DOYON UTILITIES LLC

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January 13, 2021

Air Permit Program Permit Intake Clerk
Alaska Department of Environmental Conservation
555 Cordova Street,
Anchorage, Alaska 99501

SUBJECT: Amendment to Application for Renewal of Air Quality Operating Permit No. AQ1121TVP02 Revision 2 for the Doyon Utilities – Fort Wainwright (Privatized Emission Units)

Dear Intake Clerk,

Doyon Utilities, LLC (DU) is submitting this amendment to the air quality operating permit renewal application pursuant to 40 Code of Federal Regulations (CFR) 71 adopted by reference in 18 Alaska Administrative Code (AAC) 50.326. The purpose of this amendment is to revise certain emission calculations presented in Section D of the original air quality operating permit renewal application for the DU Fort Wainwright (Privatized Emission Units) stationary source, Permit No. AQ1121TVP02, Revision 2. The revisions made to the revised Tables in Section D are highlighted in light blue. Particulate matter (PM) emissions calculations have been added as requested by the Alaska Department of Environmental Conservation (ADEC). No other changes were made to other sections of this Title V renewal application, and as a result, are not included in this submittal.

A copy of the amendment is being submitted via email to ADEC with the excel emission calculations attached for review.

Please contact Mr. Isaac Jackson at 907-455-1547 or at ijackson@doyonutilities.com with any questions.

Based on information and belief formed after reasonable inquiry, I certify that the statements and information in and attached to this document are true, accurate and complete.

Shayne Coiley
Senior Vice President

Enclosure:
Amendment to Operating Permit Renewal Application for AQ1121TVP02, Revision 2

Cc: US EPA Region X– Seattle (w/attachment)
C. Kimball, SLR – Fairbanks (w/o attachment)

CO 21-002

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Amendment to Application for Renewal of Air Quality Operating Permit AQ1121TVP02 Revision 2

for the:

Fort Wainwright (Privatized Emission Units)

prepared for:

Doyon Utilities, LLC

Prepared by:

SLR

January 2021

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Amendment to Application for Renewal of Air Quality Operating Permit AQ1121TVP02 Revision 2

for the

Fort Wainwright (Privatized Emission Units)

prepared for

Doyon Utilities, LLC

prepared by

SLR International Corporation

543 3rd Avenue, Suite 235
Fairbanks, Alaska 99701
(907) 452-2252

January 2021

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SECTION A
STATIONARY SOURCE

Form A1-R: Stationary Source Supplemental Information or Application Revision

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FORM A1-R
Stationary Source Supplemental Information or Application Revision

Permit Number: AQ1121TVP02, Revision 2

COPY

Permit Contact:	Name	Isaac Jackson
	Title	Air Program Coordinator
	Mailing Address Line 1	P.O. Box 74040
	Mailing Address Line 2	Fairbanks, Alaska 99707
	Phone Number	907-455-1547
	Email	ijackson@doyonutilities.com

Brief Description of Supplemental Information or Application Revision:

Doyon Utilities, LLC has revised Section D of the original Title V Permit Renewal Application for Permit No. AQ1121TVP02, Revision 2 originally submitted to the Alaska Department of Environmental Conservation (ADEC) on April 30, 2019. This application revision includes updated calculations for the assessable potential emissions estimates, unlimited potential emissions estimates, and actual emissions estimates. The revisions to Section D, Emissions Summary in the original application are summarized below and highlighted blue in the calculations.

- Corrected Tier 4i emission factors for EUs 29a and 31a for nitrogen oxides (NO_X), particulate matter 10 microns and less (PM_{10}), and PM 2.5 microns and less ($PM_{2.5}$).
- Revised emission factors for EU 8 to Tier 2 emission factors for NO_X, carbon monoxide (CO), PM_{10}, and $PM_{2.5}$.
- Revised emission factors for EU 14 to Tier 3 emission factors for NO_X, CO, PM_{10}, and $PM_{2.5}$.
- Revised reference to correct building number for EU 37 to MH507.
- As requested by the ADEC, added emissions calculations for PM (differences from PM_{10} calculations are highlighted).
- Added emissions calculations for $PM_{2.5}$ for ash handling and coal pile.
- Revised the wind speed in the ash handling calculations for consistency.
- Revised the PM_{10} emission factor for Ash Loadout to Truck.
- Corrected the PM_{10} emission factors for EU IDs 29a, 32a, 33a, and 37 in the Assessable Emission Estimates.
- Revised the VOC emission calculation in the Full Potential Estimate by removing EU IDs 51a and 51b inadvertently labeled as Emergency Generator Engines.

Statement of Certification:

Based on information and belief formed after reasonable inquiry, I certify that the statements and information in and attached to this document are true, accurate, and complete.

Shayne Coiley
Name of Responsible Official

Senior Vice President
Title

Signature (blue ink)

1/13/2021
Date

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SECTION B
EMISSIONS SUMMARY

Tables D-1.1 through D-1.19: Assessable Emissions Estimates

Tables D-2.1 through D-2.19: Full Potential Emissions Estimates

Tables D-3.1 through D-3.19: Actual Emissions Estimates

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Table D-1.1. Assessable Emissions Summary
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added for the January 2021 Amendment.

Emission Unit Type	Regulated Air Pollutant Emissions (tons per year) [1,2]								
	NO_X	CO	PM	PM_{10}	$PM_{2.5}$ [3]	VOC	SO_2	HAP	GHG (CO_2e) [4]
Significant	1,497.9	848.8	140.0	136.5	120.9	9.7	1,764.9	31.4	549,730
Insignificant	0.0	0.0	0.5	0.5	0.5	0.0	0.0	0.0	0
DU Emission Total	**1,497.9**	**848.8**	**140.5**	**137.0**	**121.4**	**9.7**	**1,764.9**	**31.4**	**549,730**
DU Assessable Emission Subtotals	**1,498**	**849**	**141**	**137**	**121**	**9.7**	**1,765**	**25**	**549,730**
Fees Apply to Pollutant? [5,7]	**Yes**	**Yes**	**Yes**	**No [6]**	**No [6]**	**No**	**Yes**	**Yes**	**No [8]**
Total DU Assessable Emissions	**4,277**								

Notes:

[1] Emissions are potential to emit, except where noted, based on maximum allowable operation and permit operating limits, where applicable.

[2] Regulated air pollutant calculations based on AP-42 emission factors, manufacturer data, and mass balances as shown in accompanying spreadsheets.

[3] $PM_{2.5}$ emissions are assumed to be equal to PM_{10} emissions except as noted on Table D-1.8.

[4] GHG means greenhouse gases and is the summation of CO_2, CH_4, and N_2O and applying the global warming potential for each pollutant.

[5] Fees paid on each regulated air pollutant emitted in quantities greater than 10 tpy per 18 AAC 50.410.

[6] PM_{10} and $PM_{2.5}$ emissions are a subset of PM emissions and are excluded from the assessable emissions total to avoid a double payment.

[7] HF is the only HAP with potential to emit greater than 10 tpy, per Table D-1.11.

[8] Assessable emission fees for GHGs have not been established under 18 AAC 50.

[9] Emission Units (EU) 1 through 6 at Fort Wainwright (Privatized Emission Units) have baghouses as emission control devices. EU IDs 7a-7c, 51a, 51b, and the ash bin vent filter also have emission controls.

Table D-1.2. Assessable Potential to Emit Emissions Inventory - Significant Emission Units
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added for the January 2021 Amendment.

Emission Unit				Installation Date	Fuel Type	Rating
ID	Name	Description	Bldg. No.			
1	Coal-Fired Boiler 3	Central Heat and Power Plant (CHPP)	CHPP	1953	Coal	230 MMBtu/hr
2	Coal-Fired Boiler 4	CHPP	CHPP	1953	Coal	230 MMBtu/hr
3	Coal-Fired Boiler 5	CHPP	CHPP	1953	Coal	230 MMBtu/hr
4	Coal-Fired Boiler 6	CHPP	CHPP	1953	Coal	230 MMBtu/hr
5	Coal-Fired Boiler 7	CHPP	CHPP	1953	Coal	230 MMBtu/hr
6	Coal-Fired Boiler 8	CHPP	CHPP	1953	Coal	230 MMBtu/hr
7a	South Coal Handling Dust Collector (DC-01)	Airlanco 169-AST-8	CHPP	2001	N/A	13,150 acfm
7b	South Underbunker Dust Collector (DC-02)	Airlanco 16-AST	CHPP	2005	N/A	884 acfm
7c	North Coal Handling Dust Collector (NDC-1)	Dustex C67-10-547	CHPP	2004	N/A	9,250 acfm
8	Backup Generator Engine	Caterpillar 3516C	CHPP	2009	Distillate	2,937 hp
9	Emergency Generator Engine	Detroit 6V92	1032	1988	Distillate	353 hp
14	Emergency Generator Engine	Cummins QSL-G2 NR3	1563	2008	Distillate	320 hp
22	Emergency Generator Engine	Cummins	3565	1989	Distillate	35 hp
23	Emergency Generator Engine	John Deere 6068HF150	3587	2003	Distillate	155 hp
29a	Emergency Generator Engine	John Deere 4045TF290	1056	2014	Distillate	74 hp
30a	Emergency Generator Engine	Caterpillar C4.4	3403	2018	Distillate	91 hp
31a	Emergency Generator Engine	John Deere 4045TF290	3724	2014	Distillate	74 hp
32a	Emergency Generator Engine	Caterpillar C4.4	4162	2018	Distillate	91 hp
33a	Emergency Generator Engine	Caterpillar C4.4	1002	2015	Distillate	75 hp
34	Emergency Pump Engine	Detroit Diesel 10447000	3405	1995	Distillate	220 hp
35	Emergency Pump Engine	John Deere 4045DF120	4023	2009	Distillate	55 hp
36	Emergency Pump Engine	Detroit Diesel 4031-C	3563	1995	Distillate	220 hp
37	Emergency Generator Engine	Caterpillar C4.4	MH507	2015	Distillate	75 hp
51a	Fly Ash Dust Collector (DC-1)	United Conveyor Corp. 32242	CHPP	1993	N/A	3,620 acfm
51b	Bottom Ash Dust Collector (DC-2)	United Conveyor Corp. 32242	CHPP	1994	N/A	3,620 acfm
52	Coal Storage Pile	CHPP	CHPP	Unknown	N/A	N/A

Table D-1.3. Assessable Potential to Emit Emissions Inventory - Insignificant Emission Units
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Emission Unit(s)				Installation	Fuel		Basis for
ID	Description	Make/Model	Bldg. No.	Date	Type	Rating	Insignificance
N/A	Fly and Bottom Ash Bin Vent Filter	United Conveyor Corp 96TB-BVT-25:S6	CHPP	1993	N/A	1,460 acfm	18 AAC 50.326(e)
N/A	Ash Loadout to Truck	N/A	CHPP	Unknown	N/A	N/A	18 AAC 50.326(e)
N/A	Aboveground Storage Tank	N/A	1002	2012	Diesel	80 gallons	18 AAC 50.326(g)(1)
N/A	Aboveground Storage Tank	N/A	1032	1993	Diesel	180 gallons	18 AAC 50.326(g)(1)
N/A	Aboveground Storage Tank	N/A	1563	2012	Diesel	100 gallons	18 AAC 50.326(g)(1)
N/A	Aboveground Storage Tank	N/A	3403	2012	Diesel	100 gallons	18 AAC 50.326(g)(1)
N/A	Aboveground Storage Tank	N/A	3405	1995	Diesel	500 gallons	18 AAC 50.326(g)(2)
N/A	Aboveground Storage Tank	N/A	3563	1995	Diesel	275 gallons	18 AAC 50.326(g)(2)
N/A	Aboveground Storage Tank	N/A	3565	1997	Diesel	75 gallons	18 AAC 50.326(g)(1)
N/A	Aboveground Storage Tank	N/A	3587	2002	Diesel	180 gallons	18 AAC 50.326(g)(1)
N/A	Aboveground Storage Tank	N/A	3595	2009	Diesel	1,670 gallons	18 AAC 50.326(g)(3)
N/A	Aboveground Storage Tank	N/A	3598	Unknown	Diesel	1,000 gallons	18 AAC 50.326(g)(2)
N/A	Aboveground Storage Tank	N/A	3724	2012	Diesel	100 gallons	18 AAC 50.326(g)(1)
N/A	Aboveground Storage Tank	N/A	4023	2009	Diesel	275 gallons	18 AAC 50.326(g)(2)
N/A	Aboveground Storage Tank	N/A	4162	2012	Diesel	100 gallons	18 AAC 50.326(g)(1)
N/A	Underground Storage Tank	N/A	1056	1991	Diesel	1,000 gallons	18 AAC 50.326(g)(2)
N/A	Underground Storage Tank	N/A	1563	1995	Diesel	1,000 gallons	18 AAC 50.326(g)(2)
N/A	Underground Storage Tank	N/A	3598	1991	Used oil/water	1,000 gallons	18 AAC 50.326(g)(2)

Note:
Mobile and portable tanks are not included in list because they are insignificant under 18 AAC 50.326(f)(1) and are not required to be listed in the application.

