Commonwealth of Kentucky
Division for Air Quality

STATEMENT OF BASIS / SUMMARY

Title V, Operating
Permit: V-26-011

Tennessee Valley Authority
TVA – Paradise Combined Cycle Plant
5562 Rockport Paradise Road
Drakesboro, KY 42337 -2345

April 3, 2026
Michael Baidy, Reviewer

SOURCE ID:	21-177-00006
AGENCY INTEREST:	127687
ACTIVITY:	APE20240002

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SECTION 1 – SOURCE DESCRIPTION

SIC Code and description: 4911, Electric Services (fossil fuel power generation)

Single Source Det. ☐ Yes ☒ No If Yes, Affiliated Source AI:

Source-wide Limit ☐ Yes ☒ No If Yes, See Section 4, Table A

28 Source Category ☒ Yes ☐ No If Yes, Category: Fossil-fuel boilers, or combination of fossil-fuel boilers, totaling more than 250 million BTUs per hour heat input

County: Muhlenberg
Nonattainment Area ☒ N/A ☐ PM_{10} ☐ $PM_{2.5}$ ☐ CO ☐ NO_X ☐ SO_2 ☐ Ozone ☐ Lead
If yes, list Classification: N/A

PTE* greater than 100 tpy for any criteria air pollutant ☒ Yes ☐ No
If yes, for what pollutant(s)?
☒ PM_{10} ☒ $PM_{2.5}$ ☒ CO ☒ NO_X ☐ SO_2 ☒ VOC

PTE* greater than 250 tpy for any criteria air pollutant ☒ Yes ☐ No
If yes, for what pollutant(s)?
☒ PM_{10} ☒ $PM_{2.5}$ ☒ CO ☒ NO_X ☐ SO_2 ☐ VOC

PTE* greater than 10 tpy for any single hazardous air pollutant (HAP) ☐ Yes ☒ No
If yes, list which pollutant(s): N/A

PTE* greater than 25 tpy for combined HAP ☐ Yes ☒ No

*PTE does not include self-imposed emission limitations.

Description of Facility:
Tennessee Valley Authority – Paradise Combined Cycle Plant (henceforth referred to as PCC) is located on the western bank of the Green River approximately 5 miles northeast of Drakesboro, Kentucky. The power generation facility consists of three natural gas-fired simple cycle combustion turbines (EU 137-139) and three natural gas-fired combustion turbines that can operate in either simple-cycle (individual) (EU 123-125) or combined-cycle mode (in series with one-steam turbine) (EU 120-122). The combined cycle combustion turbines each have a maximum heat input capacity of 2,300 MMBtu/hr with a capacity of 235 MW of electricity and each have duct burners rated at 400 MMBtu/hr. The simple cycle combustion turbines have a maximum heat input capacity of 2,257 MMBtu/hr with 229 MW of generating capacity at 59°F. The facility also includes various auxiliary boilers, heaters, emergency and non-emergency engines, and a multiple-cell cooling tower.

SECTION 2 – CURRENT APPLICATION AND EMISSION SUMMARY FORM

Permit Number: V-26-011 Activities: APE20240002

Received: June 5, 2024 Application Complete Date(s): August 1, 2024

Permit Action: ☐ Initial ☒ Renewal ☐ Significant Rev ☐ Minor Rev ☐ Administrative

Construction/Modification Requested? ☐Yes ☒No NSR Applicable? ☐Yes ☒No

Previous 502(b)(10) or Off-Permit Changes incorporated with this permit action ☐Yes ☒No

Description of Action:
TVA PCC requested a permit renewal on June 5, 2024, with the following changes:

- Removed EU 130 Unpaved Haul Roads for Dewatered Gypsum Transportation
- Removed EU 133 Fly Ash and Gypsum Drop points (133D), Paved Roads (133B), and Unpaved Landfill Travel (133C)
- Removed EU 134 Dewatered Gypsum Handling
- Removed EU 135 Gypsum Hauling Offsite or to Landfill
- Removed EU 136 Fly Ash & Gypsum Landfill Operations
- Removed EUs 144, 145, and 146 Red Water Pond Diesel Engine Pumps
- Removed EU 153 ESS Shop Generator
- Removed EU 154 GN23 Generator for Scale

TVA PCC requested a permit revision on May 7, 2025 to increase the operating hours for EUs 123, 124, and 125 (Simple Cycle operating modes for CTs 1, 2, and 3) from 1,500 hours total across all 3 units to 6,000 hours total across all 3 units.

The hours per year limit was initially added to EUs 123, 124, and 125 as an additional layer of protection to ensure the project did not exceed the net significant emissions increase for CO. However, the Division already implemented a limit to preclude a significant net emissions increase. The yearly CO emission limitation incorporated into the permit to be used during the transition period between startup of the new units and shutdown of the old units incorporated 90% of the SER, or 90 tpy, in addition to the baseline emissions.

This limit precluded a significant net emissions increase, and the requested increase would not change the outcome of the CO emission limit. If the facility utilized 6,000 hours per year instead of 1,500, the CO increase would still have been less than the SER, as can be seen in the revised table below:

Pollutant	Project Emissions 2014 (tpy); 1500 hours of operation	Project Emissions 2025 (tpy); 6000 hours of operation	PSD SER (tpy)
CO	34	97	100
NO_X	-5,505	-5,365	40
SO_2	-34,567	-34,560	40

If TVA PCC had requested the 6,000 hour limit at the time of the project, the Division would have accepted the limit. The Division is revising the permit to incorporate the requested change to the operating limit on hours of operation in simple cycle mode from 1,500 hours per year total to 6,000 hours per year total.

The Division determined that both the renewal and the revision changes could be issued under one permitting action and will issue both simultaneously.

V-26-011 Emission Summary				
Pollutant	2023 Actual (tpy)	Previous PTE V-18-056 R2 (tpy)	Change (tpy)	Revised PTE V-26-011 (tpy)
CO	196.93	467.1	22.03	489.13
NO_X	477.98	805.4	-59.45	745.95
PT	149.15	293.9	49.11	343.01
PM_{10}	149.15	519.6	-77.79	441.81
$PM_{2.5}$	146.88	410.9	-65.89	345.01
SO_2	14.54	72.8	9.9	82.7
VOC	57.59	106.2	18.78	124.98
Lead	9.78E-03	0.03	-1.05E-02	1.95E-02
Greenhouse Gases (GHGs)				
Carbon Dioxide	2,879,510.28	3,984,461	327,627	4,312,088
Methane	54.02	74	7.32	81.32
Nitrous Oxide	5.4	7	1.16	8.16
CO_2 Equivalent (CO_2e)	2,882,470.90	3,988,540	328,013	4,316,553
Hazardous Air Pollutants (HAPs)				
Acetaldehyde	4.28E-05	1.77	0.12	1.89
Acrolein	4.04E-05	2.84E-01	1.87E-02	3.03E-01
Benzene	2.90E-01	0.53	5.17E-02	5.82E-01
Ethyl Benzene	0.7726438	1.42	0.08	1.5
Formaldehyde	3.31	7.01	-3.69	3.32
Hexane; N-Hexane	N/A	7.09E-01	1.641	2.35
Nickel (and Compounds)	1.74E-03	1.09E-01	6.71E-03	1.16E-01
Pentane	N/A	1.30E-01	1.91E-04	1.30E-01
Propylene Oxide	2.04E-02	0.87	0.49	1.36
Toluene	9.16E-02	3.91	2.21	6.12
Xylenes (Total)	1.54	1.92	1.09	3.01
Combined HAPs:	6.05	19.13	2.05	21.18
Non-Hazardous Air Pollutants				
Ammonia	N/A	125.10	115.44	240.54
Sulfuric Acid Mist	4.17	51.99	-51.19	7.91E-01

SECTION 3 – EMISSIONS, LIMITATIONS AND BASIS

Emission Units 120, 121 & 122 Combined Cycle (3) – HRSG(3)/CT(3)/Duct Burner(3)				
Pollutant	**Emission Limit or Standard**	**Regulatory Basis for Emission Limit or Standard**	**Emission Factor Used and Basis**	**Compliance Method**
SO_2	0.06 lb/MMBtu	40 CFR 60.4330(a)(2)	2.86E-03 lb/MMscf, engineering estimate based on fuel analysis	Gas Analysis Sulfur Content is below the emission standard & Monitor fuel usage continuously, on a 12-month rolling total
NO_x	0.43 lb/MWh	40 CFR 60.4320(a)	Vendor guarantees meet these limits	NO_x CEMS
CO_2	1,000 lb/MWh	40 CFR 60, Subpart TTTT, Table 2, Item 1	117.06 lb/MMBtu, 40 CFR 98, Subpart C, Table C-1U	CO_2 CEMS
PM PM_{10} $PM_{2.5}$	0.10 lb/MMBtu	401 KAR 59:015, Section 4(1)(b)	0.011 lb/MMBtu, Vendor guarantee	Assumed to be in compliance while burning natural gas.
	20% Opacity, except a maximum of twenty-seven (27) percent opacity shall be allowed for one (1) six (6) minute period in any sixty (60) consecutive minutes	401 KAR 59:015, Section 4(2)		

Initial Construction Date: 2015

Process Description:
Three identical natural-gas-fired combustion turbine (CT) electric generating units (General Electric Model 7FA.05 [GE 7FA]). The CTs are rated at 2,300 MMBtu/hr each and have gross electrical generating capacities of 235 MW each. The one steam generator has the electrical generating capacity of 470 MW.

For nitrogen oxide (NO_x) control, the CTs are equipped with dry low-nitrogen oxide (DLN) combustors. An evaporative cooling system is installed at the compressor inlet of each CT. Evaporative cooling is achieved when filtered air passes through a saturated media and water evaporates off the wet media. This evaporation reduces the air temperature and increases the density of the combustion air. Excess water that does not evaporate is directed downward so as not to be carried along with the cooled air. Cooled air passes through a mist eliminator where leftover water droplets are removed. Clean, cool air is then

Emission Units 120, 121 & 122 Combined Cycle (3) – HRSG(3)/CT(3)/Duct Burner(3)

directed into the turbine inlet. The effect of this system allows for increased CT generation at ambient temperatures above 59°F.

During combined cycle operations, a HRSG is provided to recover the waste heat from the CT exhaust and generate steam. Each CT has one HRSG. An oxidizing catalyst for carbon monoxide (CO) and volatile organic compound (VOC) emissions control and a selective catalytic-reduction (SCR) reactor for nitrogen oxide (NO_x) emissions control is installed in each HRSG. Each HRSG contains natural gas-fired duct burners (maximum heat input of 400 MMBtu/hr per HRSG) to augment steam production during combined-cycle (CC) operations. The HRSG SCR utilizes aqueous ammonia (NH_3) to achieve NO_x reduction across the SCR reactor's catalyst as needed to maintain compliance with the emission limit. The facility has two (2) aqueous NH_3 tanks, each with a capacity of 20,000 gallons. The tanks are designed to operate under atmospheric pressure and store 19.5 percent aqueous NH_3.

