



State of Oregon
Department of
Environmental
Quality

GENERAL
AIR CONTAMINANT DISCHARGE PERMIT
ASSESSMENT REPORT
AIR CURTAIN INCINERATORS

SIC	4953
NAICS	562213
EPA ICIS-Air ID	

Source Categories (Table 1 Part, code)	B.43, B.88
Public Notice Category	Category I

Compliance and Emissions Monitoring Requirements:

FCE	
Compliance schedule	
Unassigned emissions	
Emission credits	
Special Conditions	X

Source test	
COMS	
CEMS	
PEMS	
Ambient monitoring	

Reporting Requirements

Annual report (due date)	X (Feb 15)
Quarterly report (due dates)	

Monthly report (due dates)	
Excess emissions report	
Other (specify)	

Air Programs

Synthetic Minor (SM)	X
SM -80	
NSPS (list subparts)	CCCC, EEEE, III
NESHAP (list subparts)	ZZZZ
CAO	X

NSR	
PSD	
GHG	X
RACT	
TACT	
Other (specify)	

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LIST OF ABBREVIATIONS USED IN THIS ASSESSMENT REPORT

ACDP	Air Contaminant Discharge Permit	MB	material balance
ACI	Air Curtain Incinerator	Mlb	1000 pounds
AQMA	Air Quality Management Area	MM	million
ASTM	American Society of Testing and Materials	N ₂ O	nitrous oxide (greenhouse gas)
BDT	bone dry ton	NA	not applicable
CEMS	continuous emissions monitoring system	NESHAP	National Emission Standard for Hazardous Air Pollutants
C.F.R.	Code of Federal Regulations	NO _x	oxides of nitrogen
CH ₄	methane (greenhouse gas)	NSPS	New Source Performance Standard
CMS	continuous monitoring system	NSR	New Source Review
CO	carbon monoxide	O ₂	oxygen
CO _{2e}	carbon dioxide equivalent	OAR	Oregon Administrative Rules
COMS	continuous opacity monitoring system	ORS	Oregon Revised Statutes
DEQ	Oregon Department of Environmental Quality	O&M	operation and maintenance
DPF	diesel particulate filter	Pb	lead
dscf	dry standard cubic feet	PCD	pollution control device
EF	emission factor	PEMS	predictive emissions monitoring system
EPA	United State Environmental Protection Agency	PM	particulate matter
EU	emissions unit	PM ₁₀	particulate matter less than 10 microns in size
FCAA	Federal Clean Air Act	PM _{2.5}	particulate matter less than 2.5 microns in size
GHG	greenhouse gas	PSD	Prevention of Significant Deterioration
gr/dscf	grains per dry standard cubic feet	PSEL	Plant Site Emission Limit
HAP	hazardous air pollutant	SO ₂	sulfur dioxide
ID	identification code	ST	source test
I&M	inspection and maintenance	VE	visible emissions
LRAPA	Lane Regional Air Protection Agency	VMT	vehicle mile traveled
		VOC	volatile organic compound

SOURCE DESCRIPTION AND QUALIFICATION

1. This General Permit is designed to regulate air contaminant emissions from a fire box burner type air curtain incinerator (ACI) with a certified Tier 4 engine or an electric motor, that produces biochar or ash. The ACI can be a stationary source or a portable source.
2. A facility assigned to this General Permit:
 - a. May not emit any other air pollution that requires regulation beyond that specified in this permit, except for other pollution emissions that also qualify for assignment, and are assigned, to other General Permits and categorically insignificant activities defined by OAR Chapter 340, division 200; or
 - b. May not experience reoccurring or serious compliance problems, which would make that facility ineligible for assignment to this General Permit.
3. If this General Permit does not cover all requirements applicable to the facility, the other applicable requirements must be covered by assignment to one or more General Permit Attachments in accordance with OAR 340-216-0062, otherwise the facility must obtain a Simple or Standard Permit or a source specific Title V Operating Permit. A facility requesting to be assigned to a General Permit Attachment, in accordance with OAR 340-216-0062, for a source category in a higher annual fee class, must be reassigned to the General Permit for the source category in the higher annual fee class.

FACILITY IDENTIFICATION

4. The permittee operates an ACI.
 - a. An ACI is a stationary or portable incinerator that operates by forcefully projecting a curtain of air across an open chamber or pit in which combustion occurs. This air curtain is projected across the firebox at an angle which generates a cyclonic flow within the firebox. This accelerates the combustion process and promotes uniform combustion throughout the firebox. Incinerators of this type can be constructed above or below ground and with or without refractory walls and floor, but below ground ACIs are not allowed under this permit. ACIs are different from conventional combustion devices which typically have enclosed fireboxes and controlled air technology such as mass burn, modular, and fluidized bed combustors.
 - b. Only wood waste, clean lumber, and yard waste may be burned in the ACI. Wood waste is dropped through the air curtain into the aboveground refractory-lined firebox, using a front-end loader, a grappling hook, or other device.
 - c. The blower generates an air curtain over the top of the ACI, which is forced through a row of small nozzles along the full length of the manifold to generate the high velocity "air curtain." The hot combustion gas leaves the ACI from the top front side of the air curtain opposite the manifold that generated the air curtain across the top of the ACI.
 - d. The air curtain leaves the manifold at near ambient temperature. As the sheet of air moves across, it absorbs heat from the combustion of wood waste. When the air curtain hits the front inside refractory wall of the ACI, the air curtain is deflected downward toward the bottom of the ACI. This provides excess air to support the

- combustion process. From the bottom of the ACI, the combustion gases are reflected into the underside of the air curtain.
- e. As this recirculated combustion process continues, the non-combustible part of wood waste is reduced to a clean ash or biochar that accumulates in the bottom of the furnace. For ACIs that produce ash, the ash is removed daily. For ACIs that produce biochar, there is a screen at the lower portion of the firebox and augers below the screen. After the biochar chunks fall through the screen openings, the turning augers will move the biochar out of the bottom of the box through the side wall to a conveyor where the biochar is quenched with water and transported by truck to storage.
 - f. Fugitive emissions are generated from moving the materials to be burned. The permittee will be required to develop a fugitive emission control plan upon request by DEQ if the precautions listed in the permit to prevent fugitive emissions from leaving the property boundary are not adequate. The plan must be approved by DEQ and implemented by the operator whenever fugitive emissions leave the property for more than 18 seconds in a six-minute period.
5. The permittee has been determined to be a new source for the purposes of Cleaner Air Oregon in accordance with OAR 340-245-0020 because the air quality permit application was not submitted and deemed complete, nor had construction commenced on this facility before November 16, 2018. As a new source, the permittee is required to perform a risk assessment in accordance with OAR 340-245-0050, and demonstrate compliance with the Risk Action Levels for a “New and Reconstructed Source” in OAR 340-245-8010 Table 1.

COMPLIANCE HISTORY

6. The facility will be inspected by DEQ personnel on a recurring basis to ensure compliance with the permit conditions.

OTHER PERMITS

7. No water quality permits have been issued or are required for this source. If the permittee complies with the Material Stockpiles conditions in the permit and the DEQ approved Ash/Biochar Removal and Disposal Plan, a Solid Waste permit is not required for stockpiled materials.

ATTAINMENT STATUS

8. Because the General Permit allows for portable ACIs, the source could be located in:
 - a. An attainment area;
 - b. A maintenance area:
 - A. Carbon Monoxide Maintenance Areas: Portland Maintenance; Medford Maintenance Area; Grants Pass Maintenance Area; Klamath Falls Maintenance Area; and Salem Maintenance Area
 - B. Ozone Maintenance Areas: Medford Maintenance Area; Portland-Vancouver Interstate Maintenance Area; Salem Maintenance Area

- C. PM₁₀ Maintenance Areas: Grants Pass Maintenance Area; Klamath Falls Maintenance Area; Medford-Ashland Maintenance Area; La Grande Maintenance Area; Lakeview Maintenance Area; or
- c. A nonattainment Area: PM₁₀: Klamath Falls Nonattainment Area
9. The Wilderness Act of 1964 prohibits certain activities within Wilderness Areas so as to maintain the purpose for which these lands are set aside. The following paragraph describes activities which are prohibited:

PROHIBITION OF CERTAIN USES

(c) Except as specifically provided for in this Act, and subject to existing private rights, there shall be no commercial enterprise and no permanent road within any wilderness area designated by this Act and except as necessary to meet minimum requirements for the administration of the area for the purpose of this Act (including measures required in emergencies involving the health and safety of persons within the area), there shall be no temporary road, no use of motor vehicles, motorized equipment or motorboats, no landing of aircraft, no other form of mechanical transport, and no structure or installation within any such area.

