MEMORANDUM

DATE: September 19, 2019

TO: File

FROM: EM Strategies, Inc.

SUBJECT: Grassy Mountain Mine Project; Cyanide Transportation

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Cyanide transporters are expected to comply with the International Cyanide Management Code (ICMC) for transport, as well as in the event of a release or spill, and with the Federal Motor Carrier Safety Administration's regulations for routing of hazardous materials on public highways (49 CFR Part 397). Cyanide will be delivered to the Project in dry form by truck from Winnemucca, Nevada. The ICMC's principle for cyanide transportation is to protect communities and the environment during cyanide transport. The ICMC also establishes the following standards of practice for cyanide transportation: 2.1) Establish clear lines of responsibility for safety, security, release prevention, training and emergency response in written agreements with producers, distributors and transporters; and 2.2) Require that cyanide transporters implement appropriate emergency response plans and capabilities, and employ adequate measures for cyanide management (International Cyanide Management Institute [ICMI] 2019).

Additional information on cyanide management is in the attached Cyanide Management Plan.

Reference

International Cyanide Management Institute (ICMI). 2019. *International Cyanide Management Code*. https://www.cyanidecode.org/about-cyanide-code/cyanide-code. Accessed September 19, 2019.

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Cyanide Management Plan May 2019

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Revision Status

Revision	Date	Description	Author		Approver	
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A	November 1, 2018	Issued for Internal Review	Paul Seguin	Process Engineer	Thomas Mills	Project Engineer
B	May 8, 2019	Re-Issued for Internal Review	Thomas Mills	Project Engineer	Ruth Sherrit	Director, Process and Commissioning
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1 Introduction

The International Cyanide Management Code 2009 (Code) is an industry voluntary program for cyanide producers and cyanide consumers, such as mining companies. It focuses on the safe management of cyanide and cyanidation mill leach solutions and tailings. Companies that adopt the Code must have their mining operations that use cyanide audited by an independent third party to determine the status of Code implementation. Those operations that meet the Code requirements can be certified and a unique trademark symbol can then be utilised by the certified operation. Audit results are made public to inform stakeholders of the status of cyanide management practices at the certified operation.

The objective of the Code is to improve the management of cyanide used in gold mining, assist in the protection of human health and the reduction of environmental impacts. The Code is structured along nine Principles each with standards of practice. The Principles are:

Principle 1:	Production
Principle 2:	Transportation
Principle 3:	Handling and Storage
Principle 4:	Operations
Principle 5:	Decommissioning
Principle 6:	Worker Safety
Principle 7:	Emergency Response
Principle 8:	Training
Principle 9:	Dialogue

For the Grassy Mountain PFS, preliminary plant layout designs have been developed. The design of cyanide facilities is aligned with the guidelines of the cyanide code. However, given the preliminary nature of the study, it is recognised that many of the specific cyanide code compliance actions will require further definition in subsequent phases of the project. Further, in line with the natural progression of project development it is required that project specific cyanide handling and storage design criteria as well as the specific operating procedures required by the cyanide code are developed during future phases of the project.

2 Battery Limits

The battery limits of Ausenco's scope on the Grassy Mountain PFS for the process and engineering design for the cyanide systems are:

- receipt of cyanide from the supplier into the cyanide storage area at site
- detoxification and discharge of tailings into the Tailings Storage Facility

The process and engineering design within the battery limits is impacted mainly by the following principles from the Code, and their accompanying standards of practice:

- Principle 3: Handling and Storage
- Principle 4: Operations

This report section deals with the implementation of elements in Principles 3 and 4 of the Code and describes the aspects from the Code which have been incorporated in the preliminary plant design.

3 Principle 3: Handling and Storage

3.1 General

The objective of Principle 3 in the Code is to "protect workers and the environment during cyanide handling and storage." Two standards of practice and accompanying guidelines are provided; the standards are:

Standards of Practice:

3.1 the design and construction of unloading, storage and mixing facilities

3.2 the operation of the unloading, storage and mixing facilities

The delivery of bulk cyanide is expected to be in dry form and will be supplied as 1 tonne bulk bags packed in wooden crates. The crates will be stored in a fenced and secured area. The cyanide is dissolved in water in an agitated mix tank after which the solution gravitates into a storage tank.

3.2 Reagent Receipt, Mixing and Storage – Application of the Code

"Standard of Practice 3.1 Design and construct unloading, storage and mixing facilities consistent with sound, accepted engineering practices and quality control and quality assurance procedures, spill prevention and spill containment measures."

Sodium cyanide is delivered to site in solid form (briquettes) packed in 1T bulk bags, with each bag packed in a wooden crate. The crates will be stored on site at the cyanide mix and storage area, which will be completely fenced and secured. The nominal amount of cyanide stored on site will be 8 tonnes, which will supply a 2-4 week operational reserve. This is the only area where cyanide is stored. The reagent area will be covered, but open to the air providing adequate ventilation to prevent the potential build-up of HCN vapours. The cyanide mixing and storage area is placed on an impervious concrete slab with bund walls providing 110% containment to prevent any potential seepage, giving due consideration to the potential reduction of containment volume form pumps or other equipment installed within the containment. A hydrogen cyanide (HCN) analyser is located in the mixing and storage area. The HCN analyser will activate local audible and visual alarms and alarms on the control system in the event that HCN gas is present.