Applicable Regulations:
40 CFR, Part 75, *Continuous Emission Monitoring* is applicable because the emission units utilize a continuous emissions monitoring system (CEMS) to demonstrate NO_X compliance.

401 KAR 51:160, *NO_x requirements for large utility and industrial boilers*; In October 1998, the U.S. EPA finalized the "Finding of Significant Contribution and Rulemaking for Certain States in the Ozone Transport Assessment Group Region for Purposes of Reducing Regional Transport of Ozone", commonly called the NOx SIP Call. 401 KAR 51:160 was established in response to EPA's NOx SIP Call and the requirement to implement a NOx Budget Trading Program (NBP). Beginning in 2009, the NBP was effectively replaced by the ozone season NOx program under the Clean Air Interstate Rule.

401 KAR 51:210, *CAIR NOx annual trading program*
401 KAR 51:220, *CAIR NOx ozone season trading program*
401 KAR 51:230, *CAIR SO_2 trading program*
On May 12, 2005, the U.S. EPA published the Clean Air Interstate Rule (CAIR). CAIR requires states to reduce emissions of nitrogen oxides and sulfur dioxide that contribute significantly to nonattainment and maintenance problems in downwind states with respect to the national ambient air quality standards for fine particulate matter ($PM_{2.5}$) and 8-hour ozone. Kentucky's regulations are codified in 401 KAR 51:210, CAIR NO_X annual trading program, 401 KAR 51:220, CAIR NO_X ozone season trading program, and 401 51:230, CAIR SO_2 trading program.

401 KAR 51:240, *Cross-State Air Pollution Rule (CSAPR) NOx annual trading program*
401 KAR 51:250, *Cross-State Air Pollution Rule (CSAPR) NOx ozone season group 2 trading program*
401 KAR 51:260, *Cross-State Air Pollution Rule (CSAPR) SO_2 group 1 trading program*
These regulations collectively make up the requirements commonly referred to as the Cross-State Air Pollution Rule (CSAPR). The requirements of CSAPR apply to stationary, fossil-fuel-fired boilers serving at any time, on or after January 1, 2005, a generator with nameplate capacity of more than 25MWe producing electricity for sale.

401 KAR 52:060, *Acid rain permits* is applicable to affected sources and units as set forth under 40 CFR 72.6 and incorporates by reference 40 CFR 72 – 78.

401 KAR 60:005, Section 2(2)(ffff), 40 C.F.R. 60.4300 through 60.4420, Table 1 (Subpart KKKK), *Standards of Performance for Stationary Combustion Turbines* is applicable to stationary combustion turbines with a heat input at peak load equal to or greater than 10.7 gigajoules (10 MMBtu) per hour,

Emission Units 120, 121 & 122 Combined Cycle (3) – HRSG(3)/CT(3)/Duct Burner(3)

based on the higher heating value of the fuel, which commenced construction, modification, or reconstruction after February 18, 2005. Stationary combustion turbines regulated under 40 CFR 60, Subpart KKKK are exempt from the requirements of 40 CFR 60, Subpart GG. HRSG and duct burners regulated under 40 CFR 60, Subpart KKKK are exempted from the requirements of 40 CFR 60, Subparts Da, Db, and Dc.

401 KAR 60:005, Section 2(2)(jjjj), 40 CFR 60.5508 through 60.5580, Tables 1 through 3 (Subpart TTTT), *Standards of Performance for Greenhouse Gas Emissions for Electric Generating Units* is applicable to stationary combustion turbines that commence construction after January 8, 2014, but on or before May 23, 2023.

State Origin Requirement:
401 KAR 63:020, *Potentially hazardous matter or toxic substances*

Additional Requirement Specifically for HRSG:
401 KAR 59:015, *New indirect heat exchangers*, applicable to indirect heat exchangers having a heat input capacity greater than 1 MMBtu/hr commenced on or after August 17, 1971.

Non-Applicable Regulation:
401 KAR 63:002, Section 2(4)(dddd), 40 C.F.R. 63.6080 through 63.6175, Tables 1 through 7 (Subpart YYYY), *National Emission Standards for Hazardous Air Pollutants for Stationary Combustion Turbines* is not applicable because TVA – Paradise Combined Cycle Plant is not a major source of HAP emissions [40 CFR 63.6085(b)].

Comments:
Emissions from the following operating modes were determined from manufacturer's data, AP-42 data, and PTE calculations provided by TVA PCC (See APE20240002 document *"2024 TVA PCC Permit Renewal Application"* P.55):

Combined Cycle operation without duct burners
Combined Cycle operation with duct burners
Simple Cycle operation
Startup and Shutdown (All cases: Hot, Warm, and Cold)

Emission Factor (EF) derivation calculations were provided for the following pollutants: CO, NOx, PT, PM_{10}, $PM_{2.5}$, SO_2, VOC, Sulfuric Acid.

CO emission factors were derived from the 2014 Significant Revision application when the combined cycle turbines were first installed. The specific document utilized from the application is "*Paradise Fossil Plant – Application For Significant Revision To Title V Permit V-12-041"* P.99 (Located at APE20140004, file name *"PAC Updated Permit Application 10.17.2014"*).

The CO emission factors came from vendor performance guarantees for CO (in ppmvd) at design flue-gas O_2 concentration. The performance guarantee was converted to lb/CT-minute and then from lb/CT-minute to lb/MMBtu.

Three different emission factors were obtained for CO: Simple Cycle, Combined Cycle operation without duct burners, Combined Cycle operation with duct burners.

Emission Units 120, 121 & 122 Combined Cycle (3) – HRSG(3)/CT(3)/Duct Burner(3)

NOx emission factors were derived from "*Paradise Fossil Plant – Application For Significant Revision To Title V Permit V-12-041"* P.99 (Located at APE20140004, file name *"PAC Updated Permit Application 10.17.2014"*).

The NOx emission factors came from vendor performance guarantees for NOx (in ppmvd) at 15% O_2 concentration. The performance guarantee was converted to lb/CT-minute and then from lb/CT-minute to lb/MMBtu.

Three different emission factors were obtained for NOx: Simple Cycle, Combined Cycle operation without duct burners, Combined Cycle operation with duct burners.

PM, PM_{10}, and $PM_{2.5}$ emission factors were derived from "*Paradise Fossil Plant – Application For Significant Revision To Title V Permit V-12-041"* P.97-98 (Located at APE20140004, file name *"PAC Updated Permit Application 10.17.2014"*).

The particulate matter emission factors were calculated using the heat input of the turbines and vendor guarantees for Filterable Particulate Matter (FPM) and Total Particulate Matter (TPM). To obtain Condensable Particulate Matter (CPM) values, subtract FPM from TPM. TVA PCC clarified on P.96 that TPM = FPM + CPM. The Division chose to use TPM emission factor for PM, PM_{10}, and $PM_{2.5}$ as it will be a conservative estimate. Divide the performance guarantee (in lb/CT-hour) by the heat input (in MMBtu/CT-hr) to obtain the emission factor in lb/MMBtu.
Three different emission factors were obtained for particulate matter: Simple Cycle, Combined Cycle operation without duct burners, Combined Cycle operation with duct burners.

SO_2 emission factors were derived from *"PAC Updated Permit Application 10.17.2014"* P.98-99 (See APE20140004).

The SO_2 calculations used the natural gas fuel sulfur content and the equation from AP-42 Chapter 3.1, Table 3.1-2a, footnote h. The SO_2 EF value (lb/MMBtu) is then adjusted to account for sulfuric acid (H_2SO_4) mist production which TVA PCC specifies is 5%.

Two different emission factors were obtained for SO_2: Simple Cycle and Combined Cycle operation.

Sulfuric Acid emission factors were derived from *"PAC Updated Permit Application 10.17.2014"* P.98-99 (See APE20140004).
The H_2SO_4 emission factor comes from the SO_2 EF and accounts for the difference in molecular weight. Multiply the SO_2 EF by 5/100 (5% sulfuric acid mist production) and by the ratio of molecular weights (H_2SO_4/SO_2) to obtain the sulfuric acid emission factor.
Two different emission factors were obtained for H_2SO_4: Simple Cycle and Combined Cycle operation.

VOC emission factors were derived from *"PAC Updated Permit Application 10.17.2014"* P.100 (See APE20140004).

The VOC emission factors were calculated using vendor performance guarantees for VOC at different O_2 concentrations for each operating mode. Simple cycle performance guarantee was given in parts per million wet basis (ppmvw) at design flue-gas O_2. Combined cycle operation (without duct burner and with duct burner) was given on a dry basis (ppmvd) at 15% O_2. The performance guarantee was converted to lb/CT-minute and then from lb/CT-minute to lb/MMBtu using the heat input value for a given

Emission Units 120, 121 & 122 Combined Cycle (3) – HRSG(3)/CT(3)/Duct Burner(3)

operating mode. Three different emission factors were obtained for VOC: Simple Cycle, Combined Cycle operation without duct burners, Combined Cycle operation with duct burners.

Emission Factors for Startup and Shutdown were provided in "*PAC Updated Permit Application 10.17.2014"* P.100-101 (See APE20140004). The pollutants provided were: PM, SO_2, NOx, CO, VOC, and H_2SO_4.

Sample calculations were also provided in the 2024 renewal application *"2024 TVA PCC Permit Renewal Application"* (See APE20240002) for the following pollutants (P.56-58): PM, NOx, SO_2, H_2SO_4, CO2e, Lead. These calculations cited manufacturer's data and AP-42 data.

Annual emissions for combined cycle operations were determined using the worst case scenario of operating scenarios. The Division performed emission calculations for 4 operating scenarios. The hours listed here reflect operating hours for one CT out of the three.

Case 1 assumed 8,760 hr/yr combined cycle operation with duct burners.
Case 2 assumed 8,760 hr/yr combined cycle operation without duct burners.
Case 3 assumed 8,260 hr/yr combined cycle operation with duct burners, and 500 hr/yr simple cycle operation.
Case 4 assumed 8,260 hr/yr combined cycle operation without duct burners, and 500 hr/yr simple cycle operation.

The highest potential to emit (PTE) out of the cases was chosen for estimating emissions. The highest PTE was Case 1; 8,760 hr/yr combined cycle operation with duct burners.

TVA PCC submitted a significant revision application on May 7, 2025 requesting to change the operating hours for simple cycle operation from 1,500 hours total to 6,000 hours total. The Division re-evaluated the emission calculations using the four cases above and two new cases.
Case 5 assumed 6,760 hr/yr combined cycle operation with duct burners, and 2,000 hr/yr simple cycle operation.
Case 6 assumed 6,760 hr/yr combined cycle operation without duct burners, and 2,000 hr/yr simple cycle operation.

