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Technical Support Document
Title V Permit
Salt River Project Agricultural Improvement and Power District
Copper Crossing Energy and Research Center
Permit # V20695.000

1. Background

1.1 Applicant

Salt River Project Agricultural Improvement and Power District
Copper Crossing Energy and Research Center
North Attaway Road and East Bella Vista Road, Pinal County, AZ

1.2 Application History

This permit pertains to a new natural gas power plant, operated by Salt River Project Agricultural Improvement and Power District (SRP). The SIC Code is 4911 and the NAICS Code is 221100. The facility, also known as the Copper Crossing Energy and Research Center (CCERC), is located on Pinal County parcel number #210-38-001A. The unitary permit is issued under the Pinal County Air Quality Control District (PCAQCD) State Implementation Plan (SIP) approved authority. This technical support document (TSD) summarizes the main items analyzed for this facility's permit. This permit limits emissions from this facility to be below Prevention of Significant Deterioration (PSD) levels and Nonattainment New Source Review (NNSR), therefore this facility is not subject to Best Available Control Technology (BACT) requirements.

1.3 Project Location

The proposed facility will be located within Pinal County, approximately 64 kilometers (30 miles) southeast of Tempe, Arizona. The approximate Universal Transverse Mercator (UTM) coordinates of the facility are 456,100 meters east and 3,668,500 meters north (UTM Zone 12, NAD 83). The facility is approximately 476 meters (1,560) feet above mean sea level

1.4 Attainment Classification

The source is situated in an area classified as serious non-attainment for PM10.

1.5 Permit Provisions; Regulatory Summary

This permit constitutes a "minor NSR" permit pursuant to Pinal County's SIP-approved program. The permit imposes "synthetic minor" limitations for PSD and NNSR purposes. In the context of the PSD requirements under the Clean Air Act ("CAA") and local rules, this permit constitutes a "synthetic minor" permit in that it establishes enforceable, verifiable limits to cap emissions of criteria pollutants with the exception of PM10 below the 250 TPY, and annual emissions of PM10 to less than 70 tons per year of the major emitting source threshold that would trigger a PSD permit requirement under the Clean Air Act[1]. Those "synthetic minor" limitations consist of a combination of conservative and measured emission rates for the primary pollutants, coupled with a tracking and projection system to establish verifiable, operational limitations. Pursuant to Code §3-1-084, the operative limitations constitute federally enforceable limitations.

2. Process Description

2.1 General Process

SRP is proposing to construct the CCERC Project with a generating capacity of 99 MW-gross approximately (at ISO conditions) natural gas-fueled electric generating station on an approximately 171 acre site in Pinal County, Arizona. CCERC Project will provide the incremental peak capacity, support the integration of renewable resources, and serve the peak electricity demand. The proposed facility design will include two (2) aeroderivative General Electric (GE) LM6000PC or equivalent simple cycle combustion turbines ("SCCTs"), that will drive electricity generators each approximately rated at 49.5 MW gross generation capacity.

The aeroderivative Model LM6000PC SCCTs will drive electric generators to produce electric power for supply to the grid. This combustion turbine technology is comprised of an air inlet system, two compressor sections, a combustion section, and a turbine section. The air inlet system includes an inlet air heater, inlet air cooler, air filters, and noise silencer that supplies air

[1] The proposed facility is not one of the named source categories

to the multistage axial compressor. The turbines are equipped with inlet air filters which remove dust and particulate matter from the inlet air. During hot weather, the filtered air may also be cooled by passing through an inlet air evaporative cooling system. During cold weather, the filtered air may be heated by use of a radiative heating system that is part of the anti-icing system. This system utilizes a glycol and water solution as the working fluid that is heated by induction heaters. The filtered air is drawn into the low-pressure compressor section where the air is compressed. The SCCTs are also equipped with spray intercooling, SPRINT, which allows for demineralized water to be atomized within the low-pressure compressor. The resulting increase in mass flow allows for higher power output in high ambient conditions. The low-pressure compressor section features fixed inlet guide vanes. The high-pressure section of the compressor uses independently controlled variable stator vanes to optimize air flow to the combustion section. Incorporation of these advanced airflow and cooling technologies help the proposed turbines have lower emission rates, increased fuel efficiency, and minimized unburned hydrocarbon emissions. Water is also injected into the combustion section of the turbine which reduces flame temperatures and thermal nitrogen oxides ("NOX") formation.

