STATE OF ARIZONA
TEMPORARY AQUIFER PROTECTION PERMIT NO. P-106019
SITE CODE 509495-00, PLACE ID 133722, LTF NO. 47849

1.0 AUTHORIZATION

In compliance with the provisions of Arizona Revised Statutes (A.R.S.) Title 49, Chapter 2, Articles 1, 2 and 3, Arizona Administrative Code (A.A.C.) Title 18, Chapter 9, Articles 1 and 2, A. A. C. Title 18, Chapter 11, Article 4 and amendments thereto, and the conditions set forth in this permit, Arizona Public Service (APS) is hereby authorized to operate the Cholla Power Plant - Carbon Dioxide Sequestration Pilot Test located 2 miles east of Joseph City, Navajo County, Arizona, within the Little Colorado River Plateau groundwater basin in Section 30, Township 18 North, Range 20 East of the Gila and Salt River Base Line and Meridian.

This permit becomes effective on the date of the Water Quality Division Director's signature and shall be valid for **1 year**, unless suspended or revoked pursuant to A.A.C. R18-9-A213. The permittee shall construct, operate and maintain the permitted facilities for the pilot project authorized under A.A.C. R18-9-A210:

1. Following all the conditions of this permit including the design and operational information documented or referenced below, and

2. Such that Aquifer Water Quality Standards (AWQS) are not violated at the applicable point of compliance (POC) set forth below, or if an AWQS for a pollutant has been exceeded in an aquifer at the time of permit issuance, that no additional degradation of the aquifer relative to that pollutant, and as determined at the applicable POC, occurs as a result of the discharge from the facility.

1.1 PERMITTEE INFORMATION

Facility Name:	APS – Cholla Power Plant (Carbon Sequestration Pilot Test)
Facility Address:	4801 Frontage Road Joseph City, Arizona 86032
Permittee:	APS – Cholla Power Plant
Permittee Address:	P.O. Box 188, MS 7668 Joseph City, Arizona 86032
Facility Contact:	Conrad Spencer, Plant Manager
Emergency Phone No.:	928-288-1206 (Ext. 253)
Latitude/Longitude:	34° 55' 43" N / 110° 15' 31" W
Legal Description:	Township 18N, Range 20E, Section 30, NE¼, NE¼, SE¼ of the Gila and Salt River Base Line and Meridian

1.2 AUTHORIZING SIGNATURE

Joan Card

Joan Card, Director
Water Quality Division
Arizona Department of Environmental Quality
Signed this 19th day of March, 2009

2.0 SPECIFIC CONDITIONS [A.R.S. §§ 49-203(4), 49-241(A)]

2.1 Facility / Site Description [A.R.S. § 49-243(K)(8)]

This permit allows for the installation of an injection well for the purpose of conducting a pilot test to inject approximately 2,000 tons of supercritical carbon dioxide into the Martin Formation and/or the Naco Formation. The injection will occur at approximately 3,600 feet below ground surface (ft bgs). The overall goal of the pilot test is to gain practical experience with, and demonstrate the potential for, safe carbon dioxide storage in deep underground geologic formations in a location with large, surface carbon dioxide sources, such as the Cholla Power Plant, and large subsurface carbon dioxide storage potential. This injection test will incorporate supercritical carbon dioxide to ascertain the maximum injection pressure and flow rate achievable, without causing fracturing in the geologic formation.

The site includes the following permitted discharging facilities:

Facility	Latitude	Longitude
Injection Well	34° 55' 43" N	110° 15' 31" W

Annual Registration Fee [A.R.S. § 49-242]
This fee does not apply, as the permitted facility is a pilot test not expected to last more than a few months.

Financial Capability [A.R.S. § 49-243(N) and A.A.C. R18-9-A203]
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 the facility. The estimated closure and post-closure costs are $121,275. The financial assurance mechanism was demonstrated through a performance surety bond for $121,275, pursuant to A.A.C. R18-9-A203(C)(2).

2.2 Best Available Demonstrated Control Technology [A.R.S. § 49-243(B) and A.A.C. R18-9-A202(A)(5)]

Typical best available demonstrated control technology (BADCT) practices for aquifer protection cannot necessarily be implemented here, as BADCT applies to the quality of the media added to the aquifer through various pollution removal technologies. Instead, physical parameter monitoring shall be adopted to ensure safe practices and BADCT during operational periods, in addition to pre- and post-injection water quality sampling of the injection aquifer and shallower aquifer. The overall goal of the applied BADCT shall be to (1) protect the formation from fracturing, and (2) protect the shallower drinking water aquifers from exposure to the injected carbon dioxide.

The BADCT shall follow conservative, established procedures that minimize the risk of carbon dioxide leakage into shallow aquifers and fracturing of the target injection interval, the Jerome Member of the Martin Formation (with the shallower members of the Martin Formation and the Naco Formation as the backup). Other possible outcomes of carbon dioxide injection include displacement of native fluids and chemical constituents, and potential leaching and mobilization of naturally occurring metals and minerals within the subsurface formations. Geological impacts to the nearby aquifer shall be considered with respect to site location, and shall be guarded against by the application of BADCT.

The BADCT shall be applied through well siting, construction, operation, and closure of the injection well, with the inclusion of monitoring parameters during the step-rate injection test (SRT), well integrity monitoring practices, and monitoring of carbon dioxide movement within the aquifer. Each of these methods is described in detail below.

Monitoring Step Test Parameters – The carbon dioxide injection test, as it applies to BADCT, is the measured control of the injection flow rate and monitoring of the associated pressure for the duration of the pilot test. The maximum injection pressure within the injection formation shall not exceed the maximum

allowable injection pressure as determined by the step-rate injection test using filtered formation water, as described in Section 2.2.3.3. This methodology guards against fracturing of the formation.

Prior to the carbon dioxide injection test, a pre-operational step-rate test using filtered formation water shall be conducted as discussed in Section 2.2.3.3. This step-rate test will aide in establishing the target flow rate and injection pressures for the carbon dioxide pilot test. The absolute maximum injection pressure during carbon dioxide injection at the injection formation shall not exceed 80 percent of the measured or estimated formation fracture (or parting) pressure at that depth. Section 2.2.1 presents the engineering design calculations and associated pressures for the step test.

The injection depth shall be selected based upon well logging results and formation testing. The target injection depth is anticipated between the range of 3,500 to 4,000 ft bgs.

Well Integrity – Several procedures shall be performed to test for integrity of the injection well:

1. The mechanical integrity of the well casing shall be tested with an annulus pressure test, which will be performed after the packer, tubing, tubing hanger, and wellhead pressure control equipment are installed in the well.

2. During carbon dioxide injection, water in the annular space between the well casing and the production tubing shall be maintained at a higher pressure than the pressure in the production tubing. This will ensure that if the packer or the production tubing leaks, carbon dioxide will not flow into the annular space.

3. A residual saturation tool (RST) shall be utilized to perform a geophysical logging survey in the well before and after carbon dioxide injection. The difference between the results of the two logging runs is used to infer concentrations of carbon dioxide near the wellbore and thereby identify any leakage along the cemented annular space outside the well casing. The RST has the capability to distinguish between water and carbon dioxide.

4. Pre- and post-carbon dioxide injection thermal conductivity measurements may also occur along the well bore as a supplement to the RST logging.

Monitoring Carbon Dioxide Movement – Tracking the movement of carbon dioxide within the formation is critical for the purposes of the aquifer protection and permitting program. A representative sample of the target injection aquifer formation water shall be collected prior to injection of carbon dioxide into the formation. The sample, as detailed in Section 4.1, Table I-B, will reflect ambient conditions at the point of injection. In addition to sample collection, a vertical seismic profile (VSP) shall be performed to further characterize the carbon dioxide reservoir horizon and the adjacent formations.

2.2.1 Engineering Design

The engineering design shall focus on the protection of the formation from fracturing. Since there is minimal information available on the detailed geology in the injection area, theoretical calculations and educated assumptions shall be used to determine protective levels surrounding pressurization on the formation at the point of injection. The following sections present the calculations.

