

Redhawk Power Plant
Aquifer Protection Permit 501913
Place ID 13769, LTF 62571
Significant Amendment

The Arizona Department of Environmental Quality (ADEQ) proposes to issue an Aquifer Protection Permit for the subject facility that covers the life of the facility, including operational, closure, and post closure periods unless suspended or revoked pursuant to Arizona Administrative Code (A.A.C.) R18-9-A213. 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). BADCT's purpose is to employ engineering controls, processes, operating methods or other alternatives, including site-specific characteristics (i.e., the local subsurface geology), to reduce discharge of pollutants to the greatest degree achievable before they reach the aquifer or to prevent pollutants from reaching the aquifer.

I. FACILITY INFORMATION

Name and Location

Permittee's Name:	Arizona Public Services Company
Mailing Address:	400 North 5 th Street, MS 5100 Phoenix, Arizona 85004
Facility Name and Location:	Redhawk Power Plant 11600 South 363rd Avenue Arlington, Arizona 85322

Regulatory Status

The Redhawk Power Plant is an existing facility. This permit amendment was received by ADEQ on June 17, 2015.

Amendment Type	Effective date	Amendment Item
Individual Aquifer Protection	December 17, 2001	(APP) No. 501913
Temporary Emergency Waiver	September 25, 2002	No. 501913- To operate the Brine Concentrator Pond
Significant Amendment	September 30, 2004	No. 501913
Other Amendment	November 17, 2005	No. 501913
Minor Amendment	February 6, 2011	No. 501913

Facility Description

The Redhawk Power Plant is a 1060-megawatt (MW) combined cycle power plant developed on 460 acres of land owned by Arizona Public Service Company (APS). Operations at the facility started in 2002. The Redhawk power plant is a natural gas-fired, advanced technology combustion turbine combined cycle power plant that consists of three basic components: a combustion turbine (CT) and electric generator, heat recovery steam generator (HRSG), and a steam turbine and electric generator. The CT produces electric power through the electric generator and supplies hot gases to the HRSG. The steam generated in the HRSG is sent to a condensing steam turbine that produces additional electricity. The steam turbine water is cooled via a wet mechanical draft cooling tower.

The facilities regulated under this permit consists of three lined impoundments (Makeup Water Surge Pond (MWSP), Brine Concentrator Surge Pond (BCSP) and one cell Brine Solids Drying Pond (BSDA)) used for plant operations and the temporary disposal of cooling tower blowdown. The MWSP stores makeup water for the plant operations and dust control and suppression on site. This water is received from the Palo Verde Power Plant’s reclamation plant that primarily treats the effluent water received from the City of Tolleson Wastewater Treatment Plant and the City of Phoenix’s 91st Avenue Wastewater Treatment Plant. The BCSP is used for temporary disposal of cooling tower blowdown. One of the two BSDA permitted cells (Cell #2) has been constructed. The second permitted BSDA cell (Cell #1) may be constructed in the future, when needed. The BSDA shall be used to manage the discharges from the plant’s Zero Liquid Discharge (ZLD) system and to increase water balancing options. Drainage channels direct stormwater runoff from a 100-year 24-hour storm event away from the impoundments. The domestic sewage is disposed to an on-site septic system operated under a general permit.

The depth to groundwater is approximately 240 feet below land surface at the site. The general direction of the groundwater flow is to the north-northwest.

The site includes the following permitted discharging facilities:

Facility	Latitude	Longitude
Makeup Water Surge Pond	33° 20' 20.87" North	112° 50' 33.70" West
Brine Concentrator Surge Pond	33° 19' 44.96" North	112° 50' 23.00" West
Brine Solids Drying Area (Cell 1) Not constructed	33° 19' 41.70" North	112° 50' 29.73" West
Brine Solids Drying Area (Cell 2)	33° 19' 40.67" North	112° 50' 36.62" West

Amendment Description

ADEQ has reviewed and approved the following under this significant amendment:

1. Section 2.1, Facility/Site Description: Updated the facility description and added the language to indicate that Cell #2 in the BSDA has been constructed and that Cell #1 may be constructed in the future, when needed. Updated the latitude and