Therefore, ACIs are not allowed in Class I areas, all of which are Wilderness Areas except for Crater Lake National Park:

- Mt. Hood Wilderness, as established by Public Law 88-577
- Eagle Cap Wilderness, as established by Public Law 88-577
- Hells Canyon Wilderness, as established by Public Law 94-199
- Mt. Jefferson Wilderness, as established by Public Law 90-548
- Mt. Washington Wilderness, as established by Public Law 88-577
- Three Sisters Wilderness, as established by Public Law 88-577
- Strawberry Mountain Wilderness, as established by Public Law 88-577
- Diamond Peak Wilderness, as established by Public Law 88-577
- Crater Lake National Park, as established by Public Law 32-202
- Kalmiopsis Wilderness, as established by Public Law 88-577
- Mountain Lake Wilderness, as established by Public Law 88-577
- Gearhart Mountain Wilderness, as established by Public Law 88-577

The permit contains a condition that allows operation of an ACI within certain distances of Class I areas based on the size of the ACI. These distances are based on a modeling analysis that ensures that the operations would have an impact on such area less than 1 ug/m³ (24-hour average) for the regulated pollutants listed in OAR 340-200-0020(161)(b) through (v). [OAR 340-200-0020(161)(w)]

ASSESSMENT OF EMISSIONS

10. Facilities assigned to this General Permit are sources of PM, PM₁₀, PM_{2.5}, SO₂, CO, NO_x, VOC, GHG and toxic air contaminant emissions.
11. Potential nuisances originating from this type of operation could include fugitive dust associated with material handling and smoke. The permit includes requirements to minimize fugitive dust emissions and smoke.

12. DEQ has assessed the level of emissions from these facilities and determined that facilities complying with the operational limits and monitoring requirements of this permit will remain area sources¹ and compliant with applicable emissions limits. However, facilities assigned to this permit will be required to track and report various data elements to demonstrate compliance. If DEQ determines that facilities assigned to this permit emit above permitted emissions limits, the permittee will be required to obtain a different permit.

STATE STANDARDS APPLICABILITY

13. DEQ determined that OAR chapter 340, division 230 Incinerator Regulations apply to ACIs regulated under AQGP-031 because they are included in the definition of an incinerator due to the primary purpose:

340-230-0030 Definitions

The definitions in OAR 340-200-0020, 340-238-0040 and this rule apply to this division, except for 340-230-0415 and 340-230-0500. If the same term is defined in this rule and 340-200-0020 or 340-238-0040, the definition in this rule applies to this division.

(8) "Incinerator" means any structure or furnace in which combustion takes place, the primary purpose of which is the reduction in volume and weight of unwanted material.

FEDERAL STANDARDS APPLICABILITY

14. The types of facilities regulated by this General Permit are subject to the following federal standards:
- a. 40 C.F.R. Part 60 Subpart CCCC Standards of Performance for Commercial and Industrial Solid Waste Incineration while operating as a CISWI. This subpart is applicable to commercial and industrial sources because construction of the ACI commenced after June 4, 2010 and the ACI meets the definition in 40 C.F.R. 60.2245. If the ACI is burning materials generated from commercial or industrial operations, as defined by the federal regulation, then the ACI is classified as a CISWI.
 - b. 40 C.F.R. Part 60 Subpart EEEE Standards of Performance for Other Solid Waste Incineration Units for Which Construction is Commenced After December 9, 2004, or for Which Modification or Reconstruction is Commenced on or After June 16, 2006 while operating as an OSWI. This subpart is applicable to other solid waste incineration sources because construction of the ACI commenced after December 9, 2004 and the ACI meets the definition in 40 C.F.R. 60.2888. If the ACI is burning materials generated from institutional operations, as defined by the federal regulation, then the ACI is classified as an OSWI. In addition, if the

¹ Note that 'area source' in this case does not mean a Title V Operating Permit is not required.

ACI is burning materials generated from other than an institutional facility, such as authorized materials collected from the general public and from residential, commercial, institutional, and industrial sources, the ACI is classified as an OWSI if it limits burning of these materials to 35 tons per day.

- c. If the ACI is equipped with a diesel-fired Blower Engine, the following subparts are applicable:

i. 40 C.F.R. Part 60 Subpart IIII—Standards of Performance for Stationary Compression Ignition Internal Combustion Engines. This subpart is applicable to the source if the ACI is equipped with a diesel-fired Blower Engine because:

1. Construction of the internal combustion engine commenced on or after July 11, 2005; and
2. The stationary CI ICE is manufactured after April 1, 2006; and
3. The stationary CI ICE is not a fire pump engine.

To qualify for assignment to this General Permit, the permittee must use an electric engine or Tier 4 certified diesel engine for the blower, certified according to 40 C.F.R. parts 89 and 1039, as applicable.

ii. 40 C.F.R. Part 63 Subpart ZZZZ—National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines. This subpart is applicable to the source because the permittee may own or operate a new, non-emergency compression ignition RICE at an area source of HAP emissions, constructed on or after June 12, 2006. For stationary RICE subject to regulations under 40 C.F.R. Part 60 subpart IIII Standards of Performance for Stationary Compression Ignition Internal Combustion Engines, no further requirements apply for such engines under Subpart ZZZZ. Since this source is subject to 40 C.F.R. part 60, Subpart IIII, compliance with 40 C.F.R. part 63 Subpart ZZZZ is met by complying with 40 C.F.R. part 60 Subpart IIII, per 40 C.F.R. part 63 subpart ZZZZ [63.6590(c)].

15. The following Subparts are not applicable to the source:

- a. 40 C.F.R. Part 60 Subpart Cb—Emissions Guidelines and Compliance Times for Large Municipal Waste Combustors That are Constructed on or Before September 20, 1994. This subpart is not applicable to the source because the ACI combustion capacity is not greater than 250 tons per day of municipal solid waste for which construction was commenced on or before September 20, 1994.
- b. 40 C.F.R. Part 60 Subpart Eb—Standards of Performance for Large Municipal Waste Combustors for Which Construction is Commenced After September 20, 1994 or for Which Modification or Reconstruction is Commenced After June 19, 1996. This subpart is not applicable to the source because the ACI does not have a combustion capacity greater than 250 tons per day of municipal solid waste for which construction, modification, or reconstruction is commenced after September 20, 1994.
- c. 40 C.F.R. Part 60 Subpart AAAA—Standards of Performance for Small Municipal Waste Combustion Units for Which Construction is Commenced After August 30, 1999 or for Which Modification or Reconstruction is Commenced

After June 6, 2001. This subpart is not applicable to the source because DEQ is limiting the ACI capacity to less than 35 tons per day, if the ACI is burning materials generated from other than an institutional facility, such as authorized materials collected from the general public and from residential, commercial, institutional, and industrial sources. The capacity range for Subpart AAAA of at least 35 tons per day but no more than 250 tons per day of municipal solid waste or refuse-derived fuel does not apply. In addition, the ACI does not burn 100 percent yard waste. If the ACI combusts 100 percent yard waste, the ACI must meet only the requirements under “Air Curtain Incinerators That Burn 100 Percent Yard Waste” (40 C.F.R. 60.1435 through 60.1455 and is not eligible for this General Permit.

- d. 40 C.F.R. Part 60 Subpart BBBB—Emission Guidelines and Compliance Times for Small Municipal Waste Combustion Units Constructed on or Before August 30, 1999. This subpart is not applicable to the source because construction did not commence before August 30, 1999.
- e. 40 C.F.R. Part 60 Subpart DDDD Emissions Guidelines and Compliance Times for Commercial and Industrial Solid Waste Incineration Units. This subpart is not applicable to the source because construction did not commence on or before June 4, 2010, and reconstruction or modification did not commence on or after June 4, 2001, but no later than August 7, 2013.
- f. 40 C.F.R. Part 60 Subpart FFFF—Emission Guidelines and Compliance Times for Other Solid Waste Incineration Units That Commenced Construction On or Before December 9, 2004. This subpart is not applicable to the source because construction commenced after December 9, 2004.
- g. 40 C.F.R. Part 60 Subpart JJJJ—Standards of Performance for Stationary Spark Ignition Internal Combustion Engines. This subpart is not applicable to the source because it does not operate a spark ignition internal combustion engine.

GREENHOUSE GAS REPORTING APPLICABILITY

- 16. OAR Chapter 340 division 215 is applicable to the source if emissions of greenhouse gases exceed 2,500 metric tons (2,756 short tons) of CO₂ equivalents per year. Most ACI permittees are expected to be subject to the reporting requirements of Division 215.

