

**TECHNICAL SUPPORT DOCUMENT AND STATEMENT OF BASIS  
FOR AIR QUALITY CONTROL PERMIT NO. 41787  
ISSUED TO ARIZONA PUBLIC SERVICE COMPANY - CHOLLA POWER PLANT**

March 29, 2007

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## I. INTRODUCTION

This permit is a significant permit revision to Air Quality Permit No. 33500, the Title V permit issued to Arizona Public Service Company (APS), the Permittee, for operation of its Cholla Power Plant (Cholla), located approximately two miles east of the town of Joseph City on Interstate 40, in Navajo County, Arizona, and approximately 200 miles northeast of Phoenix at an elevation of 5019 feet above sea level.

### A. Company Information

Facility Name: Cholla Power Plant  
Mailing Address: P.O. Box 188  
Mail Station 4451  
Joseph City, Navajo County, AZ 86032  
Facility Address: I-40 Frontage Road  
Joseph City, Navajo County, AZ 86032

### B. Attainment Classification

The Cholla Power Plant area is designated by the Environmental Protection Agency (EPA) as an attainment area for all criteria pollutants.

C. The Cholla Power Plant consists of four coal-fired steam generating units, associated air pollution control devices, and auxiliary equipment necessary to produce electricity. The gross megawatt capacities are as follows: Unit 1 at 125, Unit 2 at 300, Unit 3 at 300, and Unit 4 at 425 megawatts. APS has decided to implement voluntary emissions reduction projects at Cholla, including retrofitting all four boilers with low NOx burners (LNBs) and over-fire air systems summarized in Table 1:

Table 1: Low NOx Burner Retrofits Project Summary

Unit	Projected LNBs Operational Date	Expected NOx Emission Rates
1	December 31, 2007	0.22 lbs/MMBtu
2	December 31, 2008	0.22 lbs/MMBtu
3	December 31, 2008	0.22 lbs/MMBtu
4	December 31, 2009	0.22 lbs/MMBtu

While the low NOx burner retrofits will result in large NOx emission reductions, they may result in actual carbon monoxide (CO) emission increases. CO is emitted from coal-fired boilers as a result of incomplete combustion. CO emissions can be reduced by operating the boiler with higher flame temperatures, higher excess oxygen levels, and longer furnace residence times. But these techniques for reducing CO emissions increase NOx emissions. Therefore, achieving low CO and NOx emissions is a balancing act in boiler design and operation.

APS has determined that the CO net emission increase resulting from the low NOx burner retrofits could potentially be greater than the 100 tons CO per year significant level under the Prevention of Significant Deterioration (PSD) provisions, and therefore is submitting a PSD permit application for the project. The only pollutant with potential net emission increase greater than the significant level is CO, and so only CO requires a PSD review.

This permit authorizes APS to proceed with the low NOx burner retrofits at the Cholla Power Plant by incorporating into Air Quality Permit No. 33500 for CO emissions, the Best Available Control Technology (BACT) and continuous emission monitoring requirements required under the PSD regulations.

## II. EMISSIONS SUMMARY

As discussed in Section I, the low NOx burner retrofits will reduce nitrogen oxides emissions but may collaterally increase carbon monoxide emissions. Table 2 summarizes pre-project baseline emissions versus post-project potential to emit (PTE) of the two regulated criteria air pollutants.

Table 2: Emissions Summary

Steam Boiler Unit	Pollutant	Pre-Project Baseline Emissions (tpy)	Post-Project PTE <sup>(1)</sup> (tpy)
1	NOx	1,823	1,305
	CO	113	890
2	NOx	3,569	3,127
	CO	247	2,132
3	NOx	3,422	3,138
	CO	254	2,140
4	NOx	4,764	4,435
	CO	366	3,024

(1) The post-project PTE was estimated using 0.22 lb NOx per MMBtu and 0.15 lb CO per MMBtu.

## III. APPLICABLE REGULATIONS

The low NOx burner retrofitting project is considered a physical change or change in the method of operation. As indicated in Table 2, the change would result in a significant net emissions increase of carbon monoxide. Pursuant to Arizona Administrative Code (A.A.C.), Title 18, Chapter 2, Article 1, paragraph 101.63 (R18-2-101.63), the project is defined as a "major modification" and thus, the A.A.C. Title 18, Chapter 2, Article 4 analysis (Prevention of Significant Deterioration implication) is required in this permit action that includes among other things, the best available control technology (BACT) (A.A.C. R18-2-406) and air quality impact analysis (A.A.C. R18-2-407) for carbon monoxide.

