forestry.

SCER - Sarychat-Eertash Reserve, a strictly protected Zapovednik neighbouring Kumtor Concession. Sometimes referred to as SCEZ, with Zapovednik replacing Reserve. Zapovednik is a work of Russian origin meaning protected wilderness.

SEDAR - System for Electronic Document Analysis and Retrieval.

Significant Spill - Any spill that is Level III or higher, as defined by Centerra's incident reporting system, Level III spills are significant enough that they must be reported to Centerra's Board of Directors.

SME - Small or medium sized enterprise, referring usually to small businesses. Definitions vary, but typically they have less than 50 employees.

Stakeholder - Any person or group of people who may be affected in a good or bad way by the financial, safety, environmental, and social aspects of our operations and those who have an interest in or an influence on our activities.

Stakeholder Engagement - The communication with stakeholders, through various means, to find out what social and environmental issues matter most to them, with a view to a company improving decision-making and actions to address these concerns.

STP - Sewage Treatment Plant.

Sustainable Development - As used in the report Our Common Future (also known as the Brundtland Report): "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (see also Corporate Responsibility). Kumtor develops mineral deposits in a manner that does not restrict communities' efforts to sustain themselves and strives to catalyze economic activity that promotes long-term sustainability among our communities and their surroundings.

Sustainability - An approach to decision-making that integrates economic, environmental, and social considerations (see also Corporate Responsibility).

Tailings - The material that remains after recoverable metals or minerals of economic interest have been removed from ore through milling.

Threshold Limit Values (TLV) - The level/concentration of a chemical substance to which it is believed a worker can be exposed day after day for a working lifetime without adverse health effects.

TMF - The Tailings Management Facility is the combination of infrastructure to hold and manage semi-liquid tailings so as to avoid negative health and environmental impacts, consisting of delivery infrastructure, storage ponds, holding dam, water and waste treatment facilities, and discharge facilities for treated effluent.

TSP - Total suspended particulates.

USD - US Dollars.

WTP - Water Treatment Plant.

PERFORMANCE DATA

Economical and operational indicators

	2016	2017	2018
Gold produced, oz	550,960	562,749	534,563
Gold sold, kg	16,993.15	17,111	16,498
KGC's share in KR GDP, %	8.0	9.7	8.6
KGC's share in the aggregate industrial output, %	23.4	21.1	18.4

Direct economic value generated and distributed¹

	2016	2017	2018
Revenues from gold sales	683,327,685	685,163,279	660,058,489
Other income ²	1,926,887	4,069,740	1,126,089
Operating costs (Goods and Services) ^{3,5}	190,818,481	206,804,840	222,831,431
Corporate administration costs	-	-	-
Exploration costs	-	-	6,090,617
Capital expenditure ⁴	75,778,978	78,745,280	60,429,073
Other operating costs	2,304,654	2,469,333	3,097,024
Employee and contractor wages and benefits	108,861,856	117,237,524	117,800,253
Payments to providers of funds	96,292,724	96,729,304	92,988,345
Taxes and royalties	135,000,000	400,000,000	100,000,000
Community donations and investments	1,176,986	1,035,343	2,603,835
Payment to Cancer Support Fund		7,000,000	
Economic value retained	75,020,894	(220,788,605)	55,344,000

Notes:

- 1) Data has been prepared on an accrual basis and non-cash costs have been ignored.
- 2) Other income includes income from financial investments, sale of assets, and other services.
- 3) Includes capitalized overburden stripping costs.
- 4) Excludes capitalized overburden stripping costs.
- 5) Includes by-product sales (silver).

Major consumables, tonnes

	2016	2017	2018
Cement & lime	8,628	10,264	9,719
Reagents & chemicals	10,971	11,611	12,174
Grinding balls	9,871	11,389	11,759
Diesel (x1000 litres/yr)	123,846	124,652	140,262
Explosives	24,602	32,698	29,789

Local procurement in context

	2016	2017	2018
Total Payments for Goods and Services	256,175,620	266,126,258	317,703,765
Local Payments for Goods and Services	58,426,843	60,385,333	81,176,660
Local Payments for Goods and Services as% of Total	23	23	26

Environmental performance indicators

	2016	2017	2018
Direct energy consumption, GJ			
Diesel, litres/yr	119,540,637	123,846,319	140,262,495
Petrol, litres/yr	409,574	395,842	466,989
Explosives, tonnes/yr	24,602	32,698	29,789
Indirect Energy Consumption, GJ			
Electricity, GJ/yr	1,034,037	1,041,539	1,043,989
Electricity, MWh	287,233	289,316	289,997
Direct GHG Emissions (Scope 1) tonnes CO ₂ e	337,028	340,525	382,028
Indirect GHG Emissions (Scope 2) tonnes CO ₂ e	25,102	25,279	25,230
GHG intensity ratio, tonnes CO ₂ e/oz gold	0.66	0.65	0.76

Kumtor mine emissions, tonnes/year

Pollutant	MAE Standard 2018	Actual 2018
Dust that contains SiO ₂ 20-70%	783.59380	654.9818
Hydrogen cyanide	0.0008000	0.00260
Sodium hydroxide	0.0734600	0.05451
Lead and its compounds	0.0015000	0.000565
Calcium oxide dust (lime)	1.9641000	2.41350
Carbon (soot)	1.2327800	2.01890
Sulfur dioxide	6.5267200	10.38329
Welding aerosol	0.3547980	0.50530
Manganous dioxide	0.0479290	0.06880
Hydrofluoride	0.0408970	0.05930
Hydrocarbon	10.008730	15.14807
Nitrogen dioxide	85.028920	133.75458
Carbon oxide	66.031250	55.96210
Tetrafluorosilane (fluorides)	0.0156530	0.02200
Ammonia	0.3433000	1.28340
Silicon compounds	0.0156530	0.02220
Hydrochloride	0.0000770	0.00610
Nitrogen oxide	0.0732900	
Hydrocarbons (as kerosene)	2.3793400	
White Spirit	1.6129000	
Xylol	2.0814000	
Coloured aerosol	0.0294000	
Formaldehyde	0.2589000	0.45630
Benzpyrene	0.0000260	0.0000422
Ammonium nitrate		0.11380
Carbon dioxide		23.24650
Total	961.7	900.5

Waste management, tonnes

	2016	2017	2018
Industrial waste - total (tonnes)	6,996.0	10,052.0	6,751.2
Industrial waste - recycled (tonnes)	8 828	10,083.2	6,751.2
Hazardous waste - total (tonnes)	697.0	545.0	459.7
Hazardous waste - recycled (tonnes)	1,798.0	817.9	0.0
Waste Tires	1,150.0	947.8	1,176.3

***Note:** An additional 8.8 tonnes of batteries were recycled from temporary storage areas. In 2018, 1,176.3 tons of used tires were generated, 666.3 tons were transferred for recycling, 510 tons were temporarily stored at the mine.

Water Use and Treatment, mil m³

	2016	2017	2018
Sources of Water			
Total Water Extracted from Petrov Lake	5.25	5.21	5.17
Pit water pumped to the Mill	1.01	1.14	1.54
Pit water pumped to the environment	12.75	29.24	25.17
Water used for Domestic Purposes			
Water Used for Camp domestic purposes (from Petrov Lake)	0.13	0.13	0.14
Water Used for Mill domestic purposes (from Petrov Lake)	0.02	0.02	0.02
Water used for process/Mill			
Raw water used at Mill (from petrov lake)	5.06	5.03	4.91
Total water used at Mill (Petrov Lake + pit water)	6.07	6.17	6.45
Water internally recycled at Mill	6.50	6.19	8.06
Ore feed to Mill	6.3	6.2	6.3
Raw water intensity ratio (litres/tonne)	1,074	805	776
Water used for dust suppression			
Water used for dust suppression (from Petrov Lake)	0.04	0.05	0.10
Water used for dust suppression (from Pit Water)	-	0.77	0.75
Wastewater discharged to environment			
Treated wastewater discharged from ETP	4.14	4.75	4.58
Treated wastewater discharged from STP	0.10	0.10	0.13
Net water usage	1.01	0.36	0.46

Social performance indicators

	2016	2017	2018
Training Hours by Gender			
Average/Employee	35	46	38
Total Employee Training Hours	94,334	127,999	104,258
Total Number of Employees	2,665	2,764	2,765
Average/Female Employee	20	21	21
Total Female Employee Training Hours	7,073	7,385	7,279
Total Number of Female Employees	347	349	342

Social performance indicators

	2016	2017	2018
Training Hours by Gender			
Average/Male Employee	38	50	40
Total Male Employee Training Hours	87,261	120,613	96,979
Total Number of Male Employees	2,318	2,415	2,423
Training Hours by Employee Category			
Average/Senior Management	45	34	61
Total Training Hours Provided to Senior Management	1,897	1,400	2,388
Total Number of Senior Management	42	41	39
Average/Middle Management	39	45	35
Total Training Hours Provided to Middle Management	11,539	12,934	9,775
Total Number of Middle Management	294	287	278
Average/Funtional Employee	34,69	46,66	38
Total Training Hours Provided to Funtional Employees	80,898	113,665	92,094
Total Number of Funtional Employees	2,332	2,436	2,450
Health and Safety			
Annual medicals	2,485	2,870	2,633
Pre-employment medicals	254	334	162
Total visits	40,104	38,709	37,607
Reduction in overall vehicle accidents	11	14	17
Reduction in high-potential injury risk - light vehicle accidents	3	1	2
In-pit heavy versus light vehicle collisions	2	0	1
Injuries due to vehicle accidents	1	1	2
Hours worked	5,712,626	5,882,917	6,334,208
Lost time injuries (LTI's)	9	1	2
Restricted work injuries	1	1	2
Medical aid	2	1	2
First aid	17	13	9
Days lost to injury	6,349	6,026	107
LTI frequency rate	0.33	0.03	0.06
LTI severity rate	222	205	3.38
Total Reportable Injury Frequency Rate (TRIFR)	0.39	0.14	0.19
Incidents w/Property damage	31	28	16

**The discrepancy in data on the number of lost days due to injuries with lost time incidents (LTI) for 2017 compared to 2016 is due to the fact that the lost time injuries were 8 less in 2017 than in 2016. Unfortunately, in April 2017, a fatal accident occurred on the heavy equipment maintenance site. In accordance with international norms, an automatic calculation of 6,000 lost person-days was implemented due to the fatal accident and 26 lost person-days due to the lost time injury.*

Employee demographics

	2016	2017	2018
Standard national entry level wages and those paid by Kumtor			
Kyrgyz minimum wage per hour	6.33	7.14	10.06
Kumtor entry-level wage per hour	86.20	94.62	99.35
Kumtor entry-level to Kyrgyz minimum wage	14 : 1	13 : 1	10 : 1
Staffing at the Kumtor mine (as at Dec each year)			
Kyrgyz national (Total)	2,488	2,627	2,596
-men	2,165	2,306	2,291
-women	323	321	305
Expat staff (Total)	71	66	45
-men	71	66	45
-women	0	0	0
Full time staff Total (Kyrgyz + Expat)	2,559	2,693	2,641
-men	2,236	2,372	2,336
-women	323	321	305
Contractors (Total)	926	947	850
Total staff (Full time staff + Contractors)	3,485	3,640	3,491
Proportion of Kyrgyz national as full time staff (%)	97	98	98

Employee demographics

	2016	2017	2018
Total Number and Rates of New Employee Hires and Employee Turnover by Gender and Region			
Bishkek	17	29	20
Bakychi	10	5	5
Karakol	7	23	8
Jeti-Oguz	52	65	23
Ton	21	6	2
Other regions	19	11	24
Women (from all)	9	27	5
Total	126	139	82
Employee turnover (%)	3.7	6.2	3.9
Return to work and retention rates after parental leave (female employees)			
Entitled to parental Leave	8	7	12
Returned from parental leave	15	10	10

Economical and Operational Indicators

Indicator	Description	Omissions
GRI 101: Foundation 2018		
GRI 102: General Disclosures 2018		
Organizational Profile		
102-1 Name of the organization	About Kumtor mine (p.2)	-
102-2 Activities, brands, products, and services	About Kumtor mine (p.2); Environment and Sustainability Snapshot (p.10-11); Economic Value (p.24)	-
102-3 Location of headquarters	Contacts (p.123)	-
102-4 Location of operations	About Kumtor mine (p.2)	-
102-5 Ownership and legal form	About Kumtor mine (p.2)	-
102-6 Markets served	About Kumtor mine (p.2)	-
102-7 Scale of the organization	Environment and Sustainability Snapshot (p.10-11); Economic Value (p.24-25); Workplace Practices (p.34)	-
102-8 Information on employees and other workers	Workplace Practices (p.32-33)	-
102-9 Supply chain	Local Procurement (p.26-29)	-
102-10 Significant changes to the organization and its supply chain	No significant change has been occurred neither in company's operational or financial structure nor supply chain;	-
102-11 Precautionary principle or approach	Disclaimer Regarding Forward-Looking Statements (p.123)	-
102-12 External initiatives	Governance (p.14-15)	-
102-13 Membership of associations	Governance (p.14-15)	-
Strategy		
102-14 Statement from senior decision-maker	Message From the President (p.4-6)	-
Ethics and Integrity		
102-16 Values, principles, standards, and norms of behavior	Business Ethics (p.22-23), Values (p.13)	-
Governance		
102-18 Governance structure	Governance (p.14-15)	-
Stakeholder Engagement		
102-40 List of stakeholder groups	Stakeholder Engagement (p.91)	-
102-41 Collective bargaining agreements	Collective Bargaining (p.31)	-
102-42 Identifying and selecting stakeholders	Stakeholder Engagement (p.88-91)	-
102-43 Approach to stakeholder engagement	Stakeholder Engagement (p.88-91)	-
102-44 Key topics and concerns raised	Environmental Claims (p.15); Risk Management and Continuous Improvement (p.18); Stakeholder Engagement (p.90-91)	-
Reporting Practice		
102-45 Entities included in the consolidated financial statements	About This Report (p.2)	-
102-46 Defining report content and topic boundaries	About This Report (p.2); Materiality Assessment (p.19-21)	-
102-47 List of material topics	Materiality Assessment (p.19-21)	-
102-48 Restatements of information	No restatements made in information given in previous reports.	-
102-49 Changes in reporting	About This Report (p.2)	-
102-50 Reporting period	About This Report (p.2)	-