2.2.1.1 Pressure Calculations

The maximum operational injection pressure for the carbon dioxide injection pump(s) shall not exceed 3,500 pounds per square inch gauge (psig) during the carbon dioxide pilot; however, theoretical pressure shall be the primary guideline and shall be calculated in the following manner at the associated drilling depth. The fracture gradient for the injection interval shall be estimated by Eaton's Method (Eaton, 1969):

$$FG = \frac{(P_{ob} - P_r)e}{(1-e)} + P_r$$

where FG = Fracture Gradient
P_{ob} = Overburden Gradient
P_r = Reservoir Pressure Gradient
e = Poisson's Ratio

A typical overburden gradient of 1.0 pounds per square inch per foot of depth (psi/ft) is generally used in the calculation (West Texas value), and is expected to be of a similar range in Arizona. Pilot Test area drill stem tests indicate an approximate fresh water gradient for the reservoir pressure; therefore, for the estimated fracture gradient, a freshwater gradient of 0.433 psi/ft is assumed for the Jerome Member of the Martin Formation. Eaton (1969) suggests a constant value of the Poisson's ratio of 0.25 in West Texas. In general, service companies also use 0.25 for Poisson's ratio when planning fracture stimulation jobs for competent formations such as those anticipated at the test site.

An example calculation for the Jerome Injection Interval is as follows:

$$FG = \frac{(1.0-0.433)*0.25}{(1-0.25)} + 0.433$$

$$= 0.622 \text{ psi/ft}$$

The calculated value is slightly less than the observed formation fracture pressure gradient of 0.65 psi/ft of depth used in the San Juan Basin of New Mexico (Dugan Production Corp., 2007). Using the estimated formation fracture gradient of 0.622 psi/ft, the formation fracture pressure at the top of the target formation Jerome Member (3,600 ft) is estimated to equal 2,239 psi, or an incremental pressure increase of 680 psi over the estimated initial formation background pressure of 1,559 psi (freshwater gradient). This formation fracture pressure will vary depending on the depth of the injection horizon selected, which shall be based on well logs and formation testing.

However, the actual maximum injection pressure during the carbon dioxide pilot test shall be equal to or less than 80 percent of the incremental formation fracture pressure derived from the above equation (0.80 x 680 psi = 544 psi). The injection pressure at the top of the target formation Jerome Member (3,600 ft) shall be limited to no more than 2,103 psi, or an incremental pressure increase of 544 psi over the initial background pressure of 1,559 psi (freshwater gradient). The injection pressure shall be re-verified based on the pre-operational SRT performed after the well is drilled, cased, and perforated in the potential reservoir formation (refer to Section 2.2.3.3 for a description of the pre-operational SRT).

2.2.1.2 Other Parameters

The maximum flow rate for the carbon dioxide test shall be determined by the maximum allowable injection pressure as determined by the step-rate injection test using filtered formation water, as described in Section 2.2.3.3. An inline heater shall provide temperature regulation of the carbon dioxide and maintain the temperature between 40 and 70 degrees Fahrenheit. Additionally, the injection well annulus pressurization and monitoring system shall maintain a positive pressure versus the tubing pressure for leak detection. Temporary deviations from this requirement that are part of normal well operations are authorized, but shall not exceed 15 minutes in duration. For 15 minutes after the pressure differential drops below zero, the permittee shall conduct troubleshooting and proceed to restore a pressure differential. Pressurization of the annulus shall be performed using high-pressure nitrogen.

Alternatively, a small-volume, high-pressure pump connected to a low-pressure annulus fluid reserve tank may be used to maintain positive annulus pressure on the injection well. These parameters shall be monitored and recorded continuously.

2.2.1.3 Purity of Carbon Dioxide

The carbon dioxide injected during testing will be purchased from a commercial gas supplier. Bulk quantities of carbon dioxide contain small amounts of other gases. The carbon dioxide approved under this permit shall be at least 99.5% food-grade carbon dioxide by volume. The Material Safety Data Sheet (MSDS) is available for review at ADEQ and has the following information regarding maximum content of chemical constituents in food-grade carbon dioxide:

- Water 0.002%
- Total Hydrocarbons (as Methane) 0.005%
- Oxygen 0.005%
- Carbon Monoxide 0.001%
- Total Sulfur Content 0.00005%

If the total sulfur content exceeds 0.00005% (v/v) as sulfur, then the species shall be determined separately and the following limits shall apply:

- Carbonyl Sulfide 0.00005%
- Hydrogen Sulfide 0.00005%
- Sulfur Dioxide 0.0005%
- Nitric Oxide / Nitrogen Dioxide <0.0005%
- Acetaldehyde 0.00005%
- Nonvolatile Residues 0.001% (wt/wt)

Small quantities of krypton, xenon, and sulfur hexafluoride shall be added to the carbon dioxide as tracers to enable reactive transport analysis.

2.2.2 Site-specific Characteristics

The project site was selected because of its favorable location and geologic conditions. The target injection interval is the Jerome Member of the Devonian Martin Formation, the top of which is estimated to be at a depth of approximately 3,600 ft bgs. The Jerome Member is comprised of clastic sediments and lies at the base of the Martin Formation, which is approximately 200 feet thick at the project site. The Martin Formation underlies the 500-foot thick Naco Formation, which underlies the Supai Group. The Supai Group is comprised of interbedded evaporites and fine-grained mudrocks that will act as a confining zone of limited permeability that will prevent carbon dioxide from migrating upward. Thus, for simulating carbon dioxide injection, the combined 700-ft thick section of the Naco and Martin Formations is considered to be the permeable reservoir, with confining horizons at the base of the Supai above, and the Precambrian crystalline rocks below. Because supercritical carbon dioxide is buoyant, the Supai Group's very limited permeability is critical to the pilot project's success. In the event that the Martin Formation does not exhibit characteristics favorable for the injection of carbon dioxide, the overlying Naco Formation shall be evaluated for potential injection.

The structural geology of the project site is determined by geological data derived from shallow exploratory borings drilled by the permittee. Interpretation of these borings indicated the possible existence of a small, low-relief anticline structure at the project site.

In addition to the injection depth requirement, total dissolved solids (TDS) content of the formation water shall be at least 10,000 milligrams per liter (mg/l). This ensures the injection zone is suitable for testing and not suitable as a future source of drinking water.

2.2.3 Pre-operational Requirements

2.2.3.1 Injection Well Site Preparation, Drilling, and Installation

When preparing the drill site and while drilling the injection well, the permittee shall comply with the provisions of A.A.C. Title 7, Chapter 12, Article 1. The permittee shall identify all aquifers used as sources for drinking water and shall take appropriate measures to protect those aquifers from contamination due to drilling and testing. Copies of injection well reports required by A.A.C. R12-7-187 shall be submitted to ADEQ in addition to the required copies to the Arizona Oil and Gas Conservation Commission.

2.2.3.2 Testing the Water Quality of the Coconino Aquifer

Two representative groundwater samples from the shallower Coconino Aquifer shall be collected prior to any testing. These samples shall be collected from well W-125 and the injection well (during drilling) and analyzed for the constituents listed in Section 4.1, Table I-C. A post-injection groundwater sample shall be collected from W-125 and analyzed for the constituents in Section 4.2, Table II-C. Well W-125 is located between the injection well and nearest drinking water well completed in the Coconino aquifer.

2.2.3.3 Testing the Water Quality of the Injection Formation and Integrity of the Injection Well

Once the injection well is installed to specifications described in the previous section, an initial groundwater sample shall be collected and analyzed for the constituents listed in Section 4.1, Table I-B. If the TDS content of the formation sample is less than 10,000 mg/l, and/or found not suitable for carbon dioxide injection, the perforations shall be plugged and either a different horizon shall be perforated and tested, or the entire well shall be plugged and properly abandoned pursuant to A.A.C. R12-7-126 and 127.

