

GROUND WATER DISCHARGE PERMIT UGW350008
STATEMENT OF BASIS

Kennecott Utah Copper Smelter

November 2013

Description of Facility and Background Information

Kennecott Utah Copper LLC operates a modernized smelter facility located on State Highway 201 between the towns of Lakepoint and Magna. The Smelter is located on a tract of land encompassed in Sections 16, 17, 20 and 21 Township 1 South, Range 3 West, Salt Lake Base and Meridian. (112° 11' 47" W. Long. and 40° 43' 27" N. Lat., USGS 7.5 minute quadrangle Farnsworth Peak, Utah 1972)

Three different smelters designed to process copper ore concentrates have operated continuously at this location since 1906. The latest smelter was brought on-line in June 1995 and utilizes Outokumpu flash smelting technology. The ore concentrates are melted in a high-temperature process to burn off sulfur and further separate metals from non-economic minerals. The products produced are copper anodes, precious metals, and sulfuric acid (from the off-gases in the furnaces). By-products produced by the Smelter include slag, flue dusts, As/Cd cake, stack gases, and process water.

Kennecott has incorporated environmental monitoring programs to reflect system changes made to the Smelter. For compliance purposes, this permit utilizes operational monitoring and leak detection systems for process water ponds and sumps, and ground water monitoring wells. The Quarterly Inspection Form is used to document routine inspections and copies of the records are kept at the Environmental Record Keeping Center. Compliance documents required by this ground water discharge permit are submitted semi-annually to the Utah Division of Water Quality.

Site Hydrogeology

The smelter site is located at the north end of the Oquirrh Mountains. Subsurface soils consist primarily of unconsolidated sediments of Tertiary and Quaternary age. As a result of the historic changes in water levels of Lake Bonneville a complex sequence of deltaic sand and clay, beach sands and gravels, and lake clay have been deposited at this site. In addition the soils in the central part of the smelter site, adjacent to Kessler Canyon, are characterized by heterogeneous mudflow sequences apparently in response to major precipitation/runoff events from the Oquirrh Mountains. These soils include mixtures of fine and coarse gravels and cobbles in fine-grained silt and clay matrices. Gravel fractions are typified by limestone and dolomite. Three aquifer systems exist in the vicinity of the Smelter: the Bedrock Aquifer system associated with the Oquirrh Mountains, the confined Principal aquifer, and the unconfined Shallow Aquifer.

The Bedrock Aquifer system associated with the Oquirrh Mountains is comprised of highly fractured Paleozoic carbonate rocks. Recharge to this system is primarily from precipitation on the mountains to the south. The flow path through this aquifer moves from the bedrock system into the Principal and Shallow Aquifers or is discharged as spring water along bedrock contacts at the base of the mountains. Water quality of the Bedrock Aquifer system is generally good with total dissolved solids (TDS) values typically less than 2000 mg/l.

The Principal Aquifer is a confined system that includes a gravel zone and lacustrine deposits. The gravel zone was most likely derived from the local mountains during an extensive low lake cycle. The lacustrine zone consists of clay, silt and interbedded fine sand. The ground water flow direction for this aquifer is northerly

toward the Great Salt Lake. Sediments overlying the Principal Aquifer are relatively low in vertical hydraulic conductivities and created confined conditions in the underlying Principal Aquifer. Wells completed in the upper portion of the Principal Aquifer show an upward vertical hydraulic gradient. The average horizontal hydraulic conductivity of the Principal Aquifer is 4×10^{-7} cm/sec based on three wells. Water quality in the Principal Aquifer is similar in some respects to the Shallow Aquifer in that it is quite variable across the permit area. TDS concentrations vary from 1,355 to 4,420 mg/l. Concentrations of arsenic, selenium, and cadmium that exceed Utah Ground Water Quality Standards have been observed in the Principal Aquifer.

The Shallow Aquifer system consists of interbedded lacustrine Bonneville clay, silt, and fine sand. The exact depth of this system varies but is approximately the upper 35 to 50 feet of saturated sediments. The potentiometric surface for the Shallow Aquifer system depicts lateral flow in a northerly direction toward the Great Salt Lake. The average horizontal hydraulic conductivity of the Shallow Aquifer is 2.5×10^{-7} cm/sec based on hydraulic conductivity tests on five Kennecott wells. Water quality in the Shallow Aquifer is quite variable with concentrations of TDS ranging from 800 mg/L to 7,000 mg/L. The chemical makeup of the ground water in the Shallow Aquifer also varies significantly, with marked differences in concentrations of major ions such as magnesium, calcium, sodium, sulfate, and chloride. There is some evidence of impact to ground water quality from historic smelting operations. Arsenic, cadmium, and selenium values that exceed Utah Ground Water Quality Standards have been observed in the Shallow Aquifer.