The Division determined that Case 1 was still the highest PTE; 8,760 hr/yr combined cycle operation with duct burners.

Addendum regarding **401 KAR 60:005, Section 2(2)(jjjj),** 40 CFR 60.5508 through 60.5580, Tables 1 through 3 (Subpart TTTT), *Standards of Performance for Greenhouse Gas Emissions for Electric Generating Units*:

The combustion turbines (EGUs) are subject to 40 CFR 60 Subpart TTTT, Table 2, Item 1. Table 2 Item 1 specifies the CO_2 emission standard as 450 kg CO_2/MWh (1,000 lb CO_2/MWh) of gross energy output; or 470 kg CO_2/MWh (1,030 lb CO_2/MWh) of net energy output.

Emission Units 123, 124, & 125 – Simple Cycle Mode (3)				
Pollutant	**Emission Limit or Standard**	**Regulatory Basis for Emission Limit or Standard**	**Emission Factor Used and Basis**	**Compliance Method**
SO_2	0.06 lb/MMBtu	40 CFR 60.4330(a)(2)	2.86E-03 lb/MMscf, engineering estimate based on fuel analysis	Gas Analysis Sulfur Content is below the emission standard & Monitor fuel usage continuously, on a 12-month rolling total
NO_x	0.43 lb/MWh	40 CFR 60.4320(a)	Vendor guarantees meet these limits	NO_x CEMS
CO_2	1,000 lb/MWh	40 CFR 60, Subpart TTTT, Table 2, Item 1	117.06 lb/MMBtu, 40 CFR 98, Subpart C, Table C-1	CO_2 CEMS
PM PM_{10} $PM_{2.5}$	0.10 lb/MMBtu	401 KAR 59:015, Section 4(1)(b)	0.011 lb/MMBtu, Vendor guarantee	Monitor the hours of operation in simple cycle mode
	20% Opacity, except a maximum of twenty-seven (27) percent opacity shall be allowed for one (1) six (6) minute period in any sixty (60) consecutive minutes	401 KAR 59:015, Section 4(2)		

Initial Construction Date 8/1/2016

Process Description:
Simple Cycle Operations (CT): The same Natural Gas-fired Combustion Turbines (CT) used for Electric Generation in Emission Units 120, 121 and 122, operating in simple cycle independent of Heat Recovery System Generators (HRSG). The permittee has the option of operating the 3 combustion turbines in simple cycle mode as an alternate operating scenario under EU 120, 121 and 122. TVA PCC has agreed upon an operating hours limit of a maximum 6,000 hours per year combined operating time in simple cycle mode for all 3 turbines.

The 3 CTs are equipped with dry low-nitrogen oxide burners.

Applicable Regulations:
40 CFR, Part 75, *Continuous Emission Monitoring* is applicable because the emission units utilize a continuous emissions monitoring system (CEMS) to demonstrate NO_X compliance.

401 KAR 51:160, *NO_x requirements for large utility and industrial boilers*; In October 1998, the U.S. EPA finalized the "Finding of Significant Contribution and Rulemaking for Certain States in the Ozone Transport Assessment Group Region for Purposes of Reducing Regional Transport of Ozone", commonly

Emission Units 123, 124, & 125 – Simple Cycle Mode (3)

called the NOx SIP Call. 401 KAR 51:160 was established in response to EPA's NOx SIP Call and the requirement to implement a NOx Budget Trading Program (NBP). Beginning in 2009, the NBP was effectively replaced by the ozone season NOx program under the Clean Air Interstate Rule.

401 KAR 51:210, *CAIR NOx annual trading program*
401 KAR 51:220, *CAIR NOx ozone season trading program*
401 KAR 51:230, *CAIR SO_2 trading program*
On May 12, 2005, the U.S. EPA published the Clean Air Interstate Rule (CAIR). CAIR requires states to reduce emissions of nitrogen oxides and sulfur dioxide that contribute significantly to nonattainment and maintenance problems in downwind states with respect to the national ambient air quality standards for fine particulate matter ($PM_{2.5}$) and 8-hour ozone. Kentucky's regulations are codified in 401 KAR 51:210, CAIR NO_X annual trading program, 401 KAR 51:220, CAIR NO_X ozone season trading program, and 401 51:230, CAIR SO_2 trading program.

401 KAR 51:240, *Cross-State Air Pollution Rule (CSAPR) NOx annual trading program*
401 KAR 51:250, *Cross-State Air Pollution Rule (CSAPR) NOx ozone season group 2 trading program*
401 KAR 51:260, *Cross-State Air Pollution Rule (CSAPR) SO_2 group 1 trading program*
These regulations collectively make up the requirements commonly referred to as the Cross-State Air Pollution Rule (CSAPR). The requirements of CSAPR apply to stationary, fossil-fuel-fired boilers serving at any time, on or after January 1, 2005, a generator with nameplate capacity of more than 25MWe producing electricity for sale.

401 KAR 52:060, *Acid rain permits* is applicable to affected sources and units as set forth under 40 CFR 72.6 and incorporates by reference 40 CFR 72 – 78.

401 KAR 60:005, Section 2(2)(ffff), 40 C.F.R. 60.4300 through 60.4420, Table 1 (Subpart KKKK), *Standards of Performance for Stationary Combustion Turbines* is applicable to stationary combustion turbines with a heat input at peak load equal to or greater than 10.7 gigajoules (10 MMBtu) per hour, based on the higher heating value of the fuel, which commenced construction, modification, or reconstruction after February 18, 2005.

401 KAR 60:005, Section 2(2)(jjjj), 40 CFR 60.5508 through 60.5580, Tables 1 through 3 (Subpart TTTT), *Standards of Performance for Greenhouse Gas Emissions for Electric Generating Units* is applicable to stationary combustion turbines that commence construction after January 8, 2014, but on or before May 23, 2023.

State Origin Requirement:
401 KAR 63:020, *Potentially hazardous matter or toxic substances*

Additional Requirement Specifically for HRSG:
401 KAR 59:015, *New indirect heat exchangers*

Non-Applicable Regulation:
401 KAR 63:002, Section 2(4)(dddd), 40 C.F.R. 63.6080 through 63.6175, Tables 1 through 7 (Subpart YYYY), *National Emission Standards for Hazardous Air Pollutants for Stationary Combustion Turbines* is not applicable because TVA – Paradise Combined Cycle Plant is not a major source of HAP emissions [40 CFR 63.6085(b)].

Emission Units 123, 124, & 125 – Simple Cycle Mode (3)

Comments:
These units are required to comply with all Operating Limitations, Emission Limitations, Testing Requirements, Specific Monitoring Requirements, Specific Reporting Requirements, and Specific Control Equipment Operating Conditions as required for Emission Units 120, 121 and 123.

Emissions from the simple cycle operating mode were determined from manufacturer's data, AP-42 data, and PTE calculations provided by TVA PCC:

Emissions from the following operating modes were determined from manufacturer's data, AP-42 data, and PTE calculations provided by TVA PCC (See APE20240002 document *"2024 TVA PCC Permit Renewal Application"* P.55):
Combined Cycle operation without duct burners
Combined Cycle operation with duct burners
Simple Cycle operation
Startup and Shutdown (All cases: Hot, Warm, and Cold)

Emission Factor (EF) derivation calculations were provided for the following pollutants: CO, NOx, PT, PM_{10}, $PM_{2.5}$, SO_2, VOC, Sulfuric Acid.

CO emission factors were derived from the 2014 Significant Revision application when the combined cycle turbines were first installed. The specific document utilized from the application is "*Paradise Fossil Plant – Application For Significant Revision To Title V Permit V-12-041"* P.99 (Located at APE20140004, file name *"PAC Updated Permit Application 10.17.2014"*).

The CO emission factors came from vendor performance guarantees for CO (in ppmvd) at design flue-gas O_2 concentration. The performance guarantee was converted to lb/CT-minute and then from lb/CT-minute to lb/MMBtu.

Three different emission factors were obtained for CO: Simple Cycle, Combined Cycle operation without duct burners, Combined Cycle operation with duct burners.

NOx emission factors were derived from "*Paradise Fossil Plant – Application For Significant Revision To Title V Permit V-12-041"* P.99 (Located at APE20140004, file name *"PAC Updated Permit Application 10.17.2014"*).

The NOx emission factors came from vendor performance guarantees for NOx (in ppmvd) at 15% O_2 concentration. The performance guarantee was converted to lb/CT-minute and then from lb/CT-minute to lb/MMBtu.

Three different emission factors were obtained for NOx: Simple Cycle, Combined Cycle operation without duct burners, Combined Cycle operation with duct burners.

PM, PM_{10}, and $PM_{2.5}$ emission factors were derived from "*Paradise Fossil Plant – Application For Significant Revision To Title V Permit V-12-041"* P.97-98 (Located at APE20140004, file name *"PAC Updated Permit Application 10.17.2014"*).

The particulate matter emission factors were calculated using the heat input of the turbines and vendor guarantees for Filterable Particulate Matter (FPM) and Total Particulate Matter (TPM). To obtain

Emission Units 123, 124, & 125 – Simple Cycle Mode (3)

Condensable Particulate Matter (CPM) values, subtract FPM from TPM. TVA PCC clarified on P.96 that TPM = FPM + CPM. The Division chose to use TPM emission factor for PM, PM_{10}, and $PM_{2.5}$ as it will be a conservative estimate. Divide the performance guarantee (in lb/CT-hour) by the heat input (in MMBtu/CT-hr) to obtain the emission factor in lb/MMBtu.

Three different emission factors were obtained for particulate matter: Simple Cycle, Combined Cycle operation without duct burners, Combined Cycle operation with duct burners.

SO_2 emission factors were derived from *"PAC Updated Permit Application 10.17.2014"* P.98-99 (See APE20140004).
The SO_2 calculations used the natural gas fuel sulfur content and the equation from AP-42 Chapter 3.1, Table 3.1-2a, footnote h. The SO_2 EF value (lb/MMBtu) is then adjusted to account for sulfuric acid (H_2SO_4) mist production which TVA PCC specifies is 5%.
Two different emission factors were obtained for SO_2: Simple Cycle and Combined Cycle operation.

Sulfuric Acid emission factors were derived from *"PAC Updated Permit Application 10.17.2014"* P.98-99 (See APE20140004).
The H_2SO_4 emission factor comes from the SO_2 EF and accounts for the difference in molecular weight. Multiply the SO_2 EF by 5/100 (5% sulfuric acid mist production) and by the ratio of molecular weights (H_2SO_4/SO_2) to obtain the sulfuric acid emission factor.
Two different emission factors were obtained for H_2SO_4: Simple Cycle and Combined Cycle operation.

VOC emission factors were derived from *"PAC Updated Permit Application 10.17.2014"* P.100 (See APE20140004).

