DRAFT TECHNICAL REVIEW AND EVALUATION
OF Air Curtain Incinerator General Permit

I. INTRODUCTION

The Air Curtain Incinerator (ACI) General Permit is a Class II Permit for a facility class (air curtain incinerators) for statewide facilities that are similar in nature, have substantially similar emissions, and would be subject to the same or substantially similar requirements. Equipment covered under this general permit are required to have an individual "Authorization To Operate" (ATO) for each air curtain incinerator and internal combustion engine.

II. EMISSIONS

Table 1 shows the potential to emit each criteria pollutant in tons per year, for each air curtain incinerator assuming that they operate at the maximum capacity of burning 35 tons per day and powering it with a 100 HP engine[1].

Table 1: Emissions for Criteria Air Pollutants (tpy)

Pollutant	Potential to Emit (tpy)			
	Air Curtain Incinerator	100 HP Engine	Total	Permitting Exemption Threshold
NO_x	6.39	7.01	13.40	20
PM_{10}	8.30	0.96	9.26	7.5
$PM_{2.5}$	7.03	0.96	7.99	5
CO	16.61	2.93	19.54	50
SO_2	0.64	0.01	0.65	20
VOCs	5.75	1.08	6.83	20

[1] Engines used in ACIs are generally below 100 HP. For example, engines used in the ACIs manufactured by Air Burner's Inc. are typically between 40 and 75 HP. A 75 HP engine is used for an ACI capable of burning 192 tons per day, which far exceeds the 35 ton per day limit required by this general permit. Therefore, the use of 100 HP engine provide a very conservative emission estimate.

III. APPLICABLE REGULATIONS

Table 2 identifies applicable regulations and verification as to why that standard applies

Table 2: Applicable Regulations

Rule	Discussion
40 CFR 63 Subpart ZZZZ	40 CFR 63 Subpart ZZZZ are applicable to stationary reciprocating internal combustion engines located at an area source of HAP emissions.
40 CFR 60 Subpart IIII	40 CFR 60 Subpart IIII are applicable to stationary compression ignition internal combustion engines.
40 CFR 60 Subpart JJJJ	40 CFR 60 Subpart JJJJ are applicable to stationary spark ignition internal combustion engines.
A.A.C R18-2-719	Engines not subject to NSPS
A.A.C R18-2-702, 726	Abrasive blasting regulations
A.A.C R18-2-702, 727	Spray painting regulations
40 CFR 60 subpart EEEE	ACI's under this permit are subject to 40 CFR 60 subpart EEEE Other Solid Waste Incineration Units.
Maricopa, Pima and Pinal Counties Specific Rules	These regulations apply to owners and operators of ACI under this permit when entering and operating in the given county

IV. PREVIOUS PERMIT AND CONDITIONS

Table 3 compares the substantive conditions in the 2019 ACI General Permit with the conditions in this renewal permit and cross-references the previous permit conditions to their location in the renewal permit

Table 3: Previous Permit Conditions

Section No.	Determination		Comments
	Revised	Delete	
Att. "A"	X		General Provisions – Revised to represent the most recent template language
Att. "B" Section III	X		Revised to represent the most recent template language. Removed county specific rules that did not apply to all counties. Removed state wide rules with no state wide citations.
Att. "B" Section IV	X		Revised to more explicitly reference the appropriate federal regulations
Att. "B" Section V	X		Revised to represent the most recent template language
Att. "B" Section VI	X		Revised based on updates to state regulation languages
Att. "B" Section VII		X	Removed from Stationary permits

Section No.	Determination		Comments
	Revised	Delete	
Att. "B" Section VII	X		Moved and updated to be consistent with permit template language.
Att. "B" Section VIII	X		Revised to represent the most recent template language and updates to federal regulations, and new method of writing ICE regulations consistently within State of Arizona Air Quality Permits
Att. "C"	X		Revised to reflect updates to Maricopa county rules. Updated the engines section
Att. "D"	X		Revised to reflect updates to Pinal county rules
Att. "E"	X		Revised to reflect updates to Pima county rules. Added Opacity information and Class I Area protections.