Corrective Action Cleanup

The Ground Water Quality Protection Regulations require applicants to submit a corrective action plan or other response measures to be taken to remedy any violation of ground water quality standards resulting from discharges occurring prior to issuance of a ground water discharge permit. Throughout the term of the previous permit and at the time of this permit renewal, Kennecott has been pursuing a clean up of the North Area facilities under a Memorandum of Understanding between the U.S. Environmental Protection Agency Region VIII, The State of Utah Department of Environmental Quality, and Kennecott. In June 2000, Kennecott completed a revised remedial investigation of copper smelting and refining related contamination in ground water, surface water, and soils at the northern end of the Oquirrh Mountains. Ground water contaminated with arsenic, selenium, and sulfate has been identified and plume boundaries delineated. The cleanup is proceeding under the auspices of a CERCLA program. Discharge Permit UGW350008 does not require corrective action measures in addition to the CERCLA process. This permit has a compliance condition that allows the Executive Secretary to call for a Contamination Investigation and Corrective Action Plan to be submitted and made a part of this permit should the existing process fail to accomplish appropriate clean up of existing contamination at the Smelter site.

In November 2010, Kennecott submitted a Corrective Action Plan (CAP) to the Division in response to the unintended release of sulfuric acid from a breach in a containment system of the Kennecott Smelter Acid Loading Facility. In January 2011, the Division acknowledged and approved this plan. Ground water cleanup standards applicable for parameters are shown in Table 1 in Appendix D of UGW350008. The CAP incorporates the reactivation of a ground water extraction trench used to contain a sulfuric acid spill in 1995. Kennecott confirmed the functionality and efficiency of the trench through inspection and temporary pump testing to sufficiently induce water table drawdown of the vadose zone water and shallow ground water. Full functional restoration of the trench was completed by the end of 2010. Daily monitoring via remote telemetry system, quarterly monitoring by visual inspection, and equipment maintenance recommendations for preventive maintenance are conducted by Kennecott. Annual reporting of the CAP is incorporated into the second half the Smelter semi-annual which is due to the Utah Division of Water Quality no later than February 15.

Basis of Permit Issuance

While there are ground water monitoring wells along the downgradient northern perimeter of Smelter site, the effectiveness of using a well network as the sole compliance mechanism is not appropriate. The ground water quality in several portions of the smelter facility has been impacted by previous decades of smelter operations. Thus, determination of impacts from present day releases to ground water becomes quite tenuous without the presence of unaffected background ground water quality. Accordingly, this permit will not use of ground water protection levels as the primary compliance mechanism and will incorporate the following technologies:

- 1) *Leak Collection and Removal Systems* - Performance of "Best Available Technology" (BAT) controls that incorporate leak collection and removal for most major facility components and the proper maintenance of these facilities will be the compliance mechanism for this permit.

The BAT design used in the cooling tower basins and vehicle wash and maintenance buildings involves use of a geomembrane underliner beneath concrete basins or sumps with a leak collection and removal system. The leak collection and removal system is continuously monitored for water level. The performance criteria required for these facilities includes maintaining less than one foot of head on the geomembrane liner. If water levels increase to above one foot, an alarm is automatically transmitted to the Smelter control room and corrective measures spelled out in the permit must be followed. Appendix B of the permit is the BAT monitoring Plan for these structures. This plan requires a quarterly inspection for each leak collection system to verify that the water level alarm is functioning properly.

The BAT design for the two process water ponds includes two 60 mil HDPE liners with a leak collection layer between the liners. A 12-inch thick engineered subgrade with a hydraulic conductivity not to exceed 1×10^{-5} cm/sec underlies the double HDPE liner system. Each cell of the process ponds has a continuous water level monitor device as described in the previous paragraph. Appendix C of the permit is the Leak Detection and Repair Plan. This appendix describes what actions must be undertaken within specified time frames if a liner repair is needed to achieve performance criteria for the ponds. In addition to the performance criteria of maintaining less than one foot of head on the lower HDPE liner, the process ponds also have performance criteria of no more than four gallons per minute allowable leakage rate entering the leak collection layer.