REASONABLY AVAILABLE CONTROL TECHNOLOGY APPLICABILITY

- 17. The facility may be located in the Portland AQMA, Medford AQMA, or Salem SKATS but it is not one of the listed source categories in OAR 340-232-0010 or does not meet the applicability criteria, thus the RACT rules do not apply.

TYPICALLY ACHIEVABLE CONTROL TECHNOLOGY APPLICABILITY

- 18. ACIs are an alternative to traditional open burning and produce less harmful smoke and particulate matter. Therefore, DEQ considers the ACI itself to be TACT. In addition, DEQ is requiring that ACIs use either a Tier 4 certified diesel engine or an electric engine to power the blower for the air curtain. These requirements are considered Typically

Achievable Control Technology (TACT) under OAR 340-226-0130 Highest and Best Practicable Treatment and Control.

SPECIAL CONDITIONS

19. PM_{2.5} Synthetic Minor Limit

The permit contains synthetic minor limits for PM_{2.5} so that ACIs do not trigger State Type A New Source Review. A limit of 16,000 dry tons per year, for the ACI for all operating locations across the state within a 12-month period combined, results in 9 tons/year of PM_{2.5}. If ACIs were subject to State Type A New Source Review, they would be required to obtain a Standard Air Contaminant Discharge Permit. [OAR 340-210-240(1)(d)]

20. Medford-Ashland AQMA PM₁₀ Synthetic Minor Limit

The permit contains synthetic minor limits for PM₁₀ so that ACIs do not trigger State Type A New Source Review in the Medford AQMA. A limit of 37 dry tons per day and annual throughput limit of 6,750 dry tons per year, for the ACI for all locations within the Medford AQMA within a 12-month period combined, results in less than 5 tons per year on an annual basis, 50.0 pounds per day on a daily basis. If ACIs were subject to State Type A New Source Review, they would be required to obtain a Standard Air Contaminant Discharge Permit. [OAR 340-210-240(1)(d)]

21. National Ambient Air Quality Standard, Prevention of Significant Deterioration Increment and Visibility Requirements

The National Ambient Air Quality Standards, Prevention of Significant Deterioration Increment, and visibility requirements are applicable requirements for temporary Title V sources (portable ACIs), regardless of whether they trigger New Source Review/Prevention of Significant Deterioration [OAR 340-200-0020(12)(q)]:

- (q) Any national ambient air quality standard or increment or visibility requirement under part C of Title I of the FCAA, but only as it would apply to temporary sources permitted under section 504(e) of the FCAA.

In order to assure compliance with these applicable requirements, DEQ performed screening level modeling using the worst-case emissions allowed by the permit. This modeling was used to establish siting requirements that assure compliance for any source that is eligible for the General Permit.

The following requirements are included in the permit in order to assure compliance with the National Ambient Air Quality Standards and Prevention of Significant Deterioration Increment requirements:

a. National Ambient Air Quality Standards

Burning at equal to or greater than the distances to nearby exposure locations provided in Paragraph 29 will prevent concentrations of criteria pollutants from exceeding National Ambient Air Quality Standards. DEQ modeling indicates that the distances required to meet Cleaner Air Oregon thresholds also protect the National Ambient Air Quality Standards.

b. Prevention of Significant Deterioration Increment

The 24-hour maximum PSD Increment is 2 µg/m³ for PM_{2.5} for Class I Areas [OAR

340-202-0210(1)(a)(ii)]. The daily ACI capacities in the table in Paragraph 25 (also contained in the permit) result in emissions that would result in a concentration of $1 \mu\text{g}/\text{m}^3$. Burning at distances equal to or greater than the distances to Class I Areas provided in Paragraph 25 will prevent significant deterioration of air quality in Class I Areas by limiting air impacts to less $1 \mu\text{g}/\text{m}^3$ of $\text{PM}_{2.5}$ and will thus be protective of the PSD Increment for Class I Areas. See Paragraph 25 for further discussion of Significant Emission Rates as defined in OAR 340-200-0020(161)(w).

c. Visibility analysis

Sources of air pollution can cause visible plumes if emissions of particulates and nitrogen oxides are sufficiently large. A plume will be visible if its constituents scatter or absorb sufficient light so that the plume is brighter or darker than its viewing background (e.g., the sky or a terrain feature such as a mountain). Class I Areas, such as national parks and wilderness areas, are afforded special visibility protection designed to prevent such plume visual impacts to observers within a Class I Area. Because operation of an ACI could occur near a Class I Area, DEQ consulted with the Federal Land Manager of the U.S. Forest Service. The Columbia River Gorge is not a Class I area but is also an area of interest regarding visibility.

ACIs would have less impact on visibility than prescribed burning but should still be evaluated. The screening model VISCREEN can be used to calculate the potential visual impact of a plume of specified emissions for specific transport and dispersion (meteorological) conditions. The U.S. Forest Service did not recommend using VISCREEN because it requires predefined locations of the viewer and the viewing angle in order to simulate plume color and contrast. Since operation of an ACI is situationally dependent, it would be impossible to define these parameters in a general permit for a portable source. Additionally, VISCREEN fails to screen out sources, and as such, would require moving to a more complex model (i.e., PLUVUE II) which would require even more specific information including representative meteorology. Given the obvious advantage of ACI operation over open burning slash piles and the information on plume blight modeling, the U.S. Forest Service does not require any Class I area visibility impact for the ACI General Permit.

22. OSWI Throughput Limit

ACIs regulated under Subpart EEEE are limited to burn less than 35 tons per day of authorized materials collected from the general public and from residential, commercial, institutional, and industrial sources if they are located at a place other than an institutional facility. The General Permit does not contain all the Subpart EEEE requirements for ACIs that burn more than or equal to 35 tons per day as the permit establishes an upper limit of 35 tons per day. ACIs located at a place other than an institutional facility that burn 35 tons per day or more are not allowed to operate under the ACI General Permit and must apply for, and obtain, a different permit before exceeding this upper limit.

ACIs located at institutional facilities are not limited to 35 tons per day.

23. Title V Permit

Both of the following New Source Performance Standards require that owners or operators of ACIs obtain a Title V Operating Permit:

- Subpart CCCC Standards of Performance for Commercial and Industrial Solid Waste Incineration; and
- Subpart EEEE Standards of Performance for Other Solid Waste Incineration Units for Which Construction is Commenced After December 9, 2004, or for Which Modification or Reconstruction is Commenced on or After June 16, 2006

Therefore, the permittee is required to apply for a General Title V Operating Permit not later than 12 months after the date the ACI commences operation as a new source.

EMISSIONS

24. Proposed PSEL information:

Pollutant	Baseline Emission Rate (tons/yr)	Netting Basis Proposed (tons/yr)	Plant Site Emission Limits (PSEL) Proposed PSEL (tons/yr)
PM	NA	NA	24
PM ₁₀	NA	NA	14
PM _{2.5}	NA	NA	9
SO ₂	NA	NA	39
NO _x	NA	NA	39
CO	NA	NA	99
VOC	NA	NA	39
GHG (CO ₂ e)	NA	NA	74,000
Individual HAPs	NA	NA	9
Combined HAPs	NA	NA	24

- The baseline emission rate and netting basis is zero for portable sources in accordance with OAR 340-222-0046(2).
- For General Permits, the proposed PSELs for all pollutants are equal to the Generic PSEL in accordance with OAR 340-216-0064(3)(b).
- The basis for the PSEL is included in the emission detail sheets in Attachment A of this Assessment Report.
- The PSEL is a federally enforceable limit on the potential to emit.

SIGNIFICANT EMISSION RATE ANALYSIS

25. Significant emission rates are defined in OAR 340-200-0020 as thresholds for New Source Review regulated pollutants but an exception provided in subsection (w) that is lower than the listed thresholds would apply to ACIs because some ACIs are portable sources and may be located close to Class I areas: [OAR 340-200-0020(161)(w)]

“(w) Any new source or modification with an emissions increase less than the rates specified above and that is located within 10 kilometers of a Class I area, and would have an impact on such area equal to or greater than $1 \mu\text{g}/\text{m}^3$ (24 hour average) is emitting at a SER. This subsection does not apply to greenhouse gas emissions.”

DEQ performed modeling to calculate the minimum distances an ACI must be from the boundary of a Class I area to ensure that the ambient impacts would be less than $1 \mu\text{g}/\text{m}^3$ (24-hour average) for the regulated pollutants listed in OAR 340-200-0020(161)(b) through (v).