V. MODELING REQUIREMENTS

A. ADEQ conducted air quality modeling state wide to ensure that operating ACIs meet NAAQS standards and to identify additional conditions required to avoid NAAQS violations. The modeling analysis focused on PM10 and PM2.5 since the emissions for the two pollutants were above the permitting exemption threshold as shown in Table 1.

The most recent version of the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD, version 18081) was used in this modeling analysis. AERMOD is the EPA's preferred near-field dispersion modeling system for a wide range of regulatory applications. The AERMOD modeling system includes four regulatory components:

- AERMOD: the dispersion model
- AERMAP: the terrain processor for AERMOD
- AERMET: the meteorological data processor for AERMOD
- BPIPPRM: the building input processor

The terrain processor (AERMAP) and the building input processor (BPIPPRM) were not used in this analysis because they require site-specific information, not conducive of a general permit application. Moreover, an assumption of "Flat Terrain" was believed to be reasonable, since the emission sources of an air curtain incinerator are mainly ground level and the worst-case impacts are expected to occur in or near the ambient area boundary.

AERMET was used to process the meteorological data collected from 10 metrological sites across the State of Arizona. The tool AERSURFACE (version 20060) was used to estimate the surface characteristics for input to AERMET. Additionally, AERMINUTE (version 15272) was used to generate hourly average winds for input to AERMET. Further details related to processing the meteorological data are presented in the "Meteorological Data" section.

B. EMISSION RATES

The emissions from air curtain incinerators will include the emissions from burning wood waste and yard waste, as well as emissions required to power the incinerator (internal combustion engine. The model assumed that the generators would be diesel powered. The emissions for internal combustion engines were calculated according to the latest AP-42 emission factors. Emission factors for PM10 for the Air Curtain Incinerator were based on a memo by San Joaquin Valley analyzing ACI emission factors from a number of different studies[2]. PM2.5 emissions factors were from Air Burners 2017 Technical Memorandum3[3]. The emissions were based on the capacity limit of 35 ton/day in New Source Performance Standard (NSPS) subpart EEEE.

Table 4: Emission Rates for 35 ton/day throughput and 100 HP engine (g/s)

Source ID	Source Description	PM_{10}	$PM_{2.5}$
ACI	Air Curtain Incinerator	0.24	0.20
GEN	100 HP Generator[4]	0.03	0.03
Total	Total	0.27	0.23

C. SOURCE RELEASE PARAMETERS

The source release parameters were based on the T-24 Burn Boss Specifications by Air Burners Inc. for the release height and diameter, and "Emissions from the Burning of Vegetative Debris in Air Curtain Destructors" (Miller & Lemieux, 2007)5 for the temperature and velocity. The height of the box was the release height. The diameter was calculated by taking the cross-sectional area of the box and then calculating the effective diameter as if the stack were a circle. The dimensions of the T-24 Burn boss were 3.7m by 1.2m by 1.2m. The stack temperature was 920oC which was the minimum operating temperature identified in the aforementioned study. The velocity was calculated by taking the average velocity over the length of the box and the average velocity over the portion of

2. https://www.valleyair.org/busind/pto/emission_factors/Criteria/Criteria/Air-Curtain-Incinerators/EF-Determination- Analysis.pdf
3. https://airburners.net/tech_docs/regulating_air_curtain_burners.pdf
4. Generator was diesel powered
5. Miller, C. Andrew and Lemieux, Paul M.; 2007; Emissions from the Burning of Vegetative Debris in Air Curtain Destructors, *J. AWMA*

the box where the exit velocity was greater than zero based on Figure 5 of Miller and Lemieux 2007. The average velocity over the entire length assumes the air curtain is not trapping any emissions (essentially no air curtain). The average velocity over the portion of the box where the velocity is greater than zero represents the expected operation of the box. As a conservative estimate, a 75% weighted average (75% efficiency of the air curtain) of the two velocities was used for modeling.

