

# **APPENDIX A**

**Outline Specification and RFPI**

**REQUEST FOR PRELIMINARY INFORMATION AND  
OUTLINE PERFORMANCE SPECIFICATION FOR  
RMG MINING INFLUENCED WATER  
TREATMENT SYSTEMS**

**Including  
WRD II & Kazretula, WRD IV,  
Sakdrisi Central Facility,**

**Rich Metals Group (RMG)  
Madneuli and Sakdrisi  
Mines, Georgia**

## 1.0 INTRODUCTION

### 1.1 Scope

- 1.1.1** This Request for Preliminary Information (RFPI) and Outline Specification defines the requirements for three Water Treatment Systems for mine influenced water collected at Waste Rock Dump (WRD) II & Kazretula, and WRD IV at the Madneuli Mine and the Central Location at the Sakdrisi Mine properties near Bolnisi, Georgia.
- 1.1.2** The purpose of the RFPI is to invite equipment suppliers and organizations with the appropriate technical capability and experience in the design and supply of mining influenced water treatment systems to respond to this request for qualifications and budgetary cost proposals. Rich Metals Group (RMG) Copper and Gold (the Owner) will use this information to better understand the capabilities of each organization to select a suitably experienced and competent firm to establish a contractual relationship with to move forward on the three water treatment projects.
- 1.1.3** Site-specific information that may impact the supply and installation of the treatment systems is also incorporated into the following sections.
- 1.1.4** Suggested conceptual process flow diagrams showing major equipment are provided for each treatment train to be incorporated in to the Seller/Manufacturer's design and supply of the three required Treatment Systems (Attachment A).
- 1.1.5** Sections 5 -10 of this document comprises the Outline Specification and outlines the work that must be completed to confirm process selection, complete detailed design, and supply the equipment required for the three treatment systems.
- 1.1.6** The Outline Specification is included so that the Seller/Manufacturer is aware of the level of engineering work that must be completed. The suggested conceptual flow diagrams are based on limited available information but provide a common basis for preparation of the budgetary quotes for the three treatment systems.
- 1.1.7** Performance requirements of the systems are outlined and the major unit processes that comprise each system to be furnished are listed. It should be noted that this document does not attempt to enumerate the details of all accessories and appurtenances required to render each system functional. Such details shall be provided in the budgetary proposal submitted by the Seller/Manufacturer. The Seller/Manufacturer shall clearly list items that are not included in their proposal but may be required for a complete treatment system and efficient long-term operation of the treatment system. Operation will either be by Owner or procured separately by the Owner.
- 1.1.8** The level of proposal expected is a budgetary proposal so that a Seller/Manufacturer can be selected.

### 1.2 Site background information

- 1.2.1** The mining facilities are located near the town of Kazreti in the Bolnisi district, 80 km southwest of Tbilisi. Figure 1 shows the locations relative to Tbilisi and the main features of the Madneuli and Sakdrisi mines.
- 1.2.2** Figures 2 and 3 give an overview of the site and the Madneuli and Sakdrisi mines relative to the proposed locations for the three treatment systems. Note the plant indicated downstream of WRD III is not currently required by RMG.
- 1.2.3** The development of the three Water Treatment Systems is part of an overall water management infrastructure that is being planned and implemented to control and manage its legacy of historic environmental pollution as well as implement best practice measures and investment to improve the environmental performance of the Bolnisi mine, comprising the separate Madneuli and Sakdrisi

deposits. The Water Treatment Systems are part of the remedy needed to reduce the impact of the mining operations on the surrounding rivers.

- 1.2.4** Mining has been ongoing for several decades; however, the need for treatment of mining influenced water is new as environmental regulations are enforced.

## **1.3 Overview of Proposed Treatment Options**

- 1.3.1** While it is expected that the Seller/Manufacturer will include provision for conducting bench-scale treatability studies to confirm the design parameters, the objective of the Outline Specification is to outline water treatment equipment and systems that are proven in similar applications and can be installed and operational by March 2020. The three treatment systems required, expected flow rates, and main contaminants of concern are as follows:

- 1.3.2** Waste Rock Dump (WRD) II & Kazretula facility (at the Madneuli site) with a treatment design flow rate of 18 m<sup>3</sup>/hr. Treatment is required for cadmium, copper, iron, magnesium, manganese, selenium, zinc, sulphate, and pH. Treated water will be discharged to a local surface water (conveyance and discharge by others).

- 1.3.3** WRD IV (at the Madneuli site) with a treatment design flow rate of 50 m<sup>3</sup>/hr. Treatment required for cadmium, copper, iron, magnesium, manganese, zinc, sulphate, and pH. The selenium data reported for WRD IV is all non-detect, however, the detection limit is higher than the discharge criteria, therefore, if selenium treatment is determined to be required the treatment train will be same at that for the WRD II & Kazretula facility. For bid preparation purposes assume that selenium treatment is not required at WRD IV. The treated water from the WRD IV treatment plant will also be discharged to local surface water (conveyance and discharge by others).