ACI Size Category	Maximum Capacity (tons/hour)	Daily Capacity (tons/day)	Distance to Class I Area (meters)
Micro	≤ 1	12	600
Small	> 1 but ≤ 5	60	4,000
Medium	> 5 but ≤ 10	120	9,000
Large	> 10 but ≤ 13	156	10,000
35 ton/day limit	NA	35	2,000

In addition, all of the maximum capacities for the different sizes of ACIs listed in the table above would result in emissions less than the defined SER thresholds so ACIs are not subject to New Source Review.

TITLE V MAJOR SOURCE APPLICABILITY

26. The following statements describe ACIs and Title V major source applicability:

- a. A source that has the potential to emit less than major source thresholds is called a true minor. For Title V Major source applicability, ACIs are true minor sources.
- b. A source that has the potential to emit less than major source thresholds but is required by rule to obtain a Title V permit is called a Title V minor source. Because ACIs are required to obtain Title V permits under 40 C.F.R. Part 60 Subpart CCCC and 40 C.F.R. Part 60 Subpart EEEE, ACIs are Title V minor sources.

CRITERIA POLLUTANTS

27. This facility is a minor source for Title V and a synthetic minor source for New Source Review. The basis for the PSEL is included in the emission detail sheets in Attachment A of this Assessment Report.

HAZARDOUS AIR POLLUTANTS

28. This source is not a major source of hazardous air pollutants. The basis for this determination can be found in the emission detail sheets in Attachment A of this

Assessment Report.

CLEANER AIR OREGON

29. DEQ performed a Level 2 Risk Assessment for the operation of an ACI as required by the Cleaner Air Oregon (CAO) program. This assessment included Toxic Air Contaminant (TAC) emissions from the combustion of wood material inside the ACI and emissions from the diesel engine used to power the air curtain.
- a. For ACIs on public lands, impacts were modeled at receptors where the public can access. To restrict access to public lands where there are not clear property boundaries, DEQ has included a requirement that ACI operators must post signage on the roadway at the entrance of each site for the entire time the ACI is operating at that site. On private lands, receptors would be placed at the property boundary. DEQ assumed that there were residences at the property boundary and set those distances based on residential cancer risk or acute risk, which are the most protective risk levels for the pollutants released from ACIs, as opposed to noncancer chronic impacts or impacts to workers or children.
 - b. In the NAAQS analysis, DEQ modeled NO₂ concentrations at those same distances that operations would be allowed under CAO. The conclusion was that at the distances that burning is allowed for CAO, the NAAQS would also be protected. Additional restrictions for NAAQS were not necessary because the CAO distances were also protective of the NAAQS. The CAO and NAAQS modeling were independent analyses that came to the same conclusion.
 - c. DEQ established minimum distances to the closest exposure location in the table below, depending on the maximum hourly throughput of the ACI. An exposure location is a location where people may spend two (2) hours in one day, or a dwelling, group of dwellings, or commercial or institutional establishment, or other occupied structure not located on the property on which the burning is conducted.

ACI Size Category	Maximum Capacity (tons/hour)	Daily Capacity (tons/day)	Minimum Distance to Closest Exposure Location (meters)
Micro	<=1	12	90
Small	>1 but <=5	60	375
Medium	>5 but <=10	120	700
Large	>10 but <=13	156	1,000
35 ton/day limit	NA	35	225

- d. These minimum distances were set based on the risk remaining below the Toxic Lowest Achievable Emissions Rate (TLAER) source risk limit for new facilities as specified in [OAR 340-245-8010 Table 1](#). However community engagement is required for these facilities because the proposed risk is above the community engagement risk action level. DEQ developed a website for ACIs that meets the

- requirements for community engagement:
<https://www.oregon.gov/deq/aq/cao/Pages/Air-Curtain-Incinerators.aspx>
- e. The permittee will also be required to demonstrate compliance with the risk assessment results by reporting the following:
 - Location(s) for portable ACIs and closest exposure location;
 - Daily hours of operation, including start and stop times for each ACI operating location;
 - Daily and annual quantity and type of material burned in the ACI for each ACI operating location; and
 - Daily and annual quantity and type of fuel burned by the Blower Engine for each ACI operating location.
 - f. Uncertainty Discussion: There is limited information regarding the emissions of Toxic Air Contaminants from ACIs. DEQ used the best available information at the time of the risk assessment. While DEQ expects emissions to be lower than those estimated, further source testing would confirm that assumption. For that reason, risk may be overestimated or underestimated. DEQ also used residential risk values when calculating cancer and noncancer chronic risk values, which may overestimate risk if the ACI is located near a nonresidential location such as a workplace or school where people do not live.

TOXICS RELEASE INVENTORY

30. The Toxics Release Inventory (TRI) is federal program that tracks the management of certain toxic chemicals that may pose a threat to human health and the environment, over which DEQ has no regulatory authority. It is a resource for learning about toxic chemical releases and pollution prevention activities reported by certain industrial facilities. Section 313 of the Emergency Planning and Community Right-to-Know Act (EPCRA) created the TRI Program. In general, chemicals covered by the TRI Program are those that cause:

- Cancer or other chronic human health effects;
- Significant adverse acute human health effects; or
- Significant adverse environmental effects.
- There are currently over 650 chemicals covered by the TRI Program. Facilities that manufacture, process or otherwise use these chemicals in amounts above established levels must submit annual TRI reports on each chemical.

ACIs are not covered by the TRI program because:

- a. They are not one of the specific industry sectors required to report under the TRI program; and
- b. They do not manufacture, process or use TRI-listed chemicals in quantities above the established threshold levels in a given year.

COMPLIANCE ASSURANCE

31. Permittees are required to maintain records associated with throughput, fuel use,

operation and maintenance, operating parameters, complaints, and excess emissions. These items are reported to DEQ semi-annually for Title V sources and annually for all sources.

32. DEQ staff members review annual report submittals and perform site inspections of the permitted facilities on a routine basis; inspections may be performed more frequently if complaints are received.
33. Multiple opacity limits are included in the ACI General Permit. The limits are:
 - a. OAR 340-208-0110(4)
 - 20% opacity as determined by a 6-minute average opacity value.
 - b. 40 C.F.R. Part 60 Subpart CCCC Opacity Limits for Commercial and Industrial Air Curtain Incinerators (CISWI)
 - 10% opacity, except during startup, as determined by the average of three 1-hour blocks consisting of ten 6-minute average opacity values during normal operation; and
 - 35% opacity during the startup period (the first 30 minutes of operation), except during malfunctions, as determined by the average of five 6-minute average opacity values;
 - c. 40 C.F.R. Part 60 Subpart EEEE Opacity Limits for Other Solid Waste Air Curtain Incinerators (OSWI)
 - 10% opacity, except during malfunctions, as determined by a 6-minute average opacity value during normal operation; and
 - 35% opacity during the startup period (the first 30 minutes of operation), except during malfunctions, as determined by a 6-minute average opacity value.

Because of the different averaging periods and because the ACI may be operated as a CISWI or an OSWI, it is difficult to determine which opacity limit is the most stringent. The permittee is required to determine compliance with all applicable opacity limits.

REVOCAION OF ASSIGNMENT

34. Any facility that fails to demonstrate compliance, generates complaints, or fails to conform to the requirements and limitations contained in the permit may have its assignment to the General Permit revoked. The facility would then be subject to a more stringent level of permitting.