Table D-1.4. Emission Unit Parameters
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Emission Unit			Fuel Type	Electrical Output Rating	Rating	Allowable Annual Operation
ID	Name	Description				
Significant Emission Units						
1	Coal-Fired Boiler 3	Central Heat and Power Plant (CHPP)	Coal	N/A	230 MMBtu/hr	336,000 tpy[d]
2	Coal-Fired Boiler 4	CHPP	Coal	N/A	230 MMBtu/hr	
3	Coal-Fired Boiler 5	CHPP	Coal	N/A	230 MMBtu/hr	
4	Coal-Fired Boiler 6	CHPP	Coal	N/A	230 MMBtu/hr	
5	Coal-Fired Boiler 7	CHPP	Coal	N/A	230 MMBtu/hr	
6	Coal-Fired Boiler 8	CHPP	Coal	N/A	230 MMBtu/hr	
7a	South Coal Handling Dust Collector (DC-01)	Airlanco 169-AST-8	N/A	N/A	13,150 acfm[a]	2,195 hr/yr[g]
7b	South Underbunker Dust Collector (DC-02)	Airlanco 16-AST	N/A	N/A	884 acfm[a]	100 hr/yr[g]
7c	North Coal Handling Dust Collector (NDC-1)	Dustex C67-10-547	N/A	N/A	9,250 acfm[a]	45 hr/yr[g]
8	Backup Generator Engine	Caterpillar 3516C	Distillate	2,000 kW	2,937 hp[b]	500 hr/yr[e]
9	Emergency Generator Engine	Detroit 6V92	Distillate	250 kW	353 hp[c]	500 hr/yr[f]
14	Emergency Generator Engine	Cummins QSL-G2 NR3	Distillate	200 kW	320 hp[b]	500 hr/yr[f]
22	Emergency Generator Engine	Cummins	Distillate	25 kW	35 hp[c]	500 hr/yr[f]
23	Emergency Generator Engine	John Deere 6068HF150	Distillate	110 kW	155 hp[c]	500 hr/yr[f]
29a	Emergency Generator Engine	John Deere 4045TF290	Distillate	N/A	74 hp	500 hr/yr[f]
30a	Emergency Generator Engine	Caterpillar C4.4	Distillate	60 kW	91 hp[k]	500 hr/yr[f]
31a	Emergency Generator Engine	John Deere 4045TF290	Distillate	N/A	74 hp	500 hr/yr[f]
32a	Emergency Generator Engine	Caterpillar C4.4	Distillate	60 kW	91 hp[k]	500 hr/yr[f]
33a	Emergency Generator Engine	Caterpillar C4.4	Distillate	N/A	75 hp	500 hr/yr[f]
34	Emergency Pump Engine	Detroit Diesel 10447000	Distillate	N/A	220 hp	500 hr/yr[f]
35	Emergency Pump Engine	John Deere 4045DF120	Distillate	N/A	55 hp	500 hr/yr[f]
36	Emergency Pump Engine	Detroit Diesel 4031-C	Distillate	N/A	220 hp	500 hr/yr[f]
37	Emergency Generator Engine	Caterpillar C4.4	Distillate	N/A	75 hp	500 hr/yr[f]
51a	Fly Ash Dust Collector (DC-1)	United Conveyor Corp. 32242	N/A	N/A	3,620 acfm[a]	4,380 hr/yr[h]
51b	Bottom Ash Dust Collector (DC-2)	United Conveyor Corp. 32242	N/A	N/A	3,620 acfm[a]	4,380 hr/yr[h]
52	Coal Storage Pile	CHPP	N/A	N/A	N/A	84,676 tpy[j]
Insignificant Emission Units						
N/A	Fly and Bottom Ash Bin Vent Filter	United Conveyor Corp 96TB-BVT-25:S6	N/A	N/A	1,460 acfm[a]	4,380 hr/yr[h]
N/A	Ash Loadout to Truck	N/A	N/A	N/A	N/A	23,520 tpy[h]
N/A	Aboveground Storage Tanks	N/A[i]	Diesel	N/A	N/A	N/A
N/A	Underground Storage Tanks	N/A[i]	Diesel	N/A	N/A	N/A

Notes:

[a] Rating for dust collectors and vent filters is the manufacturer's design inlet gas flow rate in cubic feet per minute

[b] Engine rating from vendor data

[c] Engine rating in hp calculated from electrical output assuming 95% efficiency (hp=kW*1.341/.95).

[d] Maximum annual coal consumption, combined for Emissions Units 1 through 6, per AQ1121TVP02 Revision 2 Condition 12.1.

[e] Maximum annual operation for Emission Unit 8, per AQ1121TVP02 Revision 2 Condition 14.

[f] According to a memorandum from John S. Seitz of the EPA, 500 hours of operation is an appropriate default assumption for estimating the number of hours an emergency generator could be expected to operate per year.

[g] As calculated in Table D-1.7a

[h] As calculated in Table D-1.7b

[i] Multiple tanks, see Table D-1.3 for details

[j] As calculated in Table D-1.7c

[k] Engine rating in hp calculated from electrical output using the manufacturer provided efficiency of 88%.

Conversion factors:

Engine horsepower	1.341	hp/kw
EU IDs 9, 22, and 23 drive shaft efficiency	95%	Per Alan Schuler at ADEC
EU IDs 30a and 32a drive shaft efficiency	88%	Per vendor information

Table D-1.5. Assessable Potential to Emit Calculations - Oxides of Nitrogen (NO_X) Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added for the January 2021 Amendment.

Emission Unit ID	Emission Unit Description	Fuel Type	Factor Reference	NO_X Emission Factor	Emission Unit Rating/Capacity	Allowable Annual Operation	Potential NO_X Emissions
Significant Emission Units							
1	Coal-Fired Boiler 3	Coal	AP-42, Table 1.1-3	8.8 lb/ton	230 MMBtu/hr	336,000 tpy	1,478 tpy
2	Coal-Fired Boiler 4	Coal	AP-42, Table 1.1-3	8.8 lb/ton	230 MMBtu/hr		
3	Coal-Fired Boiler 5	Coal	AP-42, Table 1.1-3	8.8 lb/ton	230 MMBtu/hr		
4	Coal-Fired Boiler 6	Coal	AP-42, Table 1.1-3	8.8 lb/ton	230 MMBtu/hr		
5	Coal-Fired Boiler 7	Coal	AP-42, Table 1.1-3	8.8 lb/ton	230 MMBtu/hr		
6	Coal-Fired Boiler 8	Coal	AP-42, Table 1.1-3	8.8 lb/ton	230 MMBtu/hr		
7a	South Coal Handling Dust Collector (DC-01)	N/A	N/A	N /A	13,150 acfm	2,195 hr/yr	0 tpy
7b	South Underbunker Dust Collector (DC-02)	N/A	N/A	N /A	884 acfm	100 hr/yr	0 tpy
7c	North Coal Handling Dust Collector (NDC-1)	N/A	N/A	N /A	9,250 acfm	45 hr/yr	0 tpy
8	Backup Generator Engine	Distillate	EPA Tier 2 (NMHC + NOx)	8.0 g/kW-hr[1, 2]	2,937 hp	500 hr/yr	9.66 tpy
9	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	0.031 lb/hp-hr	353 hp	500 hr/yr	2.73 tpy
14	Emergency Generator Engine	Distillate	EPA Tier 3 (NMHC + NOx)	5.0 g/kW-hr[1, 2]	320 hp	500 hr/yr	0.66 tpy
22	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	0.031 lb/hp-hr	35 hp	500 hr/yr	0.27 tpy
23	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	0.031 lb/hp-hr	155 hp	500 hr/yr	1.20 tpy
29a	Emergency Generator Engine	Distillate	EPA Tier 4i (NMHC + NOx)	5.875 g/kW-hr[1, 2]	74 hp	500 hr/yr	0.18 tpy
30a	Emergency Generator Engine	Distillate	EPA Tier 3 (NMHC + NOx)	5.875 g/kW-hr[1]	91 hp	500 hr/yr	0.22 tpy
31a	Emergency Generator Engine	Distillate	EPA Tier 4i (NMHC + NOx)	5.875 g/kW-hr[1, 2]	74 hp	500 hr/yr	0.18 tpy
32a	Emergency Generator Engine	Distillate	EPA Tier 3 (NMHC + NOx)	5.875 g/kW-hr[1]	91 hp	500 hr/yr	0.22 tpy
33a	Emergency Generator Engine	Distillate	EPA Tier 3 (NMHC + NOx)	5.875 g/kW-hr[1]	75 hp	500 hr/yr	0.18 tpy
34	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	0.031 lb/hp-hr	220 hp	500 hr/yr	1.71 tpy
35	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	0.031 lb/hp-hr	55 hp	500 hr/yr	0.43 tpy
36	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	0.031 lb/hp-hr	220 hp	500 hr/yr	1.71 tpy
37	Emergency Generator Engine	Distillate	EPA Tier 3 (NMHC + NOx)	5.875 g/kW-hr[1]	75 hp	500 hr/yr	0.18 tpy
51a	Fly Ash Dust Collector (DC-1)	N/A	N/A	N/A	3,620 acfm	4,380 hr/yr	0 tpy
51b	Bottom Ash Dust Collector (DC-2)	N/A	N/A	N/A	3,620 acfm	4,380 hr/yr	0 tpy
52	Coal Storage Pile	N/A	N/A	N/A	N/A	84,676 tpy	0 tpy
						Significant Emission Units Total Assessable Potential to Emit - NO_X	**1,497.9 tpy**
Insignificant Emission Units							
N/A	Fly and Bottom Ash Bin Vent Filter	N/A	N/A	N/A	1,460 acfm	4,380 hr/yr	0 tpy
N/A	Ash Loadout to Truck	N/A	N/A	N/A	N/A	23,520 tpy	0 tpy
N/A	Aboveground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	0 tpy
N/A	Underground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	0 tpy
						Insignificant Emission Units Total Assessable Potential to Emit - NO_X	**0 tpy**
						Total Assessable Potential to Emit - NO_X	**1,497.9 tpy**

Notes:

[1] The Tier 4i, Tier 3, and Tier 2 weighted-cycle emission rates for NO_X have been multiplied by 1.25 to determine the Not-to-Exceed emission factors per 40 CFR 1039.101(e) and ADEC policy (see also 40 CFR 60.4212(c).)

[2] Emission factors for EUs 8, 14, 29a, and 31a have been corrected in this Title V renewal application amendment.

Conversion factors:

Weight	453.6 g/lb
Weight	2,000 lb/ton
Engine horsepower	1.341 hp/kw

Table D-1.6. Assessable Potential to Emit Calculations - Carbon Monoxide (CO) Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added for the January 2021 Amendment.

Emission Unit ID	Emission Unit Name	Fuel Type	Factor Reference	CO Emission Factor	Emission Unit Rating/Capacity	Allowable Annual Operation	Potential CO Emissions
Significant Emission Units							
1	Coal-Fired Boiler 3	Coal	AP-42, Table 1.1-3	5 lb/ton	230 MMBtu/hr	336,000 tpy	840.0 tpy
2	Coal-Fired Boiler 4	Coal	AP-42, Table 1.1-3	5 lb/ton	230 MMBtu/hr		
3	Coal-Fired Boiler 5	Coal	AP-42, Table 1.1-3	5 lb/ton	230 MMBtu/hr		
4	Coal-Fired Boiler 6	Coal	AP-42, Table 1.1-3	5 lb/ton	230 MMBtu/hr		
5	Coal-Fired Boiler 7	Coal	AP-42, Table 1.1-3	5 lb/ton	230 MMBtu/hr		
6	Coal-Fired Boiler 8	Coal	AP-42, Table 1.1-3	5 lb/ton	230 MMBtu/hr		
7a	South Coal Handling Dust Collector (DC-01)	N/A	N/A	N/A	13,150 acfm	2,195 hr/yr	0 tpy
7b	South Underbunker Dust Collector (DC-02)	N/A	N/A	N/A	884 acfm	100 hr/yr	0 tpy
7c	North Coal Handling Dust Collector (NDC-1)	N/A	N/A	N/A	9,250 acfm	45 hr/yr	0 tpy
8	Backup Generator Engine	Distillate	EPA Tier 2	4.375 g/kW-hr[1, 2]	2,937 hp	500 hr/yr	5.28 tpy
9	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	6.68E-03 lb/hp-hr	353 hp	500 hr/yr	0.59 tpy
14	Emergency Generator Engine	Distillate	EPA Tier 3	4.375 g/kW-hr[1, 2]	320 hp	500 hr/yr	0.58 tpy
22	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	6.68E-03 lb/hp-hr	35 hp	500 hr/yr	5.9E-02 tpy
23	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	6.68E-03 lb/hp-hr	155 hp	500 hr/yr	0.26 tpy
29a	Emergency Generator Engine	Distillate	EPA Tier 4i	6.25 g/kW-hr[1]	74 hp	500 hr/yr	0.19 tpy
30a	Emergency Generator Engine	Distillate	EPA Tier 3	6.25 g/kW-hr[1]	91 hp	500 hr/yr	0.23 tpy
31a	Emergency Generator Engine	Distillate	EPA Tier 4i	6.25 g/kW-hr[1]	74 hp	500 hr/yr	0.19 tpy
32a	Emergency Generator Engine	Distillate	EPA Tier 3	6.25 g/kW-hr[1]	91 hp	500 hr/yr	0.23 tpy
33a	Emergency Generator Engine	Distillate	EPA Tier 3	6.25 g/kW-hr[1]	75 hp	500 hr/yr	0.19 tpy
34	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	6.68E-03 lb/hp-hr	220 hp	500 hr/yr	0.37 tpy
35	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	6.68E-03 lb/hp-hr	55 hp	500 hr/yr	9.2E-02 tpy
36	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	6.68E-03 lb/hp-hr	220 hp	500 hr/yr	0.37 tpy
37	Emergency Generator Engine	Distillate	EPA Tier 3	6.25 g/kW-hr[1]	75 hp	500 hr/yr	0.19 tpy
51a	Fly Ash Dust Collector (DC-1)	N/A	N/A	N/A	3,620 acfm	4,380 hr/yr	0 tpy
51b	Bottom Ash Dust Collector (DC-2)	N/A	N/A	N/A	3,620 acfm	4,380 hr/yr	0 tpy
52	Coal Storage Pile	N/A	N/A	N/A	N/A	84,676 tpy	0 tpy
				Significant Emission Units Total Assessable Potential to Emit - CO			**848.8 tpy**
Insignificant Emission Units							
N/A	Fly and Bottom Ash Bin Vent Filter	N/A	N/A	N/A	1,460 acfm	4,380 hr/yr	0 tpy
N/A	Ash Loadout to Truck	N/A	N/A	N/A	N/A	23,520 tpy	0 tpy
N/A	Aboveground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	0 tpy
N/A	Underground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	0 tpy
				Insignificant Emission Units Total Assessable Potential to Emit - CO			**0 tpy**
					Total Assessable Potential to Emit - CO		**848.8 tpy**

Notes:

[1] The Tier 3 and Tier 2 weighted-cycle emission rates for CO have been multiplied by 1.25 to determine the Not-to-Exceed emission factors per 40 CFR 1039.101(e) and ADEC policy (see also 40 CFR 60.4212(c).)