- 1.3.4** Central location at Sakdrisi with treatment design flow rate of 300 m<sup>3</sup>/hr. Treatment for nitrite and manganese is assumed to be required; and

## **1.4 Definitions**

- 1.4.1** In this Specification, the terms listed below are defined as follows:

- Owner: RMG;
- Owner's Engineer: Golder Associates (Golder);
- Seller/Manufacturer: Company supplying the three Water Treatment Systems, to be determined;
- Business Days: Monday through Friday, excluding national holidays; and
- Water Treatment Systems or Treatment Equipment: Unit(s) capable of meeting the requirements of the following sections.

## **2.0 WATER TREATMENT SYSTEM DESCRIPTIONS**

- 2.1.1** The expected major water treatment unit operations, based on data currently available, are listed below. A preliminary process flow diagram of the three Water Treatment Systems is provided in Attachment A and the water quality and treatment goals in Attachment B.

- 2.1.2** WRD II & Kazretula – 18 m<sup>3</sup>/hr design flow:

- influent equalization pond with influent feed pumps (by RMG);
- lime high density sludge (HDS) treatment for cadmium, copper, iron, magnesium, manganese, zinc, sulphate, and silica removal. Silica removal is not required for regulatory purposes but efficient operation of the reverse osmosis system which follows the HDS system. The lime HDS system includes lime system (silo, slaker, if appropriate, and slurry feed tank), sludge densification tank, reaction tank with aeration, chemical feed systems (polymer and coagulant), rapid mix and slow mix polymer/floc tanks, and clarification;

- membrane treatment for magnesium polishing, selenium concentration, and sulphate concentration. The microfilter (or ultrafilter) is to polish suspended solids removal after the clarifier. The RO removes the majority of the dissolved constituents producing a treated water (permeate) stream that is very low dissolved solids, sulphate and other contaminants. The concentrated brine from the RO can then be further treated for selenium removal with a portion of the biotreated brine recombined with the permeate to the sulphate limit and the remaining brine recycled back to the HDS system. The membrane system includes membrane feed tank, ultrafiltration or microfiltration system, reverse osmosis system, clean-in-place for both membrane systems, chemical feed (antiscalent and other chemicals as needed), permeate tank, effluent mix tank with pH adjust capabilities, and brine tank;
- sludge dewatering system including sludge holding tank, filter press, and filtrate tank; and
- biological selenium treatment provides removal of the concentrated selenium from the brine. Biological selenium treatment on the RO brine shall be provided by an approved vendor (GE/Suez, Frontier Water Systems, or Envirogen Technologies). As shown on the PFD this system will treat RO brine and therefore the design flow shall be based on the RO modelling projections by the Seller/Manufacturer. The selenium treatment system shall be provided as a complete system and may include the bioreactor, nutrient and chemical storage and feed, backwash supply and pump, polishing treatment, and any other equipment to render the system fully functional.

### 2.1.3 WRD IV - 50 m<sup>3</sup>/hr design flow:

- influent equalization pond with influent feed pumps (by RMG);
- lime high density sludge (HDS) treatment for cadmium, copper, iron, magnesium, manganese, zinc, sulphate, and silica removal. As with the WRD II & Kazretula system silica is required for efficient operation of the membrane system. The lime HDS system includes lime system (silo, slaker, and slurry feed tank), sludge densification tank, reaction tank with aeration, chemical feed systems (polymer and coagulant), rapid mix and slow mix polymer/floc tanks, and clarification;
- the membrane system serves a similar purpose as WRD II & Kazretula to concentrate sulphate and magnesium for further treatment and to produce a high quality treated stream for blending. A portion of the concentrated brine will be returned to the HDS system for additional treatment for sulphate and magnesium removal and a portion of the brine is blended with permeate for discharge. The system includes membrane feed tank, ultrafiltration or microfiltration system, reverse osmosis system, clean-in-place for both membrane systems, chemical feed (antiscalent and other chemicals as needed), permeate tank, effluent mix tank with pH adjust capabilities, and brine tank; and
- sludge dewatering system including sludge holding tank, filter press, and filtrate tank.

### 2.1.4 Centralized Facility at Sakdrisi - 300 m<sup>3</sup>/hr design flow:

- influent equalization pond with influent feed pumps (by RMG);
- ozone treatment for oxidation of nitrite to nitrate;
- manganese dioxide media system including columns, backwash tank and pump, and chemical feed; and
- sludge dewatering system including sludge holding tank, filter press, and filtrate tank.

### 2.1.5 If additional data or site-specific information is provided and/or, if additional treatability test work conducted by the Seller/Manufacturer indicates that any or all of the three Water Treatment System

concepts must be changed, the Seller/Manufacturer may be requested to provide supplemental equipment, or to eliminate one or more units from their scope of supply.