PUBLIC NOTICE

35. General Air Contaminant Discharge Permits are authorized by Oregon Administrative Rules and are part of the State Implementation Plan. As part of the General ACDP issuance process under OAR chapter 340 division 216, a new General ACDP requires public notice as a Category III permit action according to OAR 340 division 209.
36. The New Source Performance Standards (Subpart CCCC and Subpart EEEE) require that owners or operators of ACIs obtain a Title V Operating Permit. Therefore, the permittee is required to apply for a Title V Operating Permit not later than 12 months after the date the ACI commences operation as a new source.
37. The General Air Contaminant Discharge Permit and the General Title V Permit are identical except for the titles and some of the permit conditions that apply to only one or

- the other type of permit.
38. As part of the General Title V Operating Permit issuance process under OAR chapter 340 division 209, a new General Title V Operating Permit requires public notice as a Category III permit action according to OAR 340 division 218. In order to administratively incorporate the General ACDP into a General Title V Operating Permit, DEQ has followed procedural requirements for preconstruction review that are substantially equivalent to the following requirements for issuance of a Title V Operating Permit:
 - a. Compliance requirements substantially equivalent to those in OAR 340-218-0050 through 340-218-0110;
 - b. No changes in the construction or operation of the facility that would require a permit modification under 340-218-0160 through 340-218-0180 will be allowed;
 - c. External review procedures required under OAR 340-218-0210 and 340-218-0230 be used in addition to the public notice procedures of OAR 340 division 209 for Category III permit actions;
 - d. Transmission of each permit application (including any application for permit modification), each proposed permit except when a draft permit has been submitted and the EPA determines that the submittal of the draft permit is adequate, and each final Title V Operating Permit to the EPA for 45-day review; and
 - e. Review by affected states on or before the time that DEQ provides this notice to the public under OAR 340-218-0210.
 39. Pursuant to OAR 340-216-0060(1)(c) and OAR 340-218-0210(1), issuance of a General Air Contaminant Discharge Permit and a General Title V Operating Permit requires public notice in accordance with OAR 340-209-0030(3)(c), which requires DEQ to provide notice of the proposed permit action and a minimum of 35 days for interested persons to submit written comments. The public notice was emailed/mailed on June 15, 2022 and the comment period ended on July 20, 2022.
 40. DEQ did not receive written requests for a hearing from ten persons or from an organization representing at least ten persons, within 35 days of the mailing of the public notice. Therefore, no hearing was scheduled.
 41. DEQ will provide a minimum of 30 days' notice for a hearing. DEQ will schedule a hearing at a reasonable time and place to allow interested persons to submit oral or written comments. After the comment period and hearing, if requested, DEQ will review the comments and modify the permit as may be appropriate.
 42. A proposed permit will be sent to EPA for a 45-day review period. DEQ may request and EPA may agree to an expedited review of 5 days if there were no substantive or adverse comments during the comment period.
 43. If EPA does not object in writing, any person may petition the EPA within 60 days after the expiration of EPA's 45-day review period to make such objection. Any such petition must be based only on objections to the permit that were raised with reasonable specificity during the public comment period provided for in OAR 340-218-0210, unless the petitioner demonstrates it was impracticable to raise such objections within such period, or unless the grounds for such objection arose after such period.

44. Calculation of the PSEL and toxic air contaminant emissions are attached.

AQGP-031r, air curtain incinerators
jsi/drd 06/09/22

Attachment A - ACI General Permit Emission Detail Sheets

Emission point	Operating parameter	Annual Units	Pollutant	Emission Factor	EF units	EF reference	PTE Emissions (tons/year)
ACI	16,000	tons wood	PM	1.7	lb/ton wood	DEQ Estimate	13.6
			PM10	1.3		Average of USDA Baker, Oregon and USDA San Bernardino Air Curtain Tests, Table 1	10.4
			PM2.5	1.1		USDA, Baker, Oregon Air Curtain Test	8.8
			SO2	0.1		ARB Open Burn for Orchard and Vine Crops and Forest Biomass, Table 2	0.8
			NOx	1.0		SJV Estimation Using/Averaging Data from Multiple Studies, Attachment B	8.0
			CO	2.6		USDA, Baker, Oregon Air Curtain Test, Table 1	20.8
			VOC	0.9		Average of USDA Baker, Oregon and USDA San Bernardino Air Curtain Tests, Table 1	7.2
			GHG	3663	lb/ton	DEQ GHG Calculator	29304
The emission factors are from the "Air Curtain Incinerator Emissions Factor Determination" written by the San Joaquin Valley Air Pollution Control District.							
Ash Handling	167	tons ash	PM	0.30	lb/ton ash	DEQ Estimate	0.03
			PM10	0.23			0.02
			PM2.5	0.035			0.003
Blower Engine	1,666	hours/yr	PM	1.040	lb/Mgal	NSPS IIII (75 ≤ hp < 175)	0.01
	5.5	gal/hr	PM10	1.040	lb/Mgal	NSPS IIII (75 ≤ hp < 175)	0.01
	44	gal/day	PM2.5	1.040	lb/Mgal	NSPS IIII (75 ≤ hp < 175)	0.01
	16,060	gal/yr	SO2	0.210	lb/Mgal	NSPS IIII (75 ≤ hp < 175)	0.002
			NOx	20.80	lb/Mgal	NSPS IIII (75 ≤ hp < 175)	0.2
			CO	256.6	lb/Mgal	NSPS IIII (75 ≤ hp < 175)	2.1
			VOC	9.708	lb/Mgal	NSPS IIII (75 ≤ hp < 175)	0.08
			GHG	22.5	lb/gal	DEQ GHG calculator	181
	Operating parameter	Annual Units	Pollutant	Emission	EF units	EF reference	Emissions (tons/year)
Blower Engine	1,666	hours/yr	PM	0.015	g/hp-Hr	NSPS IIII (75 ≤ hp < 175)	4.77E-03
	5.5	gal/hr	PM10	0.015	g/hp-Hr	NSPS IIII (75 ≤ hp < 175)	4.77E-03
	44	gal/day	PM2.5	0.015	g/hp-Hr	NSPS IIII (75 ≤ hp < 175)	4.77E-03
	9166	gal diesel	SO2	15	ppmw S	NSPS IIII (75 ≤ hp < 175)	9.62E-04
			NOx	0.3	g/hp-Hr	NSPS IIII (75 ≤ hp < 175)	9.53E-02
			CO	3.7	g/hp-Hr	NSPS IIII (75 ≤ hp < 175)	1.18E+00
			VOC	0.14	g/hp-Hr	NSPS IIII (75 ≤ hp < 175)	4.45E-02

PSEL

PSEL Total	
Pollutant	Emissions (tons/year)
PM	13.6
PM10	10.4
PM2.5	8.8
SO2	0.8
NOx	8.2
CO	22.9
VOC	7.3
GHG	29485

Medford PSEL	
PM10 Limit	4.5 tpy
	49 lb/day
ACI Throughput	6923.1 tpy
	37.7 lb/day
Set Limits at:	6750 tpy
	37 lb/day
PM10 emissions:	4.3875 tpy
	48.1 lb/day

Misra MK, Ragland KW, Baker AJ (1993). "Wood Ash Composition as a Function of Furnace Temperature" (PDF). Biomass and Bioenergy. 4 (2): 103–116.

<http://www.fpl.fs.fed.us/documnts/pdf1993/misra93a.pdf>

Table 1. Low temperature ash content of different wood species

Wood Species	Ash, dry basis (%)
Aspen	0.43
Yellow poplar	0.45
White oak	0.87
White oak bark	1.64
Douglas-fir bark	1.82
Average	1.04