- longitude for the discharging facilities. Added the Annual Registration Fee and Financial Capability information.
2. Section 2.2.4 Pre-operational Requirements: Change number from Section 2.2.3. Updated language to reflect the pre-operational requirement to operate Cell#1 of the BSDA upon completion.
 3. Section 2.3, Discharge Limitations: Updated the language and added Section 2.3.1 Authorized and Unauthorized Materials for the MWSP, BCSP and the BSDA.
 4. Section 2.4, Point(s) of Compliance: Updated the latitude and longitude for POC wells #1 and #2. Added POC well #3 and the Perched Groundwater Monitoring Table.
 5. Section 2.5, Monitoring Requirement: Removed Sections 2.5.1.1, 2.5.1.2 and 2.5.1.3.
 6. Section 2.5.2, Facility/Operational Monitoring: Updated the monitoring table numbers.
 - Section, 2.5.2.1, LCRS monitoring in accordance with Section 4.3, Table IV.
 - Section, 2.5.2.2, Wastewater Containment Structures, monitor in accordance with Section 4.2, Table III.
 7. Section 2.5.3, Groundwater Monitoring and Sampling Protocols: Removed requirement to monitor groundwater and Sections 2.5.3.1 and 2.5.3.2.
 8. Section 2.6.2, Exceeding of Alert Levels: Updated the monitoring table numbers.
 - Section 2.6.2.1(A) was changed from Section 4.0, Table 4 to 4.2, Table III.
 - Section 2.6.2.1(B) was changed from Section 4.0, Table 4 to 4.3, Table IV.
 - Section 2.6.2.1(C) was changed from Section 4.0, Table 4 to 4.3, Table IV.
 9. Section 2.6.2.2, Exceeding of Alert Levels Set for Discharge Monitoring has been changed to Exceeding of Alert Levels in Groundwater Monitoring that is not required under this permit amendment.
 10. Section 2.6.2.3, Exceeding of Indicator Alert Levels (IAL) Set for Groundwater Monitoring was removed.
 11. Section 3.0, Compliance Schedule: Removed the completed items and added the following requirements:
 - 3.1 Financial demonstration for the financial assurance mechanism to be updated.
 - 3.1 Estimate cost for facility closure and post-closure to be updated.

- 3.2 Final construction report and QA/QC documentation for the BSDA Cell #1 within 60 days of the completion.
 - 3.3 Submit a minor amendment to update the latitude and longitude for the BSDA Cell #1, LCRS monitoring points:
 - Sampling Point 003-E
 - Sampling Point 003-W
12. Section 4.0. Monitoring Requirements: Removed and renumbered the following tables:
- Section 4.2, Compliance Monitoring: Removed Tables 4.2.1, 4.2.1.1 and 4.2.1.2.
 - Section 4.2, Compliance Monitoring: Removed Table 4.2.3 Groundwater monitoring.
 - Section 4.3, Contingency Monitoring: Table 7 is now Table IV, Leak Collection and Removal System Monitoring. Table 8 is now Table V, Compliance Discharge Characterization for BADCT Failures and Overtopping
13. Other changes include updating the permit language to conform to the most current permit format.

II. BEST AVAILABLE DEMONSTRATED CONTROL TECHNOLOGY

Total containment through three lined impoundments of the makeup and process water shall provide pollution control at this facility. Operational methods and wastewater discharge control processes are included as part of the BADCT design. All required quality assurance and control procedures for the containment structures and treatment components were approved by ADEQ, shall be followed. All materials used in the construction of the impoundments shall be compatible with the solution received.

Makeup Water Surge Pond (MWSP)

The MWSP has a surface area of 40 acres and a storage capacity of approximately 500-acre feet. The pond is lined with a single 60-mil high density polyethylene (HDPE) geomembrane liner underlain by a one-foot thick layer of soil compacted to a permeability of less than or equal to 6×10^{-4} cm/sec. The liner system is secured in an anchor trench at the top of the slopes and the side slopes at 3H:1V. At least 2.5 feet of freeboard shall be maintained in the pond operation.