- 2.1.6** The Seller/Manufacturer may propose alternative treatment components and equipment to those listed above and shown in Attachment A if the Seller/Manufacturer can demonstrate that the alternative components will fulfil the requirements of this Specification at a lesser capital cost with equivalent or lower annual operating costs or at an equivalent/higher capital cost with sufficient annual operating cost savings to provide a 3 year payback of the increased capital cost.
- 2.1.7** Note that any alternative technologies proposed must be approved by the Owner and Owner's Engineer. Liquid residuals (such as brine and spent regenerant) are not acceptable and will not be approved unless there is a plan proposed by the Seller/Manufacturer for managing liquid residuals.
- 2.1.8** The proposed flowsheet shown in Attachment A for the systems that include RO equipment provide for a flow scheme that recombines treated brine with permeate to produce a compliant effluent and no liquid secondary waste.

## 3.0 EQUIPMENT DESCRIPTIONS

These equipment descriptions and performance requirements are based on limited information and are for the purposes of normalising the basis for preparation of budgetary quotes by the Seller Manufacturer.

### 3.1 Equalization Ponds – by The Owner

- 3.1.1** The Owner shall provide influent equalization ponds (for each system) with storage capacity to equalize flows and to smooth out quality changes. The volume of each pond is assumed to be equal to at least one month at the peak flow. It is assumed that the majority of total suspended solids (TSS) that may be present in the source water will also settle in the equalization pond so that water transferred to the treatment systems is low in TSS.
- 3.1.2** Treatability testing and additional analytical tests are required to confirm the actual TSS values and settleability. The pumps to transfer water from the ponds to the Water Treatment Systems shall also be provided by the Owner.

### 3.2 Membrane System Performance Requirements

- 3.2.1** The Seller/Manufacturer shall provide a microfiltration or ultrafiltration system with components provided on skids to the greatest extent possible. Major system components include a break tank (if required), feed pump, membranes, chemical dosing systems, clean-in-place skid, and any other components to make the system fully functional. Membranes provided shall be a standard, readily available membrane for ease of maintenance and replacement.
- 3.2.2** The Seller/Manufacturer shall provide a reverse osmosis system with components provided on skids to the greatest extent possible. Major system components include a break tank (if required), feed pump, high pressure pump, prefilters, membranes, chemical dosing systems, clean-in-place skid, and any other components to make the system fully functional. Membranes provided shall be a standard, readily available membrane for ease of maintenance and replacement.

### 3.3 Lime HDS System Performance Requirements

- 3.3.1** The Seller/Manufacturer shall provide chemical dosing systems, densification tanks, reaction tanks, clarifiers, pumps, blowers, and mixers to manage the flow shown in Section 2 and water quality shown in Attachment B. It is expected that this will include, at a minimum, the following features:
- Sludge densification tank for mixing recycled sludge with hydrated lime slurry to maintain a pH of greater than 11.5 in the densification tank. Additional treatability testing is required by Seller/Manufacturer regarding the relevant number of sludge recycles (an average of 3 sludge recycles should be used as a placeholder) and to confirm the optimal pH goal for this tank.

- Reaction tank and equipment which shall maintain a pH of 10.5 (precipitation of silica and magnesium may be required), have a hydraulic retention time to maximize sulfate removal, and provide sufficient mixing capacity to prevent the settling of TSS. Aeration should be assumed to be necessary and provided. The system shall include a reaction tank, blower system, mixing of the lime/ sludge with influent water, and automated control of the lime addition based on the reaction tank pH. Additional treatability testing is required to confirm the optimal treatment pH and reaction time.
- Clarifier(s) with coagulant/flocculant addition for the separation of precipitated solids including rake, lift mechanisms, and underflow sludge pumps. Clarifier underflow shall be routed to the sludge tank for feed to the filter press or recycled to the densification tank. The clarifier underflow shall be automated to respond to changes in influent flow rate. Additional treatability testing is required to determine settling characteristics of the densified sludge.
- Neutralization system to adjust the pH into an acceptable range for the treatment target of 6.5 to 8.5 (or for the appropriate RO influent pH). The equipment shall include a reaction tank, mixing of the neutralizing chemical with the water, and automated control of the chemical addition based on the effluent pH and flow rate. Assume hydrochloric acid is used for neutralization.
- Chemical Addition Systems – All chemical dosing systems shall be automated to respond to changes in influent flow rate or quality with capability for manual adjustment of the dose. As appropriate, the chemical dosing shall also be automated to also respond to changes in influent quality, such as pH control.
  - Lime storage silo (quicklime), slaking, make-down (dilution, rapid mix, and slow mix) and metered delivery of hydrated lime to precipitate metals and sulfate at a pH of 10.5 in the reaction tank and densify solids in the densification tank. Lime storage silo shall be sized for a minimum of 7 days of operation at the design flow. The Seller/Manufacturer shall verify with the Owner prior to final sizing of the storage silo to confirm that the silo can hold more than a full delivery truckload so that there is sufficient room in the silo to accept full truckload quantities.
  - Addition of coagulant and flocculant to produce larger, denser solid particles for enhancement of the operational efficiency of the clarification units. Coagulant/flocculant storage shall be sized for a minimum of 30 days of operation at the design flow.
  - Acid addition systems for pH adjustment of the clarifier overflow. Acceptable neutralization chemicals include hydrochloric acid, sulphuric acid, and carbon dioxide. Acid storage shall be sized for a minimum of 30 days of operation at the design flow.
  - Chemical consumption estimates are provided in Table 1 below for the purposes of bidding (actual chemical usage requirements will be determined by the Seller/Manufacturer during treatability testing).

