D R A F T R E P O R T

WOLVERINE ADVANCED EXPLORATION PROJECT ARD/ML ASSESSMENT WORKPLAN

Prepared for

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1.0 INTRODUCTION

1.1 INTRODUCTION

As part of the Environmental Assessment for Yukon Zinc Corporation's (YZC) Wolverine Project, YZC is required to conduct an Acid Rock Drainage and Metal Leaching (ARD/ML) Assessment. URS has prepared this Workplan to address this requirement, and to address recommendations provided by the Yukon Government in response to the Wolverine Project Description Report submitted by YZC in November 2004.

YZC is currently conducting an advanced exploration program at the Wolverine Project. This program includes a Rock Sampling and Testing Program to determine the geochemical characteristics of rocks excavated during the advanced exploration program. The scope of this work has been included in this Workplan.

1.2 PREVIOUS WORK

A limited number of acid-base accounting (ABA) and kinetic tests were completed on selected drill core samples for the Wolverine Project by Westmin Resources in 1996. At the time, the samples were selected to be representative of the various rock types encountered at the site in the hangingwall rocks.

A review of the ABA results for the hangingwall rock samples indicated that, in addition to the ore, a proportion of the waste rock has the potential to generate acidic drainage.

Two kinetic test samples of composited hangingwall rocks were conducted over a 26 week period. The results indicated that carbonate minerals are likely responsible for the neutralization potential of the waste rock. It was concluded that there will likely be a significant lag time before drainage from the waste rock becomes acidic. Metal analyses conducted on the humidity cell rinse water suggested that drainage from the waste rock may contain elevated levels of aluminium, manganese, strontium, and zinc.

The static and kinetic waste characterization studies focussed on the rhyolite and argillite units in the hangingwall. The iron formation in the hangingwall was not represented in the waste characterization data. Geochemical data from the iron formation shows greater amounts of carbonate minerals present than the rhyolites and argillites. This formation is likely to have some neutralizing capacity and will constitute a portion of the waste rock developed.

2.0 GEOLOGICAL AND MINERALOGICAL DESCRIPTION

2.1 DEPOSIT GEOLOGY

The Wolverine Deposit and its host stratigraphy belong to the middle unit of the Layered Metamorphic Package (LMP); which is composed of (1) a lower Devonian and older quartz-mica±garnet schist and quartzite package with an upper marble/calcareous schist unit, (2) a middle dark siliceous to carbonaceous phyllite unit interlayered with mafic to felsic volcanic rocks of Devonian to mid-Missippian-age, and (3) an upper white carbonate/quartzite package of early Pennsylvanian to Permian-age. The host stratigraphy can be traced along the northeastern side of Wolverine Lake to the southeast for more than 20 kilometres. It comprises an upright east-facing volcano-sedimentary sequence locally intruded by feldspar porphyritic subvolcanic intrusions.

In the vicinity of Wolverine Lake, the middle unit is comprised of a complex sequence of carbonaceous and tuffaceous sedimentary rocks, rhyolitic, volcanic and volcaniclastic rocks, hypabyssal intrusive rocks and several facies of banded iron formation (oxide and calcareous). Andesitic to basaltic rocks structurally overlying the felsic-sedimentary rock package is of uncertain affinity. On a more regional scale monzonitic orthogneiss outcrops to the south, and Carboniferous-Permian serpentinized (magnetite-bearing) ultramafic rocks are exposed to the north.

The Wolverine ore sequence comprises the volcano-sedimentary sequence above the footwall phyllite and below the overlying andesite. The ore sequence is a complex interval made up of carbonaceous sedimentary units, felsic volcaniclastics, argillaceous volcaniclastics, rhyolite volcanic and volcaniclastic rocks, and feldspar-quartz phyric rhyolite volcanic rocks, and subvolcanic intrusions. The massive sulphide horizon lies in the lower portion of the ore sequence. Situated above the massive sulphides are both calcite-pyrite exhalites and two or more intervals of banded magnetite iron formation (Figure 3.9).