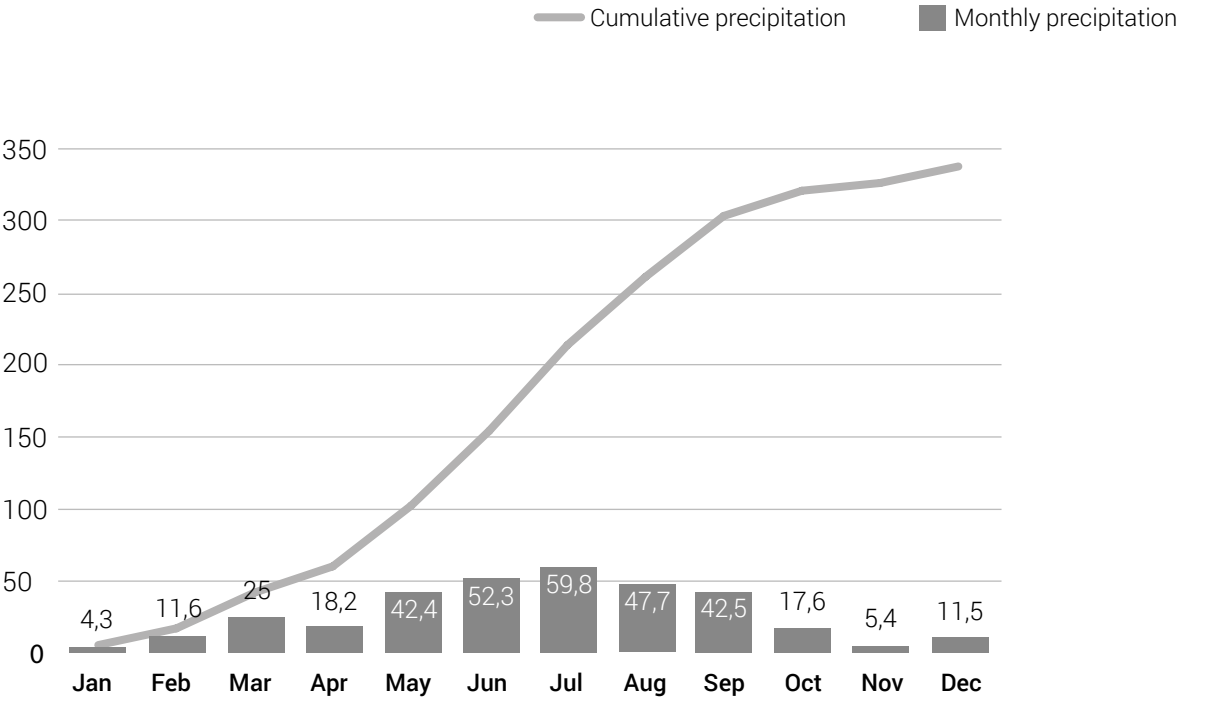
Indicator		Description	Omissions
Reporting Practice			
102-51	Date of the most recent report	About This Report (p.2)	-
102-52	Reporting cycle	About This Report (p.2)	-
102-53	Contact point for questions regarding the report	Contacts (p.124)	-
102-54	Claims of reporting in accordance with the GRI Standards	About This Report (p.2)	-
102-55	GRI content index	GRI Content Index (p.103-106)	-
102-56	External assurance	Disclaimer Regarding Forward-Looking Statements (p.123)	-
Material Issues			
Indicator		Description	Omissions
Water Management			
GRI 103: Management Approach 2018	103-1 Explanation of the material topic and its boundary	Materiality Assessment (p.19-21)	-
	103-2 The management approach and its components	Governance Model (p.14); Sustainability Management (p.18); Risk Management and Continuing Improvement (p.18-19); Environmental Responsibility (p.42); Water Use and Treatment (p.72)	-
	103-3 Evaluation of the management approach	Governance Model (p.14); Risk Management and Continuing Improvement (p.18-19); Environmental Monitoring (p.46-49)	-
GRI 303: Water 2018	303-1 Water withdrawal by source	Water Use and Treatment (p.72-75)	-
	303-2 Water sources significantly affected by withdrawal of water	Water Use and Treatment (p.72-75)	-
	303-3 Water recycled and reused	Water Use and Treatment (p.72-75)	-
GRI 306: Effluents and Waste 2018	306-1 Disclosure 306-1 Water discharge by quality and destination	Water Use and Treatment (p.72-75)	-
Biodiversity			
GRI 103: Management Approach 2018	103-1 Explanation of the material topic and its boundary	Materiality Assessment (p.19-21)	-
	103-2 The management approach and its components	Governance Model (p.14-15); Sustainability Management (p.18); Risk Management and Continuing Improvement (p.18-19); Environmental Responsibility(p.42); Biodiversity (p.50)	-
	103-3 Evaluation of the management approach	Governance Model (p.14); Risk Management and Continuing Improvement (p.18-19); Environmental Monitoring (p.46-49)	-
GRI 304: 2018	304-1 Operational sites owned, leased, managed in, or adjacent to, protected areas and areas of high biodiversity value outside protected areas	Biodiversity (p.50-56)	-
	304-2 Significant impacts of activities, products, and services on biodiversity	Biodiversity (p.50-56)	-
	304-4 IUCN Red List species and national conservation list species with habitats in areas affected by operations	Biodiversity (p.56)	-
Waste and Hazardous Material Management			
GRI 103: Management Approach 2018	103-1 Explanation of the material topic and its boundary	Materiality Assessment (p.19-21)	-
	103-2 The management approach and its components	Governance Model (p.14); Sustainability Management (p.18); Risk Management and Continuing Improvement (p.18-19); Environmental Responsibility (p.42); Waste Management (p.62-64)	-
	103-3 Evaluation of the management approach	Governance Model (p.14); Risk Management and Continuing Improvement (p.18); Environmental Monitoring (p.46-49)	-

	Indicator	Description	Omissions
Waste and Hazardous Material Management			
GRI 306: Effluents and Waste 2018	306-2 Waste by type and disposal method	Waste Management (p.64); Performance Data (p.100)	
	306-3 Significant spills	Environmental Incidents (p.17)	
G4 Sector Supplement	G4-MM3	Unprocessed Waste Rock (p.64); Tailings Management (p.66-68)	
Legal Compliance			
GRI 103: Management Approach 2018	103-1 Explanation of the material topic and its boundary	Materiality Assessment (p.19-21)	-
	103-2 The management approach and its components	Governance Model (p.14); Sustainability Management (p.18); Risk Management and Continuing Improvement (p.18-19);	-
	103-3 Evaluation of the management approach	Governance Model (p.14); Risk Management and Continuing Improvement (p.18-19)	-
GRI 307: Environmental Compliance 2018	307-1 307-1 Non-compliance with environmental laws and regulations	Legal Compliance (p.16-17)	-
Ethical Conduct and Anti-Corruption			
GRI 103: Management Approach 2018	103-1 Explanation of the material topic and its boundary	Materiality Assessment (p.19-21)	-
	103-2 The management approach and its components	Governance Model (p.14); Sustainability Management (p.18); Risk Management and Continuing Improvement (p.18-19); Business Ethics (p.22-23)	-
	103-3 Evaluation of the management approach	Governance Model (p.14); Risk Management and Continuing Improvement (p.16)	-
GRI 205: Anti-Corruption 2018	205-2 205-2 Communication and training about anti-corruption policies and procedures	Business Ethics (p.22-23)	-
Fostering Local Economies			
GRI 103: Management Approach 2018	103-1 Explanation of the material topic and its boundary	Materiality Assessment (p.19-21)	-
	103-2 The management approach and its components	Governance Model (p.14); Sustainability Management (p.18); Risk Management and Continuing Improvement (p.18-19); Local Procurement (p.26-29)	-
	103-3 Evaluation of the management approach	Governance Model (p.14); Risk Management and Continuing Improvement (p.18-19)	-
GRI 201: Economic Performance 2018	201-1 201-1 Direct economic value generated and distributed	Economic Performance (p.24-25)	-
GRI 204: Procurement Practices 2018	204-1 204-1 Proportion of spending on local suppliers	Local Procurement (p.26)	-
Local Communities			
GRI 103: Management Approach 2018	103-1 Explanation of the material topic and its boundary	Materiality Assessment (p.19-21)	-
	103-2 The management approach and its components	Governance Model (p.14); Sustainability Management (p.18); Risk Management and Continuing Improvement (p.18-19); Stakeholder Engagement(p.88-91)	-
	103-3 Evaluation of the management approach	Governance Model (p.14); Risk Management and Continuing Improvement (p.18-19)	-
GRI 413: Local Communities 2018	413-1 Operations with local community engagement, impact assessments, and development programs	Stakeholder Engagement(p.88-91);	

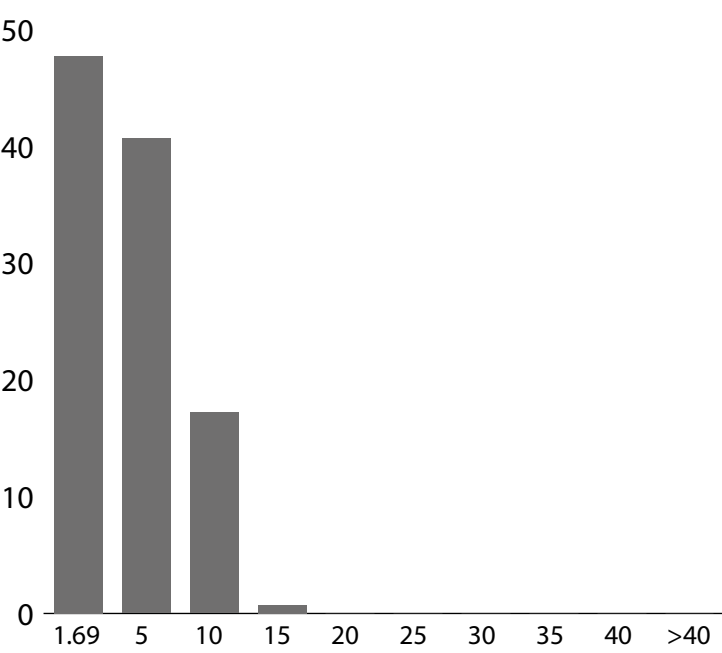
	Indicator	Description	Omissions
Occupational Health and Safety			
GRI 103: Management Approach 2018	103-1 Explanation of the material topic and its boundary	Materiality Assessment (p.19-21)	-
	103-2 The management approach and its components	Governance Model (p.14); Sustainability Management (p.18); Risk Management and Continuing Improvement (p.18-19); Collective Bargaining (p.31); Health and Safety (p.38-41)	-
	103-3 Evaluation of the management approach	Governance Model (p.14); Risk Management and Continuing Improvement (p.18-19)	-
GRI 403: Occupational Health and Safety 2018	403-2 Types of injury and rates of injury, occupational diseases, lost days, and absenteeism, and number of work-related fatalities	Health and Safety (p.39)	-
	403-3 Workers with high incidence or high risk of diseases related to their occupation	Health and Safety (p.38-41)	-
	403-4 Health and safety topics covered in formal agreements with trade unions	Collective Bargaining (p.31)	-

APPENDIX

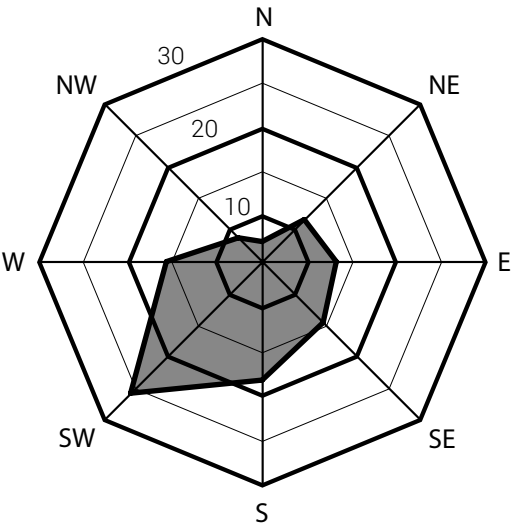
Precipitation 2018 equivalent mm of water



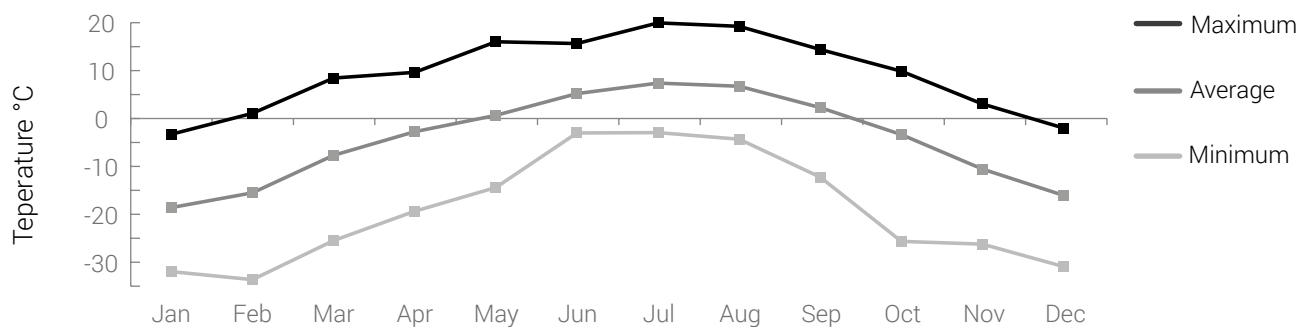
Wind Speed and Direction 2018, km/hour



Distribution of Wind Direction 2018, %



Average monthly temperatures 2018



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Minimum	-33.27	-34.95	-26.77	-20.63	-15.67	-4.25	-4.18	-5.56	-13.50	-26.94	-27.52	-32.22
Maximum	-4.51	-0.13	7.25	8.44	14.84	14.47	18.79	18.07	13.22	8.68	1.82	-3.21
Average	-19.86	-16.77	-8.92	-3.98	-0.56	3.99	6.19	5.53	1.06	-4.59	-11.81	-17.31

Radionuclides and heavy metals in dust samples - Mine Site

Station	Zn, ng/m ³	CN, ng/m ³	S, ng/m ³	As, ng/m ³	Ni, ng/m ³	Se, ng/m ³	U, ng/m ³	Sr-90, mBq/m ³	Pb-210, mBq/m ³	Ra-226, mBq/m ³
TLV ¹	1,600,000	5,000,000	330,000	10,000	200,000	200,000	200,000			
DAC ²								300,000	8,000	4,000
A1.1	4420	0.300	28	5.00	9.7	0.240	2.20	<0.06	0.001	0.020
A1.2a	4920	0.200	35	4.90	8.7	0.250	2.00	<0.06	0.001	0.020
A1.3a	6490	0.300	19	5.60	8.0	0.250	1.70	<0.06	0.001	0.080
A1.4	4430	0.200	42	6.00	9.7	0.270	1.90	<0.06	0.001	0.040
A1.5a	11700	0.200	22	2.80	8.1	0.190	2.00	<0.07	0.001	0.020
A1.6	12000	0.200	12	1.70	7.8	0.150	1.80	<0.06	0.001	0.040

Notes:

1. TLV's have been sourced from either the Agency for Toxic Substances and Disease Registry (ATSDR), or the Occupational Health & Safety Administration (OHSA). S and Zn TLV's have been adjusted using the molar ratios of SO₂ and ZnO.
2. DAC's have been sourced from the 1999 International Atomic Energy Agency (IAEA) safety standards.

Radionuclides and heavy metals in dust samples - Barskoon

Station	Zn, ng/m ³	CN, ng/m ³	S, ng/m ³	As, ng/m ³	Ni, ng/m ³	Se, ng/m ³	U, ng/m ³	Sr-90, mBq/m ³	Pb-210, mBq/m ³	Ra-226, mBq/m ³
TLV1	1,600,000	5,000,000	330,000	10,000	200,000	200,000	200,000			
DAC ²								300,000	8,000	4,000
Barskoon #1	2,620	1	950	5.3	9.1	<0.5	1.9	<0.4	1.1	0.04
Barskoon #2	1,410	1	980	5.3	13	<0.5	2.1	<0.4	1.2	<0.04
Barskoon #3	13,000	1	690	6.2	7.2	<0.5	1.9	<0.4	1	<0.04

Notes:

1. TLV's have been sourced from either the Agency for Toxic Substances and Disease Registry (ATSDR), or the Occupational Health & Safety Administration (OHSA). S and Zn TLV's have been adjusted using the molar ratios of SO₂ and ZnO.
2. DAC's have been sourced from the 1999 International Atomic Energy Agency (IAEA) safety standards.