The VOC emission factors were calculated using vendor performance guarantees for VOC at different O_2 concentrations for each operating mode. Simple cycle performance guarantee was given in parts per million wet basis (ppmvw) at design flue-gas O_2. Combined cycle operation (without duct burner and with duct burner) was given on a dry basis (ppmvd) at 15% O_2. The performance guarantee was converted to lb/CT-minute and then from lb/CT-minute to lb/MMBtu using the heat input value for a given operating mode. Three different emission factors were obtained for VOC: Simple Cycle, Combined Cycle operation without duct burners, Combined Cycle operation with duct burners.

Emission Factors for Startup and Shutdown were provided in "*PAC Updated Permit Application 10.17.2014"* P.100-101 (See APE20140004). The pollutants provided were: PM, SO_2, NOx, CO, VOC, and H_2SO_4.

Sample calculations were also provided in the 2024 renewal application *"2024 TVA PCC Permit Renewal Application"* (See APE20240002) for the following pollutants (P.56-58): PM, NOx, SO_2, H_2SO_4, CO2e, Lead. These calculations cited manufacturer's data and AP-42 data.

Annual emissions for combined cycle operations were determined using the worst case scenario of operating scenarios. The Division performed emission calculations for 4 operating scenarios. The hours listed here reflect operating hours for one CT out of the three.
Case 1 assumed 8,760 hr/yr combined cycle operation with duct burners.
Case 2 assumed 8,760 hr/yr combined cycle operation without duct burners.
Case 3 assumed 8,260 hr/yr combined cycle operation with duct burners, and 500 hr/yr simple cycle operation.

Emission Units 123, 124, & 125 – Simple Cycle Mode (3)

Case 4 assumed 8,260 hr/yr combined cycle operation without duct burners, and 500 hr/yr simple cycle operation.
The highest potential to emit (PTE) out of the cases was chosen for estimating emissions. The highest PTE was Case 1; 8,760 hr/yr combined cycle operation with duct burners.

TVA PCC submitted a significant revision application on May 7, 2025 requesting to change the operating hours for simple cycle operation from 1,500 hours total to 6,000 hours total. The Division re-evaluated the emission calculations using the four cases above and two new cases.
Case 5 assumed 6,760 hr/yr combined cycle operation with duct burners, and 2,000 hr/yr simple cycle operation.
Case 6 assumed 6,760 hr/yr combined cycle operation without duct burners, and 2,000 hr/yr simple cycle operation.

The Division determined that Case 1 was still the highest PTE; 8,760 hr/yr combined cycle operation with duct burners.

Emission Unit 137-139 – Simple Cycle Combustion Turbines (3)

Pollutant	Emission Limit or Standard	Regulatory Basis for Emission Limit or Standard	Emission Factor Used and Basis	Compliance Method
NO_x	15 ppm at 15% O_2 or 54 ng/J of useful output (0.43 lbs/MWh)	40 CFR 60.4320(a)	55.25 lbs/MMscf, based on 15 ppm at 15% O_2 limit given by 40 CFR 60, Subpart KKKK (See Comment 4)	Initial performance test & continued compliance demonstrated through CEMS monitoring and recordkeeping
SO_2	26 ng/J (0.060 lbs/MMBtu)	40 CFR 60.4330(a)(2)	0.57 lbs/MMscf, 40 CFR 75, Appendix D (See Comment 5)	Initial performance test & continued compliance from either a fuel quality certification or fuel sampling data
CO_2	50 kg/GJ (120 lbs/MMBtu)	40 CFR 60.5520(a) referencing Table 2, Item 2	53.38 lbs/MMscf, limit given by 40 CFR 60, Subpart TTTT (See Comment 6)	Compliance assumed based on manufacturer's guarantee and a maximum electric output of 766,000 MWh(Gross)/CT-year, based on a 12-operating-month rolling average

Emission Unit 137-139 – Simple Cycle Combustion Turbines (3)

Initial Construction Date: October 2023

Process Description:
Three (3) identical simple cycle, natural-gas-fired combustion turbine (CT) electric generating units (General Electric Model 7FA.05 [GE 7FA]). The CTs are each rated at 2,257 MMBtu/hr and have gross electrical generating capacities of 229 MW each at 59°F.

For nitrogen oxide (NO_x) control, the CTs are equipped with dry low-nitrogen oxide (DLN) combustors. An evaporative cooling system is installed at the compressor inlet of each CT. Evaporative cooling is achieved when filtered air passes through a saturated media and water evaporates off the wet media. This evaporation reduces the air temperature and increases the density of the combustion air. Excess water that does not evaporate is directed downward so as not to be carried along with the cooled air. Cooled air passes through a mist eliminator where leftover water droplets are removed. Clean, cool air is then directed into the turbine inlet. The effect of this system allows for increased CT generation at ambient temperatures above 59°F.

Applicable Regulations:
40 CFR, Part 75, *Continuous Emission Monitoring* is applicable because the emission units utilize a continuous emissions monitoring system (CEMS) to demonstrate NO_X compliance.

401 KAR 51:160, *NO_x requirements for large utility and industrial boilers*; In October 1998, the U.S. EPA finalized the "Finding of Significant Contribution and Rulemaking for Certain States in the Ozone Transport Assessment Group Region for Purposes of Reducing Regional Transport of Ozone", commonly called the NOx SIP Call. 401 KAR 51:160 was established in response to EPA's NOx SIP Call and the requirement to implement a NOx Budget Trading Program (NBP). Beginning in 2009, the NBP was effectively replaced by the ozone season NO_X program under the Clean Air Interstate Rule.

401 KAR 51:210, *CAIR NOx annual trading program*
401 KAR 51:220, *CAIR NOx ozone season trading program*
401 KAR 51:230, *CAIR SO2 trading program*
On May 12, 2005, the U.S. EPA published the Clean Air Interstate Rule (CAIR). CAIR requires states to reduce emissions of nitrogen oxides and sulfur dioxide that contribute significantly to nonattainment and maintenance problems in downwind states with respect to the national ambient air quality standards for fine particulate matter ($PM_{2.5}$) and 8-hour ozone. Kentucky's regulations are codified in 401 KAR 51:210, CAIR NO_X annual trading program, 401 KAR 51:220, CAIR NO_X ozone season trading program, and 401 51:230, CAIR SO_2 trading program.

401 KAR 51:240, *Cross-State Air Pollution Rule (CSAPR) NOx annual trading program*
401 KAR 51:250, *Cross-State Air Pollution Rule (CSAPR) NOx ozone season group 2 trading program*
401 KAR 51:260, *Cross-State Air Pollution Rule (CSAPR) SO_2 group 1 trading program*
These regulations collectively make up the requirements commonly referred to as the Cross-State Air Pollution Rule (CSAPR). The requirements of CSAPR apply to stationary, fossil-fuel-fired boilers serving at any time, on or after January 1, 2005, a generator with nameplate capacity of more than 25MWe producing electricity for sale.

401 KAR 52:060, *Acid rain permits* is applicable to affected sources and units as set forth under 40 CFR 72.6 and incorporates by reference 40 CFR 72 – 78.

Emission Unit 137-139 – Simple Cycle Combustion Turbines (3)

401 KAR 60:005, Section 2(2)(ffff), 40 C.F.R. 60.4300 through 60.4420, Table 1 (Subpart KKKK), *Standards of Performance for Stationary Combustion Turbines* is applicable to stationary combustion turbines with a heat input at peak load equal to or greater than 10.7 gigajoules (10 MMBtu) per hour, based on the higher heating value of the fuel, which commenced construction, modification, or reconstruction after February 18, 2005.

401 KAR 60:005, Section 2(2)(jjjj), 40 CFR 60.5508 through 60.5580, Tables 1 through 3 (Subpart TTTT), *Standards of Performance for Greenhouse Gas Emissions for Electric Generating Units* is applicable to stationary combustion turbines that commence construction after January 8, 2014, but on or before May 23, 2023.

State Origin Requirement:
401 KAR 63:020, *Potentially hazardous matter or toxic substances*

Comments:
The combustion turbines utilize a uniform fuel (natural gas) as defined in 40 CFR 60.5520(d)(1). The permittee's only monitoring and recordkeeping requirement under 40 CFR 60 Subpart TTTT, is to maintain purchase records for permitted fuels [40 CFR 60.5520(d)(1)]. The condition is repeated in 40 CFR 60.5535(a) which states that the combustion turbines are only required to maintain fuel purchase records and are not subject to the rest of the requirements in 60.5535 if the permittee burns uniform fuels as defined in 60.5520(d)(1).

1. Since electric generation from CTs vary with ambient conditions, operations are restricted by the federally enforceable 40 CFR 60, Subpart TTTT-derived generation limit of 766,000 MWh(Gross)/CT-year rather than by a maximum number of operating hours. The limit is calculated by multiplying the potential electric output (PEO) by the baseload design rate efficiency. The PEO is calculated by multiplying the baseload design rate efficiency at maximum electric production by the baseload rating. (APE20200008 Application, Equations 19-21)
2. The facility approximates a maximum of 150 startups/shutdowns per year, with each startup and shutdown lasting approximately 20 minutes (0.333 hrs) and 14 minutes (0.233 hrs), respectively. Startups result in 21.8 MWh and shutdowns accrue 7.4 MWh. The annual number of hours used in emission calculations are calculated as follows:

$$(0.333 + 0.233)\frac{hours}{event} \times 150\frac{events}{CT-yr} = 85\frac{hours}{CT-yr}$$

$$(21.8 + 7.4)\frac{MWh}{event} \times 150\frac{events}{CT-yr} = 4{,}380\frac{MWh}{CT-yr}$$

$$(766{,}000 - 4{,}380)\frac{MWh}{CT-yr} \div 229.305\ MW = 3{,}321\frac{hours}{CT-yr}$$

$$(3{,}321 + 85)\frac{hours}{CT-yr} = 3{,}405\frac{hours}{CT-yr}$$

3. GE guarantees filterable plus condensable steady-state particulate emissions (PM_{10}) of 18 lbs/CT-hour. Startup (SU) and shutdown (SD) PM_{10} emissions are each 31.3 lbs/CT-hour. The following equation can be used to determine the PM_{10} emission factor for each CT:

Emission Unit 137-139 – Simple Cycle Combustion Turbines (3)

$$\left(\frac{18\frac{lbs}{baseload\ hour}\times\frac{3{,}321\frac{baseload\ hours}{yr}}{3{,}405\frac{total\ hours}{yr}}+31.3\frac{lbs}{(SU+SD)\ hour}\times\frac{85\frac{(SU+SD)\ hours}{yr}}{3{,}405\frac{total\ hours}{yr}}}{\frac{2{,}293\frac{MMBtu}{hr}}{1020\frac{MMBtu}{MMscf}}}\right)=8.29\frac{lbs}{MMscf}$$

Where 2,293 MMBtu/hr is the HHV of each CT at 0°F.