2.2 Emission Units

Emission Units	Description	Capacity
SCCT1	GE LM6000PC Simple Cycle SCCT Aeroderivative Unit 1	490 MM Btu/hr.
SCCT2	GE LM6000PC Simple Cycle SCCT Aeroderivative Unit 2	490 MM Btu/hr.

2.3 Capture and Control

The combustion gases exit the SCCTs at temperatures ranging from 760 °F to 1,100 °F. To enable the use of selective catalytic reduction ("SCR") systems for the proposed turbines, an air injection system is included. This system supplies tempering air to the exhaust of the turbine section to reduce the exhaust gas temperature to around 800 °F at the catalyst inlet. The exhaust gases will then pass through two post combustion air quality control systems: oxidation catalysts for the control of carbon monoxide ("CO") and volatile organic compounds ("VOC"), and high-temperature SCR systems for the control of NOX emissions.

3. Project Emissions

3.1 Design Parameters and Emission Rates

Parameters	Value	Units	Source
Maximum Heat Input (59 °F, site elevation, full load, inlet conditioning and SPRINT system	490	MMBtu/hr. each (HHV)	Equipment specification
Annual utilization per SCCT for normal operation (89%)	7,811	hrs./yr.	
Maximum NO_X emission rate	4.4	lb./hr.	Equipment specification
Maximum CO emission rate	7.6	lb./hr.	Equipment specification
Maximum VOC emission rate	4.3	lb./hr.	Equipment specification
Maximum $PM/PM_{10}/PM_{2.5}$ emission rate[2]	4.2	lb./hr.	Vendor specification
Maximum SO_2 emission rate	0.001	lb of SO_2/MMBtu	Fuel specification
Maximum HAPs emission rate (site adjusted average)	1.1e-4	lb/MMBtu	AP-42, Table 3.1-3
Maximum Pb emission rate	4.93E-07	lb/MMBtu	U.S. Compilation of Air Pollutant Emission
Maximum greenhouse gas emission rate natural gas CO2e	117.10	lb/MMBtu	40 CFR 98, Table C-1 40 CFR 98, Table C-2 40 CFR 98, Table A-1

[2] PM emissions rates for combustion units, conservatively, include both filterable and condensable fractions.

Maximum greenhouse gas emission rate natural gas CO2	116.98		

3.2 Potential Emissions

The potential emissions of regulated NSR pollutants from the simple cycle combustion turbines, SCCT1 and SCCT2, during normal operation using the conservative emission rates are summarized in the table below:

Pollutant	**Emissions SCCT1 (tpy)**	**Emissions SCCT2 (tpy)**	**Total Emissions for Two SCCTs During Normal Operations (tpy)**
NO_X	17.2	17.2	34.4
CO	29.7	29.7	59.4
VOC	16.8	16.8	33.6
SO_2	1.9	1.9	3.8
PM	16.4	16.4	32.8
PM_{10}	16.4	16.4	32.8
$PM_{2.5}$	16.4	16.4	32.8
H_2SO_4	0.19	0.19	0.38
Pb	0.001	0.001	0.002
CO_2	223,765	223,765	447,530
CO_2e	224,002	224,002	448,004

3.3 Startup and Shutdown Emissions

The air pollution control systems including SCR and oxidation catalysts are not operational during the startup and shutdown of the aeroderivative combustion turbines. Water injection is used to reduce NOX emissions from these SCCTs. SCR and oxidation catalyst systems are not fully functional during periods of startup and shutdown because the exhaust gas temperatures are too low for these systems to function as designed. During a startup, as the SCCT achieves minimum emissions compliance load ("MECL"), the SCCT emissions controls reduce the stack emission rates of NOX and CO below the rates in the emissions specifications for normal operation.
For simple cycle combustion turbines, the time required for startup is much shorter than combustion turbines used in combined cycle applications. The aeroderivative SCCTs are able to achieve full capacity within 10 minutes but the SCR requires a warm-up of up to 20 minutes to achieve optimum temperature for emissions control. Therefore, the unit achieves MECL in ~ 30 minutes and for purposes of this permit application, emissions calculations have been conducted using the full 30 minutes for a startup cycle. The length of time for a normal shutdown, that is, the time from the MECL to the time when the flame out occurs, is normally 9 minutes. Therefore, the normal duration for a startup and shutdown cycle is 39 minutes.