Kumtor weather station summary 2018

2018		DAILY AVERAGE READINGS FOR 2018									hr./rdg. Total precip., mm
		W. Spd., km/h	W.dir. deg. True N	TEMPERATURE °C			Rel. hum.,%	Solar rad., KW/m²	Barom. Press., mbar	Barom. Press., mmHG	
				Avg./h	Max., 5 s.	Min., 5 s.					
JAN	max	30.52	241.15	-14.22	-4.51	-17.24	83.48	150.73	653.76	490.36	4.32
	min	2.38	70.03	-26.00	-18.44	-33.27	39.73	53.82	640.51	480.42	
	avg	9.63	155.28	-19.86	-11.85	-26.85	63.21	115.62	647.84	485.92	
	tot										
FEB	max	18.14	204.11	-6.80	-0.13	-10.54	90.48	200.73	652.41	489.34	11.68
	min	2.73	62.50	-23.84	-15.06	-34.95	42.96	95.13	647.26	485.48	
	avg	8.05	150.04	-16.77	-8.10	-24.72	64.97	159.50	649.83	487.41	
	tot										
MAR	max	20.85	247.79	-3.00	7.25	-8.83	83.54	268.26	660.45	495.38	25.00
	min	3.13	154.50	-16.31	-8.77	-26.77	46.11	186.04	644.74	483.59	
	avg	8.07	193.76	-8.92	-0.21	-17.24	67.72	225.32	652.85	489.68	
	tot										
APR	max	19.88	246.92	1.63	8.44	-4.96	83.65	356.63	662.00	496.54	18.29
	min	5.20	101.58	-9.91	-3.51	-20.63	38.45	200.70	650.03	487.56	
	avg	10.22	192.06	-3.98	3.72	-11.14	61.90	290.42	655.90	491.96	
	tot										
MAY	max	18.54	246.61	6.71	14.84	-0.04	88.30	1652.72	660.14	495.14	42.40
	min	5.32	113.51	-7.47	-3.20	-15.67	42.13	678.14	651.60	488.74	
	avg	11.70	191.77	-0.56	5.40	-6.13	62.52	1242.00	656.01	492.05	
	tot										
JUN	max	20.20	243.00	6.74	14.47	1.52	89.81	298.53	662.28	496.75	52.30
	min	5.12	114.56	1.15	5.51	-4.25	47.66	96.93	653.05	489.83	
	avg	11.21	190.62	3.99	10.39	-1.47	67.74	212.05	656.75	492.60	
	tot										
JUL	max	17.44	256.81	10.46	18.79	3.62	81.48	285.88	659.42	494.61	59.80
	min	5.95	144.79	2.42	9.11	-4.18	45.56	86.86	654.61	491.00	
	avg	10.45	197.83	6.19	12.96	0.12	65.90	191.15	656.76	492.61	
	tot										
AUG	max	17.72	235.09	9.98	18.07	4.26	82.53	261.54	661.92	496.49	47.70
	min	6.05	121.59	1.30	3.65	-5.56	44.24	65.73	654.99	491.28	
	avg	10.01	187.25	5.53	12.62	-0.62	64.95	180.52	658.65	494.03	
	tot										
SEP	max	20.79	241.20	4.24	13.22	0.26	87.79	220.56	663.23	497.46	42.50
	min	5.10	108.34	-4.76	1.94	-13.05	43.49	63.67	656.79	492.63	
	avg	10.58	186.69	1.06	7.89	-4.87	64.37	152.32	659.41	494.60	
	tot										
OCT	max	27.08	254.12	0.72	8.68	-4.31	78.45	174.10	664.89	498.71	17.60
	min	3.32	121.02	-15.89	-7.05	-26.94	48.05	77.94	648.73	486.59	
	avg	9.83	182.87	-4.59	1.72	-10.21	62.94	135.82	657.38	493.07	
	tot										
NOV	max	25.69	247.14	-4.35	1.82	-9.58	78.42	132.87	657.43	493.11	5.40
	min	4.53	154.04	-19.87	-13.02	-27.52	37.27	47.92	648.71	486.57	
	avg	11.29	204.95	-11.81	-5.34	-18.22	59.61	95.66	653.50	490.16	
	tot										
DEC	max	23.91	237.57	-12.07	-3.21	-14.04	86.91	108.67	656.96	492.76	11.53
	min	1.75	66.09	-24.76	-14.86	-32.22	40.56	59.82	648.09	486.10	
	avg	6.43	134.18	-17.31	-8.92	-24.24	66.59	84.06	651.70	488.82	
	tot										
Yearly	Max	30.52	256.81	10.46	18.79	4.26	90.48	1652.72	664.89	498.71	338.52
	Min	1.75	62.50	-26.00	-18.44	-34.95	37.27	47.92	640.51	480.42	
	Avg	11.91	177.82	-5.86	1.51	-12.51	63.99	247.45	654.74	491.09	
	tot										

W1.1 Petrov Lake (2018)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data													
Temperature (°C)	°C	2.9	3.8	2.3	2.7	2.1	5.3	10.5	9.5	7.7	6.2	4.4	6.2
Conductivity (mS/cm)	mS/cm	0.127	0.164	0.121	0.110	0.139	0.052	0.966	0.965	0.214	0.314	0.190	0.124
pH		8.2	8.6	8.2	8.3	8.1	7.7	8.0	7.9	8.1	8.0	8.4	7.9
Major Constituents													
Calcium	mg/L	17.6	17.8	15.6	14.0	14.7	6.99	16.9	16.1	17.6	15.8	20.5	16.6
Chloride	mg/L	0.50	0.60	0.60	0.60	0.60	0.25	0.80	0.50	0.50	0.50	0.70	0.60
Carbonate	mg/L	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Bicarbonate	mg/L	41.0	43.0	40.0	39.0	37.0	19.0	40.0	40.0	39.0	40.0	44.0	44.0
Potassium	mg/L	1.83	1.82	1.54	1.30	1.32	0.68	2.60	2.41	1.98	1.79	1.86	1.59
Magnesium	mg/L	3.72	3.74	3.21	2.85	3.10	1.40	4.29	3.88	3.58	3.39	4.16	3.21
Sodium	mg/L	1.96	2.21	1.73	1.49	1.50	0.70	1.96	2.19	1.87	1.74	2.07	1.75
Sulphate	mg/L	18.0	18.0	18.0	16.0	16.0	8.00	20.0	17.0	16.0	16.0	20.0	16.0
Hardness - Total	mg/L	51.0	50.0	50.0	48.0	43.0	21.0	51.0	48.0	45.0	45.0	52.0	46.0
Alkalinity - Total	mg/L	33.4	34.8	32.6	31.9	30.6	15.5	32.8	33.0	32.2	32.4	35.7	35.9
Total metals													
Silver - Total	mg/L	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150
Aluminum - Total	mg/L	0.32	1.05	0.57	0.41	0.13	0.09	5.41	1.92	1.00	0.91	0.27	0.26
Arsenic - Total	mg/L	0.00050	0.00050	0.00075	0.00050	0.00050	0.00050	0.00100	0.00100	0.00200	0.00100	0.00050	0.00050
Cadmium - Total	mg/L	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015
Chromium - Total	mg/L	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400
Copper - Total	mg/L	0.00250	0.01100	0.01325	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250
Iron - Total	mg/L	0.16	0.45	0.29	0.17	0.10	0.07	4.42	1.81	0.54	0.53	0.12	0.11
Mercury - Total	mg/L	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025
Manganese - Total	mg/L	0.02100	0.02600	0.01950	0.01300	0.00600	0.00200	0.11800	0.07900	0.03900	0.03200	0.01100	0.01100
Molybdenum - Total	mg/L	0.00400	0.00600	0.01600	0.00200	0.00900	0.00200	0.00200	0.00200	0.00200	0.00400	0.00200	0.00200
Nickel - Total	mg/L	0.01600	0.01800	0.06200	0.00250	0.03300	0.00600	0.00700	0.00250	0.00250	0.00250	0.00250	0.00250
Lead - Total	mg/L	0.00400	0.00100	0.00100	0.00100	0.00100	0.00100	0.00500	0.00600	0.00100	0.00400	0.02200	0.00100
Antimony - Total	mg/L	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Selenium - Total	mg/L	0.00050	0.00050	0.00125	0.00200	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Zinc - Total	mg/L	0.00200	0.00400	0.00450	0.00200	0.00200	0.00300	0.01400	0.00900	0.00300	0.00400	0.00200	0.00400
Nutrients													
Ammonia - N	mg/L												
Nitrite - N	mg/L												
Nitrate - N	mg/L												
Phosphorus - Total	mg/L	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Phosphate as P - Total	mg/L												
Solids													
Turbidity	NTU	15.0	14.0	10.0	6.10	5.50	2.40	148	212	221	148	27.0	20.0
TDS Total	mg/L	82.0	81.0	65.0	67.0	61.0	30.0	119	133	160	121	65.0	65.0
Dissolved Solids													
TSS Total	mg/L	0.50	2.00	5.00	0.50	3.00	1.00	54.0	59.0	53.0	40.0	5.00	4.00
Suspended Solids													
Trace Constituents													
Cyanide - Free	mg/L												
Cyanide - Total	mg/L												
Cyanide - WAD	mg/L												

W1.3 Kumtor River above ETP Discharge (2018)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data													
Temperature (°C)	°C				0.4	0.6	3.4	6.0	6.1	5.0	1.5	0.3	
Conductivity (mS/cm)	mS/cm				0.584	0.428	0.431	0.252	0.251	0.242	0.472	0.237	
pH					8.2	8.0	7.9	8.0	7.9	8.0	8.0	8.2	
Major Constituents													
Calcium	mg/L				54.9	45.6	39.6	38.4	23.2	28.7	39.8	34.6	
Chloride	mg/L				5.80	4.08	3.14	1.40	0.74	1.38	2.13	2.00	
Carbonate	mg/L				0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	
Bicarbonate	mg/L				126	86.0	68.2	59.0	48.0	54.8	71.0	69.0	
Potassium	mg/L				3.00	2.31	4.36	1.83	1.66	1.66	1.97	2.32	
Magnesium	mg/L				40.4	35.8	21.5	18.4	7.99	12.3	21.1	14.1	
Sodium	mg/L				5.06	4.08	22.88	1.93	1.71	2.01	2.62	3.84	
Sulphate	mg/L				191	133	145	101	47.0	74.5	107	75.0	
Hardness - Total	mg/L				300	219	177	152	83.8	117	169	122	
Alkalinity - Total	mg/L				103	72.8	55.8	48.5	39.4	44.7	58.2	56.9	
Total metals													
Silver - Total	mg/L				0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	
Aluminum - Total	mg/L				0.11	1.09	1.63	6.70	3.31	1.71	0.49	0.21	
Arsenic - Total	mg/L				0.00100	0.00138	0.00170	0.00365	0.00210	0.00138	0.00100	0.00050	
Cadmium - Total	mg/L				0.00015	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015	
Chromium - Total	mg/L				0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	
Copper - Total	mg/L				0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	
Iron - Total	mg/L				0.08	1.63	1.95	7.26	3.15	1.12	0.33	0.13	
Mercury - Total	mg/L				0.00025	0.00025	0.00025	0.00031	0.00025	0.00025	0.00025	0.00025	
Manganese - Total	mg/L				0.06100	0.10875	0.13260	0.25050	0.13320	0.11200	0.02475	0.01800	
Molybdenum - Total	mg/L				0.00300	0.01925	0.01300	0.00325	0.00200	0.00200	0.00275	0.00200	
Nickel - Total	mg/L				0.00438	0.09375	0.01440	0.01438	0.00750	0.00638	0.00250	0.00250	
Lead - Total	mg/L				0.00100	0.00150	0.00180	0.00525	0.00580	0.00175	0.00100	0.00100	
Antimony - Total	mg/L				0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	
Selenium - Total	mg/L				0.00125	0.00088	0.00160	0.00050	0.00050	0.00050	0.00188	0.00050	
Zinc - Total	mg/L				0.00225	0.00475	0.00640	0.02025	0.01160	0.00550	0.00325	0.00200	
Nutrients													
Ammonia - N	mg/L				0.05	0.05	0.95	0.08	0.02	0.02	0.02	0.15	
Nitrite - N	mg/L				0.0020	0.0038	0.0326	0.0005	0.0017	0.0030	0.0061	0.0030	
Nitrate - N	mg/L				0.90	0.70	1.04	0.55	0.36	0.40	0.58	0.00	
Phosphorus - Total	mg/L				0.0500	0.0500	0.0500	0.0500	0.0600	0.0500	0.0500	0.0500	
Phosphate as P - Total	mg/L				0.0150	0.0650	0.0660	0.1700	0.1280	0.1100	0.0750	0.0400	
Solids													
Turbidity	NTU				9.22	61.8	43.8	184	228	173	73.5	38.0	
TDS Total	mg/L				415	299	309	225	158	174	240	184	
Dissolved Solids													
TSS Total	mg/L				10.5	104	76.6	284	189	155	69.3	56.0	
Suspended Solids													
Trace Constituents													
Cyanide - Free	mg/L												
Cyanide - Total	mg/L												
Cyanide - WAD	mg/L												