The Wolverine Deposit consists of two stratabound lenses of massive sulphide mineralization, the Wolverine and the Lynx Zones, having a combined strike length of 800 metres and a dip length of up to 500 metres (Figure 3.10). The main massive sulphide lens in the Wolverine and Lynx zones are thought to form a contiguous tabular body referred to as the Main Lens. The Main Lens in each of the zones has a thicker core flanked by thinner massive sulphide material. In approximately 14 drill holes there is an upper lens referred to as the Upper West Lens. The Main and Upper lenses have an average true thickness of 5.1 metres, with a maximum thickness of 12.98 metres.

The deposit dips moderately to the northeast at a dip of 25 to 45 degrees. Trenching in the early 1980's in this location identified chlorite-sericite schists with narrow veinlets of copper and zinc mineralization.

The detailed stratigraphic succession of the Wolverine Zone is very similar throughout the deposit to both the east and west.

In the Wolverine area surficial geology units include morainal blankets, slopes of mixed colluvium and morainic sediments and fluvial deposits.

2.2 DEPOSIT MINERALOGY

The massive sulphide mineralization is composed mainly of pyrite, sphalerite, chalcopyrite, galena, pyrrhotite and tetrahedrite with minor amounts of other sulphosalt minerals and minor free gold. The massive sulphide mineralization may contain up to 75% sulphide minerals with quartz and carbonate gangue; although sulphide minerals generally compose about 50% of the massive sulphides.

3.0 CHARACTERIZATION PROGRAM DESIGN

3.1 OVERBURDEN

Borrow material will be used in the mine development and operation, including potential use as backfill material in the underground workings.

3.2 WASTE ROCK

Waste rock production from the Wolverine underground mine during the production phase will be very limited. Most of the underground workings will be developed in ore grade materials and therefore almost all of the rock produced from the Wolverine Mine will be processed in the mill. Any waste rock that is segregated from the ore material will remain underground and be placed with backfill in mined out areas. During the early stages of development, approximately 70,000 tonnes of waste rock will be generated during development of the access ramp and declines. Preliminary results suggest that some of this material may be potentially acid generating (PAG). Therefore, this material will be stored on surface and segregated into PAG and non acid generating (NAG) rock in a temporary facility. PAG rock will be redeposited underground as backfill at the earliest opportunity.

3.3 TAILINGS

The tailings from the Wolverine mill are anticipated to be susceptible to acid generation due to their high sulphide content. In order to limit acid development potential from the tailings mass, permanent underwater (saturated) disposal of tailings in a constructed impoundment will be used for permanent storage. A minimum water cover depth of 0.5 m will be maintained on the tailings, with depths of up to 2 m at the deepest points.

3.4 MINE WORKINGS

The deposit is located near surface and access will be by means of a decline ramp. The decline will intersect the hangingwall of the Wolverine Zone at approximately 1,750 m elevation, where it will follow the hangingwall down-dip. Access to both the Wolverine and Lynx Zones can be achieved at any elevation from this main ramp.

The most suitable method for mining the Wolverine deposit is a combination of mechanized, overhand cut-and-fill and drift-and-fill. In shallower dipping sections of the deposit, this technique will closely resemble drift-and-fill stoping. The poor quality of the hanging wall rock will require that all mined openings be backfilled.

3.5 MINE CLOSURE

Closure of the tailings facility will include treatment and release of remaining supernatant followed by reestablishment of natural drainage patterns, directing surface runoff into the tailings facility. The tailings mass will be flooded with fresh water to the design capacity of the dam. A spillway designed to handle a

1 in 1,000 year flood will built from the southwestern end of the tailings facility. Monitoring of tailings water and seepage quality will be carried out during the closure phase. The water treatment plant will continue to operate until such time as water in the tailings facility and seepage collection facility are suitable for direct release to the environment.

Closure of underground operations at Wolverine will include plugging the main access adit and vent raises. The main portal will be blasted shut and the mine workings will be left to flood as the groundwater surface returns to pre-mining levels.

3.6 PROGRAM DESIGN

Based on the proposed mine plan, a successful ARD/ML characterization and prediction plan will include the following components:

Overburden

- Static characterization of all proposed borrow materials, including acid-base accounting, sulphide and carbonate mineralogy, elemental composition (including Hg and Se) and leachate quality.