In Table below, the startup and shutdown emissions are detailed by event and the maximum annual emissions are also shown. The startup and shutdown annual emissions are calculated using an assumption of 1,460 startups and shutdowns cycles per year per SCCT. NOx, CO, VOC, and particulate matter emission rates during startup and shutdown, in terms of pounds per event, were provided by GE. Emissions of other pollutants are calculated using the emission factors for normal operation and heat input for a startup and shutdown cycle. Heat input for startup and shutdown cycle for the SCCT of from MECL heat input for the SCCT (at 200 MMBtu (HHV))

Pollutant	**Startup/Shutdown Emissions (lb/event)**	**Startup/Shutdown Emissions SCCT1 (tpy)**	**Startup/Shutdown Emissions SCCT2 (tpy)**	**Total Startup/shutdown Emissions for Two SCCTs (tpy)**
NO_X	18.2	13.3	13.3	26.6
CO	32.3	23.6	23.6	47.2
VOC	2.7	2.0	2.0	4.0
SO_2	-	0.1	0.1	0.2
PM	5.1	3.7	3.7	7.4
PM_{10}	5.1	3.7	3.7	7.4

$PM_{2.5}$	5.1	3.7	3.7	7.4
H_2SO_4	-	0.01	0.01	0.02
Pb	-	4.7E-05	4.7E-05	9.33 E-05
CO_2	-	11,079	11,079	22,158
CO_2e	-	11,091	11,091	22,182

3.4 Total Project Emissions during Normal Operations Including Startup and Shutdown Emissions

Pollutant	Total Emissions for Two SCCTs During Normal Operations	Total Startup/shutdown Emissions for Two SCCTs (tpy)	Total Emissions for Two SCCTs during Normal Operations Including Startup and Shutdown Emissions (tpy)
NO_X	34.4	26.6	60.9
CO	59.4	47.2	106.5
VOC	33.6	4.0	37.5
SO_2	3.8	0.2	4.0
PM	32.8	7.4	40.3
PM_{10}	32.8	7.4	40.3
$PM_{2.5}$	32.8	7.4	40.3
HAPs			1.3
H_2SO_4	0.38	0.02	0.4
Pb	0.002	9.3E-05	1.98 E-3
CO_2	447,530	22,158	469,688
CO_2e	448,004	22,182	470,186
Source-wide HAPs			1.33

4. Air Quality Impact Analysis

4.1 Modeling Approach

The proposed project involves the construction and operation of two (2) new simple cycle aeroderivative combustion turbine generators. The project will result in potential emissions of regulated NSR pollutants, (CO), (NOX), (VOCs), particulate matter (PM10 and PM2.5), sulfuric acid mist (H2SO4), lead (Pb) and greenhouse gases (GHGs). Although the preliminary calculations indicated that the proposed project's PTE would not exceed the major source permitting thresholds with respect to PSD, SRP planned to voluntarily conduct a modeling analysis to ensure that the proposed project will not cause or contribute to air pollution in violation of National Ambient Air Quality Standards (NAAQS). Since the proposed facility will be located in an area of Pinal County which is classified as serious non-attainment for PM10, the modeling analysis addressed the Arizona Department of Environmental Quality's (ADEQ) procedures for modeling demonstrations for both attainment and non-attainment pollutants. The protocol conforms to the modeling procedures outlined in the U.S. Environmental Protection Agency's (EPA) Guideline on Air Quality Models[3], the ADEQ's Air Dispersion Modeling Guidelines, and associated EPA modeling policy and guidance.

The modeling for air quality impact analysis was conducted using current version of the AMS/EPA AERMOD model (Version 22112). Model was run using the appropriate regulatory default options for AERMOD as stipulated by Appendix W. Meteorological inputs for AERMOD were generated using surface data from Phoenix Sky Harbor Airport with coupled upper air data from the closest upper air data site, Tucson. All regulated minor NSR pollutants with emissions in excess of the permitting exemption threshold were evaluated for NAAQS compliance. These pollutants include: NO2, CO, PM10, PM2.5, and VOC (ozone). A load screening analysis was performed to determine the operating conditions that result in the highest modeled impacts. Four load conditions were evaluated: 100%, 75%, 50%, and startup/shutdown. A conservative analysis was performed by modeling the worst case stack temperature and flow rate for multiple load conditions using the minimum value of flow and temperature at each load. The emissions used for the four load scenarios were normalized based on the relative heat input at these four loads.

[3] The proposed project is not subject to major NSR for any NSR-regulated pollutant.