W3.4 Lysyi Creek above Kumtor River (2018)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data													
Temperature (°C)	°C				0.9	2.5	5.7	7.6	5.8	3.5	1.0	0.4	
Conductivity (mS/cm)	mS/cm				0.910	1.406	1.248	0.924	1.344	1.570	1.710	1.924	
pH					8.3	8.2	8.0	8.1	7.9	8.1	8.1	8.2	
Major Constituents													
Calcium	mg/L				96.6	124	145	181	162	164	184	166	
Chloride	mg/L				9.23	11.8	8.26	7.53	5.68	10.1	12.5	17.2	
Carbonate	mg/L				1.88	0.50	0.50	0.50	0.50	0.50	2.13	1.38	
Bicarbonate	mg/L				190	200	153	155	140	177	227	361	
Potassium	mg/L				3.89	4.60	4.35	4.99	3.96	4.24	5.62	11.2	
Magnesium	mg/L				108	166	117	122	100	119	165	177	
Sodium	mg/L				8.07	10.7	5.97	4.93	4.96	7.18	9.33	17.5	
Sulphate	mg/L				490	694	660	757	639	807	911	889	
Hardness - Total	mg/L				679	885	810	906	785	776	1136	1241	
Alkalinity - Total	mg/L				158	164	125	127	115	145	190	298	
Total metals													
Silver - Total	mg/L				0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	
Aluminum - Total	mg/L				0.25	2.80	4.71	9.55	3.42	0.89	0.12	1.22	
Arsenic - Total	mg/L				0.00125	0.00400	0.00660	0.02425	0.00710	0.00188	0.00100	0.00388	
Cadmium - Total	mg/L				0.00015	0.00024	0.00015	0.00028	0.00015	0.00015	0.00015	0.00019	
Chromium - Total	mg/L				0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	
Copper - Total	mg/L				0.00250	0.00250	0.00340	0.00250	0.00250	0.00250	0.00250	0.00250	
Iron - Total	mg/L				0.26	4.29	8.57	21.41	9.60	2.33	0.23	2.76	
Mercury - Total	mg/L				0.00041	0.00025	0.00098	0.00025	0.00030	0.00025	0.00025	0.00025	
Manganese - Total	mg/L				0.15900	0.35075	0.60800	1.35750	0.88500	0.95400	0.09175	0.19050	
Molybdenum - Total	mg/L				0.00850	0.02150	0.00920	0.01500	0.00760	0.00625	0.01300	0.01150	
Nickel - Total	mg/L				0.01200	0.09825	0.05500	0.09850	0.07740	0.07063	0.03625	0.02938	
Lead - Total	mg/L				0.00100	0.00250	0.00420	0.01775	0.00640	0.00150	0.00100	0.00300	
Antimony - Total	mg/L				0.00050	0.00063	0.00070	0.00138	0.00050	0.00050	0.00050	0.00113	
Selenium - Total	mg/L				0.00163	0.00375	0.00400	0.00425	0.00300	0.00375	0.00400	0.00275	
Zinc - Total	mg/L				0.00525	0.00875	0.01860	0.05650	0.01620	0.00600	0.00350	0.00775	
Nutrients													
Ammonia - N	mg/L				0.07	0.15	0.16	0.21	0.16	0.06	0.03	0.02	
Nitrite - N	mg/L				0.0033	0.0058	0.0068	0.0005	0.0026	0.0009	0.0034	0.0024	
Nitrate - N	mg/L				1.88	2.40	2.38	2.48	1.68	2.23	3.60	2.50	
Phosphorus - Total	mg/L				0.0500	0.0875	0.1800	0.7875	0.4000	0.0875	0.0500	0.1375	
Phosphate as P - Total	mg/L				0.0263	0.1175	0.2220	0.7500	0.6500	0.2700	0.4275	0.0500	
Solids													
Turbidity	NTU				31.4	99.0	204	695	311	130	99.3	15.3	
TDS Total Dissolved Solids	mg/L				947	1269	1163	1323	1091	1385	1617	1718	
TSS Total Suspended Solids	mg/L				28.8	167	305	879	811	332	434	56.8	
Trace Constituents													
Cyanide - Free	mg/L												
Cyanide - Total	mg/L												
Cyanide - WAD	mg/L												

T8.1 Tailings Pond - Feed to ETP (2018)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data													
Temperature (°C)	°C	0.9	1.6	2.4	3.0	4.0	9.3	12.5	12.8	9.7	4.1	3.0	2.1
Conductivity (mS/cm)	mS/cm	3.625	4.379	4.821	3.649	3.056	3.208	3.076	3.401	3.412	2.727	3.662	3.568
pH		9.8	10.6	10.1	10.7	10.4	10.0	9.4	10.3	10.3	8.8	10.3	10.2
Major Constituents													
Calcium	mg/L	91.4	91.6	120.1	77.8	68.3	65.9	65.3	63.0	57.7	57.5	51.3	63.4
Chloride	mg/L	24.5	26.3	44.4	24.8	23.0	23.0	23.3	22.8	24.0	24.8	68.5	170
Carbonate	mg/L	5.63	0.50	7.40	17.75	22.00	7.30	3.25	0.50	0.50	3.00	2.75	10.8
Bicarbonate	mg/L	120	117	147	84.8	59.2	104	172	192	200	218	229	233
Potassium	mg/L	87.1	95.8	140.4	94.1	84.4	81.4	83.7	85.8	82.6	88.2	80.3	91.8
Magnesium	mg/L	6.84	7.28	9.94	5.92	5.48	5.56	5.72	5.79	5.43	5.64	5.16	6.15
Sodium	mg/L	467	511	728	498	448	439	443	456	434	454	422	484
Sulphate	mg/L	911	1019	1562	970	785	802	787	778	792	792	617	880
Hardness - Total	mg/L	308	295	398	233	192	188	180	178	178	175	179	191
Alkalinity - Total	mg/L	108	96.3	133	99.0	87.7	96.4	146	158	164	184	191	209
Total metals													
Silver - Total	mg/L	0.08525	0.08050	0.08400	0.08575	0.06500	0.04740	0.03700	0.04440	0.05060	0.06150	0.03413	0.05490
Aluminum - Total	mg/L	0.14	0.17	0.20	0.15	0.27	0.17	0.14	0.20	0.23	0.29	0.19	0.41
Arsenic - Total	mg/L	0.00550	0.00675	0.01140	0.00925	0.00720	0.00600	0.00550	0.00680	0.00620	0.00700	0.00700	0.00900
Cadmium - Total	mg/L	0.00108	0.00115	0.00186	0.00125	0.00112	0.00124	0.00130	0.00132	0.00140	0.00138	0.00180	0.00166
Chromium - Total	mg/L	0.00400	0.00400	0.01260	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400
Copper - Total	mg/L	31.6750	31.8500	44.3800	32.5250	27.7086	28.9000	26.6000	28.7800	28.3200	28.7000	25.7250	26.6800
Iron - Total	mg/L	0.52	0.76	1.11	1.08	0.84	0.51	0.42	0.45	0.51	0.74	0.52	2.03
Mercury - Total	mg/L	0.00541	0.00643	0.00786	0.00615	0.00320	0.00374	0.00375	0.00444	0.00316	0.00478	0.00475	0.00570
Manganese - Total	mg/L	0.01550	0.01250	0.02360	0.00950	0.01380	0.01680	0.02350	0.02420	0.02760	0.03600	0.03025	0.06500
Molybdenum - Total	mg/L	0.40450	0.40175	0.57800	0.40975	0.34140	0.35120	0.33825	0.36140	0.36920	0.39025	0.36150	0.44060
Nickel - Total	mg/L	0.06650	0.06350	0.10720	0.07950	0.06620	0.07060	0.08275	0.07520	0.07960	0.079625	0.076100	0.085480
Lead - Total	mg/L	0.00250	0.00375	0.00120	0.00100	0.00100	0.00100	0.00150	0.00100	0.00100	0.00125	0.01100	0.00260
Antimony - Total	mg/L	0.49125	0.49750	0.77400	0.49975	0.41280	0.40940	0.41525	0.40760	0.41160	0.44400	0.49925	0.50560
Selenium - Total	mg/L	0.02850	0.03225	0.04780	0.03525	0.03000	0.03220	0.03275	0.03000	0.03060	0.03025	0.02725	0.03760
Zinc - Total	mg/L	0.01050	0.01200	0.01780	0.01975	0.02680	0.02280	0.00950	0.00580	0.00960	0.02525	0.01775	0.04260
Nutrients													
Ammonia - N	mg/L	19.1	19.8	18.0	19.9	15.8	14.8	15.2	17.1	14.3	15.0	16.0	15.6
Nitrite - N	mg/L	0.0670	0.0813	0.0835	0.0114	0.0256	0.0504	0.0500	0.0668	0.0810	0.0760	0.0169	0.0074
Nitrate - N	mg/L	19.8	22.0	34.2	24.0	21.6	20.2	18.3	17.4	18.6	19.8	14.3	25.4
Phosphorus - Total	mg/L	0.3250	0.3250	0.5000	0.4250	0.4000	0.3600	0.3000	0.3600	0.3500	0.4000	0.3750	0.3992
Phosphate as P - Total	mg/L	0.0288	0.0200	0.0380	0.0263	0.0360	0.2160	0.0600	0.0520	0.0360	0.0275	0.0275	0.0500
Solids													
Turbidity	NTU	0.49	1.93	5.40	4.78	11.1	5.10	8.50	6.90	10.2	13.5	12.5	12.9
TDS Total Dissolved Solids	mg/L	2382	2400	3487	2248	1830	1882	1830	1861	1781	1885	1997	2073
TSS Total Suspended Solids	mg/L	1.00	4.75	10.8	6.75	10.0	3.60	5.25	6.50	6.80	8.25	8.50	9.00
Trace Constituents													
Cyanide - Free	mg/L	4.45	4.85	4.91	5.60	5.47	4.26	2.63	3.52	2.90	3.68	4.13	2.84
Cyanide - Total	mg/L	43.8	48.0	46.7	55.0	43.4	40.8	40.5	34.8	32.4	32.8	40.5	45.4
Cyanide - WAD	mg/L	41.2	44.8	44.0	51.3	41.2	39.6	37.0	33.0	31.2	30.5	37.8	42.6

T8.4 ETP Discharge into Kumtor River (2018)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature (°C)												
Conductivity (mS/cm)					4.0	7.5	12.0	12.3	8.4	4.6		
pH					1.84	2.39	2.65	2.67	2.80	2.84		
Major Constituents					7.5	7.4	7.5	7.4	7.5	7.5		
Calcium												
Chloride					42.1	59.0	60.4	45.1	28.6	30.4		
Carbonate					17.0	20.0	22.5	23.0	23.0	23.7		
Bicarbonate					0.50	0.50	0.50	0.50	0.50	0.50		
Potassium					95.0	105	101	62.5	122	118		
Magnesium					42.6	63.8	75.8	79.5	75.8	81.3		
Sodium					8.76	6.74	6.00	6.09	5.34	6.01		
Sulphate					328	473	507	525	520	559		
Hardness - Total					519	933	1029	1026	1009	1038		
Alkalinity - Total					139	174	168	132	102	102		
Total metals					77.9	95.2	82.5	51.2	100	96.9		
Silver - Total												
Aluminum - Total					0.00150	0.00150	0.00150	0.00150	0.00220	0.00233		
Arsenic - Total					0.17	0.11	0.06	0.10	0.09	0.07		
Cadmium - Total					0.00200	0.00240	0.00225	0.00340	0.00260	0.00300		
Chromium - Total					0.00050	0.00088	0.00113	0.00122	0.00128	0.00113		
Copper - Total					0.00400	0.00400	0.00400	0.00400	0.00400	0.00400		
Iron - Total					0.12100	0.14080	0.09825	0.09060	0.25100	0.30233		
Mercury - Total					0.28	0.27	0.13	0.22	0.12	0.21		
Manganese - Total					0.00230	0.00310	0.00295	0.00376	0.00300	0.00327		
Molybdenum - Total					0.03400	0.01840	0.01325	0.01440	0.01160	0.01433		
Nickel - Total					0.15800	0.25400	0.27525	0.32620	0.34700	0.34133		
Lead - Total					0.02400	0.01120	0.01350	0.01240	0.01660	0.02833		
Antimony - Total					0.00100	0.00100	0.00100	0.00100	0.00100	0.00100		
Selenium - Total					0.11800	0.21560	0.26275	0.27280	0.29780	0.31567		
Zinc - Total					0.01000	0.02220	0.02700	0.02500	0.02840	0.02700		
Nutrients					0.00200	0.00480	0.00300	0.00360	0.00270	0.00117		
Ammonia - N												
Nitrite - N					17.2	22.6	25.3	23.0	23.6	24.0		
Nitrate - N					0.610	0.496	0.898	0.712	0.624	0.633		
Phosphorus - Total					6.00	13.8	15.0	14.6	15.8	16.0		
Phosphate as P - Total					0.050	0.050	0.050	0.050	0.050	0.050		
Solids					0.020	0.019	0.020	0.022	0.060	0.007		
Turbidity												
TDS Total					9.30	4.60	1.89	1.62	0.46	0.95		
Dissolved Solids												
TSS Total					1219	1831	1944	1952	1979	1970		
Suspended Solids												
Trace Constituents					8.00	7.00	3.75	7.25	3.00	2.50		
Cyanide - Free												
Cyanide - Total					0.0100	0.0162	0.0178	0.0158	0.0192	0.0140		
Cyanide - WAD					0.1000	0.2172	0.2750	0.4380	0.5420	0.6733		
Цианид - WAD					0.0120	0.0278	0.0335	0.0416	0.0432	0.0430		

W1.4 Kumtor River Flume (2018)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data												
Temperature (°C)				0.3	1.5	5.4	6.8	7.1	6.3	1.6	0.5	
Conductivity (mS/cm)				0.518	0.40	0.49	0.27	0.22	0.58	0.62	0.456	
pH				8.2	8.1	7.9	8.1	7.9	7.9	8.0	8.5	
Major Constituents												
Calcium				57.9	47.7	37.3	28.0	26.5	32.0	49.2	53.8	
Chloride				7.50	5.38	3.94	1.75	1.50	4.73	5.00	4.00	
Carbonate				0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	
Bicarbonate				128	89.8	68.6	53.0	51.6	70.8	90.8	93.0	
Potassium				3.11	2.45	6.43	4.70	3.49	10.56	7.44	2.77	
Magnesium				40.4	31.8	17.6	9.3	8.9	14.1	25.1	27.8	
Sodium				5.72	4.55	40.2	22.6	15.1	52.0	41.9	6.40	
Sulphate				199	123	154	86	76	189	192	133	
Hardness - Total				315	204	161	95	93	142	213	226	
Alkalinity - Total				105	73.5	56.3	43.6	42.3	58.0	74.5	76.5	
Total metals												
Silver - Total				0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	
Aluminum - Total				0.24	2.01	2.63	6.14	2.87	1.32	0.42	0.19	
Arsenic - Total				0.00125	0.00188	0.00230	0.00375	0.00190	0.00163	0.00125	0.00050	
Cadmium - Total				0.00015	0.00019	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015	
Chromium - Total				0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	
Copper - Total				0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	
Iron - Total				0.22	2.63	3.51	7.10	2.87	0.82	0.93	0.13	
Mercury - Total				0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	
Manganese - Total				0.05900	0.10875	0.13580	0.23925	0.13660	0.08600	0.04825	0.03300	
Molybdenum - Total				0.00300	0.02075	0.02400	0.00925	0.00800	0.04075	0.02625	0.00200	
Nickel - Total				0.00438	0.08375	0.01580	0.01450	0.00830	0.00563	0.00488	0.00250	
Lead - Total				0.00100	0.00175	0.00280	0.00750	0.00640	0.00200	0.00375	0.00100	
Antimony - Total				0.00050	0.00050	0.01620	0.00713	0.00560	0.03375	0.01950	0.00050	
Selenium - Total				0.00088	0.00113	0.00190	0.00088	0.00080	0.00213	0.00200	0.00050	
Zinc - Total				0.00175	0.00575	0.03320	0.01925	0.01020	0.00575	0.00650	0.00200	
Nutrients												
Ammonia - N				0.06	0.04	1.76	0.97	0.71	2.79	1.54	0.18	
Nitrite - N				0.0033	0.0070	0.0506	0.0361	0.0294	0.1105	0.0560	0.0040	
Nitrate - N				0.93	0.60	1.40	0.88	0.68	2.10	1.53	0.00	
Phosphorus - Total				0.0500	0.0500	0.0900	0.1125	0.0600	0.0500	0.0500	0.0500	
Phosphate as P - Total				0.0388	0.0600	0.1260	0.1525	0.1720	0.0563	0.1850	0.0300	
Solids												
Turbidity				29.4	61.3	74.2	178	246	140	60.3	27.0	
TDS Total				427	287	342	204	185	426	418	306	
Dissolved Solids												
TSS Total				43.5	98.3	163	234	305	111	67.8	31.0	
Suspended Solids												
Trace Constituents												
Cyanide - Free				0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	
Cyanide - Total				0.00250	0.00250	0.02140	0.03050	0.01450	0.12575	0.08525	0.00250	
Cyanide - WAD				0.00250	0.00250	0.00800	0.00825	0.00750	0.01550	0.00838	0.00250	