If an acceptable injection horizon is found, a baseline geophysical survey using VSP shall be conducted prior to the SRT. The purpose of the VSP is to survey the pre-injection geologic structure and seismic velocities in the proximity of the injection well. An RST log, and possibly thermal conductivity measurements, shall also be performed and recorded prior to carbon dioxide injection to provide baseline data for comparison with repeat measurements performed after carbon dioxide injection. The comparison of pre- and post-injection data sets will test for carbon dioxide near the wellbore and therefore provide a confirmation of cement-bond and well casing integrity above the injection formation.

A step-rate injection test (SRT) using filtered formation water (produced during well development) shall be conducted on the injection well to establish maximum injection pressure prior to the carbon dioxide injection test. The SRT design and analysis are based on a paper produced by the Society of Petroleum Engineering ("*SPE 16798*"). The SRT shall be used to establish the injection pressure limitation such that pressure in the injection zone during operation shall not initiate new fractures or propagate existing fractures in the injection zone or the confining zone. In no case shall injection pressure cause the movement of injection or formation fluids into or between drinking water aquifers. Specifications for the pre-operational SRT shall include:

1. Prior to testing, shut-in the well long enough so that the bottom-hole pressure approximates shut-in formation pressure.

2. Measure pressures with a down-hole pressure sensor connected to a surface pressure recorder.

3. Use equal-length time step injection intervals throughout the test that are sufficiently long enough to overcome well bore storage. The intervals shall be a duration of at least 30 minutes per interval.

4. The flow rate shall increase with each stepped interval.

5. Record at least five time steps (data points on pressure versus flow plot) before reaching the anticipated maximum pressure.

6. At the end of the test, shut down the pumps and record the instantaneous shut-in pressure.

2.2.4 Operational Requirements

The carbon dioxide injection pilot test requires constant monitoring of flow rate, pressure, and temperature over the approximate 7- to 15-day duration. The testing and monitoring shall be as follows (the order of pre-injection and/or post-injection activities may vary):

1. Collect a water sample from the injection well and perform analyses in Section 4.2, Table I-B;

2. Conduct a pre-injection RST log and VSP survey;

3. Inject approximately 2,000 tons of supercritical carbon dioxide;

4. Wait at least one month;

5. Collect a water sample from the injection well and perform analyses in Section 4.2, Table II-B;

6. Conduct a post-injection RST log for comparison with the pre-injection RST log to test for carbon dioxide near the wellbore and thereby confirm cement-bond and well casing integrity;

7. Conduct a post-injection VSP survey for comparison with the pre-injection VSP survey to map the movement of carbon dioxide in the formation;

8. Collect a water sample from W-125 as described in Section 4.2, Table II-C, between month three and six, following completion of the injection;

9. Cement well perforations and abandon injection well pursuant to A.A.C. R12-7-126 and 127.

If damage is identified during an inspection that could cause or contribute to a discharge, proper repairs shall be promptly performed pursuant to A.A.C. R12-7-112.

2.3 Discharge Limitations [A.R.S. §§ 49-201(14), 49-243 and A.A.C. R18-9-A205(B)]

Discharge Limitations (DLs) in this permit require field calculations with respect to pressure at the injection depth. Refer to Sections 4.1 and 4.2, Tables I-A and II-A, respectively, for detailed information on DLs.

There is no discharge associated with well installation, as fluids shall be recovered, characterized, and disposed of at a licensed facility.

2.4 Point of Compliance [A.R.S. § 49-244]

The POC is established by the following monitoring location:

POC Location	Latitude	Longitude
Located 400 ft southwest of Injection Well (no well existing)	34° 55' 40" N	110° 15' 34" W

The POC is the proposed location for a monitoring well, should ADEQ require any contingency and/or corrective action pursuant to Section 2.6. The Director may amend this permit to designate additional POCs, if information on groundwater gradients or groundwater usage indicates the need.

2.5 Monitoring Requirements [A.R.S. § 49-243(K)(1), A.A.C. R18-9-A206(A)]

In addition to monitoring of the injection well, a shallow monitoring well (W-125), located between the injection well and nearest drinking water user of the shallower Coconino Aquifer, shall be monitored. This well is described below:

Monitoring Location	Latitude	Longitude
W-125 Located 1,800 feet cross-gradient of Injection Well (depth of 140 ft)	34° 55' 43" N	110° 16' 00" W

All monitoring required in this permit shall continue for the duration of the permit, regardless of the status of the facility. The permittee shall develop a site specific Quality Assurance Project Plan (QAPP) that describes in comprehensive detail the formation water sample collection and analysis procedures to ensure the result of work performed will satisfy the data quality objectives of the permit. The permittee is responsible for the quality and accuracy of all data required under this permit. If a third party collects or analyzes samples on behalf of the permittee, the permittee shall obtain a copy of the third party QAPP. All sampling, preservation, and holding times shall be in accordance with currently accepted standards of professional practice. Trip blanks, equipment blanks, and duplicate samples shall also be obtained, and chain-of-custody procedures shall be followed, in accordance with currently accepted standards of professional practice. The permittee shall consult the most recent version of the ADEQ QAPP and Title 40, PART 136 of the Environmental Protection Agency's (EPA) Code of Federal Regulations (CFR) for guidance in this regard. Copies of the QAPP, laboratory analyses and chain-of-custody forms shall be maintained at the permitted facility. Upon request, the permittee shall make these documents immediately available for review by ADEQ personnel.

2.5.1 Discharge Monitoring

Discharge monitoring parameters are included in Sections 4.1 and 4.2 in Tables I-A and II-A, respectively. Discharge monitoring is associated with flow rate, pressure, temperature, and volume with respect to the injection of formation fluid and carbon dioxide.

2.5.2 Facility / Operational Monitoring

2.5.2.1 Ambient Groundwater Monitoring

Ambient groundwater monitoring shall be conducted in the injection well and in a monitoring well (W-125), which is located in the shallow drinking water aquifer between the injection well and nearest user of the drinking water aquifer. Ambient groundwater monitoring shall be performed to establish background water quality in the injection aquifer and shallower drinking water aquifer.

2.5.2.2 Operational Groundwater Monitoring

Operational groundwater monitoring shall be performed following the carbon dioxide injection test to compare water quality in the injection aquifer and shallower drinking water aquifer to that of ambient conditions. Operational monitoring includes the collection of water quality samples pursuant to Section 4.2, Tables II-B and II-C. One sample will be collected from the injection well and the other from the shallower aquifer monitoring well W-125.

As part of the final report, a discussion of pre- and post-test conditions in both aquifers shall be presented according to Section 2.7.4 and the Compliance Schedule in Section 3.0.

2.5.3 Groundwater Monitoring and Sampling Protocols

Static water levels shall be measured and recorded prior to sampling. Well W-125 shall be purged of at least three borehole volumes (as calculated using the static water level) or until field parameters (pH, temperature, conductivity) are stable, whichever represents the greater volume. If evacuation results in the well going dry, the well shall be allowed to recover to 80 percent of the original borehole volume. An explanation for reduced pumping volumes, a record of the volume pumped, and modified sampling procedures shall be reported and submitted with the Self-Monitoring Report Form (SMRF).

The water sample to be obtained from the injection well near the base of the Coconino Formation before setting the intermediate casing will be obtained with the Modular Formation Dynamic Test (MDT) logging tool, which purges formation water through the tool and does not require purging the entire wellbore.

The pre-injection water sample from the injection formation will be obtained from development water near the end of developing the well, which is expected to be after at least three wellbore volumes have been produced.

The post-injection water sample from the injection formation will be obtained with the U-Tube Sampling System after production tubing and a packer have been installed. The injection formation will have been purged before carbon dioxide injection, after which, purging is not required or appropriate.

2.5.4 Surface Water Monitoring and Sampling Protocols

Surface water monitoring and sampling protocols are not applicable for this permit.