HAPs

Cas No.	Pollutant	Dry EF (lbs/ton)	ACI EF (lbs/ton)	ACI HAP PTE (tons)	Blower Engine EF (lb/Mgal)	Blower Engine HAP PTE (tons)	Total HAP PTE (tons)
108-05-4	Vinyl acetate	1.49E-01	1.49E-01	1.19E+00			1.19E+00
7723-14-0	Phosphorus and compounds	9.27E-02	9.27E-02	7.41E-01			7.41E-01
106-99-0	1,3-Butadiene	8.33E-02	8.33E-02	6.67E-01	0.2174	0.0017	6.68E-01
7647-01-0	Hydrochloric acid	7.41E-02	7.41E-02	5.93E-01	0.1863	0.0015	5.94E-01
75-05-8	Acetonitrile	4.82E-02	4.82E-02	3.86E-01			3.86E-01
7439-96-5	Manganese and compounds	4.69E-02	4.69E-02	3.75E-01	0.0031	0.0000	3.75E-01
1330-20-7	Xylene (mixture), including m-xylene, o-xylene, p-xylene	3.80E-02	3.80E-02	3.04E-01	0.0424	0.0003	3.04E-01
50-00-0	Formaldehyde	1.73E-02	1.73E-02	1.39E-01	1.7261	0.0139	1.53E-01
71-43-2	Benzene	1.67E-02	1.67E-02	1.33E-01	0.1863	0.0015	1.35E-01
107-13-1	Acrylonitrile	1.40E-02	1.40E-02	1.12E-01			1.12E-01
7782-50-5	Chlorine	1.34E-02	1.34E-02	1.07E-01			1.07E-01
67-56-1	Methanol	1.24E-02	1.24E-02	9.96E-02			9.96E-02
75-09-2	Dichloromethane (Methylene chloride)	9.30E-03	9.30E-03	7.44E-02			7.44E-02
100-42-5	Styrene	8.11E-03	8.11E-03	6.49E-02			6.49E-02
100-41-4	Ethyl benzene	6.72E-03	6.72E-03	5.37E-02	0.0109	0.0001	5.38E-02
75-07-0	Acetaldehyde	4.81E-03	4.81E-03	3.85E-02	0.7833	0.0063	4.48E-02
110-54-3	Hexane	4.90E-03	4.90E-03	3.92E-02	0.0269	0.0002	3.94E-02
107-02-8	Acrolein	4.42E-03	4.42E-03	3.54E-02	0.0339	0.0003	3.56E-02
123-38-6	Propionaldehyde	4.28E-03	4.28E-03	3.43E-02			3.43E-02
7664-39-3	Hydrogen fluoride	4.00E-03	4.00E-03	3.20E-02			3.20E-02
79-01-6	Trichloroethene (TCE, Trichloroethylene)	3.94E-03	3.94E-03	3.15E-02			3.15E-02
75-15-0	Carbon disulfide	3.29E-03	3.29E-03	2.64E-02			2.64E-02
98-82-8	Isopropylbenzene (Cumene)	2.84E-03	2.84E-03	2.28E-02			2.28E-02
108-95-2	Phenol	2.72E-03	2.72E-03	2.18E-02			2.18E-02
80-62-6	Methyl methacrylate	1.89E-03	1.89E-03	1.51E-02			1.51E-02
91-20-3	Naphthalene	1.69E-03	1.69E-03	1.35E-02	0.0197	0.0002	1.37E-02
71-55-6	1,1,1-Trichloroethane (Methyl chloroform)	9.83E-04	9.83E-04	7.86E-03			7.86E-03
74-87-3	Chloromethane (Methyl chloride)	6.43E-04	6.43E-04	5.14E-03			5.14E-03
84-74-2	Dibutyl phthalate	5.66E-04	5.66E-04	4.53E-03			4.53E-03
1634-04-4	Methyl tert-butyl ether	5.49E-04	5.49E-04	4.39E-03			4.39E-03
75-00-3	Chloroethane (Ethyl chloride)	5.49E-04	5.49E-04	4.39E-03			4.39E-03
75-01-4	Vinyl chloride	5.49E-04	5.49E-04	4.39E-03			4.39E-03
7439-92-1	Lead and compounds	5.29E-04	5.29E-04	4.23E-03			4.23E-03
106-93-4	Ethylene dibromide (EDB, 1,2-Dibromoethane)	5.26E-04	5.26E-04	4.20E-03			4.20E-03
107-06-2	Ethylene dichloride (EDC, 1,2-Dichloroethane)	5.26E-04	5.26E-04	4.20E-03			4.20E-03
120-82-1	1,2,4-Trichlorobenzene	5.26E-04	5.26E-04	4.20E-03			4.20E-03
123-91-1	1,4-Dioxane	5.26E-04	5.26E-04	4.20E-03			4.20E-03
542-75-6	1,3-Dichloropropene	5.26E-04	5.26E-04	4.20E-03			4.20E-03
75-34-3	1,1-Dichloroethane (Ethylidene dichloride)	5.26E-04	5.26E-04	4.20E-03			4.20E-03
79-00-5	1,1,2-Trichloroethane (Vinyl trichloride)	5.26E-04	5.26E-04	4.20E-03			4.20E-03
75-25-2	Bromoform	4.82E-04	4.82E-04	3.86E-03			3.86E-03
79-34-5	1,1,2,2-Tetrachloroethane	4.82E-04	4.82E-04	3.86E-03			3.86E-03
106-46-7	p-Dichlorobenzene (1,4-Dichlorobenzene)	4.61E-04	4.61E-04	3.69E-03			3.69E-03

HAPs

Cas No.	Pollutant	Dry EF (lbs/ton)	ACI EF (lbs/ton)	ACI HAP PTE (tons)	Blower Engine EF (lb/Mgal)	Blower Engine HAP PTE (tons)	Total HAP PTE (tons)
127-18-4	Tetrachloroethene (Perchloroethylene)	4.61E-04	4.61E-04	3.69E-03			3.69E-03
87-68-3	Hexachlorobutadiene	4.61E-04	4.61E-04	3.69E-03			3.69E-03
108-88-3	Toluene	3.59E-04	3.59E-04	2.87E-03	0.1054	0.0008	3.72E-03
100-44-7	Benzyl chloride	3.51E-04	3.51E-04	2.81E-03			2.81E-03
56-23-5	Carbon tetrachloride	3.42E-04	3.42E-04	2.73E-03			2.73E-03
67-66-3	Chloroform	3.42E-04	3.42E-04	2.73E-03			2.73E-03
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	3.29E-04	3.29E-04	2.64E-03			2.64E-03
78-87-5	1,2-Dichloropropane (Propylene dichloride)	2.86E-04	2.86E-04	2.28E-03			2.28E-03
108-90-7	Chlorobenzene	2.82E-04	2.82E-04	2.26E-03			2.26E-03
7440-02-0	Nickel and compounds	2.24E-04	2.24E-04	1.80E-03	0.0039	0.0000	1.83E-03
74-83-9	Bromomethane (Methyl bromide)	1.94E-04	1.94E-04	1.55E-03			1.55E-03
7440-38-2	Arsenic and compounds	1.22E-04	1.22E-04	9.79E-04	0.0016	0.0000	9.92E-04
18540-29-9	Chromium VI, chromate, and dichromate particulate	1.18E-04	1.18E-04	9.48E-04	0.0001	0.0000	9.49E-04
7440-43-9	Cadmium and compounds	8.48E-05	8.48E-05	6.79E-04	0.0015	0.0000	6.91E-04
7782-49-2	Selenium and compounds	5.53E-05	5.53E-05	4.42E-04	0.0022	0.0000	4.60E-04
7440-36-0	Antimony and compounds	5.29E-05	5.29E-05	4.23E-04			4.23E-04
98-86-2	Acetophenone	3.13E-05	3.13E-05	2.50E-04			2.50E-04
7439-97-6	Mercury and compounds	3.01E-05	3.01E-05	2.41E-04	0.002	0.0000	2.57E-04
7440-48-4	Cobalt and compounds	2.84E-05	2.84E-05	2.27E-04			2.27E-04
	Polycyclic Organic Matter				0.0362	0.0003	2.91E-04
7440-41-7	Beryllium and compounds	2.28E-06	2.28E-06	1.82E-05			1.82E-05
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1.08E-11	1.08E-11	8.61E-11			8.61E-11
						Total HAP:	5.49E+00

