

Aquifer Protection Permit P-106360  
 Place ID 1579, LTF 61845  
 Temporary APP Significant Amendment  
 Florence Copper Project

The Arizona Department of Environmental Quality (ADEQ) has issued a Temporary Individual Aquifer Protection Permit (APP) for the subject facility that is valid for one (1) year and may be renewed for one (1) additional year, unless suspended or revoked pursuant to Arizona Administrative Code (A.A.C.) R18-9-A210(E). This document gives pertinent information concerning the issuance of the permit. The requirements contained in this permit will allow the permittee to comply with the two key requirements of the Aquifer Protection Program: 1) meet Aquifer Water Quality Standards (AWQS) at the Point of Compliance (POC); and 2) demonstrate Best Available Demonstrated Control Technology (BADCT).

## I. FACILITY INFORMATION

### Name and Location

Permittee's Name:	Florence Copper Inc.
Mailing Address:	1575 W. Hunt Highway Florence, AZ 85132
Facility Name and Location:	Florence Copper Project 1575 W. Hunt Highway Florence, AZ 85132

### Regulatory Status

On March 6, 2012 ADEQ received an application for a Temporary Individual Aquifer Protection Permit (APP) from Curis Resources, Inc. for the copper mine historically known as the Florence Copper Project to operate the Production Test Facility (PTF). The permit was signed September 28, 2012. An Other Amendment was issued on July 3, 2013, to make several changes to the permit, in part in consideration of public comments received. A Minor Amendment was issued on February 3, 2014 to change the name on the permit from Curis Resources, Inc. to Florence Copper Inc.

On April 1, 2015, the permittee submitted this application for significant amendment in accordance with Water Quality Appeals Board (WQAB) order issued in Case No. 12-005-WQAB on November 14, 2014 (Board Order).

### Facility Description

The PTF will occupy approximately 13.8 contiguous acres. Florence Copper Inc. proposes to construct and operate the PTF over a two-year period, consisting of a 14 month leaching phase and a 9 month rinsing phase. The PTF will contain a total of 24 wells and consist of 4 Underground Injection Control (UIC) Class III injection wells, 9 recovery wells, 7 observation wells and 4 multilevel sampling wells. The

proposed In-Situ Copper Recovery (ISCR) process involves injecting a lixiviant (99.5% water mixed with 0.5% sulfuric acid) through injection wells into the oxide zone of the bedrock beneath the site for the purposes of dissolving copper minerals from the ore body. The estimated injection zone is between approximately 500 feet below ground surface (ft bgs) to 1,185 ft bgs. The resulting copper-bearing solution will be pumped by recovery wells to the surface where copper will be removed from the solution in a solvent extraction electro winning (SX/EW) plant. The barren solution from the SX/EW plant will be reacidified and re-injected back into the oxide zone. Other facilities proposed for the PTF will include SX/EW Plant, Water Impoundment, Runoff Pond, tank farm and other ancillary facilities. The permitted facilities for the Pilot Test include the following:

- 1) The Process Water Impoundment (PWI) is used to evaporate neutralized solutions and contain resulting sediments. The PWI shall be located immediately north of the runoff pond which is directly north of the SX/EW plant. The PWI shall be designed as a double liner system and include a leak collection and removal system (LCRS). The liner system shall consist of, from bottom to top; a compacted sub-grade (foundation) with liner bedding, 60-mil HDPE secondary liner, geonet, and 60-mil primary liner. The LCRS shall be equipped with: a sump located at the lowest elevation of the pond; a sump pump to remove accumulated liquids; and an alarm system for fluid detection.
- 2) The Runoff Pond is a non-stormwater pond and shall be located directly south of the PWI, north of the adjacent SX/EW plant, and northeast of the Pregnant Leachate Solution (PLS) and Raffinate tank secondary containment structure. The Runoff Pond is designed to capture direct precipitation; stormwater runoff from the roofs of on-site structures, cathode storage slab and concrete apron on the south side of the SX/EW Building; fire sprinkler water or process solutions that may enter or overflow the SX/EW Building floor sump; and any spills on or are wash down from these areas. The Runoff Pond shall be designed with a single liner that includes an engineered compacted sub-grade and 60-mil HDPE geomembrane liner. The Runoff Pond shall incorporate a sump equipped with a pump along with fluid-level detection equipment. When fluid is detected above the level set-point the pump will transfer fluid out of the Runoff Pond to the PWI via pipeline.
- 3) The In-situ Area Injection and Recovery Well Block contains a total of 24 wells and consist of 4 injection wells, 9 recovery wells, 7 observation wells and 4 multilevel sampling wells. The injection wells at the site are classified as Class III Injection wells by the USEPA and are permitted by the UIC Program. The injection and recovery wells will be designed to meet the mechanical integrity requirements in the UIC regulations, Code of Federal Regulations (CFR) part 144 and 146. All injection wells and recovery wells will be designed and installed to prevent injection into the top 40 feet (the exclusion zone) of the oxide zone. The injection and recovery of the solutions will be limited to the Oxide ore body.