Table 5: Source Release Parameters

Source ID	Source Description	Release Height (m)	Stack Temperature (K)	Stack Velocity (m/s)	Stack Diameter (m)
ACI	Air Curtain Incinerator	1.2	1193	4.54	2.38
GEN	100 HP Generator[6]	1.2	1146	54.99	0.302

D. SOURCE LAYOUT

The layout of an air curtain incinerator includes the firebox (or trench), and the internal combustion engine used to power the incinerator (assumed to be diesel powered in this analysis). Both the engine and the air curtain incinerator will be treated as point sources. The distance from the sources to the ambient air boundary was assumed to be 25 meters, considering the dimension of an air curtain incinerator, a required distance between the ACIS and any structure (50 ft) as well as a certain buffer zone.

E. BACKGROUND CONCENTRATIONS

- PM10 Background Concentrations

The Department has established the PM10 background concentrations utilized in the modeling analysis for the 2022 Hot Mix Asphalt Plant (HMAP) and Crushing & Screening (C&S) General Permit. These concentrations have been specified for both PM10 attainment areas and non-attainment areas separately (see Table 6). The Department concludes that these background concentrations are appropriate for the modeling analysis for the ACI GP.

Table 6: PM_{10} Background Concentrations

Pollutant	Averaging Period	Background Concentration ($\mu g/m^3$)		Source of Data
PM10	24-hour	PM10 Attainment Areas	60	For justification, see: http://static.azdeq.gov/permits/gnhmaptsd.pdf
		PM10 Non-Attainment Areas	90	

- $PM_{2.5}$ Background Concentrations

The Department has reviewed the 2021-2023 monitoring data collected from state or local air monitoring stations (SLAMS) in Arizona. Overall, the geographical concentration distribution of $PM_{2.5}$ aligns with that of PM_{10}. Specifically, heightened $PM_{2.5}$ concentrations were observed in monitors located within PM_{10} non-attainment areas in Maricopa, Pinal, Yuma, and Santa Cruz Counties.

On February 7, 2024, EPA lowered the primary annual National Ambient Air Quality Standards (NAAQS) for $PM_{2.5}$ from 12 $\mu g/m^3$ down to 9 $\mu g/m^3$, which became effective on May 6, 2024. Multiple monitors in Maricopa, Pinal, and Santa Cruz Counties exhibit an annual average concentration of $PM_{2.5}$ exceeding the new NAAQS of 9 $\mu g/m^3$. Although the attainment/nonattainment designations are still pending, potential new nonattainment areas could emerge in Maricopa, Pinal, and Santa Cruz Counties. Moreover, the annual average concentration of $PM_{2.5}$ in Yuma County narrowly falls below the NAAQS.

Given the uncertainties surrounding $PM_{2.5}$ designations, the Department has established the following $PM_{2.5}$ background concentrations for the ACI GP modeling analysis (see Table 7). The background concentrations for $PM_{2.5}$ have been categorized into three groups: background concentrations for Maricopa, Pinal and Santa Cruz (potential $PM_{2.5}$ non-attainment areas), background concentrations for Yuma, and background concentrations for the remaining areas (based on monitoring data collected in the Tucson metro area).

Table 7: $PM_{2.5}$ Background Concentrations

Areas	Averaging period	Background Concentration ($\mu g/m^3$)	Source of Data
Maricopa, Pinal, Santa Cruz (potential $PM_{2.5}$ non-attainment areas)	24-hour	29	https://www.epa.gov/outdoor-air-quality-data/monitor-values-report (2021-2023 data for Maricopa, Pinal, and Santa Cruz)
	Annual	Above 9	
Yuma	24-hour	21	https://www.epa.gov/outdoor-air-quality-data/monitor-values-report (2021-2023 data for Yuma)
	Annual	8.6	
Other areas	24-hour	16	https://www.epa.gov/outdoor-air-quality-data/monitor-values-report (2021-2023 data for Tucson)
	Annual	6.2	

F. METEOROLOGICAL DATA

Seven meteorological data sets were used to represent the meteorological conditions for PM10 attainment areas and three meteorological data sets for PM10 non-attainment areas, respectively. All meteorological data were processed by AERMET along with AERSURFACE. The AERMINUTE tool was also used to process 1-minute wind data collected from the Automated Surface Observing Stations (ASOS). Based on EPA's recommendations, a minimum wind speed threshold of 0.5 m/s was used to treat winds below the threshold as calms. The adjusted surface friction velocity (ADJ_U*) option was used to process all meteorological data.