2.5.5 Analytical Methodology

All samples collected under this permit shall be analyzed using Arizona state-approved methods. If no state-approved method exists, then any appropriate EPA-approved method shall be used. Regardless of the method used, the detection limits must be sufficient to determine compliance with the regulatory limits of the parameters specified in this permit. Analyses shall be performed by a laboratory licensed by the Arizona Department of Health Services, Office of Laboratory Licensure and Certification. For results to be considered valid, all analytical work shall meet quality control standards specified in the approved methods. A list of Arizona state-certified laboratories can be obtained at the address below:

Arizona Department of Health Services
Office of Laboratory Licensure and Certification
250 North 17th Avenue
Phoenix, AZ 85007
Phone: (602) 364-0720

2.5.6 Installation and Maintenance of Monitoring Equipment

Monitoring equipment required by this permit shall be installed and maintained so that representative samples required by the permit can be collected. If new groundwater wells are determined to be necessary, the construction details shall be submitted to the ADEQ Groundwater Section for approval prior to installation and the permit shall be amended to include any new points.

2.6 Contingency Plan Requirements
[A.R.S. § 49-243(K)(3), (K)(7) and A.A.C. R18-9-A204 and R18-9-A205]

2.6.1 General Contingency Plan Requirements

At least one copy of the approved contingency and emergency response plan(s) submitted in the application (Attachment 11) shall be maintained at the location where day-to-day decisions regarding the operation of the facility are made. The permittee shall be aware of and follow the contingency and emergency plans.

Any alert level (AL) that is exceeded, any violation of a DL, or other permit condition shall be reported to ADEQ following the reporting requirements in Section 2.7.3.

Contingency actions under this permit address potential problems during well construction and injection activities. The permittee is subject to enforcement action for the failure to comply with any contingency actions in this permit. The permittee is responsible for compliance with contingency plans relating to the exceedance of an AL, violation of a DL, or any other permit condition.

2.6.2 Exceeding of Alert Levels

2.6.2.1 Exceeding of Alert Levels Set for Pre-operational and Operational Monitoring

ALs for discharge monitoring are set to maintain operational parameters within safety limits with respect to fracturing of the formation.

1. If an AL set in Sections 4.1 and 4.2, Tables I-A and II-A, has been exceeded, the permittee shall perform contingency actions necessary to protect the formation from fracturing and evaluate the impact of the exceedance on the formation. The permittee shall immediately investigate to determine the cause of the AL being exceeded. The investigation shall include the following:

    a. Inspection, testing, and assessment of the current condition of all components of the injection system that may have contributed to the AL being exceeded, and

    b. Review of all data logger information, test results, and other operational control information to identify any unusual occurrences.

2. The permittee shall initiate actions identified in the approved contingency plan referenced in Section 5.0 and specific contingency measures identified in Section 2.6 to resolve any problems identified by the investigation, which may have led to an AL being exceeded. To implement any other corrective action the permittee shall obtain prior approval from ADEQ according to Section 2.6.6.

3. Within 30 days of an AL being exceeded, the permittee shall submit the related data to the ADEQ Water Quality Compliance Section, along with a summary of the findings of the investigation, the cause of the AL being exceeded, and actions taken to resolve the problem.

4. Upon review of the submitted report, the Department may amend the permit to require additional monitoring, increased frequency of monitoring, amendments to permit

conditions or other actions.

5. The facility is no longer on alert status once the operational indicator no longer indicates that an AL is being exceeded. The permittee shall, however, complete all tasks necessary to return the facility to its pre-alert operating condition.

2.6.2.2 Exceeding of Alert Levels in Groundwater Monitoring

There are no ALs set in this permit with respect to groundwater monitoring, as carbon dioxide (see Section 2.2.1.3 for purity requirements) is this injected material. However, if the post-injection sample from W-125 does not match the cation-anion balance from the pre-injection sample as described below, then ADEQ may require additional reporting and investigation.

If during groundwater monitoring, results for constituents listed in Section 4.2, Tables II-B and II-C, vary from results obtained prior to injection activities beyond that which is expected due to the test, ADEQ may require the permittee to submit a report discussing the ambient conditions in W-125 based upon historical data obtained for the Cholla Power Plant under Permit P-100568. ADEQ, after evaluation of the report, may require corrective action as discussed in Section 2.6.6.

The minimal amount of carbon dioxide injected is not expected to travel more than approximately 400 feet from the injection well; however, the shallower Coconino Aquifer shall be monitored (between the injection source and nearest water user) for groundwater quality to ensure there is no impact from the injection test. This monitoring will offer protection to users of the Coconino Aquifer. ADEQ is not requiring a deep monitoring well in the Martin or Naco Formations except as a contingency action because of the short-term duration and minimal amount of carbon dioxide used in the test.

2.6.3 Discharge Limitations Violations

1. If a DL set in Sections 4.1 and 4.2, Tables I-A and II-A, has been violated, the permittee shall immediately investigate to determine the cause of the violation. The investigation shall include the following:

   a. Inspection, testing, and assessment of the current condition of all injection control systems that may have contributed to the violation,

   b. Review of recent process logs, reports, and other operational control information to identify any unusual occurrences, and

   The permittee shall submit a report according to Section 2.7.3, which includes a summary of the findings of the investigation, the cause of the violation, and actions taken to resolve the problem. The permittee shall consider and ADEQ may require corrective action that may include control of the source of discharge, cleanup of affected soil, surface water or groundwater, and mitigation of the impact of pollutants on existing uses of the aquifer. Corrective actions shall either be specifically identified in this permit, included in an ADEQ approved contingency plan, or separately approved according to Section 2.6.6.

2. Upon review of the submitted report, the Department may amend the permit to require additional monitoring, increased frequency of monitoring, or other actions.

2.6.4 Aquifer Quality Limit Violation

There are no AQLs set in this permit; however, the Director may amend this permit to require contingency and/or corrective action, if results of the post-injection monitoring differ in chemical composition or physical properties from the pre-injection monitoring results associated with W-125.

2.6.5 Emergency Response and Contingency Requirements for Unauthorized Discharges pursuant to A.R.S. §49-201(12) and pursuant to A.R.S. § 49-241

2.6.5.1 Duty to Respond

The permittee shall act immediately to correct any condition resulting from a discharge pursuant to A.R.S. § 49-201(12) if that condition could pose an imminent and substantial endangerment to public health or the environment.

2.6.5.2 Discharge of Hazardous Substances or Toxic Pollutants

In the event of any unauthorized discharge pursuant to A.R.S. § 49-201(12) of suspected hazardous substances (A.R.S. § 49-201(18)) or toxic pollutants (A.R.S. § 49-243(I)) on the facility site, the permittee shall promptly isolate the area and attempt to identify the discharged material. The permittee shall record information, including name, nature of exposure and follow-up medical treatment, if necessary, on persons who may have been exposed during the incident. The permittee shall notify the ADEQ Northern Regional Office at (928) 779-0313, and the ADEQ Water Quality Compliance Section at (602) 771-4497 within 24 hours upon discovering the discharge of hazardous material which (a) has the potential to cause an AWQS or AQL to be exceeded, or (b) could pose an endangerment to public health or the environment.

2.6.5.3 Discharge of Non-hazardous Materials

In the event of any unauthorized discharge pursuant to A.R.S. § 49-201(12) of non-hazardous materials from the facility, the permittee shall promptly attempt to cease the discharge and isolate the discharged material. Discharged material shall be removed and the site cleaned up as soon as possible. The permittee shall notify the ADEQ Northern Regional Office at (928) 779-0313, and the ADEQ Water Quality Compliance Section at (602) 771-4497 within 24-hours upon discovering the discharge of non-hazardous material which (a) has the potential to cause an AQL to be exceeded, or (b) could pose an endangerment to public health or the environment.

2.6.5.4 Reporting Requirements

The permittee shall submit a written report for any unauthorized discharges reported under Sections 2.6.5.2 and 2.6.5.3 to ADEQ Northern Regional Office at (928) 779-0313, and the ADEQ Water Quality Compliance Section at (602) 771-4497 within 30 days of the discharge or as required by subsequent ADEQ action. The report shall summarize the event, including any human exposure, and facility response activities and include all information specified in Section 2.7.3. If a notice is issued by ADEQ subsequent to the discharge notification, any additional information requested in the notice shall also be submitted within the time frame specified in that notice. Upon review of the submitted report, ADEQ may require additional monitoring or corrective actions.