Brine Concentrator Surge Pond (BCSP)

The BCSP has a surface area of approximately 2.77 acres with a maximum storage capacity of 2.77-acre feet. The BCSP is designed to hold approximately 7 days of cooling tower blowdown and shall be maintained with at least 2.5 feet of freeboard. The liner system consists of a double liner equipped with a leak collection and removal system (LCRS). The impoundment has a 60-mil HDPE geomembrane lower liner overlying a geosynthetic clay liner (GCL) with a hydraulic conductivity of approximately 1×10^{-9} cm/sec and a 60-mil HDPE geomembrane upper liner covered by a 12 inch layer of granular soil with riprap on the side slopes. The liner system is secured in an anchor trench at the top of the slopes and the side slopes designed at 3H:1V. The interior side slope and bottom are covered with soil to resist damage due

to weathering, animals and vandalism. The exterior slopes are covered with a 6 inch layer of prepared bedding material for erosion protection.

The Leak Collection and Removal System (LCRS) was constructed in between the two HDPE geomembrane liners and consist of a HDPE geonet, a rock filled trench, and a rock filled collection sump for fluid collection and evacuation. The bottom of the pond slopes at two percent from two sides to promote drainage toward the leak collection sump at the north-central location of the pond. The leak collection trench located in the center of the pond is sloped at 0.5 percent toward the leak collection sump. A four inch diameter perforated HDPE pipe in the collection trench collects leakage and drains it to the rock filled collection sump. A 16 inch diameter perforated HDPE pipe is embedded in the rock filled collection sump and connected to a 16 inch HDPE riser pipe. The riser pipe is connected to a flow meter and a pump with a level control sensor for fluid evacuation. A sufficient sized pump shall be provided with a level control sensor for fluid evacuation.

Brine Solids Drying Area (BSDA)

The BSDA shall contain two cells and will have a surface area of approximately 12 acres. Currently the BSDA consists of Cell #2, which is approximately 4.50 acres and holds discharges from the brine concentrator until dry enough for off-site disposal or when the ZLD is not in operation. Cell #1 maybe constructed when needed. The liner system consists of a double liner equipped with a LCRS. The impoundment has a 60-mil HDPE geomembrane lower liner overlying a geosynthetic clay liner (GCL) with a hydraulic conductivity of approximately 1×10^{-9} cm/sec and a 60-mil HDPE geomembrane upper liner. The liner system is secured in an anchor trench at the top of the slopes and the side slopes designed at 3H:1V. The interior side slope and bottom are covered with soil to resist damage due to weathering, animals and vandalism. The exterior slopes are covered with a 6 inch layer of prepared bedding material for erosion protection.

The sand filled leak collection trench located in the center of the pond is sloped at 0.5 percent toward the leak collection sump. A four inch diameter, perforated HDPE pipe located in the collection trench collects leakage and drains to collection sump. A 16 inch diameter perforated HDPE pipe is embedded in the rock filled collection sump and connected to a four inch collection pipe. The riser pipe is connected to a flow meter and a pump with a level control sensor for fluid evacuation. A sufficient sized pump shall be provided with a level control sensor for fluid evacuation.

III. HYDROGEOLOGIC SETTING

The Redhawk Power Plant is underlain by alluvial deposits to a depth of at least 700 feet below ground surface (ft bgs). Groundwater occurs in multiple units within these deposits. There are several discontinuous groundwater zones that are located at shallow depths, ranging from 35 to 50 ft bgs. These zones correlate to the upper portion of the Middle Alluvial Unit (MAU) in Phoenix. The regional aquifer at the Redhawk Power Plant correlates to the Lower Alluvial Unit (LAU) in Phoenix. Groundwater within the regional aquifer occurs at depths greater than 300 ft bgs and is characterized by better water quality.

The shallowest perched groundwater zones are discontinuous and non-productive. Four MWSP seepage monitoring wells (MW-14cab, MW-14cdb, MW-14dbb1 and MW-14dcb) are completed in these zones. Using the assumption that the water levels that are observed in each of these wells occurs in the same groundwater zone, the groundwater flow direction is south-southwest.

A deeper perched groundwater zone occurs at 60 to 90 ft bgs. These deeper zones are separated from the shallowest perched zones by low permeability clay layers. Three perched deeper aquifer monitoring wells (PA-1, PA-2 and PA-3) are completed in this zone, although PA-3 is completed in a different zone than the other two monitoring wells. Groundwater flow direction is difficult to determine due to the stratified and discontinuous nature of the saturated zones and variations in monitoring well completions.