W4.1 UDD at Headwater of Arabel Suu Diversion Ditch (2018)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data												
Temperature	°C					7.5		8.0				
Conductivity	mS/cm					0.186		0.167				
pH						8.5		7.7				
Major Constituents												
Calcium	mg/L					15.4		14.7				
Chloride	mg/L					4.50		0.80				
Carbonate	mg/L					0.50		0.50				
Bicarbonate	mg/L					44.0		48.0				
Potassium	mg/L					0.41		0.52				
Magnesium	mg/L					1.84		1.73				
Sodium	mg/L					0.97		1.05				
Sulphate	mg/L					5.00		5.00				
Hardness - Total	mg/L					43.0		40.0				
Alkalinity - Total	mg/L					36.3		39.7				
Total metals												
Silver - Total	mg/L					0.00150		0.00150				
Aluminum - Total	mg/L					0.27		0.14				
Arsenic - Total	mg/L					0.00050		0.00050				
Cadmium - Total	mg/L					0.00015		0.00015				
Chromium - Total	mg/L					0.00400		0.00400				
Copper - Total	mg/L					0.00250		0.00250				
Iron - Total	mg/L					0.34		0.19				
Mercury - Total	mg/L					0.00025		0.00025				
Manganese - Total	mg/L					0.02400		0.01900				
Molybdenum - Total	mg/L					0.00200		0.00200				
Nickel - Total	mg/L					0.00250		0.00250				
Lead - Total	mg/L					0.00100		0.00200				
Antimony - Total	mg/L					0.00050		0.00050				
Selenium - Total	mg/L					0.00050		0.00050				
Zinc - Total	mg/L					0.00050		0.00050				
Nutrients												
Ammonia - N	mg/L					0.02		0.02				
Nitrite - N	mg/L					0.0050		0.0030				
Nitrate - N	mg/L					0.40		0.10				
Phosphorus - Total	mg/L					0.0500		0.0500				
Phosphate as P - Total	mg/L					0.0300		0.0200				
Solids												
Turbidity	NTU					11.0		4.20				
TDS Total	mg/L					70.0		41.0				
Dissolved Solids	mg/L											
TSS Total	mg/L					6.00		2.00				
Suspended Solids	mg/L											
Trace Constituents												
Cyanide - Free	mg/L											
Cyanide - Total	mg/L											
Cyanide - WAD	mg/L											

W4.3.1 Discharge of UDD Settling Pond into Kumtor River (2018)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data												
Temperature	°C					9.7						
Conductivity	mS/cm					0.122						
pH						8.3						
Major Constituents												
Calcium	mg/L					20.8						
Chloride	mg/L					4.30						
Carbonate	mg/L					0.50						
Bicarbonate	mg/L					64.0						
Potassium	mg/L					0.73						
Magnesium	mg/L					2.78						
Sodium	mg/L					1.37						
Sulphate	mg/L					8.00						
Hardness - Total	mg/L					60.0						
Alkalinity - Total	mg/L					52.1						
Total metals												
Silver - Total	mg/L					0.00150						
Aluminum - Total	mg/L					0.14						
Arsenic - Total	mg/L					0.00050						
Cadmium - Total	mg/L					0.00015						
Chromium - Total	mg/L					0.00400						
Copper - Total	mg/L					0.00250						
Iron - Total	mg/L					0.24						
Mercury - Total	mg/L					0.00025						
Manganese - Total	mg/L					0.01100						
Molybdenum - Total	mg/L					0.00200						
Nickel - Total	mg/L					0.00250						
Lead - Total	mg/L					0.00100						
Antimony - Total	mg/L					0.00050						
Selenium - Total	mg/L					0.00050						
Zinc - Total	mg/L					0.00500						
Nutrients												
Ammonia - N	mg/L					0.02						
Nitrite - N	mg/L					0.0020						
Nitrate - N	mg/L					0.20						
Phosphorus - Total	mg/L					0.0500						
Phosphate as P - Total	mg/L					0.0200						
Solids												
Turbidity	NTU					3.30						
TDS Total	mg/L					77.0						
Dissolved Solids	mg/L											
TSS Total	mg/L					1.00						
Suspended Solids	mg/L											
Trace Constituents												
Cyanide - Free	mg/L											
Cyanide - Total	mg/L											
Cyanide - WAD	mg/L											

W2.6.1 Chon-Sarytor Creek in Central Valley before joining Kumtor River (2018)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data												
Temperature	°C			0.3	1.4	4.5	9.6	5.9	6.6	0.3	0.3	
Conductivity	mS/cm			2.839	1.947	3.497	1.372	1.056	1.727	3.125	4.640	
pH				8.2	8.1	8.1	8.1	8.0	8.3	8.1	8.0	
Major Constituents												
Calcium	mg/L			424	294	223	162	172	226	473	474	
Chloride	mg/L			54.5	18.6	11.8	8.18	9.46	25.0	25.0	33.0	
Carbonate	mg/L			0.50	1.63	0.50	0.50	0.50	0.50	0.50	0.50	
Bicarbonate	mg/L			388	161	164	141	142	199	335	425	
Potassium	mg/L			52.9	12.3	9.40	6.88	6.75	11.4	38.5	40.0	
Magnesium	mg/L			406	115	85.8	55.6	55.8	100	316	332	
Sodium	mg/L			58.0	18.1	11.6	6.99	7.50	14.5	42.4	47.8	
Sulphate	mg/L			2285	888	672	427	455	804	1897	1319	
Hardness - Total	mg/L			3128	1154	894	579	621	1094	2592	2840	
Alkalinity - Total	mg/L			319	134	134	116	117	164	274	353	
Total metals												
Silver - Total	mg/L			0.00263	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	
Aluminum - Total	mg/L			0.04	26.2	35.3	24.3	24.2	0.55	0.92	0.29	
Arsenic - Total	mg/L			0.01300	0.02325	0.05880	0.03150	0.01720	0.00250	0.00900	0.00150	
Cadmium - Total	mg/L			0.00033	0.00036	0.00148	0.00075	0.00148	0.00015	0.00040	0.00020	
Chromium - Total	mg/L			0.00400	0.03700	0.10340	0.06025	0.02660	0.00400	0.00400	0.00400	
Copper - Total	mg/L			0.00250	0.05150	0.16960	0.08575	0.05470	0.00250	0.00250	0.00250	
Iron - Total	mg/L			0.08	41.77	54	38.9	37.09	1.17	1.07	0.19	
Mercury - Total	mg/L			0.00031	0.00036	0.00025	0.00025	0.00025	0.00038	0.00025	0.00025	
Manganese - Total	mg/L			1.07625	1.32200	4.65200	2.53200	4.85400	0.35450	1.70000	1.02133	
Molybdenum - Total	mg/L			0.06725	0.01350	0.03240	0.04825	0.04140	0.02750	0.05000	0.03767	
Nickel - Total	mg/L			0.07450	0.06475	0.17600	0.09950	0.08580	0.00625	0.06400	0.06867	
Lead - Total	mg/L			0.01225	0.03050	0.07780	0.05650	0.03240	0.00500	0.00300	0.00100	
Antimony - Total	mg/L			0.00450	0.00113	0.00170	0.00200	0.00150	0.00150	0.00300	0.00367	
Selenium - Total	mg/L			0.00613	0.00375	0.00440	0.00275	0.00260	0.00275	0.00800	0.00467	
Zinc - Total	mg/L			0.00188	0.08525	0.26380	0.14375	0.09080	0.00350	0.00700	0.00367	
Nutrients												
Ammonia - N	mg/L			5.15	2.12	1.27	0.88	1.03	1.73	5.90	4.83	
Nitrite - N	mg/L			0.0060	0.0924	0.0071	0.0005	0.0021	0.0048	0.0005	0.0053	
Nitrate - N	mg/L			142	30.8	18.6	9.05	11.6	26.5	122	44.3	
Phosphorus - Total	mg/L			0.0500	0.8750	2.4620	1.4500	0.9600	0.1100	0.3000	0.0500	
Phosphate as P - Total	mg/L			0.5650	1.8500	6.5480	5.9775	6.8660	2.7250	2.1000	0.2600	
Solids												
Turbidity	NTU			520	630	3790	2306	5087	4865	3040	536	
TDS Total	mg/L			2762	1721	1302	1504	941	1603	2293	4229	
Dissolved Solids	mg/L											
TSS Total	mg/L			804	942	4212	1577	4290	5449	4139	566	
Suspended Solids	mg/L											
Trace Constituents												
Cyanide - Free	mg/L											
Cyanide - Total	mg/L											
Cyanide - WAD	mg/L											

POR1 SUMP Collection Point for Central Pit Waters Prior to Discharge (2018)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data												
Temperature	°C				5.5	6.0	6.2	6.4	4.6	2.2		
Conductivity	mS/cm				1.540	1.453	0.923	0.829	0.783	0.832		
pH					8.1	8.0	8.0	8.1	8.2	8.3		
Major Constituents												
Calcium	mg/L				238	206	160	123	107	135		
Chloride	mg/L				22.0	17.0	6.75	7.94	10.0	9.80		
Carbonate	mg/L				0.50	0.50	0.50	0.50	0.50	0.50		
Bicarbonate	mg/L				138	145	116	122	128	137		
Potassium	mg/L				7.22	6.48	4.98	5.44	4.59	4.91		
Magnesium	mg/L				110	93.7	60.6	58.2	62.9	79.1		
Sodium	mg/L				19.9	14.0	12.7	13.3	12.2	13.9		
Sulphate	mg/L				727	710	506	406	470	544		
Hardness - Total	mg/L				916	861	602	537	586	653		
Alkalinity - Total	mg/L				113	119	95	100	105	112		
Total metals												
Silver - Total	mg/L				0.00150	0.00150	0.00150	0.00150	0.00150	0.00150		
Aluminum - Total	mg/L				1.40	1.61	1.39	0.53	0.12	0.16		
Arsenic - Total	mg/L				0.00500	0.01750	0.00750	0.00980	0.01275	0.01433		
Cadmium - Total	mg/L				0.00040	0.00026	0.00019	0.00018	0.00015	0.00015		
Chromium - Total	mg/L				0.00400	0.01700	0.00400	0.00400	0.00400	0.00400		
Copper - Total	mg/L				0.00250	0.02450	0.00250	0.00250	0.00250	0.00250		
Iron - Total	mg/L				2.38	3.0	3.06	0.84	0.16	0.22		
Mercury - Total	mg/L				0.00080	0.00036	0.00025	0.00025	0.00034	0.00025		
Manganese - Total	mg/L				0.14600	0.51350	0.13025	0.12040	0.11075	0.09767		
Molybdenum - Total	mg/L				0.10800	0.06025	0.05850	0.05260	0.05100	0.04967		
Nickel - Total	mg/L				0.12700	0.07000	0.05100	0.02860	0.05475	0.03533		
Lead - Total	mg/L				0.00100	0.01200	0.00325	0.00140	0.00125	0.00100		
Antimony - Total	mg/L				0.02000	0.01800	0.02125	0.02600	0.02950	0.02467		
Selenium - Total	mg/L				0.00500	0.00450	0.00175	0.00170	0.00175	0.00100		
Zinc - Total	mg/L				0.01100	0.04300	0.00975	0.00460	0.00575	0.00800		
Nutrients												
Ammonia - N	mg/L				0.17	0.34	0.29	0.56	0.47	0.25		
Nitrite - N	mg/L				0.0020	0.0030	0.0018	0.0342	0.0016	0.0018		
Nitrate - N	mg/L				4.20	4.13	3.60	3.90	2.98	2.47		
Phosphorus - Total	mg/L				0.0500	0.3875	0.0875	0.0500	0.0500	0.0500		
Phosphate as P - Total	mg/L				0.0400	0.4575	0.1150	0.0320	0.0250	0.0467		
Solids												
Turbidity	NTU				35.0	74.3	73.9	32.6	29.0	28.3		
TDS Total	mg/L				1366	1278	903	805	866	976		
Dissolved Solids	mg/L											
TSS Total	mg/L				66.0	102	90.8	30.6	25.3	48.3		
Suspended Solids	mg/L											
Trace Constituents												
Cyanide - Free	mg/L											
Cyanide - Total	mg/L											
Cyanide - WAD	mg/L											

SWS.3.1 Kichi-Sarytor Creek before joining Kumtor River (2018)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data												
Temperature	°C					3.2	5.8	6.6	6.0	2.4	0.7	
Conductivity	mS/cm					0.738	0.721	0.714	1.252	2.610	4.377	
pH						7.9	8.1	8.1	8.3	8.3	8.0	
Major Constituents												
Calcium	mg/L					71.2	74.2	63.2	100	218	292	
Chloride	mg/L					2.70	2.53	2.90	7.63	20.3	34.0	
Carbonate	mg/L					0.50	0.50	0.50	0.50	1.63	0.50	
Bicarbonate	mg/L					82.5	80.5	72.6	150	225	303	
Potassium	mg/L					2.19	2.70	2.92	4.54	8.25	14.3	
Magnesium	mg/L					85.7	82.5	78.5	149	358	438	
Sodium	mg/L					2.84	3.09	2.29	5.05	13.1	21.6	
Sulphate	mg/L					417	407	356	725	1730	1948	
Hardness - Total	mg/L					510	477	429	1207	1947	2233	
Alkalinity - Total	mg/L					67.8	66.0	59.5	123	170	174	
Total metals												
Silver - Total	mg/L					0.00150	0.00150	0.00150	0.00150	0.00188	0.00150	
Aluminum - Total	mg/L					0.89	4.30	2.86	0.33	0.09	0.02	
Arsenic - Total	mg/L					0.02000	0.00750	0.00510	0.00275	0.00275	0.00575	
Cadmium - Total	mg/L					0.00015	0.0001875	0.00015	0.00015	0.00015	0.000325	
Chromium - Total	mg/L					0.00400	0.00825	0.00400	0.00400	0.00400	0.00400	
Copper - Total	mg/L					0.02075	0.00625	0.00250	0.00250	0.00250	0.00250	
Iron - Total	mg/L					2.8	4.05	4.20	1.69	2.81	3.87	
Mercury - Total	mg/L					0.00025	0.00025	0.00025	0.00025	0.00025	0.0003125	
Manganese - Total	mg/L					1.04500	0.79850	0.89820	1.71475	3.33500	3.29000	
Molybdenum - Total	mg/L					0.01250	0.01400	0.00600	0.00850	0.02275	0.01775	
Nickel - Total	mg/L					0.08100	0.05600	0.07920	0.19250	0.37000	0.89875	
Lead - Total	mg/L					0.01550	0.00750	0.00660	0.00100	0.00125	0.00375	
Antimony - Total	mg/L					0.00400	0.00400	0.00190	0.00150	0.00850	0.01150	
Selenium - Total	mg/L					0.00200	0.00100	0.00150	0.00338	0.00525	0.01150	
Zinc - Total	mg/L					0.03200	0.02350	0.02000	0.00450	0.00825	0.01100	
Nutrients												
Ammonia - N	mg/L					0.20	0.23	0.14	0.37	0.64	0.86	
Nitrite - N	mg/L					0.0060	0.0005	0.0048	0.0021	0.0021	0.0038	
Nitrate - N	mg/L					1.35	1.425	1.12	3.6	4.933	5.45	
Phosphorus - Total	mg/L					0.3750	0.1250	0.2400	0.0500	0.0500	0.0500	
Phosphate as P - Total	mg/L					0.5175	0.1925	0.3820	0.0500	0.0250	0.0200	
Solids												
Turbidity	NTU					549	242	329	72.5	67.3	138	
TDS Total	mg/L					744	692	625	1203	2904	3203	
Dissolved Solids	mg/L											
TSS Total	mg/L					583	260	340	70.0	53.8	62.0	
Suspended Solids	mg/L											
Trace Constituents												
Cyanide - Free	mg/L									0.0025		
Cyanide - Total	mg/L									0.0025		
Cyanide - WAD	mg/L									0.0025		