**Table 1: Chemical Usage Estimates at Design Flow**

Chemical	WRD 2 & KAZRETULA	WRD 4
Lime (CaO)	1,820 kg/day	8,600 kg/day
Hydrochloric Acid (37%)	1.5 m <sup>3</sup> /yr	16 m <sup>3</sup> /yr
Anionic Polymer	2,200 kg/yr	7,000 kg/yr

### 3.4 Selenium Biosystem

- 3.4.1** For WRD II & Kazretula at Madneuli, the Seller/Manufacturer shall provide a complete selenium biotreatment system for the RO brine. For the purposes of bid preparation and to meet the effluent selenium treatment goal of less than 1.6 µg/L assume that the brine feed stream to the biosystem is 4 m<sup>3</sup>/hr or less with selenium that has been concentrated approximately 5 times to 105 µg/l. The selenium in the biosystem effluent must be less than 5 µg/L, in order, to meet the selenium discharge limit of 1.6 µg/L when blended back with permeate from the RO system.
- 3.4.2** Approved manufacturers for the selenium biosystem are GE/Suez, Frontier Water Systems, and Envirogen Technologies.
- 3.4.3** The selenium biosystem shall include the bioreactor, nutrient storage and feed, any pretreatment required, backwash system, and any other components to provide a fully functioning system.
- 3.4.4** Polishing treatment required to reduce residual levels of TSS, nutrients and sulphide shall also be provided as part of the selenium biosystem.

### 3.5 Oxidation System Performance Requirements

- 3.5.1** For the Central Treatment Facility at Sakdrisi, the Seller/Manufacturer shall provide Oxidation Treatment Equipment necessary to manage the flow described in Section 2 and water quality shown in Attachment B. It is expected that this will include, at a minimum, the following features:
- Oxidation reaction tank which shall have a minimum hydraulic retention time of 30 minutes and provide sufficient mixing capacity to prevent the settling of TSS. The reaction time and ozone dose should be confirmed during treatability testing conducted by the Seller/Manufacturer; and
  - Ozone generation system which shall include ozone generators, piping, diffusers, and automated control of the ozone generation.

### 3.6 Manganese Dioxide Filtration Performance Requirements

- 3.6.1** For the Central Treatment Facility at Sakdrisi, the Seller/Manufacturer shall provide manganese dioxide filtration Treatment Equipment necessary to manage the flow and water quality shown in Attachment B. It is expected that this will include, at a minimum, the following features:
- Manganese dioxide filters including any necessary feed pumps, automated chemical addition systems, and all piping/valves/instrumentation/etc. required for operation; and
  - Backwash tank with backwash pump and all piping/valves/instrumentation/etc. required for operation.

### 3.7 Surge Tank Performance Requirements

- 3.7.1** The Seller/Manufacturer shall provide surge tanks between major equipment components to allow their continuous operation, if required. The surge tanks shall have a minimum hydraulic retention time of 15 minutes at peak flow and sufficient mixing capacity to prevent the settling of TSS, if necessary. Pumps conveying water from the feed tank to downstream components shall be



provided by the Seller/Manufacturer. Any instrumentation or controls required to control level in the tank and downstream flow rate shall be provided by the Seller/Manufacturer.

### 3.8 Chemical Storage Performance Requirements

- 3.8.1 The Seller/Manufacturer shall provide all storage infrastructure, including but not limited to tanks, piping, pumps, and containment skids, for all chemicals necessary to operate the Water Treatment Systems (e.g., coagulant).
- 3.8.2 Sufficient chemical storage for 30 days of continuous Water Treatment Systems operation is required (unless otherwise specified). The required storage area will be estimated after completion of treatability testing, and if needed, the length of time for chemical storage will be revisited.
- 3.8.3 Storage infrastructure shall comply with all pertinent local, national, and European Union laws, regulations, and directives in terms of their design, fabrication, materials of construction, and compatibility with each respective treatment chemical.
- 3.8.4 The footprint of the storage infrastructure and, if applicable, the area required to store chemical delivery containers on site, shall be included in the equipment layout drawing.
- 3.8.5 Replenishing chemical storage systems shall not require additional specialized tools or equipment, excluding activities that can be undertaken with a four-wheeled forklift. If specialized tools or equipment are required, they shall be provided by the Seller/Manufacturer.
- 3.8.6 Secondary containment of storage tanks shall be provided, with a minimum capacity of 110% of the tank’s volume. If applicable local, national, or European Union laws, regulations, or directives prescribe larger secondary containment capacities, the larger criteria shall be used.