		Annual Tonnage	16000	ton/yr			
		Annual Fuel	9166	gal/yr			
TEU	Cas No	Chemical	EF		Annual (lbs/yr)	HAP	Annual Tons/yr
ACI	100-41-4	Ethyl benzene	6.7E-03	lbs/ton	1.1E+02	Y	5.4E-02
ACI	100-42-5	Styrene	8.1E-03	lbs/ton	1.3E+02	Y	6.5E-02
ACI	100-44-7	Benzyl chloride	3.5E-04	lbs/ton	5.6E+00	Y	2.8E-03
ACI	106-46-7	p-Dichlorobenzene (1,4-Dichlorobenzene)	4.6E-04	lbs/ton	7.4E+00	Y	3.7E-03
ACI	106-93-4	Ethylene dibromide (EDB, 1,2-Dibromoethane)	5.3E-04	lbs/ton	8.4E+00	Y	4.2E-03
ACI	106-99-0	1,3-Butadiene	8.3E-02	lbs/ton	1.3E+03	Y	6.7E-01
ACI	107-02-8	Acrolein	4.4E-03	lbs/ton	7.1E+01	Y	3.5E-02
ACI	107-06-2	Ethylene dichloride (EDC, 1,2-Dichloroethane)	5.3E-04	lbs/ton	8.4E+00	Y	4.2E-03
ACI	107-13-1	Acrylonitrile	1.4E-02	lbs/ton	2.2E+02	Y	1.1E-01
ACI	108-05-4	Vinyl acetate	1.5E-01	lbs/ton	2.4E+03	Y	1.2E+00
ACI	108-67-8	1,3,5-Trimethylbenzene	2.1E-03	lbs/ton	3.4E+01		1.7E-02
ACI	108-88-3	Toluene	3.6E-04	lbs/ton	5.7E+00	Y	2.9E-03
ACI	108-90-7	Chlorobenzene	2.8E-04	lbs/ton	4.5E+00	Y	2.3E-03
ACI	110-54-3	Hexane	4.9E-03	lbs/ton	7.8E+01	Y	3.9E-02
ACI	110-82-7	Cyclohexane	9.6E-03	lbs/ton	1.5E+02		7.7E-02
ACI	120-12-7	Anthracene	4.6E-05	lbs/ton	7.3E-01	Y	3.6E-04
ACI	120-82-1	1,2,4-Trichlorobenzene	5.3E-04	lbs/ton	8.4E+00	Y	4.2E-03
ACI	123-91-1	1,4-Dioxane	5.3E-04	lbs/ton	8.4E+00	Y	4.2E-03
ACI	124-48-1	Dibromochloromethane	5.3E-04	lbs/ton	8.4E+00		4.2E-03
ACI	127-18-4	Tetrachloroethene (Perchloroethylene)	4.6E-04	lbs/ton	7.4E+00	Y	3.7E-03
ACI	129-00-0	Pyrene	6.0E-05	lbs/ton	9.6E-01	Y	4.8E-04
ACI	1330-20-7	Xylene (mixture), including m-xylene, o-xylene, p-xylene	3.8E-02	lbs/ton	6.1E+02	Y	3.0E-01
ACI	156-60-5	trans-1,2-dichloroethene	6.1E-04	lbs/ton	9.8E+00		4.9E-03
ACI	1634-04-4	Methyl tert-butyl ether	5.5E-04	lbs/ton	8.8E+00	Y	4.4E-03
ACI	1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1.1E-11	lbs/ton	1.7E-07	Y	8.6E-11
ACI	191-24-2	Benzo[g,h,i]perylene	2.6E-06	lbs/ton	4.1E-02	Y	2.1E-05
ACI	193-39-5	Indeno[1,2,3-cd]pyrene	1.7E-06	lbs/ton	2.8E-02	Y	1.4E-05
ACI	19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	3.9E-11	lbs/ton	6.2E-07		3.1E-10
ACI	205-99-2	Benzo[b]fluoranthene	2.4E-06	lbs/ton	3.9E-02	Y	1.9E-05
ACI	206-44-0	Fluoranthene	2.8E-05	lbs/ton	4.5E-01	Y	2.3E-04
ACI	207-08-9	Benzo[k]fluoranthene	8.8E-07	lbs/ton	1.4E-02	Y	7.0E-06
ACI	208-96-8	Acenaphthylene	8.0E-05	lbs/ton	1.3E+00	Y	6.4E-04
ACI	218-01-9	Chrysene	1.3E-06	lbs/ton	2.1E-02	Y	1.1E-05
ACI	3268-87-9	Octachlorodibenzo-p-dioxin (OCDD)	4.3E-10	lbs/ton	6.8E-06		3.4E-09
ACI	35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	1.7E-10	lbs/ton	2.7E-06		1.3E-09
ACI	39001-02-0	Octachlorodibenzofuran (OCDF)	8.8E-11	lbs/ton	1.4E-06	Y	7.0E-10
ACI	39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	1.6E-11	lbs/ton	2.5E-07		1.3E-10
ACI	40321-76-4	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	2.3E-11	lbs/ton	3.8E-07		1.9E-10
ACI	50-32-8	Benzo[a]pyrene	4.6E-05	lbs/ton	7.4E-01	Y	3.7E-04
ACI	51207-31-9	2,3,7,8-Tetrachlorodibenzofuran (TcDF)	1.4E-10	lbs/ton	2.3E-06	Y	1.1E-09
ACI	53-70-3	Dibenz[a,h]anthracene	1.6E-07	lbs/ton	2.6E-03	Y	1.3E-06
ACI	541-73-1	1,3-Dichlorobenzene	4.8E-04	lbs/ton	7.7E+00		3.9E-03
ACI	542-75-6	1,3-Dichloropropene	5.3E-04	lbs/ton	8.4E+00	Y	4.2E-03
ACI	55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	1.6E-11	lbs/ton	2.5E-07	Y	1.3E-10
ACI	56-23-5	Carbon tetrachloride	3.4E-04	lbs/ton	5.5E+00	Y	2.7E-03
ACI	56-55-3	Benzo[a]anthracene	1.4E-06	lbs/ton	2.2E-02	Y	1.1E-05
ACI	57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	9.6E-11	lbs/ton	1.5E-06	Y	7.7E-10
ACI	57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	7.0E-11	lbs/ton	1.1E-06	Y	5.6E-10
ACI	57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	5.4E-11	lbs/ton	8.6E-07	Y	4.3E-10
ACI	57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	3.7E-11	lbs/ton	6.0E-07		3.0E-10

TEU	CasNo	Chemical	EF		Annual (lbs/yr)	HAP	Annual Tons/yr
ACI	60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	4.6E-11	lbs/ton	7.3E-07	Y	3.7E-10
ACI	67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	9.9E-11	lbs/ton	1.6E-06	Y	7.9E-10
ACI	67-63-0	Isopropyl alcohol	6.2E-02	lbs/ton	9.9E+02		5.0E-01
ACI	67-64-1	Acetone	5.8E-02	lbs/ton	9.2E+02		4.6E-01
ACI	67-66-3	Chloroform	3.4E-04	lbs/ton	5.5E+00	Y	2.7E-03
ACI	70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	6.2E-11	lbs/ton	9.9E-07	Y	5.0E-10
ACI	71-43-2	Benzene	1.7E-02	lbs/ton	2.7E+02	Y	1.3E-01
ACI	71-55-6	1,1,1-Trichloroethane (Methyl chloroform)	9.8E-04	lbs/ton	1.6E+01	Y	7.9E-03
ACI	72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	1.1E-11	lbs/ton	1.8E-07	Y	9.0E-11
ACI	74-83-9	Bromomethane (Methyl bromide)	1.9E-04	lbs/ton	3.1E+00	Y	1.6E-03
ACI	74-87-3	Chloromethane (Methyl chloride)	6.4E-04	lbs/ton	1.0E+01	Y	5.1E-03
ACI	75-00-3	Chloroethane (Ethyl chloride)	5.5E-04	lbs/ton	8.8E+00	Y	4.4E-03
ACI	75-01-4	Vinyl chloride	5.5E-04	lbs/ton	8.8E+00	Y	4.4E-03
ACI	75-05-8	Acetonitrile	4.8E-02	lbs/ton	7.7E+02	Y	3.9E-01
ACI	75-09-2	Dichloromethane (Methylene chloride)	9.3E-03	lbs/ton	1.5E+02	Y	7.4E-02
ACI	75-15-0	Carbon disulfide	3.3E-03	lbs/ton	5.3E+01	Y	2.6E-02
ACI	75-25-2	Bromoform	4.8E-04	lbs/ton	7.7E+00	Y	3.9E-03
ACI	75-27-4	Bromodichloromethane	4.8E-04	lbs/ton	7.7E+00		3.9E-03
ACI	75-34-3	1,1-Dichloroethane (Ethylidene dichloride)	5.3E-04	lbs/ton	8.4E+00	Y	4.2E-03
ACI	75-69-4	Trichlorofluoromethane (Freon 11)	5.5E-04	lbs/ton	8.8E+00		4.4E-03
ACI	78-87-5	1,2-Dichloropropane (Propylene dichloride)	2.9E-04	lbs/ton	4.6E+00	Y	2.3E-03
ACI	78-93-3	2-Butanone (Methyl ethyl ketone)	2.7E-04	lbs/ton	4.2E+00		2.1E-03
ACI	79-00-5	1,1,2-Trichloroethane (Vinyl trichloride)	5.3E-04	lbs/ton	8.4E+00	Y	4.2E-03
ACI	79-01-6	Trichloroethene (TCE, Trichloroethylene)	3.9E-03	lbs/ton	6.3E+01	Y	3.2E-02
ACI	79-34-5	1,1,2,2-Tetrachloroethane	4.8E-04	lbs/ton	7.7E+00	Y	3.9E-03
ACI	80-62-6	Methyl methacrylate	1.9E-03	lbs/ton	3.0E+01	Y	1.5E-02
ACI	83-32-9	Acenaphthene	1.5E-05	lbs/ton	2.3E-01	Y	1.2E-04
ACI	85-01-8	Phenanthrene	1.1E-04	lbs/ton	1.8E+00	Y	8.8E-04
ACI	86-73-7	Fluorene	5.1E-05	lbs/ton	8.2E-01	Y	4.1E-04
ACI	87-68-3	Hexachlorobutadiene	4.6E-04	lbs/ton	7.4E+00	Y	3.7E-03
ACI	91-20-3	Naphthalene	1.7E-03	lbs/ton	2.7E+01	Y	1.4E-02
ACI	95-47-6	o-Xylene	1.9E-04	lbs/ton	3.1E+00	Y	1.5E-03
ACI	95-50-1	1,2-Dichlorobenzene	4.8E-04	lbs/ton	7.7E+00		3.9E-03
ACI	95-63-6	1,2,4-Trimethylbenzene	7.5E-03	lbs/ton	1.2E+02		6.0E-02
ACI	96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	3.3E-04	lbs/ton	5.3E+00	Y	2.6E-03
ACI	98-82-8	Isopropylbenzene (Cumene)	2.8E-03	lbs/ton	4.6E+01	Y	2.3E-02
ACI	75-07-0	Acetaldehyde	4.8E-03	lbs/ton	7.7E+01	Y	3.8E-02
ACI	98-86-2	Acetophenone	3.1E-05	lbs/ton	5.0E-01	Y	2.5E-04
ACI	7440-36-0	Antimony and compounds	5.3E-05	lbs/ton	8.5E-01	Y	4.2E-04
ACI	7440-38-2	Arsenic and compounds	1.2E-04	lbs/ton	2.0E+00	Y	9.8E-04
ACI	7440-39-3	Barium and compounds	8.2E-02	lbs/ton	1.3E+03		6.6E-01
ACI	7440-41-7	Beryllium and compounds	2.3E-06	lbs/ton	3.6E-02	Y	1.8E-05
ACI	7440-43-9	Cadmium and compounds	8.5E-05	lbs/ton	1.4E+00	Y	6.8E-04
ACI	7782-50-5	Chlorine	1.3E-02	lbs/ton	2.1E+02	Y	1.1E-01
ACI	18540-29-9	Chromium VI, chromate, and dichromate particul	1.2E-04	lbs/ton	1.9E+00	Y	9.5E-04
ACI	7440-48-4	Cobalt and compounds	2.8E-05	lbs/ton	4.5E-01	Y	2.3E-04
ACI	7440-50-8	Copper and compounds	1.9E-03	lbs/ton	3.0E+01		1.5E-02
ACI	4170-30-3	Crotonaldehyde	7.6E-04	lbs/ton	1.2E+01		6.1E-03
ACI	84-66-2	Diethylphthalate	3.7E-04	lbs/ton	5.9E+00	Y	3.0E-03
ACI	84-74-2	Dibutyl phthalate	5.7E-04	lbs/ton	9.1E+00	Y	4.5E-03
ACI	50-00-0	Formaldehyde	1.7E-02	lbs/ton	2.8E+02	Y	1.4E-01
ACI	7647-01-0	Hydrochloric acid	7.4E-02	lbs/ton	1.2E+03	Y	5.9E-01
ACI	7664-39-3	Hydrogen fluoride	4.0E-03	lbs/ton	6.4E+01	Y	3.2E-02