4. 40 CFR 60, Subpart KKKK provides a NO_x emission standard of 15 ppm @ 15% O_2 that TVA relies upon to account for maximum NO_x emissions from the CTs. The Division reviewed the alternative limit of 96 ppm at 15% O_2 and verified that the facility would still fall under the significant emission rate increase while operating at or below 50% of peak load. The 15 ppm NO_x emission standard can be converted to lbs/yr using the following equation:

$$\frac{15ft^3NO_2}{10^6ft^3FG}\times\frac{1\ lbmol\ NO_2}{385.3ft^3NO_2}\times\frac{46.01\ lbsNO_2}{lbmol\ NO_2}\times\frac{5.33\times10^7 dscf\ FG}{hour}\times\frac{20.9-13.17}{20.9-15}\times\frac{3{,}321\ hours}{yr}=415{,}401\frac{lbs\ NO_2}{yr}$$

Where 385.3 scf/lbmol is the molar volume at standard conditions (68°F & 1atm), 46.01 lbs/lbmol is the molar mass of NO_2, 5.33x10^7 dry scf FG/hr is the exhaust flow at 0°F and 13.17% dry O_2. Air is approximately 20.9% O_2 by volume.

SU & SD NO_x emissions are 87.2 lbs/hr and 90.0 lbs/hr, respectively, and these emissions are calculated as follows:

$$87.2\frac{lbs}{hr}\times0.333\frac{hours}{event}\times150\ \frac{events}{yr}+90.0\frac{lbs}{hr}\times0.233\frac{hours}{event}\times150\frac{events}{yr}=7{,}501\frac{lbs\ NO_x}{yr}$$

The emission factor for NO_x can be calculated by adding together the baseload, SU & SD emissions, dividing by the total number of hours per CT-yr, and dividing by the hourly design rate as follows:

$$\frac{415{,}401\frac{lbs\ NO_x}{yr}+7{,}501\frac{lbs\ NO_x}{yr}}{3{,}405\frac{hours}{yr}*\frac{2{,}293\frac{MMBtu}{hr}}{1020\frac{MMBtu}{MMscf}}}=55.25\frac{lbs}{MMscf}$$

5. 40 CFR 75, Appendix D provides an SO_2 emission factor of 0.0006 lbs/MMBtu. SU and SD SO_2 emissions result in 0.497 lbs/hr and 0.317 lbs/hr, respectively. The following equation is used to calculate a total emission factor of 0.57 lbs/MMscf:

$$\frac{0.0006\frac{lbs}{MMBtu}\times2{,}293\frac{MMBtu}{hr}\times3{,}321\frac{hrs}{yr}+\left(0.497\frac{lbs}{hr}\times0.333\frac{hrs}{SU}+0.317\frac{lbs}{hr}\times0.233\frac{hrs}{SD}\right)\times150\frac{SU\&SD}{yr}}{3{,}405\frac{hours}{yr}*\frac{2{,}293\frac{MMBtu}{hr}}{1020\frac{MMBtu}{MMscf}}}\times.95$$

6. 40 CFR 60, Subpart TTTT limits CO_2 to 120 lbs/MMBtu.
7. CO & VOC emissions are calculated using manufacturer guarantees of 9 ppmvd & 1.4 ppmvw, respectively. Methane and nitrous oxide emission factors come from 40 CFR 98, Table C-2. Heavy metal emission factors come from EPRI Report No. 1005402, April 2002 and all other HAP emission factors come from AP-42, Table 3.1-3.

Emission Unit 107 – Natural Gas-fired Auxiliary Boiler				
Pollutant	**Emission Limit or Standard**	**Regulatory Basis for Emission Limit or Standard**	**Emission Factor Used and Basis**	**Compliance Method**
PM	0.10 lb/MMBtu	401 KAR 59:015, Section 4(1)(b)	0.01 lb/MMBtu, RACT/BACT/LAER	Compliance is assumed while burning natural gas
Opacity	20%, 6-minute average	401 KAR 59:015, Section 4(2)	N/A	Compliance is assumed while burning natural gas
SO_2	0.8 lb/MMBtu	401 KAR 59:015, Section 5(1)(b)1.	2.79E-3 MMBtu/hr, AP-42, Section 1.4	Compliance is assumed while burning natural gas

Initial Construction Date: 2015

Process Description:
The natural gas-fired auxiliary boiler (80 MMBtu/hr maximum rated heat input capacity) supplies steam to various equipment. The steam is used to maintain turbine steam seals during startups, preheat the condenser, aid in dissolved oxygen removal during startup, and provide freeze protection. NO_x emissions are controlled by utilizing a low-NO_x burner and flue gas recirculation (FGR). Additionally, the auxiliary boiler will include an oxygen (O_2) trim system. CO emissions are controlled through good combustion practices. The auxiliary boiler is expected to operate as needed.

Applicable Regulations:
401 KAR 59:015, *New indirect heat exchangers*, is applicable to indirect heat exchangers having a heat input capacity greater than one (1) million BTU per hour (MMBtu/hr) commenced on or after April 9, 1972.

401 KAR 60:005, Section 2(2)(d), 40 C.F.R. 60.40c through 60.48c (Subpart Dc), *Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units* is applicable to each steam generating unit for which construction is commenced after June 9, 1989 and that has a maximum design heat input capacity of 29 megawatts (MW) (100 million British thermal units per hour (MMBtu/h)) or less, but greater than or equal to 2.9 MW (10 MMBtu/h).

Non-Applicable Regulations:
401 KAR 63:002, Section 2(4)(iiii), 40 CFR 63.7480 through 63.7575, Tables 1 through 13 (Subpart DDDDD), *National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters*

401 KAR 63:002, Section 2(4)(jjjjj), 40 CFR 63.11193 through 63.11237, Tables 1 through 8 (Subpart JJJJJJ), *National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers Area Sources*

Comments:
Most of the emission factors for natural gas combustion are from AP-42, 5th Edition, Section 1.4. Emission factors for PM are based on EPA's RACT/BACT/LEAR Clearinghouse. NO_x and CO are based on manufacturer's data for natural gas combustion. The sulfur dioxide emission factor is based on 10,000

Emission Unit 107 – Natural Gas-fired Auxiliary Boiler

grains sulfur per million scf and 95% oxidation to SO_2 and 5% oxidation to sulfuric acid. Annual emissions are estimated using 8,760 hr/yr operation. Actual emissions will be much less.

With the removal of EU 3, coal fired boiler, the facility is no longer a major source of HAPs and so 40 CFR 63, Subpart DDDDD is no longer applicable to this unit. 40 CFR 63, Subpart JJJJJJ is not applicable to EU 107 as it is a natural gas fired boiler.

Emission Units 108-110 – Dew Point Natural Gas-Fired Heaters for EUs 120-125

Pollutant	Emission Limit or Standard	Regulatory Basis for Emission Limit or Standard	Emission Factor Used and Basis	Compliance Method
PM	0.10 lb/MMBtu	401 KAR 59:015, Section 4(1)(b)	0.01 lb/MMBtu, RACT/BACT/LAER	Compliance is assumed while burning natural gas
Opacity	20%, based on a 6-minute average	401 KAR 59:015, Section 4(2)	N/A	Compliance is assumed while burning natural gas
SO_2	0.80 lb/MMBtu	401 KAR 59:015, Section 5(1)(b)1.	2.79E-3 MMBtu/hr, AP-42, Section 1.4	Compliance is assumed while burning natural gas

Initial Construction Date: 2015

Process Description:
The combustion turbines require the temperature of the natural gas at the turbine interface to be above the dew point of any natural gas constituent. To achieve this, three (3) dew-point natural gas heaters are utilized. The natural gas-fired gas heaters (13.5 MMBtu/hr maximum rated heat input capacity per heater) are indirect water-bath heaters having a shell-and-tube heat exchanger configuration. CO emissions are controlled through good combustion practices. The gas heaters will include an oxygen (O_2) trim system. Each dew-point gas heater can provide 100 percent of the natural gas required for the combined-cycle facility, but each is proposed to operate year-round.

Applicable Regulations:
401 KAR 59:015, *New indirect heat exchangers*, is applicable to indirect heat exchangers having a heat input capacity greater than one (1) million BTU per hour (MMBtu/hr) commenced on or after April 9, 1972.

401 KAR 60:005, Section 2(2)(d), 40 C.F.R. 60.40c through 60.48c (Subpart Dc), *Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units* is applicable to each steam generating unit for which construction is commenced after June 9, 1989 and that has a maximum design heat input capacity of 29 megawatts (MW) (100 million British thermal units per hour (MMBtu/h)) or less, but greater than or equal to 2.9 MW (10 MMBtu/h).

Non-Applicable Regulations:
401 KAR 63:002, Section 2(4)(iiii), 40 CFR 63.7480 through 63.7575, Tables 1 through 13 (Subpart DDDDD), *National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial,*

Emission Units 108-110 – Dew Point Natural Gas-Fired Heaters for EUs 120-125

Commercial, and Institutional Boilers and Process Heaters

401 KAR 63:002, Section 2(4)(jjjjj), 40 CFR 63.11193 through 63.11237, Tables 1 through 8 (Subpart JJJJJJ), *National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers Area Sources*

Comments:
Most of the emission factors for natural gas combustion are from AP-42, 5th Edition, Section 1.4. Emission factors for PM are based on EPA's RACT/BACT/LEAR Clearinghouse. NO_x, CO, and VOC emission factors are based on manufacturer's data for natural gas combustion. The sulfur dioxide emission factor is based on 10,000 grains sulfur per million scf and 95% oxidation to SO_2 and 5% oxidation to sulfuric acid. Annual emissions are estimated using 8,760 hr/yr operation.

With the removal of EU 3, coal fired boiler, the facility is no longer a major source of HAPs and so 40 CFR 63, Subpart DDDDD is no longer applicable to this unit. 40 CFR 63, Subpart JJJJJJ is not applicable to EU 108-110 as each is a natural gas fired heater and not a boiler as defined in 40 CFR 63.11237.

Emission Unit 141-143 – Dew Point Natural Gas-Fired Heaters for EUs 137-139

Pollutant	Emission Limit or Standard	Regulatory Basis for Emission Limit or Standard	Emission Factor Used and Basis	Compliance Method
PM	0.30 lbs/MMBtu	401 KAR 59:015, Section 4(1)(c)	13.87 lbs/MMscf, Manufacturer Data	Compliance is assumed while combustion natural gas
	20% Opacity	401 KAR 59:015, Section 4(2)(b)		
SO_2	0.99 lbs/MMBtu	401 KAR 59:015, Section 5(1)(c)2.b.	95% of 0.6 lbs/MMBtu, AP-42, Table 1.4-2	

Initial Construction Date: 2023

Process Description:
The combustion turbines require the temperature of the natural gas at the turbine interface to be above the dew point of any natural gas constituent. To achieve this, three (3) dew-point natural gas heaters are utilized. The natural gas-fired heaters (10 MMBtu/hr maximum rated heat input capacity per heater) are indirect water-bath heaters having a shell-and-tube heat exchanger configuration. CO emissions are controlled through good combustion practices. The gas heaters include an oxygen (O_2) trim system and dry low-nitrogen oxide (DLN) combustors.