SWW1 Sarytor Glacier Lake Outflow at Weir (2018)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data												
Temperature	°C					5.4		4.9				
Conductivity	mS/cm					0.896		0.889				
pH						7.9		8.1				
Major Constituents												
Calcium	mg/L					70.7		72.8				
Chloride	mg/L					0.95		1.30				
Carbonate	mg/L					0.50		0.50				
Bicarbonate	mg/L					86.5		76.0				
Potassium	mg/L					1.73		1.77				
Magnesium	mg/L					82.6		76.8				
Sodium	mg/L					1.04		1.36				
Sulphate	mg/L					414		366				
Hardness - Total	mg/L					504		460				
Alkalinity - Total	mg/L					71.0		62.3				
Total metals												
Silver - Total	mg/L					0.00150		0.00150				
Aluminum - Total	mg/L					0.21		0.59				
Arsenic - Total	mg/L					0.00075		0.00100				
Cadmium - Total	mg/L					0.00015		0.00015				
Chromium - Total	mg/L					0.00400		0.00400				
Copper - Total	mg/L					0.00250		0.00250				
Iron - Total	mg/L					0.35		0.75				
Mercury - Total	mg/L					0.00025		0.00025				
Manganese - Total	mg/L					0.46400		0.63600				
Molybdenum - Total	mg/L					0.00500		0.00500				
Nickel - Total	mg/L					0.02600		0.02200				
Lead - Total	mg/L					0.00100		0.00100				
Antimony - Total	mg/L					0.00050		0.00050				
Selenium - Total	mg/L					0.00175		0.00050				
Zinc - Total	mg/L					0.00950		0.00200				
Nutrients												
Ammonia - N	mg/L					0.04		0.13				
Nitrite - N	mg/L					0.0075		0.0040				
Nitrate - N	mg/L					0.55		0.4				
Phosphorus - Total	mg/L					0.0500		0.0500				
Phosphate as P - Total	mg/L					0.0250		0.0400				
Solids												
Turbidity	NTU					14.0		18.0				
TDS Total	mg/L					756		637				
Dissolved Solids	mg/L											
TSS Total	mg/L					10.5		15.0				
Suspended Solids	mg/L											
Trace Constituents												
Cyanide - Free	mg/L											
Cyanide - Total	mg/L											
Cyanide - WAD	mg/L											

W1.5.1 Kumtor River Just Downstream of Kumtor Concession Area - Voluntary Compliance Point (2018)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data												
Temperature °C					3.3	5.3	6.7	8.0	7.6	2.5	0.5	
Conductivity mS/cm					0.478	0.440	0.303	0.273	0.604	0.897	1.173	
pH					8.3	8.0	8.1	7.9	8.1	8.1	8.4	
Major Constituents												
Calcium mg/L					56.9	38.9	33.3	31.7	38.1	69.5	101.5	
Chloride mg/L					10.0	5.92	1.65	1.90	6.08	9.13	15.1	
Carbonate mg/L					0.50	0.50	0.50	0.50	0.50	0.50	0.50	
Bicarbonate mg/L					87.0	72.8	57.8	54.8	77.0	111	169	
Potassium mg/L					2.37	4.31	2.46	3.11	10.5	10.5	4.99	
Magnesium mg/L					35.9	19.5	17.3	14.4	25.6	49.1	84.2	
Sodium mg/L					4.56	24.30	7.33	12.9	65.48	61.78	19.3	
Sulphate mg/L					157	130	99.0	97.2	238	352	284	
Hardness - Total mg/L					245	170	138	124	206	359	638	
Alkalinity - Total mg/L					71.3	59.5	47.4	44.9	63.1	90.5	139	
Total metals												
Silver - Total mg/L					0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	
Aluminum - Total mg/L					4.52	3.17	5.25	4.24	1.60	0.32	0.26	
Arsenic - Total mg/L					0.00867	0.00390	0.00375	0.00330	0.00163	0.00125	0.00175	
Cadmium - Total mg/L					0.00043	0.00015	0.00015	0.00015	0.00015	0.00019	0.00015	
Chromium - Total mg/L					0.01167	0.00540	0.00400	0.00400	0.00400	0.00400	0.00400	
Copper - Total mg/L					0.00833	0.00710	0.00250	0.00250	0.00250	0.00250	0.00250	
Iron - Total mg/L					6.88	5.29	6.15	4.97	1.22	0.29	0.32	
Mercury - Total mg/L					0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	
Manganese - Total mg/L					0.31400	0.23220	0.24375	0.22640	0.18275	0.18600	0.38125	
Molybdenum - Total mg/L					0.00633	0.01540	0.00600	0.01020	0.04425	0.02925	0.00975	
Nickel - Total mg/L					0.03333	0.01880	0.01675	0.01420	0.01525	0.01825	0.02600	
Lead - Total mg/L					0.00500	0.00460	0.00600	0.00720	0.00300	0.00100	0.00175	
Antimony - Total mg/L					0.00083	0.00960	0.00263	0.00540	0.03325	0.01875	0.00450	
Selenium - Total mg/L					0.00417	0.00170	0.00063	0.00100	0.00338	0.00325	0.00100	
Zinc - Total mg/L					0.01667	0.01300	0.01513	0.01480	0.00500	0.00263	0.00950	
Nutrients												
Ammonia - N mg/L					0.14	1.04	0.35	0.56	2.46	2.42	0.41	
Nitrite - N mg/L					0.0080	0.0358	0.0029	0.0134	0.0963	0.0525	0.0038	
Nitrate - N mg/L					1.13	1.20	0.65	0.78	2.50	3.43	1.98	
Phosphorus - Total mg/L					0.1500	0.1100	0.0625	0.0900	0.0500	0.0500	0.0500	
Phosphate as P - Total mg/L					0.3400	0.1520	0.2450	4.5520	0.0625	0.0575	0.0250	
Solids												
Turbidity NTU					268	100	228	254	125	69.8	14.2	
TDS Total mg/L					358	301	206	220	510	702	929	
Dissolved Solids mg/L												
TSS Total mg/L					481	221	364	336	119	102	19.5	
Suspended Solids mg/L												
Trace Constituents												
Cyanide - Free mg/L					0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	
Cyanide - Total mg/L					0.0025	0.0208	0.0158	0.0170	0.1033	0.0598	0.0048	
Cyanide - WAD mg/L					0.0025	0.0076	0.0045	0.0068	0.0218	0.0130	0.0034	

W6.1 Arabel Suu River - 6km from Kumtor Concession Area (2018)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data												
Temperature °C					0.2				7.9	7.7		
Conductivity mS/cm					0.226				0.136	0.252		
pH					8.3				8.1	8.1		
Major Constituents												
Calcium mg/L					35.7				29.1	47.8		
Chloride mg/L					8.50				1.80	4.40		
Carbonate mg/L					0.50				0.50	0.50		
Bicarbonate mg/L					99.0				71.0	106		
Potassium mg/L					1.21				1.00	0.91		
Magnesium mg/L					4.90				3.64	6.55		
Sodium mg/L					2.57				1.68	2.99		
Sulphate mg/L					24.0				19.0	41.0		
Hardness - Total mg/L					110				80.0	126		
Alkalinity - Total mg/L					81.3				58.5	86.9		
Total metals												
Silver - Total mg/L					0.00150				0.00150	0.00150		
Aluminum - Total mg/L					0.25				0.79	0.21		
Arsenic - Total mg/L					0.00100				0.00050	0.00050		
Cadmium - Total mg/L					0.00015				0.00015	0.00015		
Chromium - Total mg/L					0.00400				0.00400	0.00400		
Copper - Total mg/L					0.00250				0.00250	0.00250		
Iron - Total mg/L					0.43				1.38	0.21		
Mercury - Total mg/L					0.00100				0.00025	0.00025		
Manganese - Total mg/L					0.03600				0.03800	0.00900		
Molybdenum - Total mg/L					0.00600				0.00200	0.00500		
Nickel - Total mg/L					0.02200				0.00800	0.00250		
Lead - Total mg/L					0.00100				0.00600	0.00100		
Antimony - Total mg/L					0.00050				0.00050	0.00050		
Selenium - Total mg/L					0.00050				0.00050	0.00050		
Zinc - Total mg/L					0.00100				0.00600	0.00100		
Nutrients												
Ammonia - N mg/L					0.02				0.02	0.02		
Nitrite - N mg/L					0.0060				0.0040	0.0030		
Nitrate - N mg/L					0.2				0.3	0.3		
Phosphorus - Total mg/L					0.0500				0.0500	0.0500		
Phosphate as P - Total mg/L					0.0300				0.0200	0.0100		
Solids												
Turbidity NTU					21.0				47.0	5.00		
TDS Total mg/L					144				114	156		
Dissolved Solids mg/L												
TSS Total mg/L					20.0				20.0	3.00		
Suspended Solids mg/L												
Trace Constituents												
Cyanide - Free mg/L												
Cyanide - Total mg/L												
Cyanide - WAD mg/L												

W1.6 Kumtor River above Taragay River (2018)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data												
Temperature	°C					2,1	10,4	6,0	5,0			
Conductivity	mS/cm					0,473	0,274	0,263	0,644			
pH						8,1	8,0	7,9	8,0			
Major Constituents												
Calcium	mg/L					47,4	35,4	35,2	32,7			
Chloride	mg/L					8,00	1,80	1,70	8,70			
Carbonate	mg/L					0,50	0,50	0,50	0,50			
Bicarbonate	mg/L					94,0	65,0	62,0	97,0			
Potassium	mg/L					3,71	2,66	2,58	9,53			
Magnesium	mg/L					24,2	15,8	13,6	15,3			
Sodium	mg/L					20,7	9,2	9,2	61,6			
Sulphate	mg/L					131	95,0	80,0	191			
Hardness - Total	mg/L					201	135	117	171			
Alkalinity - Total	mg/L					76,8	53,5	50,9	79,4			
Total metals												
Silver - Total	mg/L					0,00150	0,00150	0,00150	0,00150			
Aluminum - Total	mg/L					0,23	8,30	7,26	0,31			
Arsenic - Total	mg/L					0,00050	0,00800	0,00500	0,00050			
Cadmium - Total	mg/L					0,00015	0,00015	0,00015	0,00015			
Chromium - Total	mg/L					0,00400	0,00400	0,00400	0,00400			
Copper - Total	mg/L					0,00500	0,00250	0,00250	0,00250			
Iron - Total	mg/L					0,26	13,20	9,02	0,21			
Mercury - Total	mg/L					0,00025	0,00025	0,00025	0,00025			
Manganese - Total	mg/L					0,06100	0,44700	0,32400	0,06000			
Molybdenum - Total	mg/L					0,01000	0,00600	0,00700	0,03500			
Nickel - Total	mg/L					0,00700	0,02400	0,01600	0,00250			
Lead - Total	mg/L					0,00100	0,00900	0,00800	0,00100			
Antimony - Total	mg/L					0,00500	0,00300	0,00300	0,03100			
Selenium - Total	mg/L					0,00050	0,00050	0,00050	0,00100			
Zinc - Total	mg/L					0,00200	0,02700	0,02000	0,00100			
Nutrients												
Ammonia - N	mg/L					0,82	0,39	0,41	2,8			
Nitrite - N	mg/L					0,01	0,00	0,00	0,10			
Nitrate - N	mg/L					1,10	0,70	0,60	2,40			
Phosphorus - Total	mg/L					0,05	0,3	0,2	0,05			
Phosphate as P - Total	mg/L					0,05	0,41	0,24	0,03			
Solids												
Turbidity	NTU					39,0	264	271	51,0			
TDS Total	mg/L					340	219	184	455			
Dissolved Solids	mg/L											
TSS Total	mg/L					51,0	661	463	44,0			
Suspended Solids	mg/L											
Trace Constituents												
Cyanide - Free	mg/L											
Cyanide - Total	mg/L											
Cyanide - WAD	mg/L											

W1.7 Taragay River below Kumtor River (2018)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data												
Temperature	°C					5,5	11,8	7,6	7,9			
Conductivity	mS/cm					0,375	0,237	0,197	0,469			
pH						8,2	7,9	8,0	8,0			
Major Constituents												
Calcium	mg/L					46,3	31,1	31,4	39,3			
Chloride	mg/L					9,50	2,20	1,80	9,00			
Carbonate	mg/L					0,50	0,50	0,50	0,50			
Bicarbonate	mg/L					105	70,0	62,0	117			
Potassium	mg/L					2,14	1,63	1,58	4,51			
Magnesium	mg/L					15,4	8,9	7,9	12,8			
Sodium	mg/L					10,1	5,5	4,9	27,3			
Sulphate	mg/L					86,0	53,0	42,0	106,0			
Hardness - Total	mg/L					171	103	90,0	178			
Alkalinity - Total	mg/L					86,2	57,3	50,9	96,2			
Total metals												
Silver - Total	mg/L					0,00150	0,00150	0,00150	0,00150			
Aluminum - Total	mg/L					0,17	6,82	9,48	0,25			
Arsenic - Total	mg/L					0,00050	0,00500	0,00600	0,00050			
Cadmium - Total	mg/L					0,00015	0,00015	0,00015	0,00015			
Chromium - Total	mg/L					0,00400	0,00400	0,00400	0,00400			
Copper - Total	mg/L					0,00250	0,00250	0,00250	0,00250			
Iron - Total	mg/L					0,18	10,4	13,0	0,21			
Mercury - Total	mg/L					0,00025	0,00025	0,00025	0,00025			
Manganese - Total	mg/L					0,02500	0,27500	0,32200	0,04100			
Molybdenum - Total	mg/L					0,00500	0,00500	0,00200	0,01500			
Nickel - Total	mg/L					0,00250	0,02100	0,01400	0,00500			
Lead - Total	mg/L					0,00100	0,00700	0,00800	0,00200			
Antimony - Total	mg/L					0,00100	0,00100	0,00200	0,01200			
Selenium - Total	mg/L					0,00050	0,00050	0,00050	0,00050			
Zinc - Total	mg/L					0,00200	0,02200	0,02500	0,00200			
Nutrients												
Ammonia - N	mg/L					0,33	0,27	0,25	1,14			
Nitrite - N	mg/L					0,0020	0,0005	0,0080	0,0390			
Nitrate - N	mg/L					0,8	0,5	0,4	1,4			
Phosphorus - Total	mg/L					0,0500	0,1000	0,2000	0,0500			
Phosphate as P - Total	mg/L					0,0300	0,2200	0,2100	0,0200			
Solids												
Turbidity	NTU					20,0	221	354	33,0			
TDS Total	mg/L					247	149	144	321			
Dissolved Solids	mg/L											
TSS Total	mg/L					30,0	293	338	28,0			
Suspended Solids	mg/L											
Trace Constituents												
Cyanide - Free	mg/L											
Cyanide - Total	mg/L											
Cyanide - WAD	mg/L											