The cyanide mix and storage area is a relatively "low- traffic" part of the site with respect to personnel movements. The mix area is readily serviced from a perimeter plant site road. Compatible reagents, sodium hydroxide and lime slurry, will share the same mixing area and containment structure (alkaline reagent area).

Incompatible reagents on the site include hydrochloric acid, sodium metabisulphite (SMBS), and copper sulphate. These reagents are potentially hazardous if mixed with cyanide as it may result in the evolution of hydrogen cyanide gas. Cyanide and incompatible reagent lines will not intersect or pass over each other and will not run over or through incompatible areas.

The copper sulphate and SMBS mixing and storage area (acidic reagent area) is separate from the alkaline reagent area, placed on an impervious concrete slab, and contains adequate bunding for 110% containment.

The HCL system is limited to a tote and dilute acid mixing tank, and the resulting solution is dosed directly into the acid wash column. The acid was column and HCL system are in a dedicated bunded acid wash area with an acid wash area sump pump. Cyanide lines will not pass through or over this area, and HCL lines will not extend beyond the bunded area.

Reference: 101768-0000-G-108 Desorption and Regeneration Area General Arrangement

101768-0000-G-110 Reagents Area General Arrangement (See Appendix 1)

101768-0000-F-010 Alkaline Reagents Process Flow Diagram

"Standard of Practice 3.2 Operate unloading, storage and mixing facilities using inspections, preventive maintenance and contingency plans to prevent or contain releases and control and respond to worker exposures."

Prior to removing cyanide from storage and performing the mixing process, operators will be fully trained and equipped with the minimum following PPE:

- Hardhat
- Full face respirator
- Rubber gloves
- Chemical resistant suit
- Rubber boots
- Personal HCN gas monitor
- Hearing protection

Cyanide solution is prepared in a semi-automated system that consists of a bag breaker chamber, agitated mix tank and storage tank. Prior to the start of the mixing procedure the area will be roped off and appropriate warning signage will be in place. Due to the sensitivity of the operation, a second operator will be assigned to monitor the operator performing the mixing procedure to provide assistance in the event of an emergency. The operator hoists the bulk bag into a bag breaker chamber from where the briquettes gravitate into an agitated mix tank. A dust collector maintains a negative pressure during the bag breaking process to control any cyanide dust generated, and water is used to dissolve the briquettes. As a safety precaution a provision is made in the design to increase the pH by dosing sodium hydroxide in the mix tank thus preventing HCN evolution. The tank levels will be monitored via the control system, and a level alarm will be installed to prevent overfilling of the tank. The water addition to the mix tank and transfer of the mixed cyanide solution to the storage tank will be controlled via the control system. A level alarm will be installed on the sump to indicate any spillage. All valves associated with mixing and storage will be automated and fail in the safe position. A safety eyewash/shower station will be installed in bund area and mixing platform.

After completion of bag cutting and emptying operations, the bag will be rinsed using a water spray arrangement integrated with the bag cutter, and all rinseate will report directly to the mix tank. Empty

rinsed bags and all associated packing materials will be collected and transported to a securely fenced area for disposal. Recycling or re-use of any cyanide packaging materials will be prohibited and will be removed and disposed of by the reagent supplier. Following mixing, the cyanide solution will flow via a transport pump to the cyanide stock tank. All piping will be socket weld stainless steel, with double block and bleed isolation.

4 Principle 4: Operations

4.1 General

The objective of Principle 4 in the Code is to "manage cyanide process solutions and waste streams to protect human health and the environment". Nine standards and accompanying guidelines are provided; the standards are summarised below:

Standards of Practice:

4.1 Set-up and management of an operating system and its controls

4.2 Systems to minimise the use of cyanide

4.3 Water management system to protect against unintentional releases

4.4 Protection of avian and land-based wildlife, and livestock

4.5 Protection of aquatic wildlife

4.6 Manage seepage and influence on groundwater

4.7 Spill prevention and containment measures

4.8 QC/QA procedures on construction of facilities and standards and specifications adopted

4.9 Monitoring programmes for wildlife and system waters

Cyanide process solutions and slurries are defined where the weak acid dissociable (WAD) cyanide concentration is greater than 0.5 mg/L.

4.2 Operations - Applications of the Code

"Standard of Practice 4.1 Introduce management and operating systems to minimize cyanide use, thereby limiting concentrations of cyanide in mill tailings."