TEU	CasNo	Chemical	EF		Annual (lbs/yr)	HAP	Annual Tons/yr
ACI	7439-92-1	Lead and compounds	5.3E-04	lbs/ton	8.5E+00		4.2E-03
ACI	7439-96-5	Manganese and compounds	4.7E-02	lbs/ton	7.5E+02	Y	3.8E-01
ACI	7439-97-6	Mercury and compounds	3.0E-05	lbs/ton	4.8E-01	Y	2.4E-04
ACI	67-56-1	Methanol	1.2E-02	lbs/ton	2.0E+02	Y	1.0E-01
ACI	1313-27-5	Molybdenum trioxide	5.3E-05	lbs/ton	8.5E-01		4.3E-04
ACI	365	Nickel and compounds	2.2E-04	lbs/ton	3.6E+00	Y	1.8E-03
ACI	108-95-2	Phenol	2.7E-03	lbs/ton	4.4E+01	Y	2.2E-02
ACI	7723-14-0	Phosphorus and compounds	9.3E-02	lbs/ton	1.5E+03	Y	7.4E-01
ACI	123-38-6	Propionaldehyde	4.3E-03	lbs/ton	6.9E+01	Y	3.4E-02
ACI	7782-49-2	Selenium and compounds	5.5E-05	lbs/ton	8.8E-01	Y	4.4E-04
ACI	7440-22-4	Silver and compounds	1.6E-02	lbs/ton	2.5E+02		1.3E-01
ACI	7440-62-2	Vanadium (fume or dust)	1.0E-05	lbs/ton	1.6E-01		8.1E-05
ACI	108-38-3	m-Xylene	6.0E-05	lbs/ton	9.6E-01	Y	4.8E-04
ACI	106-42-3	p-Xylene	6.0E-05	lbs/ton	9.6E-01	Y	4.8E-04
ACI	7440-66-6	Zinc and compounds	2.2E-02	lbs/ton	3.5E+02		1.8E-01
ACI	192-97-2	Benzo[e]pyrene	3.6E-06	lbs/ton	5.7E-02	Y	2.9E-05
ACI	205-82-3	Benzo[j]fluoranthene	2.7E-06	lbs/ton	4.2E-02	Y	2.1E-05
ACI	91-57-6	2-Methyl naphthalene	2.4E-05	lbs/ton	3.8E-01	Y	1.9E-04
ACI	198-55-0	Perylene	5.4E-07	lbs/ton	8.7E-03	Y	4.4E-06
Blower	71-43-2	Benzene	1.9E-01	lbs/Mga	1.7E+00	Y	8.5E-04
Blower	106-99-0	1,3-Butadiene	2.2E-01	lbs/Mga	2.0E+00	Y	1.0E-03
Blower	7440-43-9	Cadmium and compounds	1.5E-03	lbs/Mga	1.4E-02	Y	6.9E-06
Blower	50-00-0	Formaldehyde	1.7E+00	lbs/Mga	1.6E+01	Y	7.9E-03
Blower	18540-29-9	Chromium VI, chromate, and dichromate particulate	1.0E-04	lbs/Mga	9.2E-04	Y	4.6E-07
Blower	7440-38-2	Arsenic and compounds	1.6E-03	lbs/Mga	1.5E-02	Y	7.3E-06
Blower	7439-92-1	Lead and compounds	8.3E-03	lbs/Mga	7.6E-02		3.8E-05
Blower	365	Nickel and compounds	3.9E-03	lbs/Mga	3.6E-02	Y	1.8E-05
Blower	91-20-3	Naphthalene	2.0E-02	lbs/Mga	1.8E-01	Y	9.0E-05
Blower	401	PAHs (excluding Naphthalene)	3.6E-02	lbs/Mga	3.3E-01	Y	1.7E-04
Blower	50-32-8	Benzo[a]pyrene	3.6E-05	lbs/Mga	3.3E-04	Y	1.6E-07
Blower	75-07-0	Acetaldehyde	7.8E-01	lbs/Mga	7.2E+00	Y	3.6E-03
Blower	107-02-8	Acrolein	3.4E-02	lbs/Mga	3.1E-01	Y	1.6E-04
Blower	7664-41-7	Ammonia	2.9E+00	lbs/Mga	2.7E+01		1.3E-02
Blower	7440-50-8	Copper and compounds	4.1E-03	lbs/Mga	3.8E-02		1.9E-05
Blower	100-41-4	Ethyl benzene	1.1E-02	lbs/Mga	1.0E-01	Y	5.0E-05
Blower	110-54-3	Hexane	2.7E-02	lbs/Mga	2.5E-01	Y	1.2E-04
Blower	7647-01-0	Hydrochloric acid	1.9E-01	lbs/Mga	1.7E+00	Y	8.5E-04
Blower	7439-96-5	Manganese and compounds	3.1E-03	lbs/Mga	2.8E-02	Y	1.4E-05
Blower	7439-97-6	Mercury and compounds	2.0E-03	lbs/Mga	1.8E-02	Y	9.2E-06
Blower	7782-49-2	Selenium and compounds	2.2E-03	lbs/Mga	2.0E-02	Y	1.0E-05
Blower	108-88-3	Toluene	1.1E-01	lbs/Mga	9.7E-01	Y	4.8E-04
Blower	1330-20-7	Xylene (mixture), including m-xylene, o-xylene, p-xylene	4.2E-02	lbs/Mga	3.9E-01	Y	1.9E-04
Blower	200	Diesel Particulate Matter	5.2E-01	lbs/Mga	4.8E+00		2.4E-03

Ash Content

Misra MK, Ragland KW, Baker AJ (1993). "Wood Ash Composition as a Function of Furnace Temperature" (PDF). *Biomass and Bioenergy*. 4 (2): 103–116.
<http://www.fpl.fs.fed.us/documnts/pdf1993/misra93a.pdf>

Table 1. Low temperature ash content of different wood species

Wood Species	Ash, dry basis (%)
Aspen	0.43
Yellow poplar	0.45
White oak	0.87
White oak bark	1.64
Douglas-fir bark	1.82
Average	1.04