### **Amendment Description**

Changes to the permit to address the Board Order include the following:

1. Seven (7) Supplemental Monitoring Wells have been added, with monitoring, reporting, and contingency requirements for groundwater quality, groundwater level, and well bore electrical conductivity,
2. Bulk Electrical Conductivity monitoring, reporting and contingency requirements have been added for Observation Wells,
3. Well Bore Electrical Conductivity monitoring, reporting and contingency requirements have been added for Observation Wells, Supplemental Wells, Multi-Level Sampling Wells, and MW-01.
4. Fluid Electrical Conductivity monitoring, reporting and contingency requirements have been added at Observation Wells and Injection Wells,
5. Additional monitoring, reporting and contingency requirements have been included to confirm the cone of depression barrier,
6. Pre-Operational requirements have been updated to clarify monitoring, testing, reporting and approval requirements,
7. Compliance Schedule Items have been modified to clarify and consolidate submittals and amendments.

## **II. BEST AVAILABLE DEMONSTRATED CONTROL TECHNOLOGY**

The design of the permitted facilities mentioned above has been evaluated and determined to satisfy the requirements of A.A.C. R18-9-A202. Detailed BADCT descriptions for each facility are listed in Section 2.2.1 and Table 4.1-1 of the Temporary APP.

The PTF operation relies on hydraulic control of the ISCR solutions and cone of depression to the edge of the pollutant management area (PMA) to demonstrate BADCT. Hydraulic control will be confirmed through the use of observation wells to maintain an inward hydraulic gradient. An inward hydraulic gradient is measured by water level elevations in recovery and observation wells. In addition, potentiometric surface contour maps will be evaluated to confirm the presence of the cone of depression at the PMA. The rates of injection and recovery will be continuously monitored and controlled so that the total volume of solution recovered will be greater than the volume of solution injected, averaged over a 30-day period. Automatic controls and alarms will be used in the well field to ensure process upsets do not result in the loss of hydraulic control. Automatic controls and alarms shall be used in the well field to ensure process upsets do not result in the loss of hydrologic control. Hydrologic control over the injected solutions shall be maintained from the time injection begins and until well abandonment is completed by the applicant and approved by the appropriate agencies and groundwater in the mine blocks meets APP closure criteria.

The injection pressure from the Class III injection wells will be kept below the fracture pressure of the oxide ore body. A fracture gradient of 0.65 pounds per square

inch per foot (psi/ft) of depth was established by field test data as being adequate to prevent hydraulic fracturing of the bedrock.

### **III. COMPLIANCE WITH AQUIFER WATER QUALITY STANDARDS**

#### Pollutant Management Area-

The permittee is required to show that pollutants discharged will not cause or contribute to a violation of aquifer water quality standards (AWQS) at the points of compliance (POC) or if an AWQS for a pollutant is exceeded in an aquifer at the time of permit issuance, that no additional degradation of the aquifer relative to that pollutant and determined at the applicable POC will occur as a result of the discharge from the proposed facility. The location of the POCs, which show compliance with aquifer water quality standards, is determined by an analysis of the PMA.

The PMA is described in A.R.S. §49-244 as the limit projected in the horizontal plane of the area on which pollutants are or will be placed. The PMA includes horizontal space taken up by any liner, dike or other barrier designed to contain pollutants in the facility. Two separate PMAs have been identified for the proposed PTF operation: one PMA which circumscribes the two permitted impoundments and solution processing area, and a separate PMA on the western side of the property which includes the in-situ area injection and recovery well block and an area with a radius of 500-feet centered in the PTF. The cone of depression from pumping the PTF recovery wells will be measured at the 500-foot radius and all injected solutions must remain within this PMA.

There is one POC well (POC M52-UBF) located downgradient, northwest, of the PMA circumscribing the two permitted impoundments and solution processing area which is screened in the Upper Basin Fill Unit (UBFU) across the water table. There are six POC wells located downgradient, northwest of the PTF. Two of the POC wells are located at the edge of the PMA and monitor the Oxide Unit (M54-O) and Lower Basin Fill Unit (LBFU) (M54-LBF). The other four POC wells are located approximately 300 feet west-northwest of the edge of the PMA. Two of the POC wells monitor the LBFU (M14-GL and M15-GU) and the other two POC wells monitor the UBFU (M23-UBF) and Oxide Unit (M22-O), respectively.