[2] Emission factors for EUs 8 and 14 have been corrected in this Title V renewal application amendment.

Conversion factors:

Weight	453.6	g/lb
Weight	2,000	lb/ton
Engine horsepower	1.341	hp/kw

Table D-1.7. Assessable Potential to Emit Calculations - Particulate Matter Less Than 10 Microns (PM_{10}) Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added for the January 2021 Amendment.

Emission Unit ID	Emission Unit Name	Fuel Type	Factor Reference	PM_{10} Emission Factor	Emission Unit Rating/Capacity	Allowable Annual Operation	Potential PM_{10} Emissions
Significant Emission Units							
1	Coal-Fired Boiler 3	Coal	AP-42, Tables 1.1-5 and 1.1-6	0.782 lb/ton	230 MMBtu/hr	336,000 tpy	131.4 tpy
2	Coal-Fired Boiler 4	Coal	AP-42, Tables 1.1-5 and 1.1-6	0.782 lb/ton	230 MMBtu/hr		
3	Coal-Fired Boiler 5	Coal	AP-42, Tables 1.1-5 and 1.1-6	0.782 lb/ton	230 MMBtu/hr		
4	Coal-Fired Boiler 6	Coal	AP-42, Tables 1.1-5 and 1.1-6	0.782 lb/ton	230 MMBtu/hr		
5	Coal-Fired Boiler 7	Coal	AP-42, Tables 1.1-5 and 1.1-6	0.782 lb/ton	230 MMBtu/hr		
6	Coal-Fired Boiler 8	Coal	AP-42, Tables 1.1-5 and 1.1-6	0.782 lb/ton	230 MMBtu/hr		
7a	South Coal Handling Dust Collector (DC-01)	N/A	See detailed calculations in Table D-1.7a		13,150 acfm	2,195 hr/yr	0.30 tpy
7b	South Underbunker Dust Collector (DC-02)	N/A	See detailed calculations in Table D-1.7a		884 acfm	100 hr/yr	7.3E-03 tpy
7c	North Coal Handling Dust Collector (NDC-1)	N/A	See detailed calculations in Table D-1.7a		9,250 acfm	45 hr/yr	3.4E-02 tpy
8	Backup Generator Engine	Distillate	EPA Tier 2	0.25 g/kW-hr[1, 2]	2,937 hp	500 hr/yr	0.30 tpy
9	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	353 hp	500 hr/yr	0.19 tpy
14	Emergency Generator Engine	Distillate	EPA Tier 3	0.25 g/kW-hr[1, 2]	320 hp	500 hr/yr	3.3E-02 tpy
22	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	35 hp	500 hr/yr	1.9E-02 tpy
23	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	155 hp	500 hr/yr	8.5E-02 tpy
29a	Emergency Generator Engine	Distillate	EPA Tier 4i	0.375 g/kW-hr[1, 2]	74 hp	500 hr/yr	1.1E-02 tpy
30a	Emergency Generator Engine	Distillate	EPA Tier 3	0.5 g/kW-hr[1, 2]	91 hp	500 hr/yr	1.9E-02 tpy
31a	Emergency Generator Engine	Distillate	EPA Tier 4i	0.375 g/kW-hr[1, 2]	74 hp	500 hr/yr	1.1E-02 tpy
32a	Emergency Generator Engine	Distillate	EPA Tier 3	0.5 g/kW-hr[1, 2]	91 hp	500 hr/yr	1.9E-02 tpy
33a	Emergency Generator Engine	Distillate	EPA Tier 3	0.5 g/kW-hr[1, 2]	75 hp	500 hr/yr	1.5E-02 tpy
34	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	220 hp	500 hr/yr	0.12 tpy
35	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	55 hp	500 hr/yr	3.0E-02 tpy
36	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	220 hp	500 hr/yr	0.12 tpy
37	Emergency Generator Engine	Distillate	EPA Tier 3	0.5 g/kW-hr[1, 2]	75 hp	500 hr/yr	1.5E-02 tpy
51a	Fly Ash Dust Collector (DC-1)	N/A	See detailed calculations in Table D-1.7b		3,620 acfm	4,380 hr/yr	1.18 tpy
51b	Bottom Ash Dust Collector (DC-2)	N/A	See detailed calculations in Table D-1.7b		3,620 acfm	4,380 hr/yr	1.18 tpy
52	Coal Storage Pile	N/A	See detailed calculations in Table D-1.7c		N/A	84,676 tpy	1.42 tpy
						Significant Emission Units Total Assessable Potential to Emit - PM_{10}	**136.5 tpy**
Insignificant Emission Units							
N/A	Fly and Bottom Ash Bin Vent Filter	N/A	See detailed calculations in Table D-1.7b		1,460 acfm	4,380 hr/yr	0.47 tpy
N/A	Ash Loadout to Truck	N/A	See detailed calculations in Table D-1.7b		N/A	23,520 tpy	2.6E-04 tpy
N/A	Aboveground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	0 tpy
N/A	Underground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	0 tpy
						Insignificant Emission Units Total Assessable Potential to Emit - PM_{10}	**0.5 tpy**
						Total Assessable Potential to Emit - PM_{10}	**137.0 tpy**

Notes:

[1] The Tier 4i, Tier 3, and Tier 2 weighted-cycle emission rates for PM have been multiplied by 1.25 to determine the Not-to-Exceed emission factors per 40 CFR 1039.101(e) and ADEC policy (see also 40 CFR 60.4212(c).)

[2] Emission factors for EUs 8, 14, 29a, 30a, 31a, 32a, 33a, and 37 have been corrected in this Title V renewal application amendment.

Conversion factors:

Weight	453.6	g/lb
Weight	2,000	lb/ton
Engine horsepower	1.341	hp/kw

Table D-1.7a. Assessable Potential to Emit Calculations - Coal Handling Systems $PM/PM_{10}/PM_{2.5}$ Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added for the January 2021 Amendment.

Emission Unit			Factor Reference	PM Emission Factor	Emission Unit Rating/Capacity	Annual Operation[a]	Potential $PM/PM_{10}/PM_{2.5}$ Emissions[b]
Permit ID	Description	Year Installed					
7a	South Coal Handling Dust Collector (DC-01)	2001	Source Test, 2003	0.0025 gr/dscf	13,150 acfm	2,195 hr/yr	0.30 tpy
7b	South Underbunker Dust Collector (DC-02)	2005	Manufacturer's guarantee[c]	0.0200 gr/dscf	884 acfm	100 hr/yr	7.3E-03 tpy
7c	North Coal Handling Dust Collector (NDC-1)	2004	Typical value	0.0200 gr/dscf	9,250 acfm	45 hr/yr	3.4E-02 tpy
						Total $PM/PM_{10}/PM_{2.5}$ Emissions	**0.34 tpy**

Notes:

[a] Annual operating hours:

Maximum allowable coal consumption	336,000	tpy
Conveyor operation rate	150	tph
Annual operating hours for coal handling	2,240	hrs/yr
Average daily coal handling operations	6.14	hr/day, 365 operating days per year
Percent of time South coal handling dust collector is in use	98	percent, primary coal handling system
Percent of time North coal handling dust collector is in use	2	percent, North handling system is emergency backup to South handling system
Underbunker dust collector operating hours	100	hrs/yr, used only when emptying coal bunker for unscheduled boiler shutdown or bunker fire

[b] Coal handling dust collection emission calculations:

(exhaust rate, acfm) x (Temp at STP/Temp of exhaust) x (PM_{10} exhaust concentration, gr/dscf) x (1 lb/ 7,000 gr) x (1 ton/ 2,000 lb) x (60 min/hr) x (operation, hr/yr)

Temperature at standard conditions =	68	degrees Fahrenheit	293.15 degrees Kelvin
Exhaust temperature dust collectors =	85	degrees Fahrenheit	302.59 degrees Kelvin

[c] Manufacturer's guarantee for particle sizes 2 microns in diameter and larger

Table D-1.7b. Assessable Potential to Emit Calculations - Ash Handling System PM_{10} Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added for the January 2021 Amendment.

Emission Unit							
Permit ID	Description	Year Installed	Factor Reference	PM_{10} Emission Factor	Emission Unit Rating/Capacity	Annual Operation	Potential PM_{10} Emissions[b]
51a	Fly Ash Dust Collector (DC-1)	1993	Typical Value	0.02 gr/dscf	3,620 acfm	4,380 hr/yr[d]	1.18 tpy[a]
51b	Bottom Ash Dust Collector (DC-2)	1994	Typical Value	0.02 gr/dscf	3,620 acfm	4,380 hr/yr[d]	1.18 tpy[a]
N/A	Fly and Bottom Ash Bin Vent Filter	1993	Manufacturer's guarantee[c]	0.02 gr/scf	1,460 acfm	4,380 hr/yr[e]	0.47 tpy[a]
N/A	Ash Loadout to Truck	Unknown	AP-42, Section 13.2.4	2.19E-05 lb/ton	N/A	23,520 tpy	2.6E-04 tpy[b]
						Total PM_{10} Emissions	**2.83 tpy**

Notes:

[a] Fly and bottom ash dust collector emission calculations:

(exhaust rate, acfm) x (Temp at STP/Temp of exhaust) x (PM_{10} exhaust concentration, gr/dscf) x (1 lb/ 7,000 gr) x (1 ton/ 2,000 lb) x (60 min/hr) x (operation, hr/yr)

Temperature at standard conditions =	68	degrees Fahrenheit	293.15 degrees Kelvin
Exhaust temperature of ash bin vent filter =	150	degrees Fahrenheit	338.71 degrees Kelvin
Exhaust temperature of fan duct blower/bag filter =	150	degrees Fahrenheit	

[b] Ash loadout emission calculations:

Emission factor from AP-42, Section 13.2.4 based on empirical equation $E = k \times 0.0032 \times (U/5)^{1.3}/(M/2)^{1.4}$ lb/ton transferred where:

k = 0.35 for PM_{10}

U = mean wind speed = 4.0 mph in Fairbanks, per National Climactic Data Center (https://www.ncdc.noaa.gov/cdo-web/search)

M = ash moisture content = 27 percent (AP-42, Table 13.2.4-1)

Ash loadout emissions based on maximum coal consumption limit of	336,000	tpy
Ash content of coal per Usibelli Coal Mine website	7	percent by weight
Operations, ash tons/yr = coal consumption x (0.085 ash content)	23,520	tpy

Ash loadout emissions, tons/yr = (emission factor, lb/ton) x (ash loading, ton/yr) / (2,000 lb/ton)

[c] Manufacturer's guarantee for particle sizes over 5 microns in diameter

[d] Average run time for DC-1 and DC-2 is 12 hours/day per reasonable inquiry of plant operations

[e] Operation of ash bin vent filter assumed to be the same as the dust collectors

Table D-1.7c. Assessable Potential to Emit Calculations - Emergency Coal Storage Pile PM_{10} Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Emission Unit					
Permit ID	**Description**	**Factor Reference**	**PM_{10} Emission Factor**	**Annual Operation[b]**	**Potential PM_{10} Emissions**
	Coal chute to coal pile	AP-42, Section 13.2.4	2.46E-04 lb/ton[a]	45,845 tpy	5.64E-03 tpy
	Front end loader drop onto stockpile	AP-42, Section 13.2.4	2.46E-04 lb/ton[a]	45,845 tpy	5.64E-03 tpy
	Front end loader movement - chute to coal pile	AP-42, Section 13.2.2	2.92 lb/VMT[c]	386 VMT	0.56 tpy
	Front end loader movement - coal pile to South grizzly	AP-42, Section 13.2.2	2.92 lb/VMT[c]	534 VMT	0.78 tpy
	Front end loader movement - coal pile to North grizzly	AP-42, Section 13.2.2	2.92 lb/VMT[c]	44 VMT	0.06 tpy
	Stockpile wind erosion	AP-42, Section 13.2.5	0.00 g/m^2-yr[d]	3,370 m^2	0.00 tpy
	Front end loader drop into grizzly	AP-42, Section 13.2.4	2.46E-04 lb/ton[a]	38,831 tpy	4.78E-03 tpy
52	Coal Storage Pile			**Total PM_{10} Emissions**	**1.42 tpy**

Notes:

[a]Coal transfer emission factor from AP-42, Section 13.2.4 based on empirical equation E = k x 0.0032 x $(U/5)^{1.3}/(M/2)^{1.4}$ lb/ton transferred where:

k	0.35	for PM_{10}	
U = mean wind speed	4.0	miles/hr	Average value from September 2017 to October 2018 per NOAA NCDC.
M = coal moisture content	4.8	percent	

[b]Annual stockpile throughput:

	Coal moved to coal pile	Coal moved from coal pile	
FY 2014	21,996 tpy	11,786 tpy	
FY 2015	26,888 tpy	38,831 tpy	
FY 2016	45,845 tpy	25,773 tpy	
FY 2017	41,172 tpy	24,529 tpy	
Maximum Annual Throughput	45,845 tpy	38,831 tpy	Use maximum recorded annual throughputs to determine potentials

[c]Front end loader movement emission factor from AP-42, Section 13.2.2, Empirical Equation 1a, E = k x $(s/12)^a$ x $(W/3)^b$ lb/VMT where:

k	1.5	for PM_{10}
s = surface material silt content (haul road)	8.4	percent, from AP-42, Table 13.2.2-1
W = mean vehicle weight	27	tons, estimate
Size of load bucket	5	yd^3
Density of coal	50	lb/ft^3
Coal moved per trip	3.375	tons (Density of coal x 27 ft3/yd3 x bucket size / 2000 lb/ton)
a (empirical constant)	0.9	from AP-42, Table 13.2.2-2
b (empirical constant)	0.45	from AP-42, Table 13.2.2-2
Approximate distance from coal chute to coal pile (round trip)	150	feet
Approximate distance from coal pile to South grizzly (round trip)	250	feet
Approximate distance from coal pile to North grizzly (round trip)	1,000	feet
Percent of annual coal transferred to South grizzly	98	percent, primary coal handling system
Percent of annual coal transferred to North grizzly	2	percent, North handling system is emergency backup to South handling system
VMT = vehicles miles traveled per year		VMT = annual stockpile throughput/coal moved per trip x distanced traveled per round trip in feet / 5,280 ft/mi

[d]From AP-42, Section 13.2.5, Industrial Wind Erosion

Coal Pile at FWA CHPP (*source: Ft WW Coal Pile 2018 Volume Summary, October 2, 2018, 3-TIER Alaska LLC.*)

Average Height =	40	ft	
Width at Base =	205	ft	The minimum width (south face) of the coal pile is used as a conservative approach
Height-to-Base Ratio =	0.195		< 0.2. FWA CHPP coal pile can therefore be considered a large relatively flat pile with little penetration into the surface wind layer and a single friction velocity (using Equation (1)) can be used to for the entire surface of the coal pile. Friction velocity is a measure of wind shear stress on the erodible surface.
Surface Area of Active (North) Face =	3,370	m^2	Calculated from survey using Computer Aided Design (CAD) software in 2012. Height and width of the pile were comparable in 2018 and 2012.