## IV. CO BACT ANALYSIS

### A. General

The term "best available control technology" is defined in A.A.C. R18-2-101.19 as "an emission limitation, including a visible emissions standard, based on the maximum degree of reduction for each air pollutant listed in R18-2-101.97(a) which would be emitted from any proposed major source or major modification, taking into account energy, environmental, and economic impact and other costs, determined by the Director in accordance with R18-2-406.A.4 to be achievable for such source or modification."

The procedures for establishing BACT are set forth at A.A.C. R18-2-406.A.4 as "BACT shall be determined on a case-by-case basis and may constitute application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment, clean fuels, or innovative fuel combustion techniques, for control of such pollutant. In no event shall such application of BACT result in emissions of any pollutant,

which would exceed the emissions allowed by any applicable new source performance standard or national emission standard for hazardous air pollutants under Articles 9 and 11 of this Chapter. If the Director determines that technological or economic limitations on the application of measurement methodology to a particular emissions unit would make the imposition of an emissions standard infeasible, a design, equipment, work practice, operational standard, or combination thereof may be prescribed instead to satisfy the requirement for the application of BACT. Such standard shall, to the degree possible, set forth the emissions reduction achievable by implementation of such design, equipment, work practice, or operation and shall provide for compliance by means which achieve equivalent results.”

The U.S. EPA’s interpretive policies relating to BACT analyses are set forth in several informal guidance documents. Most notable among these are the following:

- “Guidelines for Determining Best Available Control Technology (BACT),” December 1978.
- “Prevention of Significant Deterioration Workshop Manual,” October 1980.
- “New Source Review Workshop Manual: Prevention of Significant Deterioration and Nonattainment Area Permitting,” Draft. October 1990.

The Department generally uses what is termed a “top-down” procedure when making BACT determinations. This procedure is designed to ensure that each determination is made consistent with the two core criteria for BACT: consideration of the most stringent control technologies available, and a reasoned justification, considering energy, environmental and economic impacts and other costs, of any decision to require less than the maximum degree of reduction in emissions. The framework for the top-down BACT analysis procedure used by the Department comprises five key steps as follows:

1. Identify all available control technologies with practical potential for application to the specific emission unit for the regulated pollutant under evaluation;
2. Eliminate all technically infeasible control technologies;
3. Rank remaining control technologies by effectiveness and tabulate a control hierarchy;
4. Evaluate most effective controls and document results; and
5. Select BACT, which will be the most effective practical option not rejected, based on economic, environmental, and/or energy impacts.

The five-step procedure mirrors the analytical framework set forth in the draft 1990 guidance document. However, it should be noted that the Department does not necessarily adhere to the prescriptive process described in the draft 1990 guidance document. Strict adherence to the detailed top-down BACT analysis process described in that draft document would unnecessarily restrict the Department’s judgment and discretion in weighing various factors before making case-by-case BACT determinations. Rather, as outlined in the 1978 and 1980 guidance documents, the Department has broad flexibility in applying its judgment and discretion in making these determinations.

Materials considered by the applicant and by the Department in identifying and evaluating available control options include the following:

- Entries in the RACT/BACT/LAER Clearinghouse (RBLC) maintained by the U.S. EPA. This database is the most comprehensive and up-to-date listing of control technology determinations available.
- Information provided by pollution control equipment vendors.
- Information provided by industry representatives and by other State permitting authorities. This information is particularly valuable in clarifying or updating control technology information that has not yet been entered into the RACT/BACT/LAER Clearinghouse.

The BACT evaluations and proposed BACT determinations for carbon monoxide emissions associated with the low NOx burner retrofits at the Cholla facility are discussed in the following subsection.

## B. BACT for CO Emissions

### Step 1 – Identify All Available Control Technologies

Available control technologies for CO emissions from the pulverized coal-fired boilers include good combustion practices, oxidation catalysts, and thermal oxidation.

### Step 2 – Eliminate all technically infeasible control technologies

Coal-fired boilers have several characteristics that make the use of oxidation catalysts technically infeasible, including low excess oxygen levels in the flue gas, low flue gas temperatures, and catalyst fouling/poisoning by fuel sulfur and fly ash. Because of these technical problems, oxidation catalysts have not been used to reduce CO emissions from coal-fired boilers.

Thermal oxidation would involve injecting additional air into the flue gas and heating the oxygen enriched mixture to approximately 1,500 °F to oxidize CO to carbon dioxide. However, since the combustion of the reheat fuel would also result in CO emissions, there is no evidence that thermal oxidation would result in any CO emission reductions. Since thermal oxidation has never been demonstrated on a coal-fired boiler, and because there is no evidence that it could reduce CO emissions, thermal oxidation is not considered by the Department to be a technically feasible CO control technology for coal-fired boilers.