2.6.6 Corrective Actions

Specific contingency measures identified in Section 2.6 and actions identified in the approved contingency plan referenced in Section 5.0 have already been approved by ADEQ and do not require written approval to implement.

With the exception of emergency response actions taken under Section 2.6.5, the permittee shall obtain written approval from the Groundwater Section prior to implementing a corrective action to accomplish any of the following goals in response to exceeding an AL, violation of a DL, or other permit condition:

1. Control of the source of the injected material and de-pressurize the system,

2. Cleanup of affected parts of the aquifer, and

3. Mitigation to limit the impact of pollutants on existing uses of the aquifer.

Within 30 days of completion of any corrective action, the operator shall submit to the ADEQ Water Quality Compliance Section, a written report describing the causes, impacts, and actions taken to resolve the problem.

2.7 Reporting and Recordkeeping Requirements [A.R.S. § 49-243(K)(2) and A.A.C. R18-9-A206(B) and R18-9-A207]

2.7.1 Self-monitoring Report Form

1. The permittee shall complete the SMRFs provided by ADEQ, and submit them to the Water Quality Compliance Section, Data Unit.

2. The permittee shall complete the SMRF to the extent that the information reported may be entered on the form. If no information is required during a month, the permittee shall enter "not required" on the SMRF and submit the report to ADEQ. The permittee shall use the format devised by ADEQ.

3. The tables contained in Sections 4.0 list the parameters to be monitored and the frequency for reporting results for groundwater monitoring. Analytical methods shall be recorded on the SMRFs.

4. In addition to the SMRF, the information contained in A.A.C. R18-9-A206(B)(1) shall be included for exceeding an AL, violation a DL, or any other permit condition being reported in the current reporting period.

2.7.2 Operation Inspection / Log Book Recordkeeping

A signed copy of this permit shall be maintained at all times at the location where day-to-day decisions regarding the operation of the facility are made. A log book (paper copies, forms or electronic data) of the inspections and measurements required by this permit shall be maintained at the location where day-to-day decisions are made regarding the operation of the facility. The log book shall be retained for 10 years from the date of each inspection, and upon request, the permit and the log book shall be made immediately available for review by ADEQ personnel. The information in the log book shall include, but not be limited to, the following information as applicable:

1. Name of inspector;

2. Date and shift inspection was conducted;

3. Condition of applicable facility components;

4. Any damage or malfunction, and the date and time any repairs were performed;

5. Documentation of sampling date and time;

6. Any other information required by this permit to be entered in the log book, and

7. Monitoring records for each measurement shall comply with R18-9 A206(B)(2).

2.7.3 Permit Violation and Alert Level Status Reporting

1. The permittee shall notify the Water Quality Compliance Section in writing within 5 days (except as provided in Section 2.6.5) of becoming aware of a violation of any permit condition, discharge limitation or of an AL being exceeded.

2. The permittee shall submit a written report to the Water Quality Compliance Section within 30 days of becoming aware of the violation of any permit condition or discharge limitation. The report shall document all of the following:

    a. Identification and description of the permit condition for which there has been a violation and a description of its cause.

    b. The period of violation including exact date(s) and time(s), if known, and the anticipated time period during which the violation is expected to continue.

    c. Any corrective action taken or planned to mitigate the effects of the violation, or to eliminate or prevent a recurrence of the violation.

    d. Any monitoring activity or other information which indicates that any pollutants would be reasonably expected to cause a violation of an AWQS.

    e. Proposed changes to the monitoring which include changes in constituents or increased frequency of monitoring.

    f. Description of any malfunction or failure of pollution control devices or other equipment or processes.

2.7.4 Operational, Other or Miscellaneous Reporting

A final report of the pilot test shall be prepared and submitted to ADEQ upon completion of the evaluation of test data. The report shall include, but not be limited to the following:

1. Field procedures and methodologies implemented during the well installation and testing,
2. A discussion of ambient conditions in the injection aquifer and shallow aquifer, including geology, hydrology, water quality, and any other information pertinent to the objectives of the test,
3. A discussion of injection parameters, including graphical representations (time versus pressure) of the initial formation fluid test and carbon dioxide test,
4. Any complications encountered during testing and a description of how the issue was resolved, and
5. Plugging and abandonment procedures.

2.7.5 Reporting Location

All SMRFs shall be submitted to:

Arizona Department of Environmental Quality
Water Quality Compliance Section, Data Unit
Mail Code: 5415B-1
1110 W. Washington Street
Phoenix, AZ 85007
Phone (602) 771-4513

All documents required by this permit to be submitted to the Water Quality Compliance Section shall be directed to:

Arizona Department of Environmental Quality
Water Quality Compliance Section
Mail Code: 5415B-1
1110 W. Washington Street
Phoenix, AZ 85007
Phone (602) 771-4614

and

Arizona Department of Environmental Quality
Northern Regional Office
1801 West Route 66, Suite 117
Flagstaff, Arizona 86001
Phone (928) 779-0313
Fax (928) 773-2700

All documents required by this permit to be submitted to the Groundwater Section shall be directed to:
Arizona Department of Environmental Quality
Groundwater Section
Mail Code: 5415B-3
1110 W. Washington Street
Phoenix, AZ 85007
Phone (602) 771-4428

2.7.6 Reporting Deadline

Report documents are due within 1 month of receipt of final laboratory reports, as per the Compliance Schedule in Section 3.0. Drilling information and well construction documents are due within 90 days of well completion. The final report is due by September 30, 2009, which coincides with the end of the funding period for the pilot test. If the funding period is extended by the U.S. Department of Energy, the final report date will be extended to coincide, or up to the end date of this permit, whichever comes first.

2.7.7 Changes to Facility Information in Section 1.0

The Groundwater Section and Water Quality Compliance Section shall be notified within 10 days of any change of facility information including Facility Name, Permittee Name, Mailing or Street Address, Facility Contact Person or Emergency Telephone Number.

2.8 Temporary Cessation [A.R.S. § 49-243(K)(8) and A.A.C. R18-9-A209(A)]

The permittee shall give written notice to the Water Quality Compliance Section before ceasing operation of the facility for a period of 60 days or greater. The permittee shall take the following measures upon temporary cessation:

Immediately following ADEQ's approval, the permittee shall implement the approved plan. If the permittee intends to permanently cease operation of any facility, the permittee shall submit closure notification, as set forth in Section 2.9 below.

At the time of notification, the permittee shall submit for ADEQ approval, a plan for maintenance of discharge control systems and for monitoring during the period of temporary cessation. Immediately following ADEQ's approval, the permittee shall implement the approved plan. If necessary, ADEQ shall amend permit conditions to incorporate conditions to address temporary cessation. During the period of temporary cessation, the permittee shall provide written notice to the Water Quality Compliance Section of the operational status of the facility every three years. If the permittee intends to permanently cease operation of any facility, the permittee shall submit closure notification, as set forth in Section 2.9 below.

2.9 Closure [A.R.S. §§ 49-243(K)(6), 49-252 and A.A.C. R18-9-A209(B)]

For a facility addressed under this permit, the permittee shall give written notice of closure to the Water Quality Compliance Section of the permittee's intent to cease operation without resuming activity for which the facility was designed or operated.

2.9.1 Closure Plan

Within 90 days following notification of closure, the permittee shall submit for approval to the Groundwater Section, a Closure Plan which meets the requirements of A.R.S. § 49-252 and A.A.C. R18-9-A209(B)(3). Furthermore, the plan shall include the following specific activities:

1. A complete description of well abandonment activities, and
2. A description of any site restoration.

If the closure plan achieves clean closure immediately, ADEQ shall issue a letter of approval to the permittee. If the closure plan contains a schedule for bringing the facility to a clean closure configuration at a future date, ADEQ may incorporate any part of the schedule as an amendment to this permit.