### 3.9 Sludge Dewatering Performance Requirements

- 3.9.1 The Seller/Manufacturer shall provide a plate and frame filter press to mechanically dewater the underflow from the clarifiers. Preferred operating requirements are to run the filter press only during the day shift and the Seller/Manufacturer’s proposal shall clearly state the operational requirements. Estimated sludge generation is provided in Table 2 below for the purposes of bidding (actual sludge generation will be determined by the Seller/Manufacturer during treatability testing).

Table 2: Summary of Chemical Usage

Item	WRD II & KAZRETULA	WRD IV	Centralized Facility
Sludge (dewatered to 40% solids)	1,700 m <sup>3</sup> /yr	15,000 m <sup>3</sup> /yr	TBD

- 3.9.2 Sludge pumps and sludge storage tank(s) shall be provided with the filter press. These units shall be compatible for service in high and low pH water. The sludge pumps shall be appropriate for pumping slurry material at the filter press’ design pressure. A cone bottom or slope bottom tank with a rake is preferred for the sludge storage tanks.
- 3.9.3 A filtrate storage tanks shall be provided to retain filtrate produced by the filter press. The storage tank(s) shall have sufficient hydraulic retention time to prevent TSS from settling. Filtrate shall be returned to the water Treatment Systems.
- 3.9.4 Filter cake produced by the filter press shall be gravity fed to filter cake conveyance or storage features provided by the Owner. The Owner is responsible for the removal of the filter cake from the water Treatment Systems and subsequent disposal.
- 3.9.5 Ancillary equipment (air compressor, any other required equipment) shall be clearly identified as to sizing. The Seller/Manufacturer may provide these ancillaries. If the Seller/Manufacturer opts not to provide ancillaries, the scope of supply shall be clearly documented such that the Owner can readily procure, without impact on production.

## 4.0 RFPI SUBMITTALS

**4.1.1** Budgetary quotations for complete engineering, as outlined in Sections 5 to 10 for the three treatment systems.

**4.1.2** Qualifications of the Seller/Manufacturer's team on the supply similar projects and similar water treatment facilities.

**4.1.3** Seller/Manufacturer's experience in working in Georgia or the region.

## 4.2 Proposal Submittals

**4.2.1** The Seller/Manufacturer's budgetary proposal shall include, at a minimum, the following information:

- A price quotation for the Water Treatment Systems that meets the requirements of this Specification. The quotation shall provide purchase pricing with an option to lease, if available from the Seller/Manufacturer. Components that are not included shall be itemized and priced for purchase;
- Sellers/Manufacturers planned treatability testing to confirm preliminary processes and allow for a process guarantee that the treated effluent will meet the discharge goals;
- It is preferred that access ladders/platforms, if necessary to access the top of a unit, are included. If required and not included with the proposal, this shall be noted clearly in the proposal;
- It is preferred that any recommended instrumentation, controls, monitoring equipment, and an integrated programmable logic controller (PLC) be included with the equipment and proposal; however, it shall be clearly noted if specific instrumentation is required for proper operation of the unit that is not included with the equipment and the proposal;
- A separate line item in the cost quotation for estimated freight to the Site;
- A listing of all equipment and instrumentation specifically included in the quotation, including materials of construction;
- A listing of all equipment required for operation of the equipment that is not included in the quotation and proposal;
- If a lease price is also provided and there are minimum lease periods, mobilization, and/or demobilization costs, these shall be clearly stated in the quotation and proposal;
- Preliminary layout and process drawings, showing the number of units, overall size of the equipment as assembled, and the process flow through the equipment;
- A specific statement that the system and all components are in strict accordance with this Specification and will meet the performance requirements in Section 3.0. If system/components are not in strict accordance with this Specification, the Seller/Manufacturer shall include alternative designs or systems equivalent to and guaranteed for the specified duties;
- An estimate of the operational labour required for the Water Treatment Systems;
- Expected lead and shipping times for long lead equipment. A delivery date, in terms of a fixed number of weeks from the receipt of the order;
- A listing and costs of any parts within the provided equipment that are either consumables or require regular replacement and their replacement frequency;
- A listing of any special requirements for unloading the equipment or assembly of the equipment;

- A separate line item cost for installation and start-up support on site and a typical recommended number of days of on-site support; and
- Water quality criteria for water that is required to dilute or blend chemicals, if applicable. At a minimum, the water quality criteria shall include pH, TSS, and total dissolved solids.

## 5.0 OUTLINE SPECIFICATION

- 5.1.1** The remaining sections (sections 6 to 10) in this document are intended to demonstrate the remaining work and level of detail expected when providing design and equipment submittals to RMG. These sections are provided so that the Seller/Manufacturer recognizes the level of development and engineering work that must be completed prior to equipment specification and fabrication.
- 5.1.2** The purpose of the remaining sections is to provide a common basis for the preparation of the budgetary cost proposals and the Preliminary Information Submittals.