Applicable Regulations:
401 KAR 59:015, *New indirect heat exchangers*, is applicable to indirect heat exchangers having a heat input capacity greater than one (1) million BTU per hour (MMBtu/hr) commenced on or after April 9, 1972.

Emission Unit 141-143 – Dew Point Natural Gas-Fired Heaters for EUs 137-139

401 KAR 60:005, Section 2(2)(d), 40 C.F.R. 60.40c through 60.48c (Subpart Dc), *Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units* is applicable to each steam generating unit for which construction is commenced after June 9, 1989 and that has a maximum design heat input capacity of 29 megawatts (MW) (100 million British thermal units per hour (MMBtu/h)) or less, but greater than or equal to 2.9 MW (10 MMBtu/h).

Non-Applicable Regulations:
401 KAR 63:002, Section 2(4)(iiii), 40 CFR 63.7480 through 63.7575, Tables 1 through 13 (Subpart DDDDD), *National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters*

401 KAR 63:002, Section 2(4)(jjjjj), 40 CFR 63.11193 through 63.11237, Tables 1 through 8 (Subpart JJJJJJ), *National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers Area Sources*

Comments:
Most of the emission factors for natural gas combustion are from AP-42, 5th Edition, Section 1.4. The CO, NO_x, PM, VOC, and Sulfuric Acid emission factors are based on manufacturer's data for natural gas combustion. The sulfur dioxide emission factor is based on 0.2 grains of sulfur per 100 scf with 95% oxidation to SO_2 and 5% oxidation to sulfuric acid. Annual emissions are estimated using 3,405 hr/yr operation.

Emission Unit 104 - Diesel-Fired Emergency Engine

Initial Construction Date: 2006
Manufacture Date: 10/25/2005

Process Description:
TVA - PCC installed a two-way radio system emergency diesel engine in 2006. The Cummins Model DGCA-5742774 generator engine (manufactured 10/24/2005) is rated at 90 horsepower. The heat input rating for the diesel engine is 0.690 MMBtu/hr based on diesel fuel input of 4.9 gallons per hour and diesel heat content of 140,000 Btu/gallon. The engine is limited to 100 hours of operation during any twelve consecutive months for maintenance and readiness testing. Combustion gases from the engine discharge to the atmosphere through one stack.

Applicable Regulation:
401 KAR 63:002, Section 2(4)(eeee), 40 CFR 63.6580 through 63.6675, Tables 1a through 8, and Appendix A (Subpart ZZZZ), *National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines*

Non-applicable Regulation:
401 KAR 60:005, Section 2(2)(dddd), 40 CFR 60.4200 through 60.4219, Tables 1 through 8 (Subpart IIII), *Standards of Performance for Stationary Compression Ignition Internal Combustion Engines*

Comments:
APE20140002: Engine added to permit
APE20170007: Engine manufactured date provided by facility
APE20170009: Facility requested 40 CFR 60, Subpart IIII to be a non-applicable regulation, as the engine was manufactured before April 1, 2006.
APE20200008: The facility went from a major source of HAPs to an area source; therefore, engine requirements changed from Table 2c to 2d.

The engine is considered an existing emergency engine located at an area source for HAPs. Potential hourly emissions for particulate, hydrocarbons, and carbon monoxide are calculated using the Tier 2 emission standards for 2005 model year engines multiplied by a factor of 1.25 for not-to-exceed emissions. The NOx potential hourly emissions are based on the permit limit from 40 CFR 60.4205(a), Table 1. The emission factor for sulfur dioxide is based on 15 ppm sulfur and 95% of the sulfur oxidized to SO2 and 5% to H_2SO_4. Hazardous air pollutants are based on AP-42, 5th edition, Section 3.3. Potential annual emissions are based on 500 hours per year based on EPA's definition of hours of operation for an emergency engine.

Emission Unit 115 - Diesel-Fired Fire Pump (emergency engine)				
Pollutant	**Emission Limit or Standard**	**Regulatory Basis for Emission Limit or Standard**	**Emission Factor Used and Basis**	**Compliance Method**
NMHC + NO_x	4.0 g/kW-hr (3.0 lb/HP-hr)	40 CFR 60.4205(c) referencing Table 4 and 40 CFR 60.4206	3.0 lb/HP-hr (40 CFR 60.4205(c) Table 4)	Install a certified engine according to manufacturer's emission-related specs.
PM	0.20 g/kW-hr (0.15 lb/HP-hr)		0.15 lb/HP-hr (40 CFR 60.4205(c) Table 4)	

Initial Construction Date: 2015

Process Description:
Paradise Combined Cycle Facility installed an emergency diesel engine fire pump in 2015. The Clarke Model JU6H-UFADS8 fire pump has a John Deere Model 6068HFC48 diesel engine rated at 252 hp. The heat input rating for the diesel engine is 1.96 MMBtu/hr based on diesel fuel input of 14 gallons per hour and diesel heat content of 140,000 Btu/gallon. The engine is limited to 100 hours of operation during any twelve consecutive months for maintenance and readiness testing. Combustion gases from the engine discharge to the atmosphere through one stack.

Applicable Regulations:
401 KAR 60:005, Section 2(2)(dddd), 40 CFR 60.4200 through 60.4219, Tables 1 through 8 (Subpart IIII), *Standards of Performance for Stationary Compression Ignition Internal Combustion Engines*

401 KAR 63:002, Section 2(4)(eeee), 40 CFR 63.6580 through 63.6675, Tables 1a through 8, and Appendix A (Subpart ZZZZ), *National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines*

Comments:
Potential hourly emissions for particulate, nitrogen oxides plus hydrocarbons, and carbon monoxide are calculated based on permit limits from 40 CFR 60.4205(c), Table 4. The emission factor for sulfur dioxide is based on 15 ppm sulfur and 95% of the sulfur oxidized to SO2 and 5% to H_2SO_4. Hazardous air pollutants are based on AP-42, 5th edition, Section 3.3. Potential annual emissions are based on 500 hours per year based on EPA's definition of hours of operation for an emergency engine.

Emission Unit 128 - Propane Emergency Engine (telecommunications)

Initial Construction Date: 10/2016

Process Description:
TVA - PCC has an emergency telecommunication propane generator. The Generac generator, Model RG025, is rated at 25 kW electrical (42 hp). The heat input rating for the propane engine is 0.430 MMBtu/hr based on propane fuel input of 4.7 gallons per hour and propane heat content of 91,500 Btu/gallon. The engine is limited to 100 hours of operation during any twelve consecutive months for maintenance and readiness testing. Combustion gases from the engine discharge to the atmosphere through one stack.

Applicable Regulation:
401 KAR 60:005, Section 2(2)(eee), 40 CFR 60.4230 through 60.4248, Tables 1 through 4 (Subpart JJJJ), *Standards of Performance for Stationary Spark Ignition Internal Combustion Engines*

401 KAR 63:002, Section 2(4)(eeee), 40 CFR 63.6580 through 63.6675, Tables 1a through 8, and Appendix A (Subpart ZZZZ), *National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines*

Comments:
Potential hourly emissions are calculated using the emission limit (40 CFR Part 60 Subpart JJJJ) for spark ignition standby propane engines for nitrogen oxides plus hydrocarbon and carbon monoxide. The emission factors for particulate and sulfur dioxide are from San Diego Air Pollution Control District, Uncontrolled Propane-Fired Internal Combustion Engine, 6/1999. Potential annual emissions are based on 500 hours per year based on EPA's definition of hours of operation for an emergency engine.

Emission Unit 147-155 Diesel-Fired Engines

Process Description:
Seven non-emergency diesel-fired engines:

Emission Unit	Description	Model	Rated Capacity	Construction Date	Engine Manufactured
147	Coal Yard Runoff Diesel Engine Pump #1	John Deere Model 4045TF285, Tier 3	99 HP; 0.693 MMBtu/hr	2021	2011
148	Coal Yard Runoff Diesel Engine Pump #2	John Deere Model 4045TF285, Tier 3	99 HP; 0.693 MMBtu/hr	2021	2011
151	Daniel Run Coal Fines Diesel Engine Pump #1	Deutz Model D914L04, Tier 3	78 HP; 0.546 MMBtu/hr	2021	Unknown
152	Daniel Run Coal Fines Diesel Engine Pump #2	John Deere Model 4045TF290, Tier 3	74 HP; 0.518 MMBtu/hr	2021	2012
155	GN24 Generator for Fuel Tank	Isuzu Model BZ-4LE2T, Tier 4	46 HP	2021	2018
156	Daniel Run Coal Fines Diesel Engine Pump #3	John Deere Model 4045TF290, Tier 3	74 HP; 0.518 MMBtu/hr	2025	2012

Applicable Regulations:
401 KAR 60:005, Section 2(2)(dddd), 40 CFR 60.4200 through 60.4219, Tables 1 through 8 (Subpart IIII), *Standards of Performance for Stationary Compression Ignition Internal Combustion Engines*

401 KAR 63:002, Section 2(4)(eeee), 40 CFR 63.6580 through 63.6675, Tables 1a through 8, and Appendix A (Subpart ZZZZ), *National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines*

Comments:
The following emission standards required by 40 CFR 60, Subpart IIII are used, as applicable, to calculate the potential emissions for NO_x, CO, and PM:

Emission Unit	Regulation	NO_x (g/kW-hr)	NO_x + NMHC (g/kW-hr)	CO (g/kW-hr)	PM (g/kW-hr)
147	40 CFR 1039, Appendix I, Table 3	4.7	N/A	5.0	0.40
148	40 CFR 1039, Appendix I, Table 3	4.7	N/A	5.0	0.40
151	40 CFR 1039, Appendix I, Table 3	4.7	N/A	5.0	0.40
152	40 CFR 1039, Appendix I, Table 3	4.7	N/A	5.0	0.40
155	40 CFR 1039.101, Table 1	N/A	4.7	5.5	0.03
156	40 CFR 1039, Appendix I, Table 3	4.7	N/A	5.0	0.40

Although emission units 148 and 152 are after the model year required for the Tier 3 engines' emission standards listed in 40 CFR Part 1039, they offer a more conservative emission factor than the standards for Tier 4 engines.

Emission Unit 147-155 Diesel-Fired Engines

Greenhouse gas emissions are calculated using emission factors from 40 CFR 98, Tables C-1 and C-2. All other emission factors are from AP-42, 5th edition, Section 3.3.