### Step 3 – Rank Control Effectiveness of Technically Feasible Control Options

Based on the above analysis, good combustion practices (GCP) is the only technically feasible CO control technology for pulverized coal-fired boilers. GCP or combustion controls generally include the following components:

1. Good air/fuel mixing in the combustion zone
2. High temperatures and low oxygen levels in the primary combustion zone
3. Overall excess oxygen levels high enough to complete combustion while maximizing boiler thermal efficiency
4. Sufficient residence time to complete combustion

RBLC Data indicate that the recent CO BACT emission limits using GCP for utility steam boilers have ranged from 0.10 to 0.50 lb/MMBtu with 0.15 lb/MMBtu being the lowest

permitted rate that has been demonstrated in operating practice (Rocky Mountain Power - Hardin and Black Hills Units).

The Cholla units will be retrofitted with low NOx burners and over-fire air systems. Because these boilers will be retrofitted rather than being originally designed for optimum combustion as with new units, it is uncertain whether the retrofitted units can achieve the same CO emission rates as new boilers. Therefore, rather than setting the CO emission rates equal to the lowest proposed BACT limits for new units in the RBLC, Cholla has proposed an achievable rate of 0.15 lb/MMBtu, based on a daily rolling 30-day average, a median RBLC value that has been demonstrated in practice. In addition, Cholla has also presumed a CO maximum hourly rate of 0.75 lb/MMBtu for short term dispersion modeling purposes.

CO emissions from pulverized coal-fired boilers can spike during periods of startup, shutdown, or malfunction because of unstable combustion conditions. CO (and volatile organic compound) emissions are also sensitive to boiler operating conditions. Changes in operating conditions, such as mill (pulverizer) starts and stops, can have a significant, though temporary, impact on CO emissions. This condition is further exasperated during boiler startup because the boiler itself is relatively cool, and the low air flow rates make it difficult to obtain good air/fuel mixing. To address this issue, Cholla has proposed to exclude time periods of startup, shutdown, and malfunction from the BACT limit.

#### Step 4 – Evaluate the Most Effective Controls

Because no specific CO control technologies or practices beyond good combustion practices were identified as part of this BACT analysis, additional evaluation is unnecessary.

#### Step 5 – Select BACT for CO Emissions

Based on this analysis, it can be concluded that the use of good combustion practices is the best available control technology for CO emissions for the Cholla Units 1-4 low-NOx burner retrofits project. This control technology can achieve a CO emission rate of 0.15 lb/MMBtu based on a 30-day rolling average and an hourly rate of 0.75 lb/MMBtu, excluding periods of startup, shutdown and malfunction. The Department concurs that the proposed emission limits represent BACT for CO emissions from pulverized coal-fired boilers.

## **V. MONITORING AND COMPLIANCE DEMONSTRATION PROCEDURES**

As described in Section IV, all four steam boiler units at Cholla retrofitted with low NOx burners and over-fire air systems will be subject to the CO emission limits of 0.15 lb/MMBtu on a 30-day rolling average and 0.75 lb/MMBtu on hourly basis. Cholla is required in this permit action to install and operate a continuous monitoring system at each boiler stack for carbon monoxide emissions. The monitoring system will be used to demonstrate compliance with the CO emission limits and is required to meet the following:

- 40 CFR Part 60, Appendix B, Performance Specification 4A, “Specifications and Test Procedures for Carbon Monoxide Continuous Emission Monitoring Systems in Stationary Sources”

- 40 CFR Part 60, Appendix B, Performance Specification 3, “Specifications and Test Procedures for O<sub>2</sub> and CO<sub>2</sub> Continuous Emission Monitoring Systems in Stationary Sources”
- 40 CFR Part 75, Appendix A, “Specification and Test Procedures”
- 40 CFR Part 75, Appendix B, “Quality Assurance and Quality Control Procedure”
- 40 CFR Part 75, Subpart D, “Missing Data Substitution Procedures” and Appendix C, “Missing Data Estimation Procedures”

In addition, to demonstrate initial compliance with the CO emission limits, initial stack performance tests are required to be conducted at each boiler retrofitted with the low NO<sub>x</sub> burners and over-fire air systems, using EPA Reference Method 10, “Determination of Carbon Monoxide Emissions from Stationary Sources (Instrumental Analyzer Procedure)”, in conjunction with the appropriate procedures contained in Method 19, “Determination of Sulfur Dioxide Removal Efficiency and Particulate Matter, Sulfur Dioxide, and Nitrogen Oxide Emission Rates”.