AP-42 Section 13.2.5, Equation (2)

Emission factor for wind-generated particulate emissions from mixtures of erodible and nonerodible surface material subject to disturbance, EF

$$EF\ (g/m^2\text{-}yr) = k \sum_{i=1}^{N} P_i$$

where

k = particle size multiplier (0.5 for particle size < 10 microns, per table on page 13.2.5-3)
N = number of disturbances per year
P_i = erosion potential corresponding to the fastest mile of wind for the ith period between disturbances, g/m^2

AP-42 Section 13.2.5, Equation (3)

Erosion potential function for a dry exposed surface, P

$$P = 58\ (u^* - u_t^*)^2 + 25\ (u^* - u_t^*)$$
$$P = 0 \text{ for } u^* \leq u_t^*$$

where

u^* = friction velocity (m/s)
u_t = threshold friction velocity (m/s)

AP-42 Section 13.2.5, Equation (1)

Friction velocity, u^*

$$u^* = 0.4 \times u(z) / \ln(z/z_o) \qquad \text{when } z > z_o$$

where

u^* = friction velocity (cm/s)
u(z) = wind speed at height z above test surface (cm/s)
z = height above test surface (cm)
z_o = roughness height, cm

Data:

u(z)		Use maximum wind gust speed recorded at Fairbanks International Airport for each of the previous 12 months (see table below)
z	10	meters
N	204	disturbances/year for active face, as determined from 2017 records
	17	average disturbances/month

				Uncrusted coal pile[2] (Table 13.2.5-2)				Scraper tracks on coal pile (Table 13.2.5-2)						
Month-Year	Maximum Wind Speed (u(10))[1]		Wind Direction	Roughness Height (z_o)	Threshold Friction Velocity (u_t)	Calculated Friction Velocity (u*)	Erosion potential function, P	Roughness Height (z_o)	Threshold Friction Velocity (u_t)	Calculated Friction Velocity (u*)	Erosion potential function, P	P x N	k	Emission Factor, EF
	mph	m/s	deg	cm	m/s	m/s		cm	m/s	m/s				g/m^2-yr
Oct-17	17	7.6	060	0.3	1.12	0.37	0	0.06	0.62	0.31	0	0		
Nov-17	20	8.9	270	0.3	1.12	0.44	0	0.06	0.62	0.37	0	0		
Dec-17	15	6.7	070	0.3	1.12	0.33	0	0.06	0.62	0.28	0	0		
Jan-18	17	7.6	200	0.3	1.12	0.37	0	0.06	0.62	0.31	0	0		
Feb-18	29	13.0	270	0.3	1.12	0.64	0	0.06	0.62	0.53	0	0		
Mar-18	25	11.2	270	0.3	1.12	0.55	0	0.06	0.62	0.46	0	0		
Apr-18	26	11.6	040	0.3	1.12	0.57	0	0.06	0.62	0.48	0	0		
May-18	25	11.2	300	0.3	1.12	0.55	0	0.06	0.62	0.46	0	0		
Jun-18	25	11.2	090	0.3	1.12	0.55	0	0.06	0.62	0.46	0	0		
Jul-18	22	9.8	300	0.3	1.12	0.48	0	0.06	0.62	0.40	0	0		
Aug-18	26	11.6	250	0.3	1.12	0.57	0	0.06	0.62	0.48	0	0		
Sep-18	22	9.8	260	0.3	1.12	0.48	0	0.06	0.62	0.40	0	0		
Annual Total							0				0.00	0.00	0.5	**0.00**

[1] Maximum wind speed data is from NOAA NCDC. Tower height of 10 meters confirmed by Fairbanks Weather Forecast Office, National Weather Service on 27-March-2013

[2] The erosion potential factor for the uncrusted coal pile is zero for all months. Therefore, wind erosion of the uncrusted coal pile is not a significant source of PM emissions

Table D-1.8. Assessable Potential to Emit Calculations - Particulate Matter Less Than 2.5 Microns ($PM_{2.5}$) Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added for the January 2021 Amendment.

Emission Unit ID	Emission Unit Name	Fuel Type	Factor Reference	$PM_{2.5}$ Emission Factor	Emission Unit Rating/Capacity	Allowable Annual Operation	Potential $PM_{2.5}$ Emissions
Significant Emission Units							
1	Coal-Fired Boiler 3	Coal	AP-42, Tables 1.1-5 and 1.1-6	0.697 lb/ton	230 MMBtu/hr	336,000 tpy	117.1 tpy
2	Coal-Fired Boiler 4	Coal	AP-42, Tables 1.1-5 and 1.1-6	0.697 lb/ton	230 MMBtu/hr		
3	Coal-Fired Boiler 5	Coal	AP-42, Tables 1.1-5 and 1.1-6	0.697 lb/ton	230 MMBtu/hr		
4	Coal-Fired Boiler 6	Coal	AP-42, Tables 1.1-5 and 1.1-6	0.697 lb/ton	230 MMBtu/hr		
5	Coal-Fired Boiler 7	Coal	AP-42, Tables 1.1-5 and 1.1-6	0.697 lb/ton	230 MMBtu/hr		
6	Coal-Fired Boiler 8	Coal	AP-42, Tables 1.1-5 and 1.1-6	0.697 lb/ton	230 MMBtu/hr		
7a	South Coal Handling Dust Collector (DC-01)	N/A	See detailed calculations in Table D-1.7a		13,150 acfm	2,195 hr/yr	0.30 tpy
7b	South Underbunker Dust Collector (DC-02)	N/A	See detailed calculations in Table D-1.7a		884 acfm	100 hr/yr	7.3E-03 tpy
7c	North Coal Handling Dust Collector (NDC-1)	N/A	See detailed calculations in Table D-1.7a		9,250 acfm	45 hr/yr	3.4E-02 tpy
8	Backup Generator Engine	Distillate	EPA Tier 2	0.25 g/kW-hr[1, 2]	2,937 hp	500 hr/yr	0.30 tpy
9	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	353 hp	500 hr/yr	0.19 tpy
14	Emergency Generator Engine	Distillate	EPA Tier 3	0.25 g/kW-hr[2, 3]	320 hp	500 hr/yr	3.3E-02 tpy
22	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	35 hp	500 hr/yr	1.9E-02 tpy
23	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	155 hp	500 hr/yr	8.5E-02 tpy
29a	Emergency Generator Engine	Distillate	EPA Tier 4i	0.375 g/kW-hr[2, 3]	74 hp	500 hr/yr	1.1E-02 tpy
30a	Emergency Generator Engine	Distillate	EPA Tier 3	0.5 g/kW-hr[2]	91 hp	500 hr/yr	1.9E-02 tpy
31a	Emergency Generator Engine	Distillate	EPA Tier 4i	0.375 g/kW-hr[2, 3]	74 hp	500 hr/yr	1.1E-02 tpy
32a	Emergency Generator Engine	Distillate	EPA Tier 3	0.5 g/kW-hr[2]	91 hp	500 hr/yr	1.9E-02 tpy
33a	Emergency Generator Engine	Distillate	EPA Tier 3	0.5 g/kW-hr[2]	75 hp	500 hr/yr	1.5E-02 tpy
34	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	220 hp	500 hr/yr	0.12 tpy
35	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	55 hp	500 hr/yr	3.0E-02 tpy
36	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	220 hp	500 hr/yr	0.12 tpy
37	Emergency Generator Engine	Distillate	EPA Tier 3	0.5 g/kW-hr[2]	75 hp	500 hr/yr	1.5E-02 tpy
51a	Fly Ash Dust Collector (DC-1)	N/A	See detailed calculations in Table D-1.8a		3,620 acfm	4,380 hr/yr	1.18 tpy
51b	Bottom Ash Dust Collector (DC-2)	N/A	See detailed calculations in Table D-1.8a		3,620 acfm	4,380 hr/yr	1.18 tpy
52	Coal Storage Pile	N/A	See detailed calculations in Table D-1.8b		N/A	84,676 tpy	0.14 tpy
Significant Emission Units Total Assessable Potential to Emit - $PM_{2.5}$							**120.9 tpy**
Insignificant Emission Units							
N/A	Fly and Bottom Ash Bin Vent Filter	N/A	See detailed calculations in Table D-1.8a		1,460 acfm	4,380 hr/yr	0.47 tpy
N/A	Ash Loadout to Truck	N/A	See detailed calculations in Table D-1.8a		N/A	23,520 tpy	3.9E-05 tpy
N/A	Aboveground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	0 tpy
N/A	Underground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	0 tpy
Insignificant Emission Units Total Assessable Potential to Emit - $PM_{2.5}$							**0.47 tpy**
Total Assessable Potential to Emit - $PM_{2.5}$							**121.4 tpy[1]**

Notes:

[1] $PM_{2.5}$ potential to emit calculations for all emission units other than 1 through 6, 51a, 51b, and 62 conservatively assume that $PM_{2.5}$ emissions are equal to PM_{10} emissions.

[2] The Tier 4i, Tier 3, and Tier 2 weighted-cycle emission rates for PM have been multiplied by 1.25 to determine the Not-to-Exceed emission factors per 40 CFR 1039.101(e) and ADEC policy (see also 40 CFR 60.4212(c).)

[3] Emission factors for EUs 8, 14, 29a, 31a, 51a, 51b, and 52 have been corrected in this Title V renewal application amendment.

Conversion factors:

Weight	453.6	g/lb
Weight	2,000	lb/ton
Engine horsepower	1.341	hp/kw

Table D-1.8a. Assessable Potential to Emit Calculations - Ash Handling System $PM_{2.5}$ Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added (to Table 1.7b) for the January 2021 Amendment.

Emission Unit			Factor Reference	$PM_{2.5}$ Emission Factor	Emission Unit Rating/Capacity	Annual Operation	Potential $PM_{2.5}$ Emissions[b]
Permit ID	Description	Year Installed					
51a	Fly Ash Dust Collector (DC-1)	1993	Typical Value	0.02 gr/dscf	3,620 acfm	4,380 hr/yr[d]	1.18 tpy[a]
51b	Bottom Ash Dust Collector (DC-2)	1994	Typical Value	0.02 gr/dscf	3,620 acfm	4,380 hr/yr[d]	1.18 tpy[a]
N/A	Fly and Bottom Ash Bin Vent Filter	1993	Manufacturer's guarantee[c]	0.02 gr/scf	1,460 acfm	4,380 hr/yr[e]	0.47 tpy[a]
N/A	Ash Loadout to Truck	Unknown	AP-42, Section 13.2.4	3.32E-06 lb/ton	N/A	23,520 tpy	3.9E-05 tpy[b]
						Total $PM_{2.5}$ Emissions	**2.83 tpy**

Notes:

[a] Fly and bottom ash dust collector emission calculations:

(exhaust rate, acfm) x (Temp at STP/Temp of exhaust) x (PM_{10} exhaust concentration, gr/dscf) x (1 lb/ 7,000 gr) x (1 ton/ 2,000 lb) x (60 min/hr) x (operation, hr/yr)

Temperature at standard conditions =	68	degrees Fahrenheit	293.15 degrees Kelvin
Exhaust temperature of ash bin vent filter =	150	degrees Fahrenheit	338.71 degrees Kelvin
Exhaust temperature of fan duct blower/bag filter =	150	degrees Fahrenheit	

[b] Ash loadout emission calculations:

Emission factor from AP-42, Section 13.2.4 based on empirical equation $E = k \times 0.0032 \times (U/5)^{1.3}/(M/2)^{1.4}$ lb/ton transferred where:

k = 0.053 for $PM_{2.5}$

U = mean wind speed = 4.0 mph in Fairbanks, per National Climactic Data Center (https://www.ncdc.noaa.gov/cdo-web/search)

M = ash moisture content = 27 percent (AP-42, Table 13.2.4-1)

Ash loadout emissions based on maximum coal consumption limit of	336,000	tpy
Ash content of coal per Usibelli Coal Mine website	7	percent by weight
Operations, ash tons/yr = coal consumption x (0.085 ash content)	23,520	tpy

Ash loadout emissions, tons/yr = (emission factor, lb/ton) x (ash loading, ton/yr) / (2,000 lb/ton)

[c] Manufacturer's guarantee for particle sizes over 5 microns in diameter

[d] Average run time for DC-1 and DC-2 is 12 hours/day per reasonable inquiry of plant operations

[e] Operation of ash bin vent filter assumed to be the same as the dust collectors

Table D-1.8b. Assessable Potential to Emit Calculations - Emergency Coal Storage Pile $PM_{2.5}$ Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added (to Table 1.7c) for the January 2021 Amendment.