2.9.2 Closure Completion

Upon completion of closure activities, the permittee shall give written notice to the Groundwater Section indicating that the approved Closure Plan has been implemented fully and providing supporting documentation to demonstrate that clean closure has been achieved (soil sample results, verification sampling results, groundwater data, as applicable). If clean closure has been achieved, ADEQ shall issue a letter of approval to the permittee at that time. If any of the following conditions apply, the permittee shall follow the terms of Post Closure stated in this permit:

1. Clean closure cannot be achieved at the time of closure notification or within one year thereafter under a diligent schedule of closure actions;
2. Further action is necessary to keep the facility in compliance with AWQS at the applicable POC;
3. Continued action is required to verify that the closure design has eliminated discharge to the extent intended;
4. Remedial or mitigative measures are necessary to achieve compliance with Title 49, Ch. 2; and
5. Further action is necessary to meet property use restrictions.

2.10 Post-closure [A.R.S. §§ 49-243(K)(6), 49-252 and A.A.C. R18-9-A209(C)]

Post-closure requirements shall be established based on a review of facility closure actions and will be subject to review and approval by the Groundwater Section.

In the event clean closure cannot be achieved pursuant to A.R.S. § 49-252, the permittee shall submit for approval to the Groundwater Section a Post-closure Plan that addresses post-closure maintenance and monitoring actions at the facility. The Post-closure Plan shall meet all requirements of A.R.S. §§ 49-201(30) and 49-252 and A.A.C. R18-9-A209(C). Upon approval of the Post-closure Plan, this permit shall be amended or a new permit shall be issued to incorporate all post-closure controls and monitoring activities of the Post-closure Plan.

2.10.1 Post-closure Plan

There is no Post-closure Plan required under this permit.

2.10.2 Post-closure Completion

There are no post-closure completion requirements under this permit.

3.0 COMPLIANCE SCHEDULE [A.R.S. § 49-243(K)(5) and A.A.C. R18-9-A208]

For each compliance schedule item listed below, the permittee shall submit the required information, including a cover letter that lists the compliance schedule items, to the Groundwater Section. A copy of the cover letter must also be submitted to the Water Quality Compliance Section.

Description	Due by
The permittee shall submit a well construction diagram, lithologic log and geophysical logs that confirm the well is constructed according to the Department-approved design report or plans and specifications, as applicable. Lithologic logging shall include 10-foot samples from 40 feet below ground surface to total injection well depth (samples to be provided to OGCC), and deviation survey information from every 500 feet of drilling.	Within 90 days of completion of construction
The permittee shall collect Coconino aquifer water samples from Monitoring Well W-125 and the injection well (during drilling). In addition, a sample of injection zone water shall be collected from the injection well (upon drilling completion) prior to any injection activities and report the results to the Department (Section 4.1, Tables I-B and I-C).	Within 30 days of receipt of the final laboratory report
The permittee shall collect a sample of injection zone water from the injection well at least 1 month following injection activities and report the results to the Department (Section 4.2, Table II-B).	Within 30 days of receipt of the final laboratory report
The permittee shall collect a Coconino aquifer water sample from Monitoring Well W-125 at least 1 month following injection activities and report the results to the Department (Section 4.2, Table II-C).	Within 30 days of receipt of the final laboratory report
The permittee shall submit documentation of well abandonment activities.	Within 60 days of actual well abandonment
The permittee shall submit a report discussing the findings of the pilot test, including all supporting data.	September 30, 2009, or a subsequent date up to the end of this permit, if funding for this project is extended

4.0 TABLES OF MONITORING REQUIREMENTS

4.1 PRE-OPERATIONAL MONITORING (or CONSTRUCTION REQUIREMENTS)

TABLE I-A
INJECTION WELL PRE-OPERATIONAL MONITORING[1]

Sampling Point Number	Sampling Point Identification		Latitude		Longitude
1	Injection Well		34° 55' 43" N		110° 15' 31" W
Parameter	**AL[2]**	**DL[3]**	**Units**	**Sampling Frequency**	**Reporting Frequency**
Injection Flow Rate[4]	Not Established[5]	Not Established	gpm[6]	Continuous	Monthly
Injection Temperature[7]	Not Established	Not Established	°F[8]	Continuous	Monthly
Max Operational Pressure[9]	80 percent[10]	Field Calculated[11]	psi[12]	Continuous	Monthly
Min Operational Pressure[13]	Not Established	Not Established	psi	Continuous	Monthly
Daily Injection Volume	Not Established	Not Established	gpd[14]	Continuous	Monthly

[1] Monitoring under this table shall continue through the formation water step-test.
[2] AL = Alert Level
[3] DL = Discharge Limitation
[4] Flow shall be measured using a continuous recording flow meter that totals the flows daily.
[5] Not Established = Monitoring required but no limits have been specified at time of permit issuance.
[6] gpm = gallons per minute
[7] Temperature shall be measured using a continuous recording meter downstream of the inline heater and before the wellhead.
[8] °F = degrees Fahrenheit
[9] Pressure shall be monitored continuous inline at the surface of the injection well.
[10] At no time shall operational pressure exceed 80 percent of the fracture pressure at the associated injection depth.
[11] To be calculated in the field at the associated injection depth by Eaton's Method and adjusted accordingly to site-specific conditions at the time of the test
[12] psi = pounds per square inch
[13] Pressure shall be monitored continuous inline at the surface of the injection well.
[14] gpd = gallons per day, where day equals a 24-hour period, or operational duration for a particular day

TABLE I-B
INJECTION WELL PRE-OPERATIONAL GROUNDWATER MONITORING[15]

Parameter	AL	AQL	Units	Sampling Frequency	Reporting Frequency
Indicator Parameters / Major Cations and Anions:					
Temperature (field)	Monitor[16]	Monitor	Degrees Fahrenheit	Once	Once
pH (field)	Monitor	Monitor	S.U.	Once	Once
Iron	Monitor	Monitor	mg/l	Once	Once
Manganese	Monitor	Monitor	mg/l	Once	Once
Total Organic Carbon	Monitor	Monitor	mg/l	Once	Once
Total Dissolved Solids	Monitor	Monitor	mg/l	Once	Once
Sodium	Monitor	Monitor	mg/l	Once	Once
Potassium	Monitor	Monitor	mg/l	Once	Once
Calcium	Monitor	Monitor	mg/l	Once	Once
Chloride	Monitor	Monitor	mg/l	Once	Once
Fluoride	Monitor	Monitor	mg/l	Once	Once
Sodium	Monitor	Monitor	mg/l	Once	Once
Sulfate	Monitor	Monitor	mg/l	Once	Once
Alkalinity	Monitor	Monitor	mg/l	Once	Once
Nitrite-Nitrate as N	Monitor	Monitor	mg/l	Once	Once
Specific Conductivity (field)	Monitor	Monitor	µmhos/cm[17]	Once	Once
Redox Potential	Monitor	Monitor	Eh[18]	Once	Once
Dissolved Oxygen (field)	Monitor	Monitor	mg/l	Once	Once
Dissolved Carbon Dioxide	Monitor	Monitor	mg/l	Once	Once

[15] Monitoring under this table shall be prior to the formation water step-test and after well development.
[16] Monitoring required, but no limits established. Monitoring is for informational purposes only.
[17] µmhos/cm = micromhos per centimeter
[18] Eh is a measure of redox potential and is equal to 1 millivolt (mV).