- 2) *Unit Process Well Monitoring* - There is one site where BAT design cannot feasibly include leak collection and removal. The Slag Cooling and Crushing Area is a large sloped pad with drains to collect water used in cooling slag pots. The pad BAT design includes routing of all water off the pad with no standing water allowed for this area.

This site is monitored with monitoring wells to determine if any localized degradation is occurring, NES729 and NES2556. Table 3 includes the background water quality and permit limits for the two monitoring wells that will be used for compliance monitoring in this area.

- 3) *Best Management Practices Sites* - The Acid Plant and the Hydrometallurgical Plant are facilities with concrete floors sloped to contain spillage and drainage into sump areas. Acid proof concrete basins and sumps are used where exposure to acid is a potential. Plant equipment and machinery are constructed above grade on the contained concrete surfaces.

The Anode Casting Wheel process involves a large circular concrete facility where molten copper is poured into molds and then cooled with water. The cooling water is contained in a circular concrete trench beneath the casting wheel. Water collected in the trench is pumped to a cooling tower.

These three sites do not represent much likelihood for discharge of fluids to ground water. Any spillage in the Acid Plant and Hydrometallurgical Plant will be contained in floor sumps and drains that will not be allowed to accumulate and hold fluids for more than a few hours while clean up occurs. Similarly, the Anode Casting Process involves use of water for cooling the copper anodes in the molds. This water is circulated to a cooling tower and then returned for use again. Accordingly, the performance criteria for these sites include use of best management practices (BMP) such as prompt clean up of any spills and adherence to good housekeeping practices. Appendix A of the permit spells out the best management practices that Kennecott will undertake for these three sites. These sites will be inspected to determine if potential discharges to ground water may be occurring. If these sites prove to be problematic, they may be subject to well monitoring requirements similar to the Slag Cooling Area.

Several other sites are included in the BMP group of sites. These include: materials storage pads, matte storage area & sump, and the vehicle decontamination pad & sump. The storage pads are used for outdoor storage of copper concentrate, matte copper, blister copper, copper reverts & fines and converter slag. Appendix A has been modified to include the BMP specifics for each of these sites. The pads will be total containment for any run off that does not exceed the 24 hour 25 year storm. The sumps from the matte storage area and the vehicle decontamination pad will be emptied into the process water system to avoid any leakage from these structures.

- 4) *Operational Monitoring* - Characterization of the water quality of process fluids that will result from the operation of the Smelter has been performed on two occasions during the permit term that is concluding. Kennecott is required to sample fluids utilized in the Smelter two times during the permit term. This should offer adequate ongoing characterization of process fluids prior to permit renewal in case any adjustments are needed.
- 5) *Perimeter Monitoring Wells* - The ground water monitoring well network at the northern perimeter of the Smelter provide information on ground water quality, but are not used as the formal compliance mechanism in this permit. The monitoring well data will assess use of overall best management practices at the Smelter to determine if water quality parameters are improving over time with the implementation of BMP for facilities.

It should be noted that there are several facilities within the Smelter Complex that are “permit by rule” facilities. These are listed in Table I B of the permit to identify the BAT utilized for these structures. While there are no performance criteria associated with these facilities, Kennecott is still required by the Ground Water Quality Protection Regulations and the Utah Water Quality Act to assure that no discharge of pollutants occurs from any of the permit by rule facilities. An example would be that Kennecott is responsible for conducting proper housekeeping and maintenance of the Smelter such that storm water runoff from the Smelter to the storm water ponds is not contaminated by Smelter operations.

In the future if operational monitoring reveals that any of the “permit by rule” facilities may be causing ground water contamination, these sites will be formally added to the permit with requisite performance and inspection criteria.

Basis for Specific Permit Conditions

1. *Corrective Action* - Please see the discussion on Page 2 of this statement of basis for an explanation of the rationale for this condition.
2. *Materials Storage Pad Characterization* - Most of the material to be stored on the storage pads has been characterized using the TCLP procedure. Kennecott is required to perform SPLP analysis on

qualifying materials not listed in the Permit under section I.H.2 to provide a more realistic assessment of leachate that may occur from these materials. The SPLP procedure uses a leaching procedure that is more akin to natural precipitation.

3. *Operational Monitoring* - Characterization of the water quality of Smelter process fluids. Kennecott is being required to sample fluids utilized in the smelter processes in the second and fifth years of the permit term. The list of sampling stations for operational monitoring is on Table 2 of the permit.