W1.8 Naryn River 1km upstream of Naryn (2018)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data													
Temperature (°C)	°C	-0.4	0.5	0.1	5.7	10.1	10.5	13.1	13.0	9.6	7.5	3.7	
Conductivity (mS/cm)	mS/cm	0.381	0.370	0.372	0.357	0.320	0.286	0.254	0.269	0.334	0.369	0.385	
pH		7.8	7.8	8.8	8.2	8.1	8.2	8.4	8.7	9.0	7.4	8.3	
Major Constituents													
Calcium	mg/L	54.7	53.9	49.0	49.9	49.7	44.2	44.0	43.2	36.5	52.8	61.6	59.9
Chloride	mg/L	6.10	6.30	6.40	8.18	5.24	3.15	2.53	2.58	4.50	10.18	5.50	5.80
Carbonate	mg/L	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Bicarbonate	mg/L	145	142	137	144	131	119	113	114	135	152	149	172
Potassium	mg/L	1.51	1.51	1.45	1.80	1.66	1.42	1.61	1.70	1.87	3.38	1.76	1.51
Magnesium	mg/L	15.6	16.0	14.0	15.1	13.7	12.1	11.1	10.9	10.4	15.8	18.2	16.0
Sodium	mg/L	8.68	9.03	8.18	8.75	6.41	5.38	5.05	5.24	8.29	11.83	9.23	8.04
Sulphate	mg/L	68.0	63.0	60.0	63.5	52.2	51.25	48.0	49.3	66.8	69.8	69.0	71.0
Hardness - Total	mg/L	190	181	175	178	157	144	145	132	167	181	181	215
Alkalinity - Total	mg/L	120	117	113	118	107	97.7	92.5	93.1	111	124	122	141
Total metals													
Silver - Total	mg/L	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150
Aluminum - Total	mg/L	0.05	0.21	0.92	0.53	2.74	4.52	6.02	8.73	0.42	0.15	0.19	0.10
Arsenic - Total	mg/L	0.00050	0.00050	0.00100	0.00163	0.00240	0.00338	0.00363	0.00180	0.00063	0.00100	0.00050	0.00050
Cadmium - Total	mg/L	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015	0.00019	0.00015	0.00015	0.00015	0.00015
Chromium - Total	mg/L	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400
Copper - Total	mg/L	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250
Iron - Total	mg/L	0.11	0.34	0.95	0.56	3.89	5.64	8.80	13.57	0.61	0.24	0.30	0.18
Mercury - Total	mg/L	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025
Manganese - Total	mg/L	0.00800	0.01200	0.03900	0.02875	0.14220	0.21675	0.26500	0.45300	0.04650	0.02325	0.03000	0.00600
Molybdenum - Total	mg/L	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00275	0.00200	0.00375	0.00250	0.00400	0.00200
Nickel - Total	mg/L	0.00600	0.00600	0.00250	0.00313	0.00710	0.01338	0.01225	0.00738	0.00250	0.00250	0.00250	0.00250
Lead - Total	mg/L	0.00300	0.00100	0.00100	0.00100	0.00260	0.00100	0.00625	0.00250	0.00100	0.00225	0.00400	0.00200
Antimony - Total	mg/L	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00063	0.00063	0.00050	0.00050	0.00050
Selenium - Total	mg/L	0.00050	0.00100	0.00050	0.00125	0.00110	0.00125	0.00088	0.00050	0.00125	0.00088	0.00200	0.00200
Zinc - Total	mg/L	0.00300	0.00300	0.00400	0.00325	0.01120	0.01575	0.02025	0.02750	0.01100	0.01000	0.00500	0.00300
Nutrients													
Ammonia - N	mg/L	0.06	0.02	0.28	0.035	0.02	0.1	0.1	0.185	0.1825	0.0725	0.02	0.02
Nitrite - N	mg/L	0.0010	0.0020	0.0120	0.0065	0.0068	0.0083	0.0030	0.0049	0.0058	0.0038	0.0030	0.0010
Nitrate - N	mg/L	0.70	0.70	0.70	0.63	0.52	0.48	0.48	0.50	0.70	0.85	0.70	0.90
Phosphorus - Total	mg/L	0.0500	0.0500	0.0500	0.0500	0.1300	0.1875	0.1750	0.4750	0.0500	0.0500	0.0500	0.0500
Phosphate as P - Total	mg/L	0.0100	0.0050	0.0600	0.1000	0.1940	0.4125	0.4975	0.9375	0.0725	0.0300	0.0300	0.0100
Solids													
Turbidity	NTU	0.6	3.8	27.0	80.8	101.9	159.5	332.3	690.8	22.3	3.7	4.1	0.3
TDS Total	mg/L	227	212	212	232	199	185	176	183	219	254	210	271.00
Dissolved Solids													
TSS Total	mg/L	0.50	9.00	41.0	176	302	760	1587	1190	76.3	11.3	13.0	0.50
Suspended Solids													
Trace Constituents													
Cyanide - Free	mg/L	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
Cyanide - Total	mg/L	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
Cyanide - WAD	mg/L	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025

W1.8F Naryn River below Naryn STP Discharge (2018)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data													
Temperature (°C)	°C		0.3	2.6	6.6	10.1	11.0						
Conductivity (mS/cm)	mS/cm		0.398	0.493	0.435	0.335	0.292						
pH			8.0	8.1	8.3	8.5	8.2						
Major Constituents													
Calcium	mg/L	57.6	58.2	53.4	50.8	50.5	43.9						
Chloride	mg/L	7.40	8.50	9.20	10.83	6.14	4.38						
Carbonate	mg/L	0.50	0.50	0.50	0.50	0.50	0.50						
Bicarbonate	mg/L	150	151	151	160	134	123						
Potassium	mg/L	1.50	1.70	1.57	1.83	1.61	1.31						
Magnesium	mg/L	16.0	17.1	15.3	16.3	14.0	12.1						
Sodium	mg/L	10.0	11.6	11.7	10.1	7.39	6.45						
Sulphate	mg/L	70.0	66.0	66.0	69.5	54.4	53.3						
Hardness - Total	mg/L	190	190	194	194	159	151						
Alkalinity - Total	mg/L	124	124	124	132	110	101						
Total metals													
Silver - Total	mg/L	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150						
Aluminum - Total	mg/L	0.08	0.27	0.76	0.42	2.87	3.77						
Arsenic - Total	mg/L	0.00050	0.00050	0.00200	0.00188	0.00320	0.00275						
Cadmium - Total	mg/L	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015						
Chromium - Total	mg/L	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400						
Copper - Total	mg/L	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250						
Iron - Total	mg/L	0.12	0.38	0.83	0.48	4.15	5.10						
Mercury - Total	mg/L	0.00025	0.00025	0.00025	0.00025	0.00025	0.00061						
Manganese - Total	mg/L	0.00900	0.01900	0.03700	0.03700	0.15760	0.18975						
Molybdenum - Total	mg/L	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200						
Nickel - Total	mg/L	0.00700	0.00250	0.00250	0.00250	0.00540	0.00988						
Lead - Total	mg/L	0.00500	0.00100	0.00100	0.00100	0.00300	0.00350						
Antimony - Total	mg/L	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050						
Selenium - Total	mg/L	0.00050	0.00200	0.00200	0.00150	0.00140	0.00050						
Zinc - Total	mg/L	0.00600	0.00400	0.00300	0.00300	0.01300	0.01625						
Nutrients													
Ammonia - N	mg/L	0.06	0.02	0.12	0.05	0.03	0.08						
Nitrite - N	mg/L	0.0020	0.0030	0.0120	0.0043	0.0076	0.0045						
Nitrate - N	mg/L	0.90	1.00	1.30	1.20	0.64	0.68						
Phosphorus - Total	mg/L	0.0500	0.0500	0.0500	0.0500	0.1600	0.1875						
Phosphate as P - Total	mg/L	0.0200	0.0050	0.0400	0.0750	0.1440	0.1825						
Solids													
Turbidity	NTU	0.45	4.40	23.0	70.2	111	166						
TDS Total	mg/L	250	230	247	256	211	197						
Dissolved Solids													
TSS Total	mg/L	1.00	7.00	35.0	106	219	278						
Suspended Solids													
Trace Constituents													
Cyanide - Free	mg/L	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025						
Cyanide - Total	mg/L	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025						
Cyanide - WAD	mg/L	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025						

P5.2N Tap Water at the New Camp (2018)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data													
Temperature	°C	10.4	10.8	9.6	9.2	9.8	10.3	11.9	12.3	12.8	10.8	9.6	8.5
Conductivity	mS/cm	0.128	0.131	0.129	0.129	0.116	0.115	0.113	0.136	0.118	0.165	0.113	0.122
pH		8.2	8.4	8.1	8.0	7.8	7.5	8.0	8.0	8.2	7.6	8.4	8.5
Major Constituents													
Calcium	mg/L	170	16.8	16.4	15.8	15.9	13.2	16.3	15.6	14.5	16.1	15.8	17.4
Chloride	mg/L	1.70	1.65	2.72	2.25	1.80	1.56	1.45	2.23	1.42	1.78	1.58	1.15
Carbonate	mg/L	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Bicarbonate	mg/L	35.0	33.3	32.8	29.0	18.8	12.4	28.3	21.5	22.2	23.0	25.0	36.0
Potassium	mg/L	1.44	1.47	1.41	1.32	1.32	1.06	1.38	1.24	1.20	1.25	1.41	1.52
Magnesium	mg/L	3.35	3.41	3.25	3.12	3.12	2.71	3.72	3.23	2.77	3.05	3.14	3.39
Sodium	mg/L	2.68	2.67	3.53	2.97	2.81	2.34	2.10	2.96	2.04	2.45	2.40	2.44
Sulphate	mg/L	24.5	24.0	24.2	24.5	31.0	31.6	31.0	33.0	28.2	30.8	31.5	22.6
Hardness - Total	mg/L	50.0	51.0	50.0	47.8	43.5	39.8	50.8	47.0	44.2	46.0	49.3	51.6
Alkalinity - Total	mg/L	27.0	27.1	26.8	23.8	15.4	10.2	23.2	17.8	18.3	19.0	20.7	29.5
Total metals													
Silver - Total	mg/L	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150
Aluminum - Total	mg/L	0.23	0.12	0.08	0.12	0.20	0.37	0.11	0.10	0.11	0.08	0.13	0.13
Arsenic - Total	mg/L	0.00050	0.00050	0.00080	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00113	0.00050
Cadmium - Total	mg/L	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015
Chromium - Total	mg/L	0.00600	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400
Copper - Total	mg/L	0.00388	0.00338	0.00250	0.00363	0.00250	0.00340	0.00250	0.00250	0.00250	0.00250	0.00250	0.00250
Iron - Total	mg/L	0.13	0.08	0.09	0.08	0.14	0.19	0.11	0.14	0.12	0.11	0.09	0.06
Mercury - Total	mg/L	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025
Manganese - Total	mg/L	0.00650	0.00475	0.00400	0.00350	0.00475	0.00520	0.00600	0.00625	0.00600	0.00500	0.00238	0.00360
Molybdenum - Total	mg/L	0.01075	0.00700	0.01400	0.00200	0.00200	0.00240	0.00350	0.00200	0.00200	0.00200	0.00200	0.00460
Nickel - Total	mg/L	0.03775	0.02088	0.04660	0.00250	0.00450	0.00490	0.00813	0.00250	0.00250	0.00250	0.00250	0.00750
Lead - Total	mg/L	0.00175	0.00100	0.00100	0.00100	0.00100	0.00180	0.00100	0.00100	0.00100	0.00100	0.00125	0.00100
Antimony - Total	mg/L	0.00188	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Selenium - Total	mg/L	0.00088	0.00138	0.00080	0.00088	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Zinc - Total	mg/L	0.00375	0.00425	0.00320	0.00475	0.00575	0.00680	0.00500	0.00188	0.00240	0.00375	0.00275	0.00420
Nutrients													
Ammonia - N	mg/L	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Nitrite - N	mg/L	0.0010	0.0015	0.0007	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Nitrate - N	mg/L	0.3250	0.3000	0.3200	0.3000	0.2750	0.2200	0.2750	0.3000	0.3000	0.3000	0.3000	0.2800
Phosphorus - Total	mg/L	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Phosphate as P - Total	mg/L	0.0050	0.0063	0.0060	0.0050	0.0050	0.0050	0.0213	0.0088	0.0060	0.0050	0.0050	0.0050
Solids													
Turbidity	NTU	2.47	0.67	0.40	0.39	0.30	1.95	0.47	2.17	2.08	0.44	1.16	1.05
TDS Total	mg/L	72.5	64.5	73.4	71.8	69.0	68.2	74.0	73.3	65.2	71.0	73.8	72.0
Dissolved Solids	mg/L												
TSS Total	mg/L	1.38	0.50	0.70	0.50	0.50	2.00	0.50	1.63	1.40	0.50	0.88	1.10
Suspended Solids	mg/L												
Trace Constituents													
Cyanide - Free	mg/L												
Cyanide - Total	mg/L												
Cyanide - WAD	mg/L												