Emission Unit		Factor Reference	$PM_{2.5}$ Emission Factor	Annual Operation[b]	Potential $PM_{2.5}$ Emissions
Permit ID	Description				
	Coal chute to coal pile	AP-42, Section 13.2.4	3.73E-05 lb/ton[a]	45,845 tpy	8.5E-04 tpy
	Front end loader drop onto stockpile	AP-42, Section 13.2.4	3.73E-05 lb/ton[a]	45,845 tpy	8.5E-04 tpy
	Front end loader movement - chute to coal pile	AP-42, Section 13.2.2	0.29 lb/VMT[c]	386 VMT	5.6E-02 tpy
	Front end loader movement - coal pile to South grizzly	AP-42, Section 13.2.2	0.29 lb/VMT[c]	534 VMT	7.8E-02 tpy
	Front end loader movement - coal pile to North grizzly	AP-42, Section 13.2.2	0.29 lb/VMT[c]	44 VMT	6.4E-03 tpy
	Stockpile wind erosion	AP-42, Section 13.2.5	0.00 g/m^2-yr[d]	3,370 m^2	0.00 tpy
	Front end loader drop into grizzly	AP-42, Section 13.2.4	3.73E-05 lb/ton[a]	38,831 tpy	7.2E-04 tpy
52	Coal Storage Pile			**Total $PM_{2.5}$ Emissions**	**0.14 tpy**

Notes:

[a]Coal transfer emission factor from AP-42, Section 13.2.4 based on empirical equation $E = k \times 0.0032 \times (U/5)^{1.3}/(M/2)^{1.4}$ lb/ton transferred where:

k	0.053	for $PM_{2.5}$	
U = mean wind speed	4.0	miles/hr	Average value from September 2017 to October 2018 per NOAA NCDC.
M = coal moisture content	4.8	percent	

[b]Annual stockpile throughput:

	Coal moved to coal pile	Coal moved from coal pile	
FY 2014	21,996 tpy	11,786 tpy	
FY 2015	26,888 tpy	38,831 tpy	
FY 2016	45,845 tpy	25,773 tpy	
FY 2017	41,172 tpy	24,529 tpy	
Maximum Annual Throughput	45,845 tpy	38,831 tpy	Use maximum recorded annual throughputs to determine potentials

[c]Front end loader movement emission factor from AP-42, Section 13.2.2, Empirical Equation 1a, $E = k \times (s/12)^a \times (W/3)^b$ lb/VMT where:

k	0.15	for $PM_{2.5}$
s = surface material silt content (haul road)	8.4	percent, from AP-42, Table 13.2.2-1
W = mean vehicle weight	27	tons, estimate
Size of load bucket	5	yd^3
Density of coal	50	lb/ft^3
Coal moved per trip	3.375	tons (Density of coal x 27 ft3/yd3 x bucket size / 2000 lb/ton)
a (empirical constant)	0.9	from AP-42, Table 13.2.2-2 for $PM_{2.5}$
b (empirical constant)	0.45	from AP-42, Table 13.2.2-2
Approximate distance from coal chute to coal pile (round trip)	150	feet
Approximate distance from coal pile to South grizzly (round trip)	250	feet
Approximate distance from coal pile to North grizzly (round trip)	1,000	feet
Percent of annual coal transferred to South grizzly	98	percent, primary coal handling system
Percent of annual coal transferred to North grizzly	2	percent, North handling system is emergency backup to South handling system
VMT = vehicles miles traveled per year		VMT = annual stockpile throughput/coal moved per trip x distanced traveled per round trip in feet / 5,280 ft/mi

[d]From AP-42, Section 13.2.5, Industrial Wind Erosion

Coal Pile at FWA CHPP (*source: Ft WW Coal Pile 2018 Volume Summary, October 2, 2018, 3-TIER Alaska LLC.*)

Average Height =	40	ft	
Width at Base =	205	ft	The minimum width (south face) of the coal pile is used as a conservative approach
Height-to-Base Ratio =	0.195		< 0.2. FWA CHPP coal pile can therefore be considered a large relatively flat pile with little penetration into the surface wind layer and a single friction velocity (using Equation (1)) can be used to for the entire surface of the coal pile. Friction velocity is a measure of wind shear stress on the erodible surface.
Surface Area of Active (North) Face =	3,370	m^2	Calculated from survey using Computer Aided Design (CAD) software in 2012. Height and width of the pile were comparable in 2018 and 2012.

AP-42 Section 13.2.5, Equation (2)

Emission factor for wind-generated particulate emissions from mixtures of erodible and nonerodible surface material subject to disturbance, EF

$$EF\ (g/m^2\text{-}yr) = k \sum_{i=1}^{N} P_i$$

where

k = particle size multiplier (0.075 for particle size < 2.5 microns, per table on page 13.2.5-3)
N = number of disturbances per year
P_i = erosion potential corresponding to the fastest mile of wind for the ith period between disturbances, g/m^2

AP-42 Section 13.2.5, Equation (3)

Erosion potential function for a dry exposed surface, P

$$P = 58\ (u^* - u_t^*)^2 + 25\ (u^* - u_t^*)$$
$$P = 0 \text{ for } u^* \leq u_t^*$$

where

u^* = friction velocity (m/s)
u_t = threshold friction velocity (m/s)

AP-42 Section 13.2.5, Equation (1)

Friction velocity, u^*

$$u^* = 0.4 \times u(z) / \ln(z/z_o) \quad \text{when } z > z_o$$

where

u^* = friction velocity (cm/s)
u(z) = wind speed at height z above test surface (cm/s)
z = height above test surface (cm)
z_o = roughness height, cm

Data:

u(z)		Use maximum wind gust speed recorded at Fairbanks International Airport for each of the previous 12 months (see table below)
z	10	meters
N	204	disturbances/year for active face, as determined from 2017 records
	17	average disturbances/month

Month-Year	Maximum Wind Speed (u(10))[1]		Wind Direction	Uncrusted coal pile[2] (Table 13.2.5-2)				Scraper tracks on coal pile (Table 13.2.5-2)						
				Roughness Height (z_o)	Threshold Friction Velocity (u_t)	Calculated Friction Velocity (u*)	Erosion potential function, P	Roughness Height (z_o)	Threshold Friction Velocity (u_t)	Calculated Friction Velocity (u*)	Erosion potential function, P	P x N	k	Emission Factor, EF
	mph	m/s	deg	cm	m/s	m/s		cm	m/s	m/s				g/m^2-yr
Oct-17	17	7.6	060	0.3	1.12	0.37	0	0.06	0.62	0.31	0	0		
Nov-17	20	8.9	270	0.3	1.12	0.44	0	0.06	0.62	0.37	0	0		
Dec-17	15	6.7	070	0.3	1.12	0.33	0	0.06	0.62	0.28	0	0		
Jan-18	17	7.6	200	0.3	1.12	0.37	0	0.06	0.62	0.31	0	0		
Feb-18	29	13.0	270	0.3	1.12	0.64	0	0.06	0.62	0.53	0	0		
Mar-18	25	11.2	270	0.3	1.12	0.55	0	0.06	0.62	0.46	0	0		
Apr-18	26	11.6	040	0.3	1.12	0.57	0	0.06	0.62	0.48	0	0		
May-18	25	11.2	300	0.3	1.12	0.55	0	0.06	0.62	0.46	0	0		
Jun-18	25	11.2	090	0.3	1.12	0.55	0	0.06	0.62	0.46	0	0		
Jul-18	22	9.8	300	0.3	1.12	0.48	0	0.06	0.62	0.40	0	0		
Aug-18	26	11.6	250	0.3	1.12	0.57	0	0.06	0.62	0.48	0	0		
Sep-18	22	9.8	260	0.3	1.12	0.48	0	0.06	0.62	0.40	0	0		
Annual Total							0				0.00	0.00	0.75	**0.00**

[1] Maximum wind speed data is from NOAA NCDC. Tower height of 10 meters confirmed by Fairbanks Weather Forecast Office, National Weather Service on 27-March-2013

[2] The erosion potential factor for the uncrusted coal pile is zero for all months. Therefore, wind erosion of the uncrusted coal pile is not a significant source of PM emissions

Table D-1.9. Assessable Potential to Emit Calculations - Volatile Organic Compounds (VOC) Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Emission Unit ID	Emission Unit Name	Fuel Type	Factor Reference	VOC Emission Factor	Emission Unit Rating/Capacity	Allowable Annual Operation	Potential VOC Emissions
Significant Emission Units							
1	Coal-Fired Boiler 3	Coal	AP-42, Table 1.1-19	0.05 lb/ton	230 MMBtu/hr	336,000 tpy	8.4 tpy
2	Coal-Fired Boiler 4	Coal	AP-42, Table 1.1-19	0.05 lb/ton	230 MMBtu/hr		
3	Coal-Fired Boiler 5	Coal	AP-42, Table 1.1-19	0.05 lb/ton	230 MMBtu/hr		
4	Coal-Fired Boiler 6	Coal	AP-42, Table 1.1-19	0.05 lb/ton	230 MMBtu/hr		
5	Coal-Fired Boiler 7	Coal	AP-42, Table 1.1-19	0.05 lb/ton	230 MMBtu/hr		
6	Coal-Fired Boiler 8	Coal	AP-42, Table 1.1-19	0.05 lb/ton	230 MMBtu/hr		
7a	South Coal Handling Dust Collector (DC-01)	N/A	N/A	N/A	13,150 acfm	2,195 hr/yr	0 tpy
7b	South Underbunker Dust Collector (DC-02)	N/A	N/A	N/A	884 acfm	100 hr/yr	0 tpy
7c	North Coal Handling Dust Collector (NDC-1)	N/A	N/A	N/A	9,250 acfm	45 hr/yr	0 tpy
8	Backup Generator Engine	Distillate	Vendor	0.11 g/hp-hr	2,937 hp	500 hr/yr	0.18 tpy
9	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	353 hp	500 hr/yr	2.2E-01 tpy
14	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	320 hp	500 hr/yr	2.0E-01 tpy
22	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	35 hp	500 hr/yr	2.2E-02 tpy
23	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	155 hp	500 hr/yr	9.8E-02 tpy
29a	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	74 hp	500 hr/yr	4.7E-02 tpy
30a	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	91 hp	500 hr/yr	5.7E-02 tpy
31a	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	74 hp	500 hr/yr	4.7E-02 tpy
32a	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	91 hp	500 hr/yr	5.7E-02 tpy
33a	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	75 hp	500 hr/yr	4.7E-02 tpy
34	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	220 hp	500 hr/yr	1.4E-01 tpy
35	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	55 hp	500 hr/yr	3.5E-02 tpy
36	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	220 hp	500 hr/yr	1.4E-01 tpy
37	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	75 hp	500 hr/yr	4.7E-02 tpy
51a	Fly Ash Dust Collector (DC-1)	N/A	N/A	N/A	3,620 acfm	4,380 hr/yr	0 tpy
51b	Bottom Ash Dust Collector (DC-2)	N/A	N/A	N/A	3,620 acfm	4,380 hr/yr	0 tpy
52	Coal Storage Pile	N/A	N/A	N/A	N/A	84,676 tpy	0 tpy
					Significant Emission Units Total Assessable Potential to Emit - VOC		**9.7 tpy**
Insignificant Emission Units							
N/A	Fly and Bottom Ash Bin Vent Filter	N/A	N/A	N/A	1,460 acfm	4,380 hr/yr	0 tpy
N/A	Ash Loadout to Truck	N/A	N/A	N/A	N/A	23,520 tpy	0 tpy
N/A	Aboveground Storage Tanks	Diesel	N/A	N/A[1]	N/A	N/A	0 tpy
N/A	Underground Storage Tanks	Diesel	N/A	N/A[1]	N/A	N/A	0 tpy
					Insignificant Emission Units Total Assessable Potential to Emit - VOC		**0 tpy**
					Total Assessable Potential to Emit - VOC		**9.7 tpy**

[1] VOC emissions from storage tanks are negligible since the tanks are small, store only diesel, and have a low tank turnover rate.

Conversion factors:

Weight	2,000 lb/ton
Weight	453.6 grams per pound

Table D-1.10. Assessable Potential to Emit Calculations - Sulfur Dioxide (SO_2) Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Emission Unit ID	Emission Unit Name	Fuel Type	Fuel Sulfur Content	Factor Reference	SO_2 Emission Factor	Emission Unit Rating/Capacity	Allowable Annual Operation	Potential SO_2 Emissions
Significant Emission Units								
1	Coal-Fired Boiler 3	Coal	0.3 wt. pct.[a]	AP-42 Table 1.1-3	10.5 lb/ton-coal	230 MMBtu/hr	336,000 tpy	1,764 tpy
2	Coal-Fired Boiler 4	Coal	0.3 wt. pct.[a]	AP-42 Table 1.1-3	10.5 lb/ton-coal	230 MMBtu/hr		
3	Coal-Fired Boiler 5	Coal	0.3 wt. pct.[a]	AP-42 Table 1.1-3	10.5 lb/ton-coal	230 MMBtu/hr		
4	Coal-Fired Boiler 6	Coal	0.3 wt. pct.[a]	AP-42 Table 1.1-3	10.5 lb/ton-coal	230 MMBtu/hr		
5	Coal-Fired Boiler 7	Coal	0.3 wt. pct.[a]	AP-42 Table 1.1-3	10.5 lb/ton-coal	230 MMBtu/hr		
6	Coal-Fired Boiler 8	Coal	0.3 wt. pct.[a]	AP-42 Table 1.1-3	10.5 lb/ton-coal	230 MMBtu/hr		
7a	South Coal Handling Dust Collector (DC-01)	N/A	N/A	N/A	N/A	13,150 acfm	2,195 hr/yr	0 tpy
7b	South Underbunker Dust Collector (DC-02)	N/A	N/A	N/A	N/A	884 acfm	100 hr/yr	0 tpy
7c	North Coal Handling Dust Collector (NDC-1)	N/A	N/A	N/A	N/A	9,250 acfm	45 hr/yr	0 tpy
8	Backup Generator Engine	Distillate	0.0015 wt. pct.[b]	Mass balance	0.2 lb/1000 gal	2,937 hp	500 hr/yr	7.9E-03 tpy
9	Emergency Generator Engine	Distillate	0.50 wt. pct.	Mass balance	70.5 lb/1000 gal	353 hp	500 hr/yr	3.2E-01 tpy
14	Emergency Generator Engine	Distillate	0.0015 wt. pct.[b]	Mass balance	0.2 lb/1000 gal	320 hp	500 hr/yr	8.6E-04 tpy
22	Emergency Generator Engine	Distillate	0.50 wt. pct.	Mass balance	70.5 lb/1000 gal	35 hp	500 hr/yr	3.2E-02 tpy
23	Emergency Generator Engine	Distillate	0.50 wt. pct.	Mass balance	70.5 lb/1000 gal	155 hp	500 hr/yr	1.4E-01 tpy
29a	Emergency Generator Engine	Distillate	0.0015 wt. pct.[b]	Mass balance	0.2 lb/1000 gal	74 hp	500 hr/yr	2.0E-04 tpy
30a	Emergency Generator Engine	Distillate	0.0015 wt. pct.[b]	Mass balance	0.2 lb/1000 gal	91 hp	500 hr/yr	2.6E-04 tpy
31a	Emergency Generator Engine	Distillate	0.0015 wt. pct.[b]	Mass balance	0.2 lb/1000 gal	74 hp	500 hr/yr	2.0E-04 tpy
32a	Emergency Generator Engine	Distillate	0.0015 wt. pct.[b]	Mass balance	0.2 lb/1000 gal	91 hp	500 hr/yr	2.6E-04 tpy
33a	Emergency Generator Engine	Distillate	0.0015 wt. pct.[b]	Mass balance	0.2 lb/1000 gal	75 hp	500 hr/yr	2.3E-04 tpy
34	Emergency Pump Engine	Distillate	0.50 wt. pct.	Mass balance	70.5 lb/1000 gal	220 hp	500 hr/yr	2.0E-01 tpy
35	Emergency Pump Engine	Distillate	0.0015 wt. pct.[b]	Mass balance	0.2 lb/1000 gal	55 hp	500 hr/yr	1.5E-04 tpy
36	Emergency Pump Engine	Distillate	0.50 wt. pct.	Mass balance	70.5 lb/1000 gal	220 hp	500 hr/yr	2.0E-01 tpy
37	Emergency Generator Engine	Distillate	0.0015 wt. pct.[b]	Mass balance	0.2 lb/1000 gal	75 hp	500 hr/yr	2.3E-04 tpy
51a	Fly Ash Dust Collector (DC-1)	N/A	N/A	N/A	N/A	3,620 acfm	4,380 hr/yr	0 tpy
51b	Bottom Ash Dust Collector (DC-2)	N/A	N/A	N/A	N/A	3,620 acfm	4,380 hr/yr	0 tpy
52	Coal Storage Pile	N/A	N/A	N/A	N/A	N/A	84,676 tpy	0 tpy
Significant Emission Units Total Assessable Potential to Emit - SO_2								**1,764.9 tpy**
Insignificant Emission Units								
N/A	Fly and Bottom Ash Bin Vent Filter	N/A	N/A	N/A	N/A	1,460 acfm	4,380 hr/yr	0 tpy
N/A	Ash Loadout to Truck	N/A	N/A	N/A	N/A	N/A	23,520 tpy	0 tpy
N/A	Aboveground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	N/A	0 tpy
N/A	Underground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	N/A	0 tpy
Insignificant Emission Units Total Assessable Potential to Emit - SO_2								**0 tpy**
Total Assessable Potential to Emit - SO_2								**1,764.9 tpy**

Notes:

[a] Maximum sulfur content based on the historic average coal sulfur content from Usibelli Coal Mine.

[b] For engines subject to 40 CFR 60 Subpart IIII, fuel used must meet the requirements of 40 CFR 80.510(b).

Conversion factors:

Diesel Heating Value	137,000	Btu/gal	*From AP 42, Appendix A, Page A-5*
Density of Diesel	7.05	lb/gal	*From AP 42, Appendix A, Page A-7, density for Distillate Oil*
Engine Heat Rate	7,000	Btu/hp-hr	*Average brake-specific fuel consumption (BSFC) from AP 42, Table 3.3-1, footnote a*
EU IDs 30a and 32a Fuel Consumption Rate	5.0	gal/hr	*From vendor information.*
EU IDs 33a and 37 Fuel Consumption Rate	4.4	gal/hr	*From vendor information.*
Weight	2,000	lb/ton	

Table D-1.11. Summary of Estimated Potential Hazardous Air Pollutants (HAP) Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Hazardous Air Pollutant	HAP Emissions by Emission Unit Category (tons per year)[a,c]					Total HAP Emissions
	Coal-Fired Boilers	Diesel Engines <600 hp	Diesel Engines >600 hp	Coal Preparation and Ash Handling[b]	Insignificant Units[b]	
Acetaldehyde	9.58E-02	2.47E-03	1.30E-04	----	----	9.84E-02
Acetophenone	2.52E-03	----	----	----	----	2.52E-03
Acrolein	4.87E-02	2.98E-04	4.05E-05	----	----	4.91E-02
Benzene	2.18E-01	3.00E-03	3.99E-03	----	----	2.25E-01
Benzyl chloride	1.18E-01	----	----	----	----	1.18E-01
Biphenyl	2.86E-04	----	----	----	----	2.86E-04
Bis(2-ethylhexyl)phthalate (DEHP)	1.23E-02	----	----	----	----	1.23E-02
Bromoform	6.55E-03	----	----	----	----	6.55E-03
1,3 Butadiene	----	1.26E-04	----	----	----	1.26E-04
Carbon disulfide	2.18E-02	----	----	----	----	2.18E-02
2-Chloroacetophenone	1.18E-03	----	----	----	----	1.18E-03
Chlorobenzene	3.70E-03	----	----	----	----	3.70E-03
Chloroform	9.91E-03	----	----	----	----	9.91E-03
Cumene	8.90E-04	----	----	----	----	8.90E-04
Dibenzofurans	1.83E-07	----	----	----	----	1.83E-07
Dimethyl sulfate	8.06E-03	----	----	----	----	8.06E-03
2,4-Dinitrotoluene	4.70E-05	----	----	----	----	4.70E-05
Ethyl benzene	1.58E-02	----	----	----	----	1.58E-02
Ethyl chloride (Chloroethane)	7.06E-03	----	----	----	----	7.06E-03
Ethylene dibromide (Dibromoethane)	2.02E-04	----	----	----	----	2.02E-04
Ethylene dichloride (1,2-Dichloroethane)	6.72E-03	----	----	----	----	6.72E-03
Formaldehyde	4.03E-02	3.80E-03	4.06E-04	----	----	4.45E-02
Hexane	1.13E-02	----	----	----	----	1.13E-02
Hydrochloric acid	2.31E+00	----	----	----	----	2.31E+00
Hydrogen fluoride (Hydrofluoric acid)	2.52E+01	----	----	----	----	2.52E+01
Isophorone	9.74E-02	----	----	----	----	9.74E-02
Methyl bromide (Bromomethane)	2.69E-02	----	----	----	----	2.69E-02
Methyl chloride (chloromethane)	8.90E-02	----	----	----	----	8.90E-02
Methyl hydrazine	2.86E-02	----	----	----	----	2.86E-02
Methyl methacrylate	3.36E-03	----	----	----	----	3.36E-03
Methyl tert butyl ether	5.88E-03	----	----	----	----	5.88E-03
Methylene chloride (Dichloromethane)	4.87E-02	----	----	----	----	4.87E-02
Phenol	2.69E-03	----	----	----	----	2.69E-03
Polycyclic Organic Matter (POM)	3.20E-03	1.08E-03	1.09E-03	----	----	5.37E-03
Propionaldehyde	6.38E-02	----	----	----	----	6.38E-02
Styrene	4.20E-03	----	----	----	----	4.20E-03
Chlorinated dibenzo-p-dioxins (Total)	2.35E-09	----	----	----	----	2.35E-09
Tetrachloroethylene (Perchloroethylene)	7.22E-03	----	----	----	----	7.22E-03
Toluene	4.03E-02	1.32E-03	1.44E-03	----	----	4.31E-02
1,1,2-Trichloroethane	3.36E-03	----	----	----	----	3.36E-03
Vinyl acetate	1.28E-03	----	----	----	----	1.28E-03
Xylenes (isomers and mixture)	6.22E-03	9.17E-04	9.92E-04	----	----	8.13E-03
Antimony Compounds	3.02E-03	----	----	----	----	3.02E-03
Arsenic Compounds (inorganic including arsine)	6.89E-02	----	----	----	----	6.89E-02
Beryllium Compounds	3.53E-03	----	----	----	----	3.53E-03
Cadmium Compounds	8.57E-03	----	----	----	----	8.57E-03
Chromium Compounds	5.70E-02	----	----	----	----	5.70E-02
Cobalt Compounds	1.68E-02	----	----	----	----	1.68E-02
Cynaide Compounds	4.20E-01	----	----	----	----	4.20E-01
Lead Compounds	7.06E-02	----	----	----	----	7.06E-02
Magnesium Compounds	1.85E+00	----	----	----	----	1.85E+00
Manganese Compounds	8.23E-02	----	----	----	----	8.23E-02
Mercury Compounds	2.32E-03	----	----	----	----	2.32E-03
Nickel Compounds	4.70E-02	----	----	----	----	4.70E-02
Selenium Compounds	2.18E-01	----	----	----	----	2.18E-01
Total HAPs - Maximum Individual HAP	**25.2**	**3.8E-03**	**4.0E-03**	**0.0**	**0.0**	**25.2**
Total HAPs - Unit Category/Source	**31.4**	**1.3E-02**	**8.1E-03**	**0.0**	**0.0**	**31.4**

Notes:

[a] See individual emissions unit category emissions calculations for details on methodology and assumptions.

[b] Emission units in the coal preparation and handling, ash handling and coal storage pile systems do not have HAP emissions.

[c] HAP emissions from the fuel storage tanks are negligible.

Table D-1.12. Estimated Potential HAP Emissions - Coal-Fired Boilers
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

		Maximum Total Fuel Input:	336,000 Tons of Coal/yr
		Source Category Emission Calculations	
CAS No.	Chemical Name	Emission Factor [1]	Estimated Emissions
79005	1,1,2-Trichloroethane	2.00E-05 lb/ton	3.36E-03 tpy
1746016	2,3,7,8-Tetrachlorodibenzo-p-dioxin	1.40E-11 lb/ton	2.35E-09 tpy
121142	2,4-Dinitrotoluene	2.80E-07 lb/ton	4.70E-05 tpy
532274	2-Chloroacetophenone	7.00E-06 lb/ton	1.18E-03 tpy
75-07-0	Acetaldehyde	5.70E-04 lb/ton	9.58E-02 tpy
98862	Acetophenone	1.50E-05 lb/ton	2.52E-03 tpy
107-02-8	Acrolein	2.90E-04 lb/ton	4.87E-02 tpy
N/A	Antimony Compounds	1.80E-05 lb/ton	3.02E-03 tpy
N/A	Arsenic Compounds	4.10E-04 lb/ton	6.89E-02 tpy
71-43-2	Benzene	1.30E-03 lb/ton	0.22 tpy
100447	Benzyl chloride	7.00E-04 lb/ton	0.12 tpy
N/A	Beryllium Compounds	2.10E-05 lb/ton	3.53E-03 tpy
92524	Biphenyl	1.70E-06 lb/ton	2.86E-04 tpy
117817	Bis(2-ethylhexyl)phthalate (DEHP)	7.30E-05 lb/ton	1.23E-02 tpy
75252	Bromoform	3.90E-05 lb/ton	6.55E-03 tpy
N/A	Cadmium Compounds	5.10E-05 lb/ton	8.57E-03 tpy
75150	Carbon disulfide	1.30E-04 lb/ton	2.18E-02 tpy
108907	Chlorobenzene	2.20E-05 lb/ton	3.70E-03 tpy
67663	Chloroform	5.90E-05 lb/ton	9.91E-03 tpy
N/A	Chromium Compounds	3.39E-04 lb/ton	5.70E-02 tpy
N/A	Cobalt Compounds	1.00E-04 lb/ton	1.68E-02 tpy
98828	Cumene	5.30E-06 lb/ton	8.90E-04 tpy
N/A	Cyanide Compounds	2.50E-03 lb/ton	0.42 tpy
132649	Dibenzofurans	1.09E-09 lb/ton	1.83E-07 tpy
77781	Dimethyl sulfate	4.80E-05 lb/ton	8.06E-03 tpy
100-41-4	Ethyl benzene	9.40E-05 lb/ton	1.58E-02 tpy
75003	Ethyl chloride (Chloroethane)	4.20E-05 lb/ton	7.06E-03 tpy
1006934	Ethylene dibromide (Dibromoethane)	1.20E-06 lb/ton	2.02E-04 tpy
107062	Ethylene dichloride (1,2-Dichloroethane)	4.00E-05 lb/ton	6.72E-03 tpy
50-00-0	Formaldehyde	2.40E-04 lb/ton	4.03E-02 tpy
110543	Hexane	6.70E-05 lb/ton	1.13E-02 tpy
7647010	Hydrochloric acid[2]	1.38E-02 lb/ton	2.31 tpy
7664393	Hydrogen fluoride (Hydrofluoric acid)	0.15 lb/ton	25.2 tpy
78591	Isophorone	5.80E-04 lb/ton	9.74E-02 tpy
N/A	Lead Compounds	4.20E-04 lb/ton	7.06E-02 tpy
N/A	Magnesium Compounds	1.10E-02 lb/ton	1.85 tpy
N/A	Manganese Compounds	4.90E-04 lb/ton	8.23E-02 tpy
N/A	Mercury Compounds[3]	1.38E-05 lb/ton	2.32E-03 tpy
74839	Methyl bromide(Bromomethane)	1.60E-04 lb/ton	2.69E-02 tpy
60344	Methyl hydrazine	1.70E-04 lb/ton	2.86E-02 tpy
80626	Methyl methacrylate	2.00E-05 lb/ton	3.36E-03 tpy
1634044	Methyl tert butyl ether	3.50E-05 lb/ton	5.88E-03 tpy
74873	Methylchloride (chloromethane)	5.30E-04 lb/ton	8.90E-02 tpy
75092	Methylene chloride (Dichloromethane)	2.90E-04 lb/ton	4.87E-02 tpy
N/A	Nickel Compounds	2.80E-04 lb/ton	4.70E-02 tpy
108952	Phenol	1.60E-05 lb/ton	2.69E-03 tpy
N/A	Polycylic Organic Matter	1.91E-05 lb/ton	3.20E-03 tpy
123386	Propionaldehyde	3.80E-04 lb/ton	6.38E-02 tpy
N/A	Selenium Compounds	1.30E-03 lb/ton	0.22 tpy
100425	Styrene	2.50E-05 lb/ton	4.20E-03 tpy
127184	Tetrachloroethylene (Perchloroethylene)	4.30E-05 lb/ton	7.22E-03 tpy
108-88-3	Toluene	2.40E-04 lb/ton	4.03E-02 tpy
108054	Vinyl acetate	7.60E-06 lb/ton	1.28E-03 tpy
1330-20-7	Xylenes (isomers and mixture)	3.70E-05 lb/ton	6.22E-03 tpy
		Total HAP Emissions	**31.419 tpy**

Notes:

[1] Reference: AP-42, Tables 1.1-12, 1.1-13, 1.1-14, 1.1-18

[2] Maximum 1-hour emission rate measured during April 2017 source test (0.00091 lb/MMBtu, Run 1, EU 4).