Approximately 150 to 200 feet of clay, the Palo Verde Clay, separates the shallower perched groundwater zones from the regional aquifer. The top of the regional aquifer occurs at depths ranging from 300 to 330 ft bgs. The regional aquifer occurs under confined conditions with the potentiometric groundwater level occurring approximately 180 to 210 ft bgs, with the groundwater flow direction being northwest.

Based upon the analysis of the discharge characterization and twelve years of quarterly groundwater monitoring in the perched groundwater zones from the MWSP seepage monitoring wells there are no variations in groundwater quality. ADEQ agrees that monitoring from the seepage monitoring wells is no longer necessary. However, the seepage monitoring wells will remain in place as a contingency action if there is a liner failure that results in an unexpected loss of fluid in the MWSP.

IV. STORM WATER/SURFACE WATER CONSIDERATIONS

There are no perennial or ephemeral surface water bodies located at the property. The nearest significant surface water bodies to the property are Centennial Wash and Luke Wash located approximately ½ to 2 miles from the property. The 100-year flood plain occurs approximately 1/4 to 1 mile southwest of the property within Centennial Wash and approximately two miles northeast of the property within Luke Wash.

At the time of site construction, the site was graded to divert surface flow and protect on-site structures.

V. COMPLIANCE WITH AQUIFER WATER QUALITY STANDARDS

Monitoring and Reporting Requirements

Routine groundwater monitoring is not required under the terms of this permit.

The three impoundments are lined, therefore the PMA and DIA are lines circumscribed around each impoundment.

Points of Compliance

The POCs are established by the following conceptual location(s):

POC Wells	POC Location	Latitude	Longitude
POC #1	Northwest corner of the MWSP	33° 20' 25.84" North	112° 50' 40.97" West
POC #2	Northwest corner of the BCSP	33° 19' 47.42" North	112° 50' 24.02" West
POC #3	Northwest corner of the BSDA	33° 19' 43.98" North	112° 50' 37.97" West

No groundwater monitoring is required under this permit.

Perched Groundwater Monitoring

Four groundwater monitoring wells have been installed to monitor the perched groundwater systems. The four monitoring wells are as follows:

Monitoring Well	Latitude	Longitude	DWR Number
MW-14cab	33° 20' 24" North	112° 50' 42" West	55-588913
MW-14dbb1	33° 20' 26" North	112° 50' 29" West	55-588914
MW-14cdb	33° 20' 13" North	112° 50' 41" West	55-588915
MW-14dcb	33° 20' 14" North	112° 50' 25" West	55-588916

No groundwater monitoring is currently required from the perched groundwater monitoring wells.

VI. COMPLIANCE SCHEDULE

Section 3.0, Compliance Schedule contains requirements for:

- 3.1 Financial demonstration for the financial assurance mechanism to be updated.
- 3.2 Estimate cost for facility closure and post-closure to be updated.
- 3.3 Final construction report and QA/QC documentation for the BSDA Cell #1 within 60 days of the completion.
- 3.4 Submit a minor amendment to update the latitude and longitude for the BSDA Cell #1, monitoring points for LCRS 003-E and 003.W

VII. OTHER REQUIREMENTS FOR ISSUING THIS PERMIT

Technical Capability

The Arizona Public Service – Redhawk Power Plant 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).

The permit 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 Arizona Public Service 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 the facility. The estimated closure and post closure cost is \$20,048,029.00. The financial assurance mechanism was demonstrated through a financial test for self-assurance and a statement by permittee's chief financial officer in accordance with A.A.C. R18-9-A203(C)(1)(b) and (c).

Zoning Requirements

The Arizona Public Service – Redhawk Plant has been properly zoned for the permitted use and the permittee has complied with applicable zoning ordinances in accordance with A.R.S. § 49-243(O) and A.A.C. R18-9-A201(B)(3).

VIII. 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 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. 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.

The public notice was published in the West Valley View newspaper on April 20, 2016, under public notice No. 16-64.

IX. ADDITIONAL INFORMATION

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

Arizona Department of Environmental Quality
Water Quality Division – APP Unit
Attn: Monica Phillips
1110 W. Washington St., Mail Code: 5500B-3
Phoenix, Arizona 85007
Phone: (602) 771- 2253