Waste Rock

- Static characterization of all rock types in the deposit, including acid-base accounting, sulphide and carbonate mineralogy, elemental composition (including Hg and Se) and leachate quality,
- Classification of the ARD/ML characteristics of the deposit, either by rock type, alteration type, or both,
- Kinetic testing of the deposit rocks to determine their weathering characteristics, both as waste rock stored on surface and as wall rocks exposed within the mine workings, and
- Prediction of leachate water quality from temporary storage of waste rock on surface.

Tailings

- Static characterization of the tailings, including acid-base accounting, sulphide and carbonate mineralogy, elemental composition (including Hg and Se) and leachate quality,
- Kinetic testing of the tailings to determine their weathering/leaching characteristics, both as exposed tailings and as subaqueous deposits within the tailings impoundment, and
- Prediction of the tailings impoundment water quality, both for the water cover and as potential seepage during operation and post-closure,

Mine Workings

- Assessment of the ARD/ML characteristics of the mine surfaces, using the waste rock database,
- Assessment of the backfill ARD/ML characteristics, using simulated backfill mixtures of tailings, overburden and waste rock, and
- Prediction of mine water quality, including both the operational water quality and the stable mine pool following flooding of the workings.

4.0 SAMPLE COLLECTION AND ANALYSIS

This section contains the details of the proposed sample collection and analysis methods to be used for the Wolverine ARD/ML Assessment. Methodologies described in this section are based on accepted methods described in the *Draft Guidelines and Recommended Methods for the Prediction of Metal Leaching and Acid Rock Drainage at Minesites in British Columbia* (Price, 1997).

4.1 SAMPLE COLLECTION

4.1.1 Overburden

Samples from proposed borrow areas and other areas where overburden will be exposed during mine construction will be collected. The samples will be collected from test pits and/or boreholes during the course of geotechnical investigations planned for 2005. Representative samples weighing from 2 to 5 kg will be collected, depending upon the grain size of the materials. At present, it is estimated that 5 samples will be collected for analysis.

4.1.2 Rock

Rock samples will be collected from core collected as part of the 2005 drill program. Discrete samples representing individual rock types will be collected by YZC geologists. The samples will be selected to represent the different volumes of rock types found within the deposit, with a minimum of three samples per rock type. Samples for the ARD/ML Assessment will be collected from the same intervals as those used for the standard geochemical analyses performed during the exploration program. Representative samples weighing approximately 2 kg will be collected from splits of the core. The samples will be selected and collected by the YZC site geologist in consultation with URS. The samples will be shipped using the accepted QA/QC protocols to an accredited commercial laboratory for analysis.

A limited volume of waste rock will be produced and stored on surface during mining (70,000 tonnes). Most of the workings development will take place in ore-grade materials which will be shipped to the mill for processing. At present, it is expected that approximately 50 samples, representing the waste rock and rock types exposed within the workings, will be collected for analysis.

4.1.3 Tailings

Samples of tailings produced from pilot plant testing will be submitted for static and kinetic testing. Samples will be kept refrigerated until testing commences. Depending upon the batch testing completed, multiple samples of tailings representing different process methods may be available for static and kinetic testing. The tailings will also be combined with waste rock and overburden to simulate various backfill types proposed for deposition underground.

4.2 STATIC GEOCHEMICAL METHODS

4.2.1 Acid-base Accounting

Acid base accounting (ABA) will be used to evaluate the acid generation potential of the materials. The modified Sobek method will be used and will include sulphur speciation (total sulphur, sulphate sulphur and sulphide sulphur by difference) and carbonate speciation (neutralization potential and carbonate neutralization potential).

4.2.2 Elemental Composition

Elemental composition of the samples will be determined using an aqua regia digest followed by ICP-MS analysis. The resulting data will provide low level detection limits for approximately 30 elements. Additional analyses will be done on the samples for low-level selenium and mercury using element-specific methods.

Results from the elemental composition will be compared with ABA testing results to determine correlations between neutralization potential (NP) and calcium and magnesium contents of the rocks. Potential correlations between sulphur species and other elements (i.e. Fe, Zn, etc.) will also be examined. Significant correlations may indicate that element concentrations can be utilized to classify the acid generation and/or neutralization capacity of the rock types. These correlations could be applied to the extensive rock geochemical database to map out volumes of potentially acid generating (PAG) and non acid generating (NAG) rock.