Conversion Factors Used:
140,000 Btu/gal
453.6 g/lb
1.341 HP/kW

Potential annual emissions are based on 8,760 hours per year per engine.

APE20240002:
Removed EU 153 and 154 from the list as these generators have been removed from the facility.
On October 23rd, 2024, the Division received an email from TVA stating that EU 149 and 150 were removed from the facility on August 15th, 2024. See email *TVA Paradise - RE Application question - 11-4-2024*.

On October 8th, 2025, the Division received an email from TVA PCC stating that a new diesel engine will be added in 2025. The diesel engine is the same model and manufacture year (2012) as EU 152. The engine was added to the permit as EU 157 "Daniel Run Coal Fines Engine Pump #3". See email *TVA Paradise – RE Application question – 10-22-2025*.

On April 1st, 2026, the Division received an update from TVA stating that EU 148 was manufactured in 2011 instead of 2013. The current permit and statement of basis were updated accordingly. See email *TVA Paradise – Courtesy copy comment – 4-1-2026*.

Emission Unit 114 – 16 Cell Cooling Towers for CT's				
Pollutant	**Emission Limit or Standard**	**Regulatory Basis for Emission Limit or Standard**	**Emission Factor Used and Basis**	**Compliance Method**
PM	2.58 lbs/hr if the process rate is 0.5 tons/hr or less	401 KAR 59:010, Section 3(2)	$1.93x10^{-5}$ lb/ton AP-42 Section 13.4	Drift Eliminators (control efficiency accounted for in emission factor)
	$3.59P^{0.62}$ lbs/hr, where P is the process rate in tons/hr if the process rate is greater than 0.5 tons/hr and less than or equal to 30 tons/hr			
	$17.31P^{0.16}$ lbs/hr if the process rate is greater than 30 tons/hr			
	20% opacity	401 KAR 59:010, Section 3(1)(a)	----	----

Construction Date: 11/2015

Process Description:
Paradise Combined Cycle Plant (PCC) has a 16 cell mechanical-draft counter-flow cooling tower that provides cooling for the condensing steam turbine exhaust and the plant auxiliary equipment. It serves the design heat duty with a circulating cooling water flow rate of 289,000 gallons per minute. The drift rate will not exceed 0.0005 percent. Drift eliminators are installed to reduce the particulate emissions. The cooling tower is complete with pumps, water chemistry control, and fire protection.

Applicable Regulation:
401 KAR 59:010, *New process operations* is applicable to each affected facility, associated with a process operation, which is not subject to another emission standard with respect to particulates, commenced on or after July 2, 1975.

Comments:
Emissions from the cooling tower are determined from the circulating cooling water rate of 289,000 gallons per minute, design drift efficiency of 0.0005%, a concentration factor of 10, and intake water quality data. Particulate emissions are based on the total-solids content of the cooling water 1,100 ppm (350 ppm total dissolved solids + 750 ppm total suspended solids). Annual emissions are based on continuous operation of the cooling towers.

Emission Unit 157 – Combined Cycle Plant Gasoline Tank

Construction Date: 05/2022

Process Description:
The 300 gallon gasoline fuel tank is a horizontal fixed roof tank. The unit dispenses fuel to motor equipment on site. The monthly throughput is 250 gal/month.

Applicable Regulations:
401 KAR 63:002, Section 2(4)(ddddd), 40 C.F.R. 63.11110 through 63.11132, Tables 1 through 3 (Subpart CCCCCC), *National Emission Standards for Hazardous Air Pollutants for Source Category: Gasoline Dispensing Facilities*, is applicable to each gasoline dispensing facility (GDF) located at an area source.

401 KAR 63:020, *Potentially hazardous matter or toxic substances*, is applicable to each affected facility which emits or may emit potentially hazardous matter or toxic substances, provided such emissions are not elsewhere subject to the provisions of the administrative regulations of the Division for Air Quality.

Comments:
TVA PCC estimated their maximum monthly fuel consumption as 250 gallons/month. See email *TVA Paradise – RE Application question – 10-22-2025*.

SECTION 3 – EMISSIONS, LIMITATIONS AND BASIS (CONTINUED)

Testing Requirements\Results

Emission Unit(s)	Control Device	Parameter	Regulatory Basis	Frequency	Test Method	Permit Limit	Test Result	Thruput and Operating Parameter(s) Established During Test	Activity Graybar	Date of last Compliance Testing
137	Dry Low NO_X	NO_X	40 CFR 60, Subpart KKKK	9 RATA Runs (Annual)	7E	15 ppm NO_X @ 15% O_2	1.46%	234 MW	CMN20240004 CMN20240005 CMN20240006	2/6-8/2024
		O_2			3A		0.86%			
138		NO_X			7E		6.14%	232 MW		
		O_2			3A		1.42%			
139		NO_X			7E		2.66%	227 MW		
		O_2			3A		0.28%			
120	Selective Catalytic Reduction & Catalytic Oxidation inherent for each HRSG	NO_X	40 CFR 60, Subpart KKKK	9 RATA Runs (Annual)	7E	15 ppm NO_X @ 15% O_2	3.59%	369 MW	CMN20240001 CMN20240002 CMN20240003	1/30-31/2024 & 2/1/2024
		O_2			3A		2.05%			
121		NO_X			7E		1.87%	346 MW		
		O_2			3A		1.58%			
122		NO_X			7E		2.42%	366 MW		
		O_2			3A		1.06%			
120	Selective Catalytic Reduction & Catalytic Oxidation inherent for each HRSG	NO_X	40 CFR 60, Subpart KKKK	9 RATA Runs (Annual)	7E	15 ppm NO_X @ 15% O_2	7.87%	340 MW	CMN20230001 CMN20230002 CMN20230003	3/7-9/2023
		O_2			3A		1.41%			
121		NO_X			7E		4.99%	346 MW		
		O_2			3A		0.78%			
122		NO_X			7E		7.92%	342 MW		
		O_2			3A		1.60%			
120	Selective Catalytic	NO_X	40 CFR 60, Subpart	9 RATA Runs	7E	15 ppm NO_X @	10.48%	336 MW	CMN20220008	4/5-7/2022
		O_2			3A		1.49%			

Emission Unit(s)	Control Device	Parameter	Regulatory Basis	Frequency	Test Method	Permit Limit	Test Result	Thruput and Operating Parameter(s) Established During Test	Activity Graybar	Date of last Compliance Testing
121	Reduction & Catalytic Oxidation inherent for each HRSG	NO_X	KKKK	(Annual)	7E	15% O_2	5.04%	304 MW		
		O_2			3A		1.55%			
122		NO_X			7E		3.90%	340 MW		
		O_2			3A		2.23%			
123	Dry Low NO_X	NO_X	40 CFR 60, Subpart KKKK	9 RATA Runs (Initial)	7E	15 ppm NO_X @ 15% O_2	0.78%	219 MW	CMN20220001 CMN20220003 CMN20220005	10/19-20/2022
		O_2			3A		4.72%			
124		NO_X			7E		4.37%	225 MW		
		O_2			3A		0.54%			
125		NO_X			7E		11.23%	226 MW		
		O_2			3A		0.64%			
120	Selective Catalytic Reduction & Catalytic Oxidation inherent for each HRSG	CO	40 CFR 60, Subpart KKKK	9 RATA Runs (Initial)	10	15 ppm NOx @ 15% O_2	0.46ppm @ 15% O_2	334 MW	CMN20210001 CMN20210002 CMN20210003	3/16/2021
		NO_X			7E		3.10%			
		O_2			3A		1.31%			
121		CO			10		0.31ppm @ 15% O_2	337 MW		
		NO_X			7E		2.37%			
		O_2			3A		0.28%			
122		CO			10		0.58ppm @ 15% O_2	333 MW		
		NO_X			7E		4.74%			
		O_2			3A		1.60%			

Footnotes: Previous performance tests are listed in previous Statement of Basis.

SECTION 4 – SOURCE INFORMATION AND REQUIREMENTS

Table A - Group Requirements:

N/A

Table B - Summary of Applicable Regulations:

Applicable Regulations	Emission Unit
401 KAR 51:017, *Prevention of significant deterioration of air quality*	EUs 120-125
401 KAR 51:160, *NO_x requirements for large utility and industrial boilers*	EUs 120-125 & 137-139
401 KAR 51:210, *CAIR NO_x annual trading program*	EUs 120-125 & 137-139
401 KAR 51:220, *CAIR NO_x ozone season trading program*	EUs 120-125 & 137-139
401 KAR 51:230, *CAIR SO_2 trading program*	EUs 120-125 & 137-139
401 KAR 51:240, *Cross-State Air Pollution Rule (CSAPR) NOx annual trading program*	EUs 120-125 & 137-139
401 KAR 51:250, *Cross-State Air Pollution Rule (CSAPR) NOx ozone season group 2 trading program*	EUs 120-125 & 137-139
401 KAR 51:260, *Cross-State Air Pollution Rule (CSAPR) SO_2 group 1 trading program*	EUs 120-125 & 137-139
401 KAR 52:060, *Acid Rain Permits*	EUs 120-125 & 137-139
401 KAR 59:010, *New process operations*	EUs 114 & 137-139
401 KAR 59:015, *New indirect heat exchangers*	EUs 107 - 110 & 141-143
401 KAR 60:005, Section 2(2)(d), 40 CFR 60.40c through 60.48c (Subpart Dc), *Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units*	EUs 107 - 110 & 141-143
401 KAR 60:005, Section 2(2)(dddd), 40 CFR 60.4200 through 60.4219, Tables 1 through 8 (Subpart IIII), *Standards of Performance for Stationary Compression Ignition Internal Combustion Engines*	EUs 115 & 147-156

401 KAR 60:005, Section 2(2)(eee), 40 CFR 60.4230 through 60.4248, Tables 1 through 4 (Subpart JJJJ), *Standards of Performance for Stationary Spark Ignition Internal Combustion Engines*	EU 128
401 KAR 60:005, Section 2(2)(ffff), 40 CFR 60.4300 through 60.4420, Table 1 (Subpart KKKK), *Standards of Performance for Stationary Combustion Turbines*	EUs 120-125 & 137-139
401 KAR 60:005, Section 2(2)(jjjj), 40 CFR 60.5508 through 60.5580, Tables 1 through 3 (Subpart TTTT), *Standards of Performance for Greenhouse Gas Emissions for Electric Generating Units*	EUs 120-125 & 137-139
401 KAR 63:002, Section 2(4)(eeee), 40 CFR 63.6580 through 63.6675, Tables 1a through 8, and Appendix A (Subpart ZZZZ), *National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines*	EUs 104, & 147-156
40 CFR Part 75, *Continuous Emission Monitoring*	EUs 120-125 & 137-139
401 KAR 63:020, *Potentially hazardous matter or toxic substances*	EUs 120-125, 137-139, & 157
401 KAR 63:002, Section 2(4)(ddddd), 40 C.F.R. 63.11110 through 63.11132, Tables 1 through 3 (Subpart CCCCCC), *National Emission Standards for Hazardous Air Pollutants for Source Category: Gasoline Dispensing Facilities*	EU 157