In the leach train cyanide solution is added to the first two tanks to ensure efficient use of the cyanide, mitigating the risk of overdosing cyanide. Vendor supplied cyanide analysers (titrator type) measure the free cyanide concentration in the first and last CIL tank, and alarms if outside of target range. The cyanide analyser controls sodium cyanide addition to the first CIL tank. Further addition of trim cyanide addition to the second tank is by manual adjustment, by the leach area process operator, if the free cyanide concentration is manually measured to be below target.

"Standard of Practice 4.2 Implement management and operating systems designed to protect human health and the environment including contingency planning and inspection and preventive maintenance procedures."

Lime is added to the pre-aeration tank to achieve a suitable pH level in the pulp and to minimise the potential hydrolysis of sodium cyanide to form unacceptable levels of hydrogen cyanide gas (HCN). A pH control system is installed on each circuit (pre-aeration and leach) with interlocked control valves. The pH of the slurry in the first two tanks is measured with dual in-line pH meters. The output signals from the pH transmitters feedback to a PID controller which regulates the lime dose rate to the pre-aeration tank to achieve a pre-set pH value in the leach tank. Separate manual valves off the lime ring main will be available for manually dosing in the leach tanks from the field.

Hydrogen cyanide (HCN) analysers will be located in the CIL area. The HCN analysers will activate local audible and visual alarms and alarms on the control system in the event that HCN gas is present. Personal cyanide monitoring devices will be provided to personnel working in the leach and CIL area. Clear and unambiguous signs and safety eye-wash/shower stations will be provided at key locations in areas of regular worker activities.

"Standard of Practice 4.3 Implement a comprehensive water management program to protect against unintentional releases."

All cyanide containing vessels will be located on impervious concrete slabs and bunded to provide 110% containment of the largest vessel. In the event that a spill or release occurs outside the bunded catchment areas, site grading and ditching has been designed such that all contact water flows to a collection pond. The collection pond will be double lined to prevent any seepage to the environment and will be reclaimed back to the process when necessary. Additional information on the water management plan can be found in Appendix C of the Consolidated Permit Application.

"Standard of Practice 4.4 Implement measures to protect birds, other wildlife and livestock from adverse effects of cyanide process solutions."

Reference Appendix I – Wildlife Mitigation Plan.

"Standard of Practice 4.5 Implement measures to protect fish and wildlife from direct and indirect discharges of cyanide process solutions to surface water."

Reference Appendix I – Wildlife Mitigation Plan.

"Standard of Practice 4.6 Implement measures designed to manage seepage from cyanide facilities to protect the beneficial uses of ground water."

All cyanide storage, mixing, leach, CIL and detox tanks will be installed on cast in-situ concrete slab-on-grade (impervious to prevent seepage). All CIL tailings will be treated in the cyanide destruction circuit before the tailings slurry is pumped to the TSF. In accordance with the Code, the discharge of detoxified slurry complies with the "not to exceed 50 mg/L (ppm) CNwad" criteria at the point of discharge into the TSF. It is recognized that the "not to exceed" limit for Oregon is 30 mg/L (ppm). The proven and effective air/SO_2/Cu^{2+} process is selected for this cyanide destruction duty.

The CIL tails overflow the last CIL tank and pass through a carbon safety screen before entering the cyanide detox tank where sodium metabisulphite (SMBS) and copper sulphate will be added. Low-pressure air is sparged to aid the oxidation of cyanide to cyanate, and lime is dosed to maintain the pH. Detoxified slurry overflows the detoxification reactor through a tailings sampler before gravitating to the tailings pumpbox. The tailings discharge line out of the process plant bund will be double contained with leak detection to alert pipeline failure or spillage.

Reference: 101768-0000-G-107 CIL Area General Arrangement

"*Standard of Practice 4.7 Provide spill prevention or containment measures for process tanks and pipelines*."

The CIL tanks will be installed on cast in-situ concrete slab-on-grade (impervious to prevent seepage). The slab supporting the tanks is part of the containment slab but 300 mm higher, in octagonal shape and placed monolithically with the containment slab. The slab has the same construction as the typical slab-on-grade, with 50 mm Styrofoam underside to provide insulation, 150 mm drain rock underneath the Styrofoam, and structural fill below down to the firm load bearing strata. The CIL area bunded volume is sufficient to contain 110% of the live volume of the largest tank, giving due consideration to rainfall and to the potential reduction of containment volume form pumps or other equipment installed within the containment. Floor sump pumps in the area return any spillage to the circuit for re-processing. Cyanide piping will be socket welded stainless steel, with double block and bleed isolation.

Reference: 101768-1200-C-102 CIL Area Containment General Arrangement

"Standard of Practice 4.8 Implement quality control/quality assurance procedures to confirm that cyanide facilities are constructed according to accepted engineering standards and specifications."

Reference: Appendix AA – Quality Assurance Plan

"Standard of Practice 4.9 Implement monitoring programs to evaluate the effects of cyanide use on wildlife, surface and ground water quality."

Reference: Appendix G – Monitoring Plan

Appendix 1 – Reagent Mixing and Storage Area