## 6.0 TREATABILITY STUDIES

- 6.1.1** Samples of water will be provided by the Owner for the Seller/Manufacturer to validate the treatment process, determine treatment conditions, size equipment, and to estimate chemical consumption, waste generation and chemical storage requirement, and overall footprint of the Treatment Equipment.
- 6.1.2** The level and scope of treatability testing will be determined by the Seller/ Manufacturer to allow for their process guarantee but will include at a minimum bench scale testing for the lime HDS systems, and the oxidation system/manganese dioxide filtration processes included in the central treatment facility at Sakdrisi.
- 6.1.3** Bench-scale testing on WRD III (not included in the current treatment requirements) and WRD IV water samples has been conducted by a local Georgian testing company. The bench testing conducted was lime addition jar testing and the report has been included as Attachment C.

## 7.0 GENERAL REQUIREMENTS

### 7.1 Referenced Codes and Standards

- 7.1.1** The latest revision of European codes and standards and Georgian Government regulations shall be used as of the date of award of the contract or purchase order, unless noted otherwise. In case of conflict between this Specification and the referenced codes and standards, the more stringent requirements shall govern, unless explicitly noted otherwise in the contract or purchase order.
- 7.1.2** Additionally, the Seller/Manufacturer must ensure that the proposed Water Treatment Systems produces effluent water quality at the end of pipe that meets the limits presented in Attachment B. Note that the treatment targets are provided for the purposes of this outline specification and initial design of the systems, however, may be modified as the permitting process proceeds. Some revision to the designs proposed based on this Specification may be required. Therefore, the proposal requested should be at a budgetary level submitted for the purposes of selecting a Seller/Manufacturer to work with on these projects capable of providing the three systems required. In addition, Attachment B lists the regulatory discharge limits for regulated parameters. Data and tables presented in the body of this specification may only present limits for those parameters measured in the water sources. If additional data is obtained or the water quality changed by the

addition of treatment chemicals the regulatory limits in Attachment B (or future revisions to the Georgian regulations) prevail.

## 7.2 Project Site Conditions

**7.2.1** The following project site conditions must be taken into consideration by the Seller/Manufacturer:

- Elevation of the plant sites range from approximately 470 to 950 m above mean sea level (all Treatment Equipment should be sized based on the maximum elevation). The Seller/manufacturer is to confirm the exact location for the water treatment plant with the Owner prior to commencing detailed design;
- The expected temperature range at Site is -15°C to 40°C based on the last 10 years of data from the nearby Bolnisi weather station. The Seller/Manufacturer shall confirm this temperature range with the Owner prior to commencing detailed design. The Seller/Manufacturer must inform any winterization requirements in the proposal;
- Wind load requirement is to be determined and will be provided if necessary; and
- Seismic zone information is to be provided to the Seller/Manufacturer by the Owner.

## 7.3 Construction Features

**7.3.1** The following construction features must be provided:

- The equipment shall have all internal and external components pre-assembled to the extent possible, while still allowing for shipment to the Site;
- The equipment shall include lifting lugs or other means to lift and move equipment. Any special requirements other than a forklift for unloading and moving equipment shall be listed in the proposal;
- All components shall be fabricated, manufactured, welded, fused, glued, or otherwise connected in accordance with the Seller/Manufacturer's standard practices and processes and industry standards;
- Electrolytic action between metals and materials that are not identical shall be prevented. For connections between metals that are not identical, suitable dielectric isolation shall be provided and installed;
- The wetted parts of the equipment unit shall be constructed of materials or have coatings compatible with the water quality parameters shown in Attachment B of this Specification;
- Carbon steel equipment, frames, and skids shall have exterior surfaces prepared (painted/coated) for corrosion resistance;
- Surfaces must be clean and dry, with weld spatter, burrs, and rough spots smoothed or removed prior to painting (if applicable) or shipment;
- Ladders, platforms, and railings shall be compliant with applicable safety standards, and handrails and toe boards shall be painted yellow. Access shall be provided to all areas where regular maintenance is performed; and
- All exposed moving parts shall be provided with guards to protect personnel from contact with the moving parts. The guards shall be removable to provide access to the part for maintenance.

## 7.4 Other General Requirements

**7.4.1** The Water Treatment Systems shall be of an approved design and fabricated by a Seller/Manufacturer regularly engaged in the production of Water Treatment Equipment, with a minimum 10 years of experience. All equipment and material shall be supplied in compliance with the specifications as intended for a complete and operational system. The Seller/Manufacturer can procure treatment processes that they do not normally supply from other known manufacturers to

incorporate into a complete water treatment system. As an example the selenium biotreatment system could be procured by the Seller/Manufacturer from Suez or Frontier and incorporated into the Seller/Manufacturer's water treatment system for the WRD II & Kazretula facility.

