Baseline NOx Emissions and Representative NOx Concentrations for Facilities Regulated under Proposed Rule 1109.1 – *Emissions of Oxides of Nitrogen from Petroleum Refineries and Related Operations*

November 5, 2021

Proposed Rule 1109.1 – *Emissions of Oxides of Nitrogen from Petroleum Refineries and Related Operations*, establishes NOx concentration limits for refinery equipment. Under Proposed Rule 1109.1 operators have an option to meet the NOx concentrations through alternative compliance plans. One of the compliance plans is an implementation plan called an "I-Plan" which uses Baseline NOx Emissions and Representative NOx Concentrations for each Unit that is included in the I-Plan. This document is a companion to implementation of Rule 1109.1 ensuring agreement as to the baseline NOx emissions and representative NOx concentrations that are needed in calculating the facility's BARCT emission reduction targets required for the I-Plan.

Paragraph (h)(3) of PR 1109.1 references this document, which includes the Baseline NOx Emissions and Representative NOx Concentrations for each Unit for facilities with six or more Units. This document is being presented to the Governing Board for approval, as companion to PR 1109.1, at the Public Hearing for PR 1109.1. Any change to the Baseline NOx Emissions or representative NOx concentrations in this document would require a facility to request in writing to the Executive Office 30 days after rule adoption. Approval of any change to more accurately represent the Baseline NOx Emissions or Representative NOx Concentrations will be based on annual emissions data, CEMS data, source test data, and any other documentation that substantiates the change. If the change, however, is greater than five percent of the corresponding value for the individual unit, that change will need to be presented to the Stationary Source Committee no later than February 18, 2022.

The following tables for the five major petroleum refineries, three related operations, and two smaller refineries present each unit subject to the rule by device ID, equipment category, size, baseline annual NOx emissions, and representative NOx concentration.

Table 1. Chevron Baseline Emissions and Representative NOx Concentrations

CHEVRON				
Device ID	**Category**	**Size (MMBtu/hr)**	**Baseline Annual Emissions (tons)**	**Representative NOx Concentration (ppmv)**
D641	Heater	365	68.3	24
D643	Heater	220	26.2	20.3
D451	Heater	102	37	69.8
D3053	Gas Turbine	506	49	6.4
D3054	Duct Burner	120		
D203	FCCU	-	49.7	6
D3973	FCC SU Heater	165	-	-
D2198	Gas Turbine	560	41.5	8.3
D2199	Duct Burner	119.7		
D20	Heater	217	27.9	31.3
D625	Heater	63	24.9	58.6
D617	Heater	57	23.8	105
D623	Heater	63	23.8	53.8
D2207	Gas Turbine	560	40.2	4.4
D2208	Duct Burner	119.7		
D502	Heater	70	21.5	85
D619	Heater	57	19.2	74.3
D504	Heater	77	18.1	83.9
D618	Heater	57	17.5	82.8
D620	Heater	57	17.1	74.3
D2216	Boiler	342	15.5	47.4
D82	Heater	315	6.3	7.9
D83	Heater	315	6.9	7.9
D84	Heater	219	5.4	7.9
D159	Heater	176	14.9	10.4
D160	Heater	176	16.5	10.4
D161	Heater	176	17.1	10.4
D955	SRU/TGI	58	22.4	58.3
D927	SRU/TGI	30	15.7	53
D466	Heater	62	3.4	7.8
D467	Heater	62	3.6	7.8
D911	SRU/TGI	30	15.4	43.4
D390	Heater	31	6	28.3
D453	Heater	44	3.5	21.3

C3493	Vapor Incinerator	3	3.7	45.1
D1910	Heater	37	3.8	38
D398	Heater	19	3.7	38
C2158	Vapor Incinerator	3	3.1	86.3
D428	Heater	36	4.4	41.7
D364	Heater	26	2	18.1
C3148	Vapor Incinerator	1	0.018	80.1
C3805	Vapor Incinerator	2	0	-
C3806	Vapor Incinerator	2	0.032	28.3
D3778	Heater	78	0.6	1.3
D3695	Heater	83	0.8	1.9
D473	Heater	88	0.4	1.7
D472	Heater	123	0.7	1.7
D471	Heater	177	0.8	1.7
D3031	Heater	199	1	1.7
D3530	SMR Heater	653	9.1	1.5
D4354	Gas Turbine	509	9.1	1.1
D4355	Duct Burner	132		
C4344	SRU/TGI	50	2.9	4.2