#### Discharge Impact Area-

The DIA is defined by A.R.S. §49-201.13. The DIA means the potential aerial extent of pollutant migration, as projected on the land surface, as the result of a discharge from a facility. The DIA was determined using groundwater modeling program MODFLOW SURFACT. The groundwater flow modeling was used to determine the DIA five years after closure and cessation of hydraulic control at the PTF. The projected DIA was calculated for multiple model layers and assumed a sulfate concentration of 750 mg/L throughout the impact recovery zone (IRZ) at the time of closure. The greatest aerial extent of sulfate migration was defined at a sulfate concentration 2 mg/L above background. The maximum aerial extent of migration during the five year post-closure period was approximately 150 feet from the PTF well field in the lower oxide zone.

### Hydrology

The saturated geologic formations underlying the site have been divided into three distinct water bearing units referred to the Upper Basin Fill Unit (UBFU), the Lower Basin Fill Unit (LBFU), and the Oxide Bedrock Unit. The UBFU consists of unconsolidated to slightly consolidated sands and gravels, with lenses of finer grained material. The unit ranges in thickness between 200 and 250 feet in thickness within the ISCR area. The upper portions of the UBFU are not saturated and form the lower vadose zone which extended to depths to approximately 150 ft bgs. The Middle Fine Grained Unit (MFGU) consists of calcareous clay to silty sand, approximately 20 to 30 feet thick and is not considered a main water bearing unit at the site. Beneath the MFGU is the Lower Basin Fill Unit (LBFU). The LBFU consists of coarse gravel, fanglomerate and breccia. The LBFU ranges in thickness from 70 to 750 feet, based on the structural relief of the bedrock contact beneath the LBFU. The LBFU in the test area is approximately 80 feet thick. Groundwater in this unit typically exhibits confined to semi-confined conditions. The bedrock underlying the LBFU study consists of Precambrian quartz monzonite and Tertiary granodiorite porphyry. The bedrock unit is further divided into the upper Oxide zone and the lower Sulfide zone. The upper Oxide zone is approximately 200 to 1,500 feet thick, and is the geologic formation targeted for in-situ mining. Groundwater movement through the Oxide bedrock unit is dominantly controlled by secondary permeability features such as faults or fractures. The Oxide Unit is fully saturated and exhibits confined to semi-confined aquifer conditions. The sulfide mineralization below the Oxide ore body is of unknown lateral and vertical extent. The Sulfide bedrock unit does not yield appreciable quantities of water and is not targeted for in-situ mining at the PTF.

Depth to groundwater is approximately 200 feet bgs. Groundwater levels have declined approximately an average of 65 feet over the past 15 years for each of the water bearing units at the site. The decline in water levels is attributed to a dissipation of a recharge impulses associated with higher than normal flows in the Gila River during the early 1990's. Typical groundwater elevation fluctuations in the UBFU range between 5 and 8 feet, and between 10 to 15 feet, but as much as 20 feet in the LBFU and Oxide units.

The groundwater flow direction is predominately to the northwest, with some variation depending on seasonal groundwater pumping from irrigation wells located on and off-site. During periods of sustained agricultural pumping, groundwater flow shifts to the west but reverts back to the locally dominant northwest flow direction during non-pumping seasons. These changes have been observed each year from 1995 to present, and the seasonal shift in groundwater flow direction is most pronounced in the LBFU and Oxide Zone water bearing zones. The Gila River is the principal source of groundwater recharge in the region and is the significant hydrologic feature affecting groundwater flow direction near the site.

**Monitoring and Reporting Requirements**

The permit requirements for discharge monitoring, quarterly and semi-annual compliance groundwater monitoring, and operational monitoring are listed in the Section 4.1 of the Temporary APP in Tables 4.1-2 through 4.1-8. All reporting shall be submitted in accordance with Section 2.7.

**Point(s) of Compliance:**

There are 7 designated POC wells for the Florence Copper Project PTF; all monitor for both hazardous and non-hazardous substances. The Temporary APP requires both quarterly and semi-annual compliance groundwater monitoring at all POC locations. The parameters to be monitored are listed in Section 4.1, Tables 4.1-6 and 4.1-7 of the Temporary APP.