- 7.4.2** The Seller/Manufacturer shall provide equipment that allows operational flexibility for treatment of the specified influent feed water quality range. The initial treatment concepts have been developed based on the average values of the available data, which is limited for some sources. The treatment system shall be refined based on treatability testing if necessary. There are also other water management activities that are to occur in parallel with the Water Treatment Systems that may impact some or all of the sources. Many of these activities are aimed at diverting as much clean run-off water as possible.
- 7.4.3** The Treatment Equipment must be capable of operating continuously at maximum flow and over the water quality ranges specified in Attachment B. The effluent water quality treatment targets for all parameters shall be consistently met for all conditions with minimum shut-down requirements. Any required maintenance or other activities that may cause equipment to be offline for maintenance or other purposes by the Seller/Manufacturer must be limited and an estimate must be provided in the Proposal.
- 7.4.4** While the primary treatment unit operations are focused on the removal of contaminants of concern that exceed the associated treatment targets, the design of the equipment provided shall take into account the effects of other constituents as provided in Attachment B, which may have an effect on treatment efficiency. An example includes the impact of silica concentrations on the treatment pH for the lime HDS systems that are followed by RO systems.
- 7.4.5** The Treatment Equipment must accommodate Owner initiated intermittent shut-down periods with subsequent re-start of the equipment by the Owners operations personnel. During operations, intermittent shut-down may be a few hours to a few days to accommodate other site activities, holidays, maintenance and other planned or unplanned shut-down periods.
- 7.4.6** Required maintenance of the Treatment System and long-term shut-downs (more than a week in duration) must be scheduled. Minimal start-up time of the Water Treatment Systems is desired. Any unusual shut-down and re-start procedures for proposed equipment or longer term shut down should be noted by the Seller/Manufacturer.
- 7.4.7** Interconnecting piping, valves, fitting, and controls between the major process components shall be provided by Seller/Manufacturer. If the Seller/Manufacturer does not provide interconnections, a bill of materials shall be provided by the Seller/Manufacturer to the Owners Engineer so that materials can be procured and installed to provide a fully integrated and operational system.
- 7.4.8** Any required surge tanks and associated transfer pumps need to be provided by the Seller/Manufacturer.
- 7.4.9** The Seller/Manufacturer shall provide information on the expected turn-up/turn-down capabilities
- 7.4.10** Minimal requirement for operator input to the Water Treatment Systems and more automation of the systems is desired. Seller/Manufacturers estimate of the operational labor should be provided with the proposal.
- 7.4.11** The Treatment Equipment shall operate with process support utilities (electrical power, access roads, supervisory control, and data acquisition) that are available on site and provided by Owner. Electrical power provided by owner is 400/230 volt, 3-phase, 4-wire plus ground solid, 50 Hertz.
- 7.4.12** It is expected that for the three systems at Madneuli that have RO systems that permeate can be used for any plant water requirements. The Seller/Manufacturer must confirm with the Owner that an appropriate water service line is available at the Site for diluting and blending chemicals, if required, for the Central Water Treatment System at Sakdrisi. If a potable water service line is not available, fully treated effluent from the Water Treatment System must be used for diluting and blending chemicals. If additional Treatment Equipment is required to allow the reuse of treated effluent for chemical preparation (e.g., cartridge filters), it shall be provided by the

Seller/Manufacturer and the cost for the additional equipment must be provided and approved by the Owner.

**7.4.13** Redundant equipment shall be provided for all pumps and blowers required for the Water Treatment Systems.

**7.4.14** Freeze protection for exposed piping, equipment etc. outside the building envelope shall be provided.

## 8.0 SELLER/MANUFACTURER EXCLUSIONS

**8.1.1** The following features are to be provided by the Owner:

- Building (or enclosure) and foundations to contain the Treatment Equipment with the exception of the lime silos and clarifiers (which are expected to be located outside the building envelope). The building will include heat and freeze protection is not required for Treatment Equipment within the building envelope;
- A potable water service line will be provided to the water treatment plant for dilution and blending of chemicals as needed;
- Electrical connections, as required, will be provided to the site of the water treatment plant;
- Health and safety equipment and supporting infrastructure, such as emergency showers and eyewash stations, are to comply with all local applicable codes, standards, and regulations;
- Disposal of filter cake produced by the sludge dewatering process. Owner's filter cake disposal components to receive filter cake via gravity from the filter press;
- Owner to ensure that water can be stored on-site when the water treatment plant is shut-down; and
- Raw mine water from the three sources is to be pumped and conveyed (engineered and built by others) to the Water Treatment Systems.

## 9.0 SUBMITTALS

### 9.1 Design/Construction Submittals

**9.1.1** The following information shall be submitted, as a minimum, by the Seller/Manufacturer for the Owner and Owners Engineer to review and approve before manufacturing/shipping:

- Treatability study results and basis for equipment selection and sizing;
- Process and Instrumentation Diagrams drawings: Drawings showing process flow and control scheme, including all Treatment Equipment and monitoring and control instruments;
- Arrangement Drawings: Drawings showing location, layout, and dimensions of all system components;
- Electrical and Control Drawings/Descriptions (if applicable): Drawings and/or written descriptions showing control logic, component layout, and wiring connections. Drawings shall include all pneumatic lines, components, and connections. Electrical drawings must be signed and sealed by a registered electrical engineer hired by the Seller/Manufacturer;
- Structural Drawings: Empty and operating weight data, including distribution of weight, for equipment and piping. Skid design drawings shall include member sizing and layout details. Structural drawings must be signed and sealed by a registered structural engineer hired by the Seller/Manufacturer;

- Component Information: Information including materials of construction, coatings (including colour selection), and catalogue information of major components;
- Test results, signed by the Seller/Manufacturer, which indicate the equipment is capable of handling specified influent and effluent water conditions; and
- Calculations showing the effective settling area, neutralization capacity, or other similar calculations that may be required to determine the size and number of units required.