The criteria pollutant air quality analysis, to demonstrate that the expansion project will not cause or contribute to a NAAQS exceedance, was conducted in two phases: an initial or significant impact analysis, and refined analysis if necessary. In the significant impact analysis, the calculated maximum impacts were determined for each pollutant. These impacts were used to determine the net change in air quality resulting from the proposed project. A single year of on-site meteorological data was modeled. Maximum modeled concentrations were compared to the pollutant-specific significant impact levels for all pollutants and averaging times.

Pollutants with impacts that exceeded the significant impact analysis were evaluated for NAAQS compliance in a refined analysis.

4.2 Significant Impact Analysis

For the significant impact analysis the new combustion turbines were modeled and the results were compared against the Significant Impact Limits (SILs).

Table 5 – Significant Impact Analysis Results

Pollutant	Averaging Period	Maximum Modeled Impact (μg/m^3)	PSD Significant Impact Level (μg/m^3)	Maximum Distance to a Significant Impact (km)
NO2	1-hr	15.1	7.5	25.2
	Annual	0.28	1.0	NA
CO	1-hr	23.5	2,000	NA
	8-hr	7.03	500	NA
PM2.5	24-hr	0.73	1.2	NA
	Annual	0.12	0.2	NA
PM10	24-hr	0.73	5	NA
SO2	1-hr	0.45	7.8	NA
	3-hr	0.25	25	NA

4.3 Refined Analysis

Following the determination of significant impacts, a refined air quality analysis to determine compliance with NAAQS was conducted for PM10 and 1-hr NO2. Each source's potential emission rate was used. The refined modeling analysis results were added to the "background" concentration representing the air quality impacts from local/regional/global emissions. The background air quality levels were based on air quality measurements from monitoring sites in Pinal County and elsewhere in Arizona, as applicable. As seen in Table 6 below, the cumulative modeling analysis for PM10 and NO2 showed compliance with the NAAQS.

Table 6 – Refined Analysis Results

Pollutant	Averaging Period	Modeled Concentration (μg/m^3)	Background Concentration (μg/m^3)	Total Concentration (μg/m^3)	Standard (μg/m^3)
NO2	1-hr	7.52	101	108	188
PM10	24-hr	0.73	106	107	150

4.4 Learning Site Analysis

Formaldehyde impacts were modeled at the Magma Ranch K-8 School, which is located approximately 1.4 miles to the southeast of the CCERC. Maximum formaldehyde impacts from the entire modeled receptor grid were conservatively compared to the acute and chronic formaldehyde concentrations listed in the policy.

Table 7 - Learning Site Analysis Results

Pollutant	Averaging Period	Modeled Concentration (μg/m^3)	Acceptable Ambient Concentration (AAC) (μg/m^3)
Formaldehyde	1-hr	0.1045	17,000
	Annual	0.0019	0.146

4.5 Conclusion

PCAQCD, along with expertise of Air Resource Specialists, has reviewed the modeling data and inputs provided in the CCERC's permit application. The modeling results demonstrate that the proposed project will not violate the NAAQS standards for any NSR pollutants.

5 Federal Regulations Applicability

5.1 NSPS KKKK - Standards of Performance for Stationary Combustion Turbines

This NSPS Subpart applies to stationary combustion turbines that commenced construction, modification or reconstruction after February 18, 2005. The installation and operation of two proposed natural gas-fired simple cycle stationary combustion turbines, SCCT1 and SCCT2 meet the affected facility definition under this standard. Therefore, they are subject to the requirements of 40 CFR 60 Subpart KKKK.

5.2 NSPS TTTT - Standards of Performance for Greenhouse Gas Emissions for Electric Generating Units

This NSPS Subpart applies to greenhouse gas emissions from stationary combustion turbines that commence construction after January 8, 2014, or that commence reconstruction after June 18, 2014, as provided by 40 CFR §60.5509 (a). The two proposed new simple cycle combustion turbines, each have a base load rating greater than 250 MMBtu per hour of fossil fuel and serve generators capable of selling greater than 25 MW electricity, meeting the applicability criteria of this subpart. Therefore, these units are subject to the requirements of this standard.

5.3 NESHAP YYYY – National Emission Standards for Hazardous Air Pollutants for Stationary Combustion Turbines

NESHAP 40 CFR 63, Subpart YYYY applies to stationary combustion turbines at major sources of HAP emissions. Since the CCERC project is an area source, therefore the new combustion turbines will not be subject to the requirements of this subpart.