Table 2. Phillips 66 Baseline Emissions and Representative NOx Concentrations

PHILLIPS 66					
Device ID	**Facility**	**Category**	**Size (MMBtu/hr)**	**Baseline Annual Emissions (tons)**	**Representative NOx Concentration (ppmv)**
D688	Wilmington	Boiler	250	56	79
D154	Wilmington	Heater	110	16	64
D155	Wilmington	Heater	100	14.5	64
D156	Wilmington	Heater	70	10	64
D157	Wilmington	Heater	42	6	64
D158	Wilmington	Heater	24	3.5	64
D1	Wilmington	FCCU	-	57	14
D44	Wilmington	FCC SU Heater	87	-	-
D687	Wilmington	Boiler	179	41	61
D135	Wilmington	Heater	116	13.6	38
D136	Wilmington	Heater	68	8.2	38
D137	Wilmington	Heater	71	8.6	38
D138	Wilmington	Heater	56	6.6	38
D139	Wilmington	Heater	19	2	38
D684	Wilmington	Boiler	~~304~~142	29	101
D828	Wilmington	Gas Turbine	646	46	4.5
D829	Wilmington	Duct Burner	99		
D264	Wilmington	Heater	135	25	56
D194	Wilmington	Heater	60	20	82
D146	Wilmington	Heater	76	11	30
D686	Wilmington	Boiler	304	9	10
D220	Wilmington	SMR Heater	350	9	8
D333	Wilmington	Sulfuric Acid Furnace	74	9	14
D332	Wilmington	Sulfuric Acid SU Heater	15	0	190
D262	Wilmington	Heater	37	5	37
D148	Wilmington	Heater	27	4.3	37
D259	Wilmington	Heater	39	4.4	37
D152	Wilmington	Heater	30	4	37
D150	Wilmington	Heater	38	3.6	37
D133	Wilmington	Heater	35	3.2	37
D161	Wilmington	Heater	31	3.5	37
D39	Wilmington	Heater	29	2.5	37
D329	Wilmington	Heater	29	2.5	37
D142	Wilmington	Heater	17	2.2	37
D129	Wilmington	Heater	27	1.8	37

PHILLIPS 66					
Device ID	**Facility**	**Category**	**Size (MMBtu/hr)**	**Baseline Annual Emissions (tons)**	**Representative NOx Concentration (ppmv)**
D163	Wilmington	Heater	14	1.4	37
D260	Wilmington	Heater	17	1.4	37
D40	Wilmington	Heater	10	1	37
D1720	Wilmington	Heater	41	0	3
D1349	Wilmington	SMR Heater	460	9	4
C436	Wilmington	SRU/TGI	20	2	19
C456	Wilmington	SRU/TGI	20	3	15
D430	Carson	Boiler	352	96	77
D210	Carson	SMR Heater	340	90.4	64
D59	Carson	Heater	350	73	40
D174	Carson	Heater	70	18.5	75
D105	Carson	Heater	175	21	30
D104	Carson	Heater	175	19	30
D79	Carson	Heater	154	18	25
D78	Carson	Heater	154	17	23
D429	Carson	Boiler	352	14	10
D713	Carson	Heater	22	1.6	30
C292	Carson	SRU/TGI	15	1	11
C294	Carson	SRU/TGI	28	17	26

- Carson Facility ID: 171109
- Wilmington Facility ID: 171107

Table 3. Marathon Baseline Emissions and Representative NOx Concentrations

MARATHON (TESORO REFINERY)					
Device ID	**Facility**	**Category**	**Size (MMBtu/hr)**	**Baseline Annual Emissions (tons)**	**Representative NOx Concentration (ppmv)**
D27	Carson	Heater	550	56.5	21
D20	Calciner	Coke Calciner	120	260.9	65
D570	Carson	SMR Heater	650	48.9	11
D629	Carson	Heater	173	27.5	32
D535	Carson	Heater	310	27.9	23
D532	Carson	Heater	255	20.8	16
D31	Carson	Heater	130	18.3	30
D151	Carson	Heater	130	18.1	36
D155	Carson	Heater	130	17.5	34
D423	Carson	Heater	80	16.5	73
D153	Carson	Heater	130	16.9	33
D67	Carson	Heater	120	15.4	31
D29	Carson	Heater	150	14.8	28
D33	Carson	Heater	100	11.4	24
D539	Carson	Heater	52	5.4	23
D421	Carson	Heater	82	4.6	18
D625	Carson	Heater	39	5.4	23
C54	SRP	SRU/TGI	52	5.9	68
D250	Carson	Heater	89	3	22
C910	Carson	SRU/TGI	45	25.1	34
C2413	Carson	SRU/TGI	40	14.1	19
D538	Carson	Heater	39	4.2	20
D416	Carson	Heater	24	3.4	28
D626	Carson	Heater	39	3.3	28
D628	Carson	Heater	39	3.4	23
D63	Carson	Heater	360	5.3	5.1
D541	Carson	Heater	39	4.3	16
D1465	Carson	SMR Heater	427	11	5.1
D627	Carson	Heater	39	3.7	17
C56	SRP	SRU/TGI	45	2.4	98
D419	Carson	Heater	52	1.9	15
D425	Carson	Heater	22	2.4	28
D1433	Carson	Heater	13	1.4	31
D418	Carson	Heater	11	1.3	34
D417	Carson	Heater	10	1.3	17