[3] Maximum 1-hour emission rate measured during April 2017 source test (9.12E-07 lb/MMBtu, Run 1, EU 4).

Conversion Factors:

Coal Heating Value 15.1 MMBtu/ton *From http://www.usibelli.com/coal/data-sheet*

Table D-1.13. Estimated Potential HAP Emissions - Diesel-Fired Engines Greater Than 600 Horsepower
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

CAS No.	Chemical Name	HAP Emission Calculations	
		Emission Factor[a]	All Emission Units > 600 hp
75-07-0	Acetaldehyde	2.52E-05 lb/MMBtu	1.30E-04 tpy
107-02-8	Acrolein	7.88E-06 lb/MMBtu	4.05E-05 tpy
71-43-2	Benzene	7.76E-04 lb/MMBtu	3.99E-03 tpy
50-00-0	Formaldehyde	7.89E-05 lb/MMBtu	4.06E-04 tpy
108-88-3	Toluene	2.81E-04 lb/MMBtu	1.44E-03 tpy
1330-20-7	Xylenes (isomers and mixture)	1.93E-04 lb/MMBtu	9.92E-04 tpy
N/A	Polycylic Organic Matter (PAH)	2.12E-04 lb/MMBtu	1.09E-03 tpy
		TOTAL	**8.09E-03 tpy**

Notes:
[a] Reference: AP-42, Tables 3.3-3 and 3.4-4.

Conversion Factors:

Engine Heat Rate	7,000	Btu/hp-hr	*Average brake-specific fuel consumption (BSFC) from AP 42, Table 3.3-1, footnote a*
Weight	2,000	lb/ton	

Calculations:

Maximum Heat Input (MMBtu/yr) = Engine Rating (hp) x Engine Heat Rate (Btu/hp-hr) x Allowable Annual Operation (hr/yr) / 1E6 (Btu/MMBtu)

Diesel-Fired Engines Greater Than 600 Horsepower:			
Emission Unit	Engine Rating (hp)	Allowable Annual Operation (hr/yr)	Maximum Heat Input (MMBtu/yr)
8	2,937	500	10,280
		TOTAL Heat Input (MMBtu/yr)	**10,280**

Table D-1.14. Estimated Potential HAP Emissions - Diesel-Fired Engines Less Than 600 Horsepower
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

CAS No.	Chemical Name	HAP Emission Calculations	
		Emission Factor [a]	All Emission Units < 600 hp
75-07-0	Acetaldehyde	7.67E-04 lb/MMBtu	2.47E-03 tpy
107-02-8	Acrolein	9.25E-05 lb/MMBtu	2.98E-04 tpy
71-43-2	Benzene	9.33E-04 lb/MMBtu	3.00E-03 tpy
106-99-0	1,3-Butadiene	3.91E-05 lb/MMBtu	1.26E-04 tpy
50-00-0	Formaldehyde	1.18E-03 lb/MMBtu	3.80E-03 tpy
108-88-3	Toluene	4.09E-04 lb/MMBtu	1.32E-03 tpy
1330-20-7	Xylenes (isomers and mixture)	2.85E-04 lb/MMBtu	9.17E-04 tpy
N/A	Polycylic Organic Matter	3.36E-04 lb/MMBtu	1.08E-03 tpy
		TOTAL	**1.30E-02 tpy**

Diesel-Fired Engines Less Than 600 Horsepower:			
Emission Unit	Engine Rating (hp)	Allowable Annual Operation (hr/yr)	Maximum Heat Input (MMBtu/yr)
9	353	500	1235
14	320	500	1120
22	35	500	124
23	155	500	543
29a	74	500	259
30a	91	500	320
31a	74	500	259
32a	91	500	320
33a	75	500	263
34	220	500	770
35	55	500	193
36	220	500	770
37	75	500	263
		TOTAL Heat Input (MMBtu/yr)	**6,437**

Notes:
[a] Reference: AP-42, Table 3.3-2.

Conversion Factors:

Engine Heat Rate	7,000	Btu/hp-hr
Weight	2,000	lb/ton

Calculations:

Maximum Heat Input (MMBtu/yr) = Engine Rating (hp) x Engine Heat Rate (Btu/hp-hr) x Allowable Annual Operation (hr/yr) / 1E6 (Btu/MMBtu)

Table D-1.15. Summary of Estimated Greenhouse Gas (GHG) Emissions [a]
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

GHG Pollutant	GHG Emissions (tons per year) [b]			
	Significant Emission Units	Insignificant Emission Units	Global Warming Potential	Total
Carbon Dioxide	545,515	0	1	**545,515**
Methane	61.7	0	25	**1,541**
Nitrous Oxide	9.0	0	298	**2,673**
Hydrofluorocarbons	0	0	Multiple	**0**
Perfluorocarbons	0	0	Multiple	**0**
Sulfur hexafluoride	0	0	22,800	**0**
			Total - GHG (CO_2e) [c]	**549,730**

Notes:

[a] GHG are the aggregate group of six greenhouse gases defined under 40 CFR 52.21(b)(49)(i) and 40 CFR 71.2.

[b] See individual emissions unit category emissions calculations for details on methodology and assumptions.

[c] GHG (CO_2e) emissions = CO_2 emissions + (25 * CH_4 emissions) + (298 * N_2O emissions).

Table D-1.16. Potential Greenhouse Gases (GHG) Calculations - Carbon Dioxide (CO_2) Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Emission Unit ID	Emission Unit Name	Fuel Type	Factor Reference	CO_2 Emission Factor	Emission Unit Rating/Capacity	Allowable Annual Operation	Maximum Heat Input	Potential CO_2 Emissions
Significant Emission Units								
1	Coal-Fired Boiler 3	Coal	40 CFR 98 Table C-1	97.17 kg/MMBtu	230 MMBtu/hr	336,000 tpy	5,080,320 MMBtu/yr	544,152 tpy
2	Coal-Fired Boiler 4	Coal	40 CFR 98 Table C-1	97.17 kg/MMBtu	230 MMBtu/hr			
3	Coal-Fired Boiler 5	Coal	40 CFR 98 Table C-1	97.17 kg/MMBtu	230 MMBtu/hr			
4	Coal-Fired Boiler 6	Coal	40 CFR 98 Table C-1	97.17 kg/MMBtu	230 MMBtu/hr			
5	Coal-Fired Boiler 7	Coal	40 CFR 98 Table C-1	97.17 kg/MMBtu	230 MMBtu/hr			
6	Coal-Fired Boiler 8	Coal	40 CFR 98 Table C-1	97.17 kg/MMBtu	230 MMBtu/hr			
7a	South Coal Handling Dust Collector (DC-01)	N/A	N/A	N/A	13,150 acfm	2,195 hr/yr	N/A	0 tpy
7b	South Underbunker Dust Collector (DC-02)	N/A	N/A	N/A	884 acfm	100 hr/yr	N/A	0 tpy
7c	North Coal Handling Dust Collector (NDC-1)	N/A	N/A	N/A	9,250 acfm	45 hr/yr	N/A	0 tpy
8	Backup Generator Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	2,937 hp	500 hr/yr	10,280 MMBtu/yr	838.0 tpy
9	Emergency Generator Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	353 hp	500 hr/yr	1,235 MMBtu/yr	100.7 tpy
14	Emergency Generator Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	320 hp	500 hr/yr	1,120 MMBtu/yr	91.3 tpy
22	Emergency Generator Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	35 hp	500 hr/yr	124 MMBtu/yr	10.1 tpy
23	Emergency Generator Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	155 hp	500 hr/yr	543 MMBtu/yr	44.3 tpy
29a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	74 hp	500 hr/yr	259 MMBtu/yr	21.1 tpy
30a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	91 hp	500 hr/yr	320 MMBtu/yr	26.1 tpy
31a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	74 hp	500 hr/yr	259 MMBtu/yr	21.1 tpy
32a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	91 hp	500 hr/yr	320 MMBtu/yr	26.1 tpy
33a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	75 hp	500 hr/yr	263 MMBtu/yr	21.4 tpy
34	Emergency Pump Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	220 hp	500 hr/yr	770 MMBtu/yr	62.8 tpy
35	Emergency Pump Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	55 hp	500 hr/yr	193 MMBtu/yr	15.7 tpy
36	Emergency Pump Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	220 hp	500 hr/yr	770 MMBtu/yr	62.8 tpy
37	Emergency Generator Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	75 hp	500 hr/yr	263 MMBtu/yr	21.4 tpy
51a	Fly Ash Dust Collector (DC-1)	N/A	N/A	N/A	3,620 acfm	4,380 hr/yr	N/A	0 tpy
51b	Bottom Ash Dust Collector (DC-2)	N/A	N/A	N/A	3,620 acfm	4,380 hr/yr	N/A	0 tpy
52	Coal Storage Pile	N/A	N/A	N/A	N/A	84,676 tpy	N/A	0 tpy
							Significant Emission Units Total Potential to Emit - CO_2	**545,515 tpy**
Insignificant Emission Units								
N/A	Fly and Bottom Ash Bin Vent Filter	N/A	N/A	N/A	1,460 acfm	4,380 hr/yr	N/A	0 tpy
N/A	Ash Loadout to Truck	N/A	N/A	N/A	N/A	23,520 tpy	N/A	0 tpy
N/A	Aboveground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	N/A	0 tpy
N/A	Underground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	N/A	0 tpy
							Insignificant Emission Units Total Potential to Emit - CO_2	**0 tpy**
							Total Potential to Emit - CO_2	**545,515 tpy**

Calculations:

Maximum heat input, coal (MMBtu/yr) = Allowable annual operation (tons/yr) x Coal Heating Value (MMBtu/ton)
Maximum heat input, engines (MMBtu/yr) = Engine Rating (hp) x Engine Heat Rate (Btu/hp-hr) x Allowable Annual Operation (hr/yr) / 1E6 (Btu/MMBtu)

Conversion factors:

Engine Heat Rate:	7,000 Btu/hp-hr	*Average brake-specific fuel consumption (BSFC) from AP 42, Table 3.3-1, footnote a*
Mass:	907.2 kg/ton	
Coal Heating Value:	15.1 MMBtu/ton	*From http://www.usibelli.com/coal/data-sheet*

Table D-1.17. Potential Greenhouse Gases (GHG) Calculations - Methane (CH_4) Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Emission Unit ID	Emission Unit Name	Fuel Type	Factor Reference	CH_4 Emission Factor	Emission Unit Rating/Capacity	Allowable Annual Operation [1]	Maximum Heat Input	Potential CH_4 Emissions
Significant Emission Units								
1	Coal-Fired Boiler 3	Coal	40 CFR 98 Table C-2	1.1E-02 kg/MMBtu	230 MMBtu/hr	336,000 tpy	5,080,320 MMBtu/yr	61.6 tpy
2	Coal-Fired Boiler 4	Coal	40 CFR 98 Table C-2	1.1E-02 kg/MMBtu	230 MMBtu/hr			
3	Coal-Fired Boiler 5	Coal	40 CFR 98 Table C-2	1.1E-02 kg/MMBtu	230 MMBtu/hr			
4	Coal-Fired Boiler 6	Coal	40 CFR 98 Table C-2	1.1E-02 kg/MMBtu	230 MMBtu/hr			
5	Coal-Fired Boiler 7	Coal	40 CFR 98 Table C-2	1.1E-02 kg/MMBtu	230 MMBtu/hr			
6	Coal-Fired Boiler 8	Coal	40 CFR 98 Table C-2	1.1E-02 kg/MMBtu	230 MMBtu/hr			
7a	South Coal Handling Dust Collector (DC-01)	N/A	N/A	N/A	13,150 acfm	2,195 hr/yr	N/A	0 tpy
7b	South Underbunker Dust Collector (DC-02)	N/A	N/A	N/A	884 acfm	100 hr/yr	N/A	0 tpy
7c	North Coal Handling Dust Collector (NDC-1)	N/A	N/A	N/A	9,250 acfm	45 hr/yr	N/A	0 tpy
8	Backup Generator Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	2,937 hp	500 hr/yr	10,280 MMBtu/yr	3.4E-02 tpy
9	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	353 hp	500 hr/yr	1,235 MMBtu/yr	4.1E-03 tpy
14	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	320 hp	500 hr/yr	1,120 MMBtu/yr	3.7E-03 tpy
22	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	35 hp	500 hr/yr	124 MMBtu/yr	4.1E-04 tpy
23	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	155 hp	500 hr/yr	543 MMBtu/yr	1.8E-03 tpy
29a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	74 hp	500 hr/yr	259 MMBtu/yr	8.6E-04 tpy
30a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	91 hp	500 hr/yr	320 MMBtu/yr	1.1E-03 tpy
31a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	74 hp	500 hr/yr	259 MMBtu/yr	8.6E-04 tpy
32a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	91 hp	500 hr/yr	320 MMBtu/yr	1.1E-03 tpy
33a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	75 hp	500 hr/yr	263 MMBtu/yr	8.7E-04 tpy
34	Emergency Pump Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	220 hp	500 hr/yr	770 MMBtu/yr	2.5E-03 tpy
35	Emergency Pump Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	55 hp	500 hr/yr	193 MMBtu/yr	6.4E-04 tpy
36	Emergency Pump Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	220 hp	500 hr/yr	770 MMBtu/yr	2.5E-03 tpy
37	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	75 hp	500 hr/yr	263 MMBtu/yr	8.7E-04 tpy
51a	Fly Ash Dust Collector (DC-1)	N/A	N/A	N/A	3,620 acfm	4,380 hr/yr	N/A	0 tpy
51b	Bottom Ash Dust Collector (DC-2)	N/A	N/A	N/A	3,620 acfm	4,380 hr/yr	N/A	0 tpy
52	Coal Storage Pile	N/A	N/A	N/A	N/A	84,676 tpy	N/A	0 tpy
							Significant Emission Units Total Potential to Emit - CH_4	**61.7 tpy**
Insignificant Emission Units								
N/A	Fly and Bottom Ash Bin Vent Filter	N/A	N/A	N/A	1,460 acfm	4,380 hr/yr	N/A	0 tpy
N/A	Ash Loadout to Truck	N/A	N/A	N/A	N/A	23,520 tpy	N/A	0 tpy
N/A	Aboveground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	N/A	0 tpy
N/A	Underground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	N/A	0 tpy
							Insignificant Emission Units Total Potential to Emit - CH_4	**0 tpy**
							Total Potential to Emit - CH_4	**61.7 tpy**