## VI. AIR QUALITY IMPACT ANALYSIS

### A. General

The Cholla facility is located in an area that has been designated as attainment or unclassifiable for all criteria pollutants, therefore, the pertinent requirements for ambient air quality impact analyses and other impact analyses are found in A.A.C. R18-2-406.A.5 and R18-2-407. The air quality analyses must demonstrate that the project’s proposed significant emission increases will not cause or contribute to an exceedance of any applicable National Ambient Air Quality Standard (NAAQS) or PSD increment. As noted in Section II of this Technical Support Document, carbon monoxide is the only criteria air pollutant that is proposed to be emitted in significant quantities.

The NAAQS are maximum concentration “ceilings” measured in terms of the total concentration of a pollutant in the atmosphere. For a new or modified source, compliance with any NAAQS is based upon the total estimated air quality, which is the sum of the background ambient concentrations, the estimated ambient impacts of existing sources of air pollution, and the estimated ambient impacts of the applicant’s proposed emissions. The NAAQS for carbon monoxide are 10 mg/m<sup>3</sup> over 8-hour averaging interval and 40 mg/m<sup>3</sup> over 1-hour averaging interval.

A PSD increment, on the other hand, is the maximum increase in ambient concentration that is allowed to occur above a baseline concentration for a pollutant. Significant deterioration is said to occur when the amount of a new pollution would exceed the applicable PSD increment. There are no PSD increments established for carbon monoxide.

Additional analyses required under A.A.C. R18-2-407 include an analysis of the impairment to visibility, soils, and vegetation, and an analysis of the air quality impact projected for the area as a result of general commercial, residential, industrial, and other growth associated with the new source or modification. These analyses do not apply to the carbon monoxide since there is no growth associated with the proposed low NO<sub>x</sub> burner project and no known facts that indicate that CO emissions would lead to the impairment to visibility, soil and vegetation.

The Cholla facility is located 35 km distant from the Petrified Forest Class I area. The Federal Land Manager for the Class I area was contacted and no analyses have been requested pertaining to impacts of the low NOx burner project on visibility and other Air Quality Related Values.

B. Modeled CO Emission Rates

As described in Section IV, the proposed CO BACT emission limit for all four boilers will be 0.15lb/MMBtu on a 30-day basis. Table 3 presents the CO emission rate calculations for the 30-day BACT limit as well as for a higher CO hourly rate that addresses operating variability.

Table 3: Project CO Emissions

	Unit 1	Unit 2	Unit 3	Unit 4
Heat input (MMBtu/hr)	1,354	3,245	3,257	4,603
CO BACT limit (lb/MMBtu, 30-day average)	0.15	0.15	0.15	0.15
CO maximum hourly rate (lb/MMBtu)	0.75	0.75	0.75	0.75
Modeled CO maximum hourly rate(lb/hr)	1,016	2,434	2,443	3,452

C. Modeling Analysis Design

EPA guidance for performing air quality modeling analyses is set forth in Chapter C of EPA's New Source Review Workshop Manual, Draft - October 1990, and in EPA's "Guideline on Air Quality Models", 40 CFR Part 51, Appendix W. ADEQ modeling guidance is contained in the ADEQ Modeling Guidelines. All modeling procedures used for the Cholla analysis are consistent with relevant EPA and ADEQ guidance. The AERMOD (version 04300) dispersion model was used for the assessment of the ambient air impacts. This is the current EPA and ADEQ approved model for PSD modeling analyses. Outlined in the following are the results of the modeling. For detailed discussion such as meteorological data, receptor network, source locations and parameters, and building downwash, please review the permit application package submitted by APS.

D. Modeling Results

The CO modeling analysis was conducted in two steps: a significant impact analysis, followed if necessary by a cumulative NAAQS analysis. Table 4 presents the summary of the significant impact modeling. The highest modeled short-term concentrations were tabulated for comparison to the significant impact level (SIL). The project's ambient impacts are less than the SIL for all averaging intervals for CO. Therefore, a cumulative NAAQS analyses is not required.

Table 4: CO Significant Impacts Analysis Results

Average interval	Maximum impact ( $\mu\text{g}/\text{m}^3$ )	SIL ( $\mu\text{g}/\text{m}^3$ )	Cumulative analysis? (yes/no)
1-hour	1,643	2,000	No
8-hour	316	500	No