Table 6: Meteorological Data Sets used for the ACI modeling Analysis

Data Name	Surface Data	Upper Air Data	Data Period	County	For PM_{10} attainment areas or non-attainment areas?
Flagstaff	Flagstaff Pulliam Airport	Flagstaff (KFGZ)	01/01/2017-12/31/2021	Coconino	Attainment
Prescott	Ernest A. Love Field	Flagstaff (KFGZ)	01/01/2017-12/31/2021	Coconino	Attainment
Kingman	Kingman Airport	Las Vegas (KVEF)	01/01/2017-12/31/2021	Mohave	Attainment
Tucson	Tucson International Airport	Tucson (KTUS)	01/01/2017-12/31/2021	Pima	Attainment
Safford	Safford Regional Airport	Tucson (KTUS)	01/01/2017-12/31/2021	Graham	Attainment
Winslow	Winslow–Lindbergh Regional Airport	Albuquerque (KABQ)	01/01/2017-12/31/2021	Navajo	Attainment
St Johns	St. Johns Industrial Air Park	Albuquerque (KABQ)	01/01/2017-12/31/2021	Apache	Attainment
Phoenix	Phoenix Sky Harbor International Airport	Tucson(KTUS)	01/01/2017-12/31/2021	Maricopa	Non-attainment
Nogales	Nogales International Airport	Tucson (KTUS)	01/01/2017-12/31/2021	Santa Cruz	Non-attainment

Yuma	Yuma Marine Corps Air Station	Tucson (KTUS)	01/01/2017-12/31/2021	Yuma	Non-attainment

G. RECEPTORS

The following section covers the procedure for running the model for one county and was used for all other counties in a similar manner. Modeling area radius was set at 5 km due to the impacts of the incinerator being close to ground level. A polar receptor grid was used starting at 25 m from the incinerator. This was based on the minimum distance required between the incinerator and another structure, the size of the smallest incinerator (Burn Boss T-24) and a 4 m buffer for larger boxes.

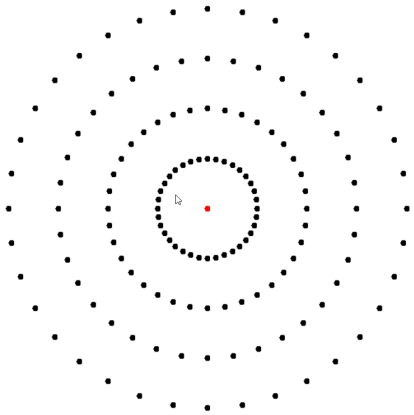

Figure 1: Polar Grid

H. ANNUAL THROUGHPUT LIMIT

The modeling analysis should demonstrate that emissions from the new source or modification will not interfere with attainment or maintenance of the NAAQS. In particular, the modeling analysis should demonstrate either of the following:

- The emissions from the source will have an ambient impact below the significant levels (SILs) (referred to the SIL demonstration);
- The ambient concentrations resulting from the source combined with representative background concentrations will below a NAAQS (referred to the NAAQS demonstration).

As detailed in Section E, $PM_{2.5}$ levels in parts of Maricopa, Pinal, and Santa Cruz counties exceed the annual NAAQS. As such, the NAAQS demonstration is not viable in these areas, leaving the SIL demonstration as the sole option. On April 30, 2024, the EPA issued the "Supplement to the Guidance on Significant Impact Levels for Ozone and Fine Particles in the Prevention of Significant Deterioration Permitting Program", establishing a new $PM_{2.5}$ annual SIL of 0.13 $\mu g/m^3$. To ensure emissions from the ACI emission units remain below this SIL in these areas, the Department proposes an annual throughput limit of 3,500 tpy for Maricopa, Pinal, and Santa Cruz counties. Additionally, this annual limit is proposed for Yuma County, as its annual background concentration

nears the NAAQS, necessitating the imposition of the annual throughput limit for NAAQS compliance demonstration.

VI. MODELING RESULTS

The Tables below summarize the final modeling results and additional requirements to demonstrate NAAQS compliance.