Table C - Summary of Precluded Regulations:

Precluded Regulations	Emission Unit
401 KAR 51:017, *Prevention of significant deterioration of air quality*, Sections 8 to 16	SOURCE-WIDE

SECTION 4 – SOURCE INFORMATION AND REQUIREMENTS (CONTINUED)

Table D - Summary of Non Applicable Regulations:

Non Applicable Regulations	Emission Unit
401 KAR 63:002, Section 2(4)(iiii), 40 CFR 63.7480 through 63.7575, Tables 1 through 13 (Subpart DDDDD), *National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters*	EUs 107, 108-110, & 141-143
401 KAR 63:002, Section 2(4)(jjjjj), 40 CFR 63.11193 through 63.11237, Tables 1 through 8 (Subpart JJJJJJ), *National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers Area Sources*	EUs 107, 108-110, & 141-143
401 KAR 60:005, Section 2(2)(dddd), 40 CFR 60.4200 through 60.4219, Tables 1 through 8 (Subpart IIII), *Standards of Performance for Stationary Compression Ignition Internal Combustion Engines*	EU 104

Air Toxic Analysis

401 KAR 63:020, *Potentially Hazardous Matter or Toxic Substances*
The Division for Air Quality (Division) has performed modeling using SCREEN View on January 20, 2021 of potentially hazardous matter or toxic substances (Formaldehyde and Toluene) that may be emitted by the facility based upon the process rates, material formulations, stack heights and other pertinent information provided by the applicant. Based upon this information, the Division has determined that the conditions outlined in this permit will assure compliance with the requirements of 401 KAR 63:020.

Single Source Determination
N/A

SECTION 5 – PERMITTING HISTORY

Permit	Permit Type	Activity#	Complete Date	Issuance Date	Summary of Action	PSD/Syn Minor
V-04-024	Construction & Operating	APE20040002	2/7/1997	8/18/2006 Permit withdrawn 8/25/2006	Title V Renewal Application Withdrawn due to EPA objections	
V-07-018	Construction & Operating	APE20070001	4/9/2007	11/2/2007	Resolved EPA objections by incorporating source-specific SIP with an SO_2 limit on PAF3 from 5.4 lb/MMBtu to 1.2 lb/MMBtu	PSD
V-07-018 R1	Minor Revision	APE20090002	4/29/2009	12/16/2009	Opacity Mitigation System to reduce fine particulate emissions while reducing SO_3	N/A
V-12-041	Renewal	APE20120002	4/30/2012	8/30/2013	Renewal	N/A
V-12-041 R1	Construction & Operating	APE20140002	3/12/2014	4/20/2015	Construction of 3-to-1 combined cycle combustion turbine system	Synthetic Minor Preclusion to PSD
V-12-041 R2	Construction & Operating	APE20160003 APE20160004 APE20160005 APE20170004 APE20170007 APE20170008 APE20170009 APE20180002	8/1/2016 9/27/2016 1/9/2017 5/26/2017 2/5/2018 12/22/2017 3/22/2017 1/11/2018	8/28/2018	Emergency engine Gypsum dewatering system Federally enforceable limit for SO_2 for 1-hr SO_2 NAAQS Dry landfill for CCR due to new federal regulatory requirements Removal of COMS in lieu of CEMS Correction to emergency engine regulatory applicability determination	Synthetic Minor Preclusion to PSD
V-18-056	Renewal	APE20180004 APE20180008 APE20190003	8/8/2018	12/8/2019	Title V Renewal	N/A

Permit	Permit Type	Activity#	Complete Date	Issuance Date	Summary of Action	PSD/Syn Minor
V-18-056 R1	Construction & Operating	APE20200008	1/26/2021	8/15/2021	Remove PAF03 & associated operations; Add EUs 137-139 & 141-143	Synthetic Minor
V-18-056 R2	Construction & Operating	APE20210007 APE20210013 APE20220003	1/3/2022 1/3/2022 4/27/2022	12/12/2022	Addition of EUs 144-146, 147-153, 154, & 155	N/A

SECTION 6 – PERMIT APPLICATION HISTORY

N/A

APPENDIX A – ABBREVIATIONS AND ACRONYMS

AAQS – Ambient Air Quality Standards
BACT – Best Available Control Technology, see 401 KAR 51:001, Section (1)(25)
Btu – British thermal unit
CAM – Compliance Assurance Monitoring
CO – Carbon Monoxide
CO_2e – Carbon Dioxide Equivalent, calculated using the global warming potential
CT – Combustion Turbine
Division – Kentucky Division for Air Quality
EF – Emission Factor
EGU – Electric Generating Unit
ESP – Electrostatic Precipitator
EU – Emission Unit
FGD – Flue Gas Desulfurization
GHG – Greenhouse Gas
H_2SO_4 – Sulfuric Acid
HAP – Hazardous Air Pollutant
HCl – Hydrogen Chloride (Gaseous)
HF – Hydrogen Fluoride (Gaseous)
HHV – Higher Heating Value
HP – Horsepower
J – Joule
lbs – pounds
MSDS – Material Safety Data Sheets
MW – Mega Watts
mmHg – Millimeter of mercury column height
MMBtu – Million British thermal units
MMscf – Million standard cubic feet
MWh – Mega-Watt hour
NAAQS – National Ambient Air Quality Standards
NESHAP – National Emissions Standards for Hazardous Air Pollutants
ng – nanogram
NG – Natural Gas
NO_x – Nitrogen Oxides
NSR – New Source Review
PAF – Paradise Fossil Plant
PCC – Paradise Combined Cycle
PCT – Paradise Simple Combustion Turbines
PEI – Project Emissions Increase
PM or PT – Particulate Matter
PM_{10} – Particulate Matter equal to or smaller than 10 micrometers
$PM_{2.5}$ – Particulate Matter equal to or smaller than 2.5 micrometers
ppm – parts per million
PSD – Prevention of Significant Deterioration, see 401 KAR 51:001, Section 1(197)
PTE – Potential to Emit, see 401 KAR 51:001, Section (1)(190)
SCR – Selective Catalytic Reduction System
SD – Shutdown

SER – Significant Emission Rate, see 401 KAR 51:001, Section (1)(218)(a)
SO_2 – Sulfur Dioxide
SO_3 – Sulfur Trioxide
SU – Startup
TF – Total Fluoride (Particulate & Gaseous)
tpy – ton per year
TVA – Tennessee Valley Authority
VOC – Volatile Organic Compounds

APPENDIX B – INDIRECT HEAT EXCHANGER HISTORY

EU	Fuel(s)	Capacity (MMBtu/hr)	Construction Date	Date Removed	Total Heat Input Capacity for PM (MMBtu/hr)	PM Limit (lb / MMBtu)	Total Heat Input Capacity for SO_2 (MMBtu/hr)	SO_2 Limit (lb / MMBtu)
1	Coal	6,959	1963	2017	13,969.6	0.11	N/A[1]	N/A[1]
2	Coal	6,959	1963	2017	13,969.6	0.11	N/A[1]	N/A[1]
3	Coal	11,457	1970	2020	25,467.4	0.11	N/A[2]	N/A[2]
4	#2 Fuel Oil	25.8	1963	2018	13,969.6	0.11	13,969.6	2.1
5	#2 Fuel Oil	25.8	1963	2018	13,969.6	0.11	13,969.6	2.1
6	#2 Fuel Oil	25.8	1970	2018	25,467.4	0.11	25,467.4	2.1
7	#2 Fuel Oil	2.5	1970	2018	25,467.4	0.10	25,467.4	0.8
8	#2 Fuel Oil	2.5	1970	2018	25,467.4	0.10	25,467.4	0.8

EU	Fuel(s)	Capacity (MMBtu/hr)	Construction Date	Date Removed	Total Heat Input Capacity for PM (MMBtu/hr)	PM Limit (lb / MMBtu)	Total Heat Input Capacity for SO_2 (MMBtu/hr)	SO_2 Limit (lb / MMBtu)
9	#2 Fuel Oil	2.5	1970	2018	25,467.4	0.10	25,467.4	0.8
10	#2 Fuel Oil	2.5	1970	2018	25,467.4	0.10	25,467.4	0.8
11	#2 Fuel Oil	2.5	1970	2018	25,467.4	0.10	25,467.4	0.8
12	#2 Fuel Oil	2.5	1970	2018	25,467.4	0.10	25,467.4	0.8
13	#2 Fuel Oil	2.5	1981	2018	25,474.9	0.10	25,474.9	0.8
14	#2 Fuel Oil	2.5	1981	2018	25,474.9	0.10	25,474.9	0.8
15	#2 Fuel Oil	2.5	1981	2018	25,474.9	0.10	25,474.9	0.8
107	Natural Gas	80	2015	N/A	25,554.9	0.10	25,554.9	0.8
108	Natural Gas	13.5	2015	N/A	25,595.4	0.10	25,595.4	0.8
109	Natural Gas	13.5	2015	N/A	25,595.4	0.10	25,595.4	0.8

EU	Fuel(s)	Capacity (MMBtu/hr)	Construction Date	Date Removed	Total Heat Input Capacity for PM (MMBtu/hr)	PM Limit (lb / MMBtu)	Total Heat Input Capacity for SO_2 (MMBtu/hr)	SO_2 Limit (lb / MMBtu)
110	Natural Gas	13.5	2015	N/A	25,595.4	0.10	25,595.4	0.8
111	Natural Gas & #2 Fuel Oil	450	2015	2020	26,945.4	0.10	26,945.4	N/A[3]
112	Natural Gas & #2 Fuel Oil	450	2015	2020	26,945.4	0.10	26,945.4	N/A[3]
113	Natural Gas & #2 Fuel Oil	450	2015	2020	26,945.4	0.10	26,945.4	N/A[3]
141	Natural Gas	10	2023	N/A	150.5	0.30	150.5	0.99
142	Natural Gas	10	2023	N/A	150.5	0.30	150.5	0.99
143	Natural Gas	10	2023	N/A	150.5	0.30	150.5	0.99

Footnotes:

1. SO_2 emissions shall not exceed 1.2 lbs/MMBtu based on a 24-hour average. [40 CFR 52.939(c)(49) *A Revision to the KY SIP for TVA Paradise Steam Plant*]
2. SO_2 emissions shall not exceed 1.2 lbs/MMBtu when the scrubber is operating and 3.1 lbs/MMBtu when the scrubber is bypassed based on a 24-hr avg. [40 CFR 52.939(c)(49)]
3. These units are exempt from the SO_2 emission limits by firing only gaseous fuel. [40 CFR 60.42b(k)(2)]