TABLE I-B (continued)
INJECTION WELL PRE-OPERATIONAL GROUNDWATER MONITORING[19]

Parameter	AL	AQL	Units	Sampling Frequency	Reporting Frequency
Metals:					
Antimony	Monitor	Monitor	mg/l	Once	Once
Arsenic	Monitor	Monitor	mg/l	Once	Once
Barium	Monitor	Monitor	mg/l	Once	Once
Beryllium	Monitor	Monitor	mg/l	Once	Once
Boron	Monitor	Monitor	mg/l	Once	Once
Cadmium	Monitor	Monitor	mg/l	Once	Once
Chromium	Monitor	Monitor	mg/l	Once	Once
Lead	Monitor	Monitor	mg/l	Once	Once
Magnesium	Monitor	Monitor	mg/l	Once	Once
Mercury	Monitor	Monitor	mg/l	Once	Once
Nickel	Monitor	Monitor	mg/l	Once	Once
Selenium	Monitor	Monitor	mg/l	Once	Once

[19] Monitoring under this table shall be prior to the formation water step-test and after well development.

TABLE I-C
COCONINO AQUIFER PRE-OPERATIONAL GROUNDWATER MONITORING[20]

Sampling Point Number	Sampling Point Identification			Latitude	Longitude
1	Injection Well (Coconino Aquifer)			34° 55' 43" N	110° 15' 31" W
2	Monitoring Well (W-125)			34° 55' 43" N	110° 16' 00" W
Parameter	**AL**	**AQL**	**Units**	**Sampling Frequency**	**Reporting Frequency**
Indicator Parameters / Major Cations and Anions:					
Temperature (field)	Monitor[21]	Monitor	Degrees Fahrenheit	Once	Once
pH (field)	Monitor	Monitor	S.U.	Once	Once
Iron	Monitor	Monitor	mg/l	Once	Once
Manganese	Monitor	Monitor	mg/l	Once	Once
Total Organic Carbon	Monitor	Monitor	mg/l	Once	Once
Total Dissolved Solids	Monitor	Monitor	mg/l	Once	Once
Sodium	Monitor	Monitor	mg/l	Once	Once
Potassium	Monitor	Monitor	mg/l	Once	Once
Calcium	Monitor	Monitor	mg/l	Once	Once
Magnesium	Monitor	Monitor	mg/l	Once	Once
Chloride	Monitor	Monitor	mg/l	Once	Once
Fluoride	Monitor	Monitor	mg/l	Once	Once
Sodium	Monitor	Monitor	mg/l	Once	Once
Sulfate	Monitor	Monitor	mg/l	Once	Once
Alkalinity	Monitor	Monitor	mg/l	Once	Once
Specific Conductivity (field)	Monitor	Monitor	µmhos/cm[22]	Once	Once
Dissolved Oxygen	Monitor	Monitor	mg/l	Once	Once
Dissolved Carbon Dioxide	Monitor	Monitor	mg/l	Once	Once

[20] Monitoring under this table shall be prior to any injection activities.
[21] Monitoring required, but no limits established. Monitoring is for informational purposes only.
[22] µmhos/cm = micromhos per centimeter

4.2 COMPLIANCE (or OPERATIONAL) MONITORING

TABLE II-A
INJECTION WELL OPERATIONAL MONITORING[23]

Sampling Point Number	Sampling Point Identification		Latitude		Longitude
1	Injection Well		34° 55' 43" N		110° 15' 31" W
Parameter	**AL[24]**	**DL[25]**	**Units**	**Sampling Frequency**	**Reporting Frequency**
Injection Flow Rate[26]	Not Established[27]	Not Established	gpm[28]	Continuous	Monthly
Injection Temperature[29]	Not Established	Not Established	°F[30]	Continuous	Monthly
Max Operational Pressure[31]	80 percent[32]	Field Calculated[33]	psi[34]	Continuous	Monthly
Min Operational Pressure[35]	Not Established	Not Established	psi	Continuous	Monthly
Daily Injection Volume	Not Established	Not Established	gpd[36]	Continuous	Monthly

[23] Monitoring under this table shall continue through the carbon dioxide injection test.
[24] AL = Alert Level
[25] DL = Discharge Limitation
[26] Flow shall be measured using a continuous recording flow meter that totals the flows daily.
[27] Not Established = Monitoring required but no limits have been specified at time of permit issuance.
[28] gpm = gallons per minute
[29] Temperature shall be measured using a continuous recording meter downstream of the inline heater and before the wellhead.
[30] °F = degrees Fahrenheit
[31] Pressure shall be monitored continuous inline at the surface of the injection well.
[32] At no time shall operational pressure exceed 80 percent of the breakthrough pressure at the associated injection depth.
[33] To be calculated in the field at the associated injection depth by Eaton's Method and adjusted accordingly to site-specific conditions at the time of the test
[34] psi = pounds per square inch
[35] Pressure shall be monitored continuous inline at the surface of the injection well.
[36] gpd = gallons per day, where day equals a 24-hour period, or operational duration for a particular day

TABLE II-B
INJECTION WELL OPERATIONAL GROUNDWATER MONITORING[37]

Parameter	AL	AQL	Units	Sampling Frequency	Reporting Frequency
Indicator Parameters / Major Cations and Anions:					
Temperature (field)	Monitor[38]	Monitor	Degrees Fahrenheit	Once	Once
pH (field)	Monitor	Monitor	S.U.	Once	Once
Iron	Monitor	Monitor	mg/l	Once	Once
Manganese	Monitor	Monitor	mg/l	Once	Once
Total Organic Carbon	Monitor	Monitor	mg/l	Once	Once
Total Dissolved Solids	Monitor	Monitor	mg/l	Once	Once
Sodium	Monitor	Monitor	mg/l	Once	Once
Potassium	Monitor	Monitor	mg/l	Once	Once
Calcium	Monitor	Monitor	mg/l	Once	Once
Chloride	Monitor	Monitor	mg/l	Once	Once
Fluoride	Monitor	Monitor	mg/l	Once	Once
Sodium	Monitor	Monitor	mg/l	Once	Once
Sulfate	Monitor	Monitor	mg/l	Once	Once
Alkalinity	Monitor	Monitor	mg/l	Once	Once
Nitrite-Nitrate as N	Monitor	Monitor	mg/l	Once	Once
Specific Conductivity (field)	Monitor	Monitor	µmhos/cm[39]	Once	Once
Redox Potential	Monitor	Monitor	Eh[40]	Once	Once
Dissolved Oxygen (field)	Monitor	Monitor	mg/l	Once	Once
Dissolved Carbon Dioxide	Monitor	Monitor	mg/l	Once	Once

[37] Monitoring under this table shall be performed following carbon dioxide injection.
[38] Monitoring required, but no limits established. Monitoring is for informational purposes only.
[39] µmhos/cm = micromhos per centimeter
[40] Eh is a measure of redox potential and is equal to 1 millivolt (mV).

TABLE II-B (continued)
INJECTION WELL OPERATIONAL GROUNDWATER MONITORING[41]

Parameter	AL	AQL	Units	Sampling Frequency	Reporting Frequency
Metals:					
Antimony	Monitor	Monitor	mg/l	Once	Once
Arsenic	Monitor	Monitor	mg/l	Once	Once
Barium	Monitor	Monitor	mg/l	Once	Once
Beryllium	Monitor	Monitor	mg/l	Once	Once
Boron	Monitor	Monitor	mg/l	Once	Once
Cadmium	Monitor	Monitor	mg/l	Once	Once
Chromium	Monitor	Monitor	mg/l	Once	Once
Lead	Monitor	Monitor	mg/l	Once	Once
Magnesium	Monitor	Monitor	mg/l	Once	Once
Mercury	Monitor	Monitor	mg/l	Once	Once
Nickel	Monitor	Monitor	mg/l	Once	Once
Selenium	Monitor	Monitor	mg/l	Once	Once

[41] Monitoring under this table shall be performed following carbon dioxide injection.