Table 7: $PM_{2.5}$ Modeling Results

Meteorological Dataset	Modeled Concentration ($\mu g/m^3$)		Background Concentration ($\mu g/m^3$)		Total Concentration ($\mu g/m^3$)		NAAQS
	24-hour[a]	Annual	24-hour	Annual	24-hour	Annual	
Phoenix	2.1	0.11[b,c]	29	Above 9	31.1	-	24-hour: 35 $\mu g/m^3$ Annual: 9 $\mu g/m^3$
Nogales	2.7	0.129[b,c]	29	Above 9	31.7	-	
Yuma	3.6	0.15[b]	21	8.6	24.6	8.75	
Flagstaff	9.2	1.42	16	6.2	25.2	7.62	
Prescott	3.0	0.61	16	6.2	19.0	6.81	
Kingman	9.3	1.47	16	6.2	25.3	7.67	
Safford	5.9	0.92	16	6.2	21.9	7.12	
St Johns	8.5	1.07	16	6.2	24.5	7.27	
Tucson	3.5	0.41	16	6.2	19.5	6.61	
Winslow	8.8	1.13	16	6.2	24.8	7.33	

[a] *Based on 35 tpd;*
[b] *Based on the annual throughput of 3,500 tpy;*
[c] *Modeled concentrations are below the SIL of 0.13 $\mu g/m^3$.*

Table 10: 24-hour PM_{10} Modeling Results

Meteorological Dataset	Modeled Concentration ($\mu g/m^3$)[a]	Background Concentration ($\mu g/m^3$)	Total Concentration ($\mu g/m^3$)	NAAQS
Phoenix	4.6	90	94.6	150 $\mu g/m^3$
Nogales	7.0	90	97.0	
Yuma	9.3	90	99.3	
Flagstaff	23.2	60	83.2	
Prescott	6.3	60	66.3	
Kingman	23.1	60	83.1	
Safford	12.3	60	72.3	
St Johns	20.4	60	80.4	
Tucson	7.4	60	67.4	
Winslow	23.0	60	83.0	

[a] *Based on 35 tpd*

Further analysis was conducted to assess the NAAQS compliance with an alternative firebox. Utilizing Kingman meteorological data (reflecting the highest modeled $PM_{2.5}$ levels in Table 9), adjustments were made to the stack parameters to align with the Air Burners Firebox 119 and Firebox S-220. The resultant modeled concentrations for Firebox 119 and Firebox S-220 were found to be lower compared to those for T-24 Burn

Boss. This disparity arises from all three fireboxes emitting at the same rate, while Firebox 119 and Firebox S-220 have larger diameters and release heights, allowing for better dispersion of pollutants into the ambient air.

VII. LIST OF ABBREVIATIONS

A.A.C. ..... Arizona Administrative Code
ACI..... Air Curtain Incinerator
ADEQ ..... Arizona Department of Environmental Quality
AERMAP ....……..Terrain data preprocessor for AERMOD
AERMET…… ….Meteorological data preprocessor for AERMOD
AERMOD.....……AMS/EPA Regulatory Model
AERSURFACE……Surface characteristics preprocessor for AERMOD
ADJ_U*…….……Adjusted Surface Friction Velocity
Btu/ft^3 ..... British Thermal Units per Cubic Foot
Btu/hr ..... British Thermal Units per Hour
CFR..... Code of Federal Regulations
CO..... Carbon Monoxide
EPNG..... El Paso Natural Gas Company
FERC ..... Federal Energy Regulatory Commissions
HAP ..... Hazardous Air Pollutant
hp .....Horsepower
lb/hr .....Pound per Hour
NAAQS..... Nation Ambient Air Quality Standards
NO_x .....Nitrogen Oxides
PM ..... Particulate Matter
PM_{10}..... Particulate Matter Nominally less than 10 Micrometers
SO_x..... Sulfur Oxides
VOC.....Volatile Organic Compound
ASOS ……Automated Surface Observing Stations
BPIPPRM…….Building Input Processor for AERMOD
C&S ……..……..Crushing & Screening
HMAP ……..……..Hot Mix Asphalt Plant
NAAQS……..….National Ambient Air Quality Standards
NSPS ……..……New Source Performance Standard
SLAMS…….State or Local Air Monitoring Stations