**Additional Groundwater Monitoring:**

For the purpose of this permit, ADEQ has established a use protection level (UPL) for arsenic of 0.01 mg/L, which is consistent with EPA's revised primary drinking water standard for arsenic. The northwest corner of the State Mineral Lease Land, on which the PTF will be located, has been conservatively designated as the down gradient point at which the arsenic UPL will be applied. Consistent with ADEQ's substantive policy statement titled "Using Narrative Aquifer Water Quality Standards to Develop Permit Conditions for Aquifer Protection Permits" (Oct. 2003), an alert level for arsenic will be establish for each of the in-situ POC wells (see Section 3.0, Compliance Schedule) through consideration of fate and transport of arsenic to ensure that the UPL is not exceeded at the northwest corner of the State Mineral Lease Land.

Monitoring well MW-01 shall be located in the down gradient groundwater direction at or near the PTF well field boundary. The placement of MW-01 shall be sufficiently located to measure changes in chemical groundwater concentrations in the injection zones within the time frames allowed by the Temporary APP, but no more than one-year from the effective date of this permit using aquifer travel times. Water chemistry, electrical conductivity and groundwater contour data will be monitored at MW-01. Monitoring well MW-01 shall be installed and approved by ADEQ in accordance with the Compliance Schedule Section 3.0.

The permit also includes a network of seven additional supplemental wells, seven observation wells, and four multi-level wells that will be used to monitor for any potential migration of solutions outside of the permitted area of solution injection. Water chemistry, electrical conductivity and groundwater contour data will be used as indicators of any potential loss of hydraulic control during operation of the PTF.

**IV. STORM WATER AND SURFACE WATER CONSIDERATIONS**

The Project shall contain and control the run-on and run-off from a 100-year 24-hour storm event so that no contaminated storm water will discharge from the site. The Process Water Impoundment and Run-off pond will contain all storm water run-on into the facility and all run-off generated within the facility.

## **V. COMPLIANCE SCHEDULE**

The Temporary APP includes an extensive compliance schedule requiring the permittee to submit several items, including: initial discharge characterization, ambient groundwater quality monitoring data, electrical conductivity monitoring and well completion/abandonment reports.

## **VI. OTHER REQUIREMENTS FOR ISSUING THIS PERMIT**

### **Technical Capability**

Florence Copper Inc. has demonstrated the technical competence necessary to carry out the terms and conditions of the permit in accordance with A.R.S. § 49-243(N) and A.A.C. R18-9-A202(B). All documentation required by this amendment application has been sealed accordingly.

ADEQ requires that appropriate documents be sealed by an Arizona registered geologist or professional engineer. This requirement is a part of an on-going demonstration of technical capability. The permittee is expected to maintain technical capability throughout the life of the facility.

### **Financial Capability**

The permittee has demonstrated financial capability under A.R.S. § 49-243(N) and A.A.C. R18-9-A203. The permittee shall maintain financial capability throughout the life of this permit. The estimated closure cost is \$3,946,194. The financial assurance mechanism was demonstrated through a performance surety bond in the amount of \$3,946,194 (A.A.C. R18-9-A203 (C)(2)).

### **Zoning Requirements**

Mining activity of greater than five contiguous acres is exempt from zoning requirements pursuant to A.R.S. § 11-812.

## **VII. ADMINISTRATIVE INFORMATION**

### **Public Notice (A.A.C. R18-9-108(A))**

The public notice is the vehicle for informing all interested parties and members of the general public of the contents of a draft permit or other significant action with respect to a permit or application. The basic intent of this requirement is to ensure that all interested parties have an opportunity to comment on significant actions of the permitting agency with respect to a permit application or permit. This permit shall be public noticed in a local newspaper after a pre-notice review by the applicant and other affected agencies.

**Public Comment Period (A.A.C. R18-9-109(A))**

The aquifer protection program rules require that permits be public noticed in a newspaper of general circulation within the area affected by the facility or activity and provide a minimum of 30 calendar days for interested parties to respond in writing to ADEQ. After the closing of the public comment period, ADEQ is required to respond to all significant comments. As this permit amendment was submitted subsequent to an appeal, public comment is limited to only those sections that were remanded to the department for additional development.

**Public Hearing (A.A.C R18-9-109(B))**

A public hearing is scheduled for May 19, 2016 at Florence High School.

**VIII. ADDITIONAL INFORMATION**

Additional information relating to this proposed permit may be obtained from:

Arizona Department of Environmental Quality  
Water Quality Division  
Attn: Richard Mendolia  
1110 W. Washington St., Mail Code: 5415B-3  
Phoenix, Arizona 85007  
Phone: (602) 771- 4374