**9.1.2** Seller/Manufacturer's standard Operations and Maintenance (O&M) Manuals shall be provided at time of equipment shipment to be reviewed by the Owners Engineer. The O&M Manual will be prepared in English. At a minimum the O&M Manual shall include:

- System operation;
- Long-term and short-term shut-down procedures;
- Start-up procedures after long-term and short-term shut-downs;
- Cleaning procedures;
- Troubleshooting;
- Routine maintenance procedures including calibration requirements;
- Listing of common spare parts, priced;
- Estimated chemical consumption and waste generation;
- Estimated power requirement and energy consumption;
- Estimated O&M cost estimate; and
- Appendices containing O&M Manuals of ancillary equipment suppliers.

**9.1.3** Project bill of materials, including mechanical and electrical components utilized, shall be provided at time of Treatment Equipment shipment.

**9.1.4** Installation instructions and a listing of any special tools required for installation shall be provided at time of shipment.

## **9.2 Quality Control Submittals**

**9.2.1** Seller/Manufacturer shall submit documentation regarding their quality control procedures and standard practices to assure that Treatment Equipment is shipped in good working order.

**9.2.2** Seller/Manufacturer's documentation of inspection and test results (if any) shall be submitted at time of Treatment Equipment shipment.

**9.2.3** Seller/Manufacturer's documentation of leak testing of piping and equipment, as appropriate, shall be provided at the time of Treatment Equipment shipment.

**9.2.4** Certificate of Conformance Statement indicating that the equipment supplied meets the requirements of the Specification shall be submitted at time of Treatment Equipment shipment.

**9.2.5** Welding must be done in accordance with local codes and standards to prevent steel corrosion. Welding and passivation must be carried out by the manufacturer. All welders are to be certified

and fully qualified in welding procedures required for the materials welded. Welders Certificate must be provided and the certification must meet the level of work to be undertaken.

### **9.3 Field Quality Control and Inspection Submittals**

**9.3.1** All equipment provided by the Seller/Manufacturer that is designed to contain liquid must be leak tested per European standard leak testing procedures.

**9.3.2** No other inspections or tests (except for leak testing) are specifically required by the Owners Engineer. However, the Seller/Manufacturer is expected to have and follow an internal quality control plan detailing appropriate inspections, standards, and tests to ensure that equipment performs as intended and is in good working order when shipped. The overall objective is to ensure a quality end product that meets or exceeds the intent of this Specification.

**9.3.3** The Owners Engineer and Owner reserve the right to inspection and surveillance at any time prior to equipment shipment. Surveillance of the Seller/Manufacturer's work may be monitored by Owners Engineer personnel to monitor or observe an activity and verify that the activity conforms to the specified requirements.

### **9.4 Warranty and Process Guarantee Submittals**

**9.4.1** Seller/Manufacturer shall provide a submittal that provides a warranty for materials to be free from defects for a period of one year from purchase. Any corrective measures required during the initial lease or purchase period will be at the Seller/Manufacturer's expense.

**9.4.2** Seller/Manufacturer shall provide a submittal that provides a guarantee that the equipment will operate at the range of conditions described in Section 2 and Attachment B and meet the performance requirements in this specification when the unit is properly operated. The process guarantee is subject to treatability studies to be conducted by the Seller/Manufacturer.

## **10.0 DELIVERY, STORAGE AND HANDLING, AND FIELD SERVICE**

### **10.1 Packing and Shipping**

**10.1.1** Components of the construction phase Water Treatment Systems shall be delivered assembled by the Seller/Manufacturer to the extent possible. Alternatively, the components (including any loose components) of the equipment shall be crated in a structurally adequate packing container by the Seller/Manufacturer, to prevent damage during shipping on an international freighter and to facilitate ease of handling.

**10.1.2** For the purposes of the quotation and proposal, the Seller/Manufacturer shall provide in their proposal the approximate freight costs from the Seller/Manufacturer's facility to the Site. The Seller/Manufacturer shall be responsible for loss or damage of merchandise while shipment is in the possession of the carrier and until it is delivered and unloaded at the Site.

**10.1.3** Seller/Manufacturer will use equipment and tools suitable for unloading, transporting, storing, and supporting the equipment during installation. Caution will be employed to prevent equipment damage resulting from abrupt contact with other materials or equipment.

### **10.2 Acceptance at Site**

**10.2.1** Owner shall be responsible for loss or damage once the Water Treatment System has been Verified To Meet The Requirements In This Specification.

### **10.3 Storage and Protection**

**10.3.1** The equipment shall be stored and protected from the weather, in accordance with the Seller/Manufacturer's recommendations.