4.2.3 Mineralogy

Representative rock and tailings samples will be analysed using the Reitveld XRD method. This method provides quantitative measurement of the mineralogical composition of a material to a detection limit of approximately <1%. These analyses will give detailed information on the form and content of sulphides, carbonates and other minerals that compose the rock and tailings.

The mineralogy of the rock samples will also be assessed from the results of core logging and thin section microscopic work carried out as part of the exploration program.

4.2.4 Shake Flask Tests

Samples of waste rock, tailings and overburden will be tested for leachable metals using a shake flask testing method such as the SWEP or TCLP test. The results from these tests will be used to assess the proportion of readily soluble metals in the samples.

4.3 KINETIC GEOCHEMICAL METHODS

4.3.1 Humidity Cells

Standard humidity cells will be used to test samples of rock and tailings. One cell will be set up for each of the 5 rock types in the deposit, and one tailings cell will be initiated. In addition, cells will be established to simulate the weathering of backfill using blended composites of tailings, waste rock and/or

overburden. These cells will be operated for a minimum period of 20 weeks, or until stable leaching rates are observed.

Results from the waste rock humidity cells will be used to estimate the leachate quality from the temporary storage pad, and from rock exposed in the mine workings. The data will also be used to determine the potential lag times until acid generation in the various rock types.

The tailings humidity cell results will be used to predict the weathering characteristics and leachate quality of exposed (beached) tailings. Results from the backfill humidity cells will be used to simulate the in-situ oxidation of backfill prior to flooding at mine closure.

Leachates from the humidity cells will be analysed weekly for pH, sulphate, conductivity, acidity, alkalinity and metals, including low level selenium and mercury.

4.3.2 Column Tests

Two types of column test will be used: subaqueous columns containing tailings, and trickle leach columns containing simulated backfill. The subaqueous tailings columns will be used to simulate the potential leaching from tailings that are deposited below water level in the impoundment. The trickle leach columns will be used to simulate the water quality of leachate discharging from backfill stored underground prior to the flooding of the underground workings.

Leachates from the columns will be analysed weekly for pH, sulphate, conductivity, acidity, alkalinity and metals, including low level selenium and mercury.

4.3.3 Field Tests

During the 2005 exploration program, bulk samples of waste rock from the exploration adit development will be placed in constructed field test pads. Leachates from the waste rock will be collected and analysed as part of the on site water quality monitoring program. The leachates will be analysed for pH, sulphate, conductivity, acidity, alkalinity and metals, including low level selenium and mercury. These data will be compared to the results of the humidity cell testwork to correlate laboratory weathering and leaching characteristics with observed field characteristics.

4.4 QUALITY CONTROL

Quality control will be achieved by using standard environmental and mineral exploration sample handing protocols. Replicate samples will be collected in the field every 10 samples. Samples will be numbered using the projects sample numbering scheme using a unique number not related to the sample. Samples will be shipped separately from the exploration samples to an accredited environmental laboratory for processing and analysis.

5.0 ASSESSMENT RESULTS AND DELIVERABLES

A detailed ARD/ML Assessment report will be produced to support the Environmental Assessment. Key elements of the ARD/ML Assessment were described in Section 3.6. Subjects that will be discussed in the report include:

- Mineralogical composition / speciation of rock and tailings,
- Static characterization and classification of all rock, tailings and overburden.
- Kinetic testing of all rock types and tailings to simulate operational and post-closure conditions,
- Prediction of leachate water quality and lag time to acid generation for rock and tailings, and
- Development of operational and post-closure water quality models for the mine workings and tailings pond.

Testing methodologies and all laboratory results will be included in the report. A final report will be submitted to the Yukon Government as part of the supporting documentation to the Environmental Assessment.

6.0 REFERENCES

Price, Dr. William A. April 1997, DRAFT Guidelines and Recommended Methods for the Prediction of Metal Leaching and Acid Rock Drainage at Minesites in British Columbia, Reclamation Section, Energy and Minerals Division, Ministry of Employment and Investment.

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DRAFT REPORT

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