MARATHON (TESORO REFINERY)					
Device ID	**Facility**	**Category**	**Size (MMBtu/hr)**	**Baseline Annual Emissions (tons)**	**Representative NOx Concentration (ppmv)**
D1233	Carson	Gas Turbine	~~1,326~~ 985.5	54.8	3
D1234	Carson	Duct Burner	340		
D1239	Carson	Gas Turbine	~~1,326~~ 985.5	53.4	2.7
D1240	Carson	Duct Burner	340		
D1226	Carson	Gas Turbine	~~1,326~~ 985.5	49.7	2.6
D1227	Carson	Duct Burner	340		
D1236	Carson	Gas Turbine	~~1,326~~ 985.5	55.9	2.7
D1237	Carson	Duct Burner	340		
D164	Carson	FCCU	-	7.3	1
D2837	Carson	FCC SU Heater	165	-	-
C2979	Carson	Vapor Incinerator	4	2.6	35
D724/D725	Wilmington	Boiler	368	132.9	114
D722/D723	Wilmington	Boiler	368	108.8	83
D76/D77	SRP	Boiler	225	34.7	48
D812	Wilmington	Gas Turbine	392	65.4	8
D810	Wilmington	Gas Turbine	392	59.6	10
D32	Wilmington	Heater	218	43.1	59
D9	Wilmington	Heater	200	37.5	40
D247	Wilmington	Heater	82	8	43
D248	Wilmington	Heater	50	9.4	43
D249	Wilmington	Heater	29	4.2	43
D146	Wilmington	Heater	69	23.3	134
D33	Wilmington	Heater	252	22.6	17
D388	Wilmington	Heater	147	15.2	16
D214	Wilmington	Heater	56	2.9	17
D215	Wilmington	Heater	36	2.6	17
D216	Wilmington	Heater	31	2	17
D217	Wilmington	Heater	31	4.6	17
D158	Wilmington	Heater	204	9.4	84
D386	Wilmington	Heater	48	2.2	19
D387	Wilmington	Heater	71	3.9	19
D120	Wilmington	Heater	45	8.9	63
D157	Wilmington	Heater	49	8.7	63
D218	Wilmington	Heater	60	7.2	26
D384	Wilmington	Heater	48	2.2	18
D385	Wilmington	Heater	24	1.1	18

D1122	Wilmington	Boiler	140	1.9	7
D777	Wilmington	SMR Heater	146	5.4	7
D250	Wilmington	Heater	35	2.3	31
D770	Wilmington	Heater	63	1.6	7

- Carson Facility ID: 174655
- Wilmington Facility ID: 800436
- Coke Calciner Facility ID: 174591
- Sulfur Recovery Plant (SRP) Facility ID: 151798

Table 4. Torrance Refinery Baseline Emissions and Representative NOx Concentrations

TORRANCE REFINERY				
Device ID	**Category**	**Size (MMBtu/hr)**	**Baseline Annual Emissions (tons)**	**Representative NOx Concentration (ppmv)**
D803	Boiler	309	203.5	116.8
D805	Boiler	291	141.8	35.2
D151	FCCU	-	100.7	10.3
C164	CO Boiler	464	-	-
D2320	FCC SU Heater	132	-	-
D913	Heater	457	48.5	16.3
D914	Heater	161	16.3	16.3
D917	Heater	91	23.9	60.6
D918	Heater	91	24.5	67.6
D120	Heater	126	21	70
D930	Heater	129	23.6	51.2
D83	Heater	67	16.7	52.5
D84	Heater	67	16.2	53
D85	Heater	74	15.4	43.2
D931	Heater	73	13.8	51.2
D269	Heater	107	10.6	43.1
D920	Heater	108	7.1	22.4
D1239	Boiler	340	8	7.2
D1236	Boiler	340	4.9	5.8
C626	Vapor Incinerator	60	7.2	45.4
D949	Heater	40	3.5	23.8
D234	Heater	60	0.5	13.1
D235	Heater	60	1	13.1
D950	Heater	64	1.4	11.7
C686	Vapor Incinerator	4	2.8	38
D927	Heater	17	3	11.7
D231	Heater	60	0.4	13.1
D232	Heater	60	0.5	13.1
D928	Heater	17	2.6	11.7
D929	Heater	21	0.4	27.1
D1403	Heater	21	0.4	27.1
C687	Vapor Incinerator	4	1.2	38
C952	SRU/TGI	100	15.9	19.6