P5.3 Mill Kitchen Tap (2018)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data													
Temperature	°C	11.2	13.8	11.3	11.2	12.3	12.3	14.5	17.5	16.0	15.0	13.6	13.1
Conductivity	mS/cm	0.141	0.138	0.131	0.126	0.126	0.125	0.339	0.125	0.120	0.123	0.128	0.125
pH		8.7	7.9	7.7	7.6	7.2	6.1	7.4	7.7	7.7	7.3	7.7	7.8
Major Constituents													
Calcium	mg/L	17.1	16.8	16.2	15.5	15.6	12.4	16.1	15.7	14.5	20.8	16.0	17.0
Chloride	mg/L	1.78	2.03	1.44	1.33	2.00	2.46	2.65	3.08	2.60	2.58	1.55	1.12
Carbonate	mg/L	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Bicarbonate	mg/L	23.8	16.3	17.8	14.8	13.8	5.6	21.8	21.3	21.8	17.5	15.5	31.0
Potassium	mg/L	1.50	1.42	1.36	1.32	1.32	1.02	1.42	1.31	1.21	1.26	1.50	1.48
Magnesium	mg/L	3.39	3.39	3.21	3.10	3.08	2.58	3.74	3.20	2.80	3.14	3.16	3.34
Sodium	mg/L	2.85	3.01	2.30	2.18	2.87	3.17	3.25	3.85	3.18	3.23	2.50	2.54
Sulphate	mg/L	32.8	38.0	35.8	35.8	38.0	41.6	36.8	32.5	28.8	36.0	39.0	27.4
Hardness - Total	mg/L	49.5	51.0	49.4	47.5	43.5	38.2	51.0	46.8	44.4	46.0	49.8	52.2
Alkalinity - Total	mg/L	19.5	13.4	14.5	12.2	11.4	4.6	17.7	17.6	18.0	14.3	12.7	25.3
Total metals													
Silver - Total	mg/L	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150
Aluminum - Total	mg/L	0.08	0.07	0.14	0.16	0.23	0.28	0.32	0.16	0.08	0.12	0.16	0.14
Arsenic - Total	mg/L	0.00050	0.00050	0.00110	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Cadmium - Total	mg/L	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015
Chromium - Total	mg/L	0.00625	0.00525	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400
Copper - Total	mg/L	0.01300	0.00863	0.00490	0.00725	0.00250	0.00560	0.00250	0.00250	0.00250	0.00250	0.00250	0.00340
Iron - Total	mg/L	0.09	0.06	0.05	0.04	0.06	0.12	0.20	0.11	0.06	0.07	0.07	0.05
Mercury - Total	mg/L	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025
Manganese - Total	mg/L	0.00675	0.00500	0.00420	0.00325	0.00350	0.00520	0.00950	0.00575	0.00380	0.00375	0.00300	0.00380
Molybdenum - Total	mg/L	0.01150	0.00575	0.01180	0.00200	0.00200	0.00200	0.00400	0.00200	0.00200	0.00275	0.00200	0.00360
Nickel - Total	mg/L	0.03925	0.01750	0.03980	0.00250	0.00550	0.00520	0.00788	0.00250	0.00250	0.00250	0.00250	0.00340
Lead - Total	mg/L	0.00200	0.00325	0.00220	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Antimony - Total	mg/L	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Selenium - Total	mg/L	0.00050	0.00150	0.00050	0.00050	0.00088	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Zinc - Total	mg/L	0.01225	0.01350	0.00880	0.00550	0.01200	0.02320	0.01925	0.00700	0.00960	0.01425	0.01250	0.00760
Nutrients													
Ammonia - N	mg/L	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Nitrite - N	mg/L	0.0013	0.0010	0.0006	0.0005	0.0005	0.0005	0.0009	0.0006	0.0005	0.0005	0.0006	0.0006
Nitrate - N	mg/L	0.3250	0.3000	0.3000	0.3000	0.2750	0.2200	0.3500	0.3000	0.3000	0.3000	0.3000	0.2400
Phosphorus - Total	mg/L	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Phosphate as P - Total	mg/L	0.0050	0.0075	0.0060	0.0050	0.0050	0.0050	0.0088	0.0100	0.0060	0.0050	0.0050	0.0050
Solids													
Turbidity	NTU	0.88	0.34	0.68	0.81	2.94	3.84	6.88	2.30	0.98	0.96	0.92	0.49
TDS Total	mg/L	74.3	63.8	71.2	71.5	67.0	72.0	78.5	73.3	64.8	73.0	76.5	69.6

SDP Treated Sewage Discharge into Kumtor River (2018)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data													
Temperature (°C)	°C							8.2	11.6	11.2	2.1		
Conductivity	mS/cm							0.571	0.590	0.446	0.620		
pH								7.9	7.5	8.1	7.9		
Major Constituents													
Calcium	mg/L							20.8	19.8	18.2	21.9		
Chloride	mg/L							29.0	18.2	24.1	32.0		
Carbonate	mg/L							0.5	0.5	0.5	0.5		
Bicarbonate	mg/L							47.5	51.0	54.6	101.0		
Potassium	mg/L							6.74	4.36	3.87	7.32		
Magnesium	mg/L							4.69	4.64	4.33	4.92		
Sodium	mg/L							37.8	22.0	24.6	38.0		
Sulphate	mg/L							42.5	33.3	33.2	49.5		
Hardness - Total	mg/L							62.5	58.3	59.0	79.5		
Alkalinity - Total	mg/L							39.1	41.9	58.8	83.1		
Total metals													
Silver - Total	mg/L												
Aluminum - Total	mg/L												
Arsenic - Total	mg/L												
Cadmium - Total	mg/L												
Chromium - Total	mg/L												
Copper - Total	mg/L												
Iron - Total	mg/L												
Mercury - Total	mg/L												
Manganese - Total	mg/L												
Molybdenum - Total	mg/L												
Nickel - Total	mg/L												
Lead - Total	mg/L												
Antimony - Total	mg/L												
Selenium - Total	mg/L												
Zinc - Total	mg/L												
Nutrients													
Ammonia - N	mg/L							2.34	2.14	1.82	4.00		
Nitrite - N	mg/L							0.10	0.12	0.08	0.14		
Nitrate - N	mg/L							6.15	2.06	2.5	3.8		
Phosphorus - Total	mg/L												
Phosphate as P - Total	mg/L							1.97	1.44	1.02	2.85		
Solids													
Turbidity	NTU							11.5	7.58	5.34	7.15		
TDS Total	mg/L							211	431	155	259		
Dissolved Solids	mg/L												
TSS Total	mg/L							10.5	5.25	4.60	8.50		
Suspended Solids	mg/L												
Trace Constituents													
Cyanide - Free	mg/L												
Cyanide - Total	mg/L												
Cyanide - WAD	mg/L												
Biochemical													
Oxygen Demand (BOD5)								7.0	11	7.6	11		
MBAS								0.1	0.2	0.2	0.4		

TPX-FILTER End of Tailings Spigot - Pressure Filtered (2018)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Data													
Temperature (°C)	°C	14.5	13.7	15.3	15.7	15.7	16.9	18.0	18.2	17.9	14.5	14.9	14.2
Conductivity (mS/cm)	mS/cm	3.731	3.392	3.426	3.293	3.308	3.445	3.266	2.765	2.981	3.029	3.457	3.548
pH		11.9	11.8	11.4	11.6	11.8	11.5	11.8	11.5	11.4	11.5	11.9	12.0
Major Constituents													
Calcium	mg/L	189	83.0	118	143	111	214	216	57.8	64.5	47.9	31.2	62.8
Chloride	mg/L	17.3	22.2	16.0	16.5	17.0	17.2	10.0	13.3	12.2	14.0	15.0	18.0
Carbonate	mg/L	127	86.5	176	134	218	108	122	115	147	161	140	192
Bicarbonate	mg/L	0.5	9.9	4.8	0.5	0.5	2.8	0.5	4.4	0.5	0.5	0.5	0.5
Potassium	mg/L	105	91.1	93.2	85.2	100.5	96.4	122	118	105	107	92.6	96.8
Magnesium	mg/L	0.04	0.18	0.58	0.29	0.04	0.18	0.03	0.32	0.07	0.12	0.13	0.03
Sodium	mg/L	454	446	502	349	724	386	362	446	378	565	522	777
Sulphate	mg/L	593	508	432	388	491	594	356	517	481	547	427	605
Hardness - Total	mg/L	487	192	265	316	293	487	535	229	180	136	192	255
Alkalinity - Total	mg/L	623	346.5	592	437.8	965.0	547.4	698	427	347	430	468	837
Soluble metals													
Silver - Soluble	mg/L	0.03938	0.02983	0.03670	0.06050	0.07700	0.04360	0.02850	0.01813	0.01000	0.09950	0.12175	0.36450
Aluminum - Soluble	mg/L	1.39	1.88	0.85	1.27	4.94	2.02	1.94	3.56	2.40	3.09	2.42	0.99
Arsenic - Soluble	mg/L	0.00900	0.01318	0.01120	0.01150	0.01533	0.00800	0.00525	0.00975	0.00900	0.01000	0.01025	0.00900
Cadmium - Soluble	mg/L	0.00155	0.00122	0.00162	0.00208	0.00173	0.00234	0.00138	0.00145	0.00162	0.00210	0.00460	0.00305
Chromium - Soluble	mg/L	0.00575	0.00483	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00400	0.00950	0.00700
Copper - Soluble	mg/L	12.4	7.6	18.4	36.3	17.2	9.75	11.9	6.76	6.21	7.13	6.00	30.7
Iron - Soluble	mg/L	0.30875	0.93467	1.54040	3.93250	2.75867	1.02180	0.53400	0.87050	0.37100	0.25625	0.49800	6.72500
Mercury - Soluble	mg/L	0.00254	0.00418	0.00340	0.00268	0.00347	0.00156	0.00208	0.00703	0.00644	0.00855	0.00818	0.01045
Manganese - Soluble	mg/L	0.00488	0.01109	0.01000	0.00400	0.00567	0.02200	0.03000	0.04700	0.00580	0.01713	0.04288	0.00363
Molybdenum - Soluble	mg/L	0.45550	0.40183	0.42940	0.56850	0.52500	0.43860	0.33150	0.32525	0.30700	0.37975	0.61575	0.66100
Nickel - Soluble	mg/L	0.54275	0.62873	1.10460	0.68550	2.08667	0.62220	0.59500	0.95075	0.54940	0.77500	0.77525	2.02000
Lead - Soluble	mg/L	0.00150	0.00100	0.00120	0.00100	0.00233	0.00100	0.00200	0.00100	0.00140	0.00550	0.00425	0.00100
Antimony - Soluble	mg/L	0.21188	0.48382	0.79160	0.21100	0.07267	0.10350	0.05800	0.28900	0.56440	0.37250	0.46150	0.45600
Selenium - Soluble	mg/L	0.01588	0.02433	0.06000	0.08750	0.10067	0.07460	0.02050	0.01800	0.01780	0.02225	0.02325	0.04125
Zinc - Soluble	mg/L	0.20750	0.01767	0.47580	0.28750	0.09233	0.23040	0.05600	0.19575	0.50080	0.60600	0.74500	0.44400
Nutrients													
Ammonia - N	mg/L	14.7	24.6	24.7	12.6	27.6	9.8	9.7	16.9	11.5	17.0	18.5	12.4
Nitrite - N	mg/L	0.0076	0.0073	0.0098	0.0006	0.0043	0.0026	0.0041	0.0031	0.0025	0.0091	0.0015	0.0109
Nitrate - N	mg/L	22.8	17.8	29.0	19.0	36.3	16.7	12.7	20.0	13.8	58.8	14.1	49.0
Phosphorus - Soluble	mg/L	0.1500	0.1000	0.7000	1.1000	0.7333	0.4000	0.4500	0.4750	0.3620	0.5750	0.5000	1.3820
Phosphate as P - Total	mg/L	0.0150	0.0125	0.0340	0.0350	0.0400	0.0270	0.0450	0.0525	0.0380	0.0400	0.0250	0.0600
Solids													
Turbidity	NTU	2.15	5.20	7.27	3.58	1.68	0.45	3.62	0.94	0.38	4.68	1.21	2.92
TDS Total	mg/L	2289	1800	2344	1856	2893	2165	2107	2173	1950	2455	2291	3050
Dissolved Solids	mg/L												
TSS Total	mg/L	43.0	33.7	35.4	37.0	26.3	33.4	55.0	23.8	14.0	25.8	17.0	23.0
Suspended Solids	mg/L												
Trace Constituents													
Cyanide - Free	mg/L	50.2	23.4	38.8	43.2	59.0	54.2	56.0	53.3	58.0	68.0	85.8	118
Cyanide - Total	mg/L	126	65.6	115	109	115	114	122	125	156	159	194	254
Cyanide - WAD	mg/L	112	54.5	99.5	96.3	102	96.8	112	103	130	129	165	212

MAD and MAC Limits

Parameter	Units	T8.4 (MAD Limit)	SDP (MAD Limit)	W1.5.1 (MAC Limit - Communal Use)
Chlorine (Cl)	mg/L		3324.9	350
Magnesium	mg/L	16.9		50
Sodium	mg/L	808.60		200
Sulphate	mg/L	1157.19	371.7	500
Silver - Total	mg/L			0.05
Aluminum - Total	mg/L			0.5
Arsenic - Total	mg/L			0.01
Boron (B)	mg/L			0.5
Barium (Ba)	mg/L			0.7
Beryllium (Be)	mg/L			0.0002
Bismuth (Bi)	mg/L			0.1
Cadmium - Total	mg/L			0.001
Cobalt (Co)	mg/L			0.1
Chromium - Total	mg/L			0.05
Copper - Total	mg/L	1.00		1
Fluorine	mg/L			1.5
Iron - Total	mg/L	1.8		0.3
Mercury - Total	mg/L			0.0005
Manganese - Total	mg/L	0.29		0.1
Molybdenum - Total	mg/L	1.014		0.25
Nickel - Total	mg/L	0.040		0.02
Lead - Total	mg/L			0.01
Antimony - Total	mg/L	0.492		0.005
Selenium - Total	mg/L			0.01
Silicon	mg/L			10
Vanadium	mg/L			0.1
Zinc - Total	mg/L	1.00		1
Ammonia - N	mg/L	23.48	2.03	1.5
Nitrite - N	mg/L		12.46	3.3
Nitrate - N	mg/L		145.43	45
Cyanide - Free (CN-F)	mg/L	0.1280		
Cyanide - WAD (CN-WAD)	mg/L			0.035
Total Suspended Solids (TSS)	mg/L	77.7	185.6	
Biochemical Oxygen Demand (BOD5)	mg/L		15.21	
MBAS	mg/L		11.32	0.5
Hydrocarbons	mg/L			0.3

Laboratory Detection Limit

Parameter	Units	Method Detection Limit
Major Constituents		
Ca	mg/L	0.05
Cl	mg/L	0.5
CO ₃	mg/L	1
HCO ₃	mg/L	1
K	mg/L	0.09
Mg	mg/L	0.5
Na	mg/L	0.5
SO ₄	mg/L	1
T-Hardness	mg/L	1
T-Alkalinity	mg/L	1
Total Metals		
Ag	mg/L	0.003
Al	mg/L	0.03
As	mg/L	0.005
Ba	mg/L	0.0003
Be	mg/L	0.008
Cd	mg/L	0.005
Co	mg/L	0.004
Cr	mg/L	0.0005
Cu	mg/L	0.003
F	mg/L	0.005
Fe	mg/L	0.005
Hg	mg/L	0.002
Mn	mg/L	0.001
Mo	mg/L	0.001
Ni	mg/L	0.001
Pb	mg/L	
Sb	mg/L	0.04
Se	mg/L	0.001
Si	mg/L	0.1
V	mg/L	0.1
Zn	mg/L	0.01
Nutrients		
Un-ionized NH ₃		0.35
NH ₃	mg/L	1
NO ₃ -N	mg/L	1
NO ₂ -N	mg/L	
T-PO ₄	mg/L	0.2
TKN	mg/L	0.005
Solids		0.005
Turb-L	NTU	0.35
TDS	mg/L	1
TSS	mg/L	1
Trace Constituents		
CN-F	mg/L	0.005
CN-T	mg/L	0.005
CN-WAD	mg/L	0.005

Cautionary note regarding forward-looking statements

Certain information contained or incorporated by reference herein may include “forward-looking-statements” within the meaning of certain securities laws. Such forward-looking statements involve risks, uncertainties, and other factors that could cause actual results, performance, prospects, and opportunities to differ materially from those expressed or implied by such forward-looking statements.

For a detailed discussion of such risks, uncertainties, and other factors, the Management's Discussion and Analysis included in Centerra's most recent Annual Report and Annual Information Form, both of which are available on Centerra's website www.centerragold.com. Although Centerra believes that the assumptions inherent in these forward-looking statements are reasonable, the reader should not place undue reliance on these statements. Forward-looking information is as of December 31, 2018 Centerra disclaims any intention or obligation to update or revise any forward-looking statements whether as a result of new information, future events or otherwise. The data in this Report has not been independently verified.

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