TABLE II-C
WELL W-125 OPERATIONAL GROUNDWATER MONITORING[42]

Sampling Point Number	Sampling Point Identification			Latitude	Longitude
2	Monitoring Well (W-125)			34° 55' 43" N	110° 16' 00" W
Parameter	**AL**	**AQL**	**Units**	**Sampling Frequency**	**Reporting Frequency**
Indicator Parameters / Major Cations and Anions:					
Temperature (field)	Monitor[43]	Monitor	Degrees Fahrenheit	Once	Once
pH (field)	Monitor	Monitor	S.U.	Once	Once
Iron	Monitor	Monitor	mg/l	Once	Once
Manganese	Monitor	Monitor	mg/l	Once	Once
Total Organic Carbon	Monitor	Monitor	mg/l	Once	Once
Total Dissolved Solids	Monitor	Monitor	mg/l	Once	Once
Sodium	Monitor	Monitor	mg/l	Once	Once
Potassium	Monitor	Monitor	mg/l	Once	Once
Calcium	Monitor	Monitor	mg/l	Once	Once
Magnesium	Monitor	Monitor	mg/l	Once	Once
Chloride	Monitor	Monitor	mg/l	Once	Once
Fluoride	Monitor	Monitor	mg/l	Once	Once
Sodium	Monitor	Monitor	mg/l	Once	Once
Sulfate	Monitor	Monitor	mg/l	Once	Once
Alkalinity	Monitor	Monitor	mg/l	Once	Once
Specific Conductivity (field)	Monitor	Monitor	µmhos/cm[44]	Once	Once
Dissolved Oxygen	Monitor	Monitor	mg/l	Once	Once
Dissolved Carbon Dioxide	Monitor	Monitor	mg/l	Once	Once

[42] Monitoring under this table shall be performed following carbon dioxide injection.
[43] Monitoring required, but no limits established. Monitoring is for informational purposes only.
[44] µmhos/cm = micromhos per centimeter

4.2 COMPLIANCE MONITORING

TABLE III
FACILITY INSPECTION

Pollution Control Structures/Parameter	Performance Levels	Inspection Frequency[45]	Reporting Frequency
Formation Water Pump Integrity	Good working condition	Daily	Monthly
Carbon Dioxide Pump Integrity	Good working condition	Daily	Monthly
Carbon Dioxide Storage Tanks[46]	Good working condition; visually inspect for defects; [Tanks are not individually monitored for pressure. Ambient temperature changes result in internal tank pressure changes. Visual inspection is sufficient.]	Daily	Monthly
Injection Equipment Components[50]	Good working condition; visually inspect for defects; check for any leakage via pressure monitoring	Daily	Monthly
Inline Heater	Good working condition	Daily	Monthly
Pressure and Temperature Monitors[50]	Good working condition	Daily	Monthly
Flow Meters[50]	Good working condition	Daily	Monthly
Surge Protection System	Good working condition	Daily	Monthly
Annulus Fluid Reservoir and Pressurization System[50]	Good working condition; visually inspect for leaks; check for any leakage via pressure monitoring	Daily	Monthly

[45] Write "Not Applicable" in SMRF, if component not in operation for that day.
[46] If issue(s) exist, specify individual piece of equipment with description of problem.

5.0 REFERENCES AND PERTINENT INFORMATION

The terms and conditions set forth in this permit have been developed based upon the information contained in the following, which are on file with the Department:

1. APP Application dated June 12, 2008, received by ADEQ June 16, 2008
2. Public Notice, dated January 30, 2009
3. Public Hearing not applicable
4. Responsiveness Summary dated March 17, 2009

6.0 NOTIFICATION PROVISIONS

6.1 Annual Registration Fees

The permittee is notified of the obligation to pay an Annual Registration Fee to ADEQ. The Annual Registration Fee is based upon the amount of daily influent or discharge of pollutants in gallons per day as established by A.R.S. § 49-242.

6.2 Duty to Comply [A.R.S. §§ 49-221 through 49-263]

The permittee is notified of the obligation to comply with all conditions of this permit and all applicable provisions of Title 49, Chapter 2, Articles 1, 2 and 3 of the Arizona Revised Statutes, Title 18, Chapter 9, Articles 1 through 4, and Title 18, Chapter 11, Article 4 of the Arizona Administrative Code. Any permit non-compliance constitutes a violation and is grounds for an enforcement action pursuant to Title 49, Chapter 2, Article 4 or permit amendment, suspension, or revocation.

6.3 Duty to Provide Information [A.R.S. §§ 49-243(K)(2) and 49-243(K)(8)]

The permittee shall furnish to the Director, or an authorized representative, within a time specified, any information which the Director may request to determine whether cause exists for amending or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the Director, upon request, copies of records required to be kept by this permit.

6.4 Compliance with Aquifer Water Quality Standards [A.R.S. §§ 49-243(B)(2) and 49-243(B)(3)]

The permittee shall not cause or contribute to a violation of an aquifer water quality standard at the applicable POC for the facility. Where, at the time of issuance of the permit, an aquifer already exceeds an aquifer water quality standard for a pollutant, the permittee shall not discharge that pollutant so as to further degrade, at the applicable POC for the facility, the water quality of any aquifer for that pollutant.

6.5 Technical and Financial Capability [A.R.S. §§ 49-243(K)(8) and 49-243(N) and A.A.C. R18-9-A202(B) and R18-9-A203(E) and (F)]

The permittee shall have and maintain the technical and financial capability necessary to fully carry out the terms and conditions of this permit. Any bond, insurance policy, trust fund, or other financial assurance mechanism provided as a demonstration of financial capability in the permit application, pursuant to A.A.C. R18-9-A203(D), shall be in effect prior to any discharge authorized by this permit and shall remain in effect for the duration of the permit.

6.6 Reporting of Bankruptcy or Environmental Enforcement [A.A.C. R18-9-A207(C)]

The permittee shall notify the Director within 5 days after the occurrence of any one of the following:

1. The filing of bankruptcy by the permittee.
2. The entry of any order or judgment not issued by the Director against the permittee for the enforcement of any environmental protection statute or rule.

6.7 Monitoring and Records [A.R.S. § 49-243(K)(8) and A.A.C. R18-9-A206]

The permittee shall conduct any monitoring activity necessary to assure compliance with this permit, with the applicable water quality standards established pursuant to A.R.S. §§ 49-221 and 49-223 and §§ 49-241 through 49-252.

6.8 Inspection and Entry [A.R.S. §§ 41-1009, 49-203(B) and 49-243(K)(8)]

In accordance with A.R.S. §§ 41-1009 and 49-203(B), the permittee shall allow the Director, or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to enter and inspect the facility as reasonably necessary to ensure compliance with Title 49, Chapter 2, Article 3 of the Arizona Revised Statutes, and Title 18, Chapter 9, Articles 1 through 4 of the Arizona Administrative Code and the terms and conditions of this permit.

6.9 Duty to Modify [A.R.S. § 49-243(K)(8) and A.A.C. R18-9-A211]

The permittee shall apply for and receive a written amendment before deviating from any of the designs

or operational practices specified by this permit.

6.10 Permit Action: Amendment, Transfer, Suspension & Revocation
[A.R.S. §§ 49-201, 49-241 through 251, A.A.C. R18-9-A211, R18-9-A212 and R18-9-A213]
This permit may be amended, transferred, renewed, or revoked for cause, under the rules of the Department.

The permittee shall notify the Groundwater Section in writing within 15 days after any change in the owner or operator of the facility. The notification shall state the permit number, the name of the facility, the date of property transfer, and the name, address, and phone number where the new owner or operator can be reached. The operator shall advise the new owner or operators of the terms of this permit and the need for permit transfer in accordance with the rules.

7.0 ADDITIONAL PERMIT CONDITIONS

7.1 Other Information [A.R.S. § 49-243(K)(8)]

Where the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Director, the permittee shall promptly submit the correct facts or information.

7.2 Severability [A.R.S. §§ 49-201, 49-241 through 251, A.A.C. R18-9-A211, R18-9-A212 and R18-9-A213]

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby. The filing of a request by the permittee for a permit action does not stay or suspend the effectiveness of any existing permit condition.

7.3 Permit Transfer

This permit may not be transferred to any other person except after notice to and approval of the transfer by the Department. No transfer shall be approved until the applicant complies with all transfer requirements as specified in A.A.C. R18-9-A212(B) and (C).