Table 5. Ultramar Baseline Emissions and Representative NOx Concentrations

ULTRAMAR (VALERO)					
Device ID	**Facility**	**Category**	**Size (MMBtu/hr)**	**Baseline Annual Emissions (tons)**	**Representative NOx Concentration (ppmv)**
D36	Wilmington	FCCU	-	87.7	23.3
D38	Wilmington	FCC SU Heater	100	-	-
D74	Wilmington	Heater	258	30.9	38.4
D3	Wilmington	Heater	159	17.2	30.8
D6	Wilmington	Heater	136	13.5	19
D52	Wilmington	Heater	36	18.9	96
D22	Wilmington	Heater	95	9.5	29.8
D12	Wilmington	Heater	144	8.8	26.7
D53	Wilmington	Heater	68	8.2	23.2
D8	Wilmington	Heater	49	6.3	34.4
D98	Wilmington	Heater	57	5.8	23.1
D768	Wilmington	Heater	110	5.9	10.3
D1550	Wilmington	Boiler	245	5.4	5.2
D73	Wilmington	Heater	30	4.8	20.7
D59	Wilmington	Heater	26	3.2	33.5
D60	Wilmington	Heater	30	3.6	26.2
D429	Wilmington	Heater	30	1	6.3
D430	Wilmington	Heater	200	6.5	6.3
D9	Wilmington	Heater	20	2.5	25.7
D378	Wilmington	Boiler	128	2.6	5.6
C1260	Wilmington	SRU/TGI	36	3	89.8
D377	Wilmington	Boiler	39	0	0
D1669	Wilmington	Gas Turbine	342	3.2	2.1
D179	Asphalt Plant	Heater	15.4	0.03	13.5
D13	Asphalt Plant	Heater	19.3	2.9	20.7
D63	Asphalt Plant	Boiler	14.5	1.9	31
D64	Asphalt Plant	Boiler	14.5	1.9	30.1

- Wilmington Facility ID: 800026
- Valero Asphalt Plant Facility ID: 800393

Table 6. Air Products Baseline Emissions and Representative NOx Concentrations

Device ID	Facility	Category	Size (MMBtu/hr)	Baseline Annual Emissions (tons)	Representative NOx Concentration (ppmv)
D30	Carson	SMR Heater	764	16.5	3.9
D38	Wilmington	SMR Heater	785	21.6	5.7
D367	Torrance	SMR Heater	527	131.1	53.4
D925*/~~D926*~~	Torrance	SMR Heater ~~and GTG~~	~~1,247~~ 931	29.9	4.4
D926*	Torrance	Gas Turbine	316		

*****Device ID D925 and D926 share a combined stack, however D926 is owned by Torrance Refinery. Air Products is responsible for the combined stack and emissions for both D925 and D926.

Table 7. Air Liquide Baseline Emissions and Representative NOx Concentrations

Device ID	Facility	Category	Size (MMBtu/hr)	Baseline Annual Emissions (tons)	Representative NOx Concentration (ppmv)
D24	El Segundo	SMR Heater	780	20	3.7

Table 8. Lunday-Thagard Baseline Emissions and Representative NOx Concentrations

Device ID	Category	Size (MMBtu/hr)	Baseline Annual Emissions (tons)	Representative NOx Concentration (ppmv)
D19	Heater	6	0.87	12
D20	Heater	39.0	12.2	49
D84	Heater	5.5	0.74	58
D214	Boiler	29.4	0.10	7.9
D231	Boiler	39.9	0.78	7.4
C97	Vapor Incinerator	14	11.2	88
C105	Vapor Incinerator	1.4	0.56	101

Table 9. Eco-Services Baseline Emissions and Representative NOx Concentrations

Device ID	Category	Size (MMBtu/hr)	Baseline Annual Emissions (tons)	Representative NOx Concentration (ppmv)
D1	Sulfuric Acid Furnace	150	23.3	22
D98	SU Heater	50	0.38	94.4
D139	SU Boiler	49	0.19	29.6
C126	Flare	1.09	0.22	-

Table 10. Alt Air Baseline Emissions and Representative NOx Concentrations

Device ID	Category	Size (MMBtu/hr)	Baseline Emissions (tons)	Representative NOx (ppmv)
D44	Heater	12.8	-	2.7
D45	Heater	5	-	2.7
D46	Heater	28	0.32	2.7
D374	Boiler	44.5	6.2	71.6
D375	Boiler	44.5	0	-
D376	Boiler	65.9	8.4	105.1
C175	Vapor Incinerator	10	3.7	110
D691	Vapor Incinerator	8	0	-
C882	Vapor Incinerator	1.2	0.12	-
C887	Vapor Incinerator	1.2	0.25	-
C531	Vapor Incinerator	30	4.7	68.2
D569	Vapor Incinerator	8	-	-
D677~~/D679~~	Gas Turbine~~/Duct Burner~~	~~140~~ 90	0	1.7
D679	Duct Burner	50		