Calculations:

Maximum heat input, coal (MMBtu/yr) = Allowable annual operation (tons/yr) x Coal Heating Value (MMBtu/ton)
Maximum heat input, engines (MMBtu/yr) = Engine Rating (hp) x Engine Heat Rate (Btu/hp-hr) x Allowable Annual Operation (hr/yr) / 1E6 (Btu/MMBtu)

Conversion factors:

Engine Heat Rate:	7,000 Btu/hp-hr	*Average brake-specific fuel consumption (BSFC) from AP 42, Table 3.3-1, footnote a*
Mass:	907.2 kg/ton	
Coal Heating Value:	15.1 MMBtu/ton	*From http://www.usibelli.com/coal/data-sheet*

Table D-1.18. Potential Greenhouse Gases (GHG) Calculations - Nitrous Oxide (N_2O) Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Emission Unit ID	Emission Unit Name	Fuel Type	Factor Reference	N_2O Emission Factor	Emission Unit Rating/Capacity	Allowable Annual Operation [1]	Maximum Heat Input	Potential N_2O Emissions
Significant Emission Units								
1	Coal-Fired Boiler 3	Coal	40 CFR 98 Table C-2	1.6E-03 kg/MMBtu	230 MMBtu/hr	336,000 tpy	5,080,320 MMBtu/yr	9.0 tpy
2	Coal-Fired Boiler 4	Coal	40 CFR 98 Table C-2	1.6E-03 kg/MMBtu	230 MMBtu/hr			
3	Coal-Fired Boiler 5	Coal	40 CFR 98 Table C-2	1.6E-03 kg/MMBtu	230 MMBtu/hr			
4	Coal-Fired Boiler 6	Coal	40 CFR 98 Table C-2	1.6E-03 kg/MMBtu	230 MMBtu/hr			
5	Coal-Fired Boiler 7	Coal	40 CFR 98 Table C-2	1.6E-03 kg/MMBtu	230 MMBtu/hr			
6	Coal-Fired Boiler 8	Coal	40 CFR 98 Table C-2	1.6E-03 kg/MMBtu	230 MMBtu/hr			
7a	South Coal Handling Dust Collector (DC-01)	N/A	N/A	N/A	13,150 acfm	2,195 hr/yr	N/A	0 tpy
7b	South Underbunker Dust Collector (DC-02)	N/A	N/A	N/A	884 acfm	100 hr/yr	N/A	0 tpy
7c	North Coal Handling Dust Collector (NDC-1)	N/A	N/A	N/A	9,250 acfm	45 hr/yr	N/A	0 tpy
8	Backup Generator Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	2,937 hp	500 hr/yr	10,280 MMBtu/yr	6.8E-03 tpy
9	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	353 hp	500 hr/yr	1,235 MMBtu/yr	8.2E-04 tpy
14	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	320 hp	500 hr/yr	1,120 MMBtu/yr	7.4E-04 tpy
22	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	35 hp	500 hr/yr	124 MMBtu/yr	8.2E-05 tpy
23	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	155 hp	500 hr/yr	543 MMBtu/yr	3.6E-04 tpy
29a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	74 hp	500 hr/yr	259 MMBtu/yr	1.7E-04 tpy
30a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	91 hp	500 hr/yr	320 MMBtu/yr	2.1E-04 tpy
31a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	74 hp	500 hr/yr	259 MMBtu/yr	1.7E-04 tpy
32a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	91 hp	500 hr/yr	320 MMBtu/yr	2.1E-04 tpy
33a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	75 hp	500 hr/yr	263 MMBtu/yr	1.7E-04 tpy
34	Emergency Pump Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	220 hp	500 hr/yr	770 MMBtu/yr	5.1E-04 tpy
35	Emergency Pump Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	55 hp	500 hr/yr	193 MMBtu/yr	1.3E-04 tpy
36	Emergency Pump Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	220 hp	500 hr/yr	770 MMBtu/yr	5.1E-04 tpy
37	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	75 hp	500 hr/yr	263 MMBtu/yr	1.7E-04 tpy
51a	Fly Ash Dust Collector (DC-1)	N/A	N/A	N/A	3,620 acfm	4,380 hr/yr	N/A	0 tpy
51b	Bottom Ash Dust Collector (DC-2)	N/A	N/A	N/A	3,620 acfm	4,380 hr/yr	N/A	0 tpy
52	Coal Storage Pile	N/A	N/A	N/A	N/A	84,676 tpy	N/A	0 tpy
							Significant Emission Units Total Potential to Emit - N_2O	**9.0 tpy**
Insignificant Emission Units								
N/A	Fly and Bottom Ash Bin Vent Filter	N/A	N/A	N/A	1,460 acfm	4,380 hr/yr	N/A	0 tpy
N/A	Ash Loadout to Truck	N/A	N/A	N/A	N/A	23,520 tpy	N/A	0 tpy
N/A	Aboveground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	N/A	0 tpy
N/A	Underground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	N/A	0 tpy
							Insignificant Emission Units Total Potential to Emit - N_2O	**0 tpy**
							Total Potential to Emit - N_2O	**9.0 tpy**

Calculations:

Maximum heat input, coal (MMBtu/yr) = Allowable annual operation (tons/yr) x Coal Heating Value (MMBtu/ton)

Maximum heat input, engines (MMBtu/yr) = Engine Rating (hp) x Engine Heat Rate (Btu/hp-hr) x Allowable Annual Operation (hr/yr) / 1E6 (Btu/MMBtu)

Conversion factors:

Engine Heat Rate:	7,000 Btu/hp-hr	*Average brake-specific fuel consumption (BSFC) from AP 42, Table 3.3-1, footnote a*
Mass:	907.2 kg/ton	
Coal Heating Value:	15.1 MMBtu/ton	*From http://www.usibelli.com/coal/data-sheet*

Table D-1.19. Assessable Potential to Emit Calculations - Particulate Matter (PM) Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added (to Table 1.7) for the January 2021 Amendment.

Emission Unit ID	Emission Unit Name	Fuel Type	Factor Reference	PM Emission Factor	Emission Unit Rating/Capacity	Allowable Annual Operation	Potential PM Emissions
Significant Emission Units							
1	Coal-Fired Boiler 3	Coal	AP-42, Tables 1.1-5 and 1.1-6	0.782 lb/ton	230 MMBtu/hr	336,000 tpy	131.4 tpy
2	Coal-Fired Boiler 4	Coal	AP-42, Tables 1.1-5 and 1.1-6	0.782 lb/ton	230 MMBtu/hr		
3	Coal-Fired Boiler 5	Coal	AP-42, Tables 1.1-5 and 1.1-6	0.782 lb/ton	230 MMBtu/hr		
4	Coal-Fired Boiler 6	Coal	AP-42, Tables 1.1-5 and 1.1-6	0.782 lb/ton	230 MMBtu/hr		
5	Coal-Fired Boiler 7	Coal	AP-42, Tables 1.1-5 and 1.1-6	0.782 lb/ton	230 MMBtu/hr		
6	Coal-Fired Boiler 8	Coal	AP-42, Tables 1.1-5 and 1.1-6	0.782 lb/ton	230 MMBtu/hr		
7a	South Coal Handling Dust Collector (DC-01)	N/A	See detailed calculations in Table D-1.7a		13,150 acfm	2,195 hr/yr	0.30 tpy
7b	South Underbunker Dust Collector (DC-02)	N/A	See detailed calculations in Table D-1.7a		884 acfm	100 hr/yr	7.3E-03 tpy
7c	North Coal Handling Dust Collector (NDC-1)	N/A	See detailed calculations in Table D-1.7a		9,250 acfm	45 hr/yr	3.4E-02 tpy
8	Backup Generator Engine	Distillate	EPA Tier 2	0.25 g/kW-hr[1, 2]	2,937 hp	500 hr/yr	0.30 tpy
9	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	353 hp	500 hr/yr	0.19 tpy
14	Emergency Generator Engine	Distillate	EPA Tier 3	0.25 g/kW-hr[1, 2]	320 hp	500 hr/yr	3.3E-02 tpy
22	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	35 hp	500 hr/yr	1.9E-02 tpy
23	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	155 hp	500 hr/yr	8.5E-02 tpy
29a	Emergency Generator Engine	Distillate	EPA Tier 4i	0.375 g/kW-hr[1, 2]	74 hp	500 hr/yr	1.1E-02 tpy
30a	Emergency Generator Engine	Distillate	EPA Tier 3	0.5 g/kW-hr[1, 2]	91 hp	500 hr/yr	1.9E-02 tpy
31a	Emergency Generator Engine	Distillate	EPA Tier 4i	0.375 g/kW-hr[1, 2]	74 hp	500 hr/yr	1.1E-02 tpy
32a	Emergency Generator Engine	Distillate	EPA Tier 3	0.5 g/kW-hr[1, 2]	91 hp	500 hr/yr	1.9E-02 tpy
33a	Emergency Generator Engine	Distillate	EPA Tier 3	0.5 g/kW-hr[1, 2]	75 hp	500 hr/yr	1.5E-02 tpy
34	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	220 hp	500 hr/yr	0.12 tpy
35	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	55 hp	500 hr/yr	3.0E-02 tpy
36	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	220 hp	500 hr/yr	0.12 tpy
37	Emergency Generator Engine	Distillate	EPA Tier 3	0.5 g/kW-hr[1, 2]	75 hp	500 hr/yr	1.5E-02 tpy
51a	Fly Ash Dust Collector (DC-1)	N/A	See detailed calculations in Table D-1.19a		3,620 acfm	4,380 hr/yr	1.18 tpy
51b	Bottom Ash Dust Collector (DC-2)	N/A	See detailed calculations in Table D-1.19a		3,620 acfm	4,380 hr/yr	1.18 tpy
52	Coal Storage Pile	N/A	See detailed calculations in Table D-1.19b		N/A	84,676 tpy	4.98 tpy
						Significant Emission Units Total Assessable Potential to Emit - PM	**140.0 tpy**
Insignificant Emission Units							
N/A	Fly and Bottom Ash Bin Vent Filter	N/A	See detailed calculations in Table D-1.19a		1,460 acfm	4,380 hr/yr	0.47 tpy
N/A	Ash Loadout to Truck	N/A	See detailed calculations in Table D-1.19a		N/A	23,520 tpy	5.4E-04 tpy
N/A	Aboveground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	0 tpy
N/A	Underground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	0 tpy
						Insignificant Emission Units Total Assessable Potential to Emit - PM	**0.5 tpy**
						Total Assessable Potential to Emit - PM	**140.5 tpy**

Notes:

[1] The Tier 4i, Tier 3, and Tier 2 weighted-cycle emission rates for PM have been multiplied by 1.25 to determine the Not-to-Exceed emission factors per 40 CFR 1039.101(e) and ADEC policy (see also 40 CFR 60.4212(c).)

Conversion factors:

Weight	453.6 g/lb
Weight	2,000 lb/ton
Engine horsepower	1.341 hp/kw

Table D-1.19a. Assessable Potential to Emit Calculations - Ash Handling System PM Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added (to Table 1.7b) for the January 2021 Amendment.

Emission Unit			Factor Reference	PM Emission Factor	Emission Unit Rating/Capacity	Annual Operation	Potential PM Emissions[b]
Permit ID	Description	Year Installed					
51a	Fly Ash Dust Collector (DC-1)	1993	Typical Value	0.02 gr/dscf	3,620 acfm	4,380 hr/yr[d]	1.18 tpy[a]
51b	Bottom Ash Dust Collector (DC-2)	1994	Typical Value	0.02 gr/dscf	3,620 acfm	4,380 hr/yr[d]	1.18 tpy[a]
N/A	Fly and Bottom Ash Bin Vent Filter	1993	Manufacturer's guarantee[c]	0.02 gr/scf	1,460 acfm	4,380 hr/yr[e]	0.47 tpy[a]
N/A	Ash Loadout to Truck	Unknown	AP-42, Section 13.2.4	4.63E-05 lb/ton	N/A	23,520 tpy	5.4E-04 tpy[b]
						Total PM Emissions	**2.83 tpy**

Notes:

[a] Fly and bottom ash dust collector emission calculations:

(exhaust rate, acfm) x (Temp at STP/Temp of exhaust) x (PM_{10} exhaust concentration, gr/dscf) x (1 lb/ 7,000 gr) x (1 ton/ 2,000 lb) x (60 min/hr) x (operation, hr/yr)

Temperature at standard conditions =	68	degrees Fahrenheit	293.15 degrees Kelvin
Exhaust temperature of ash bin vent filter =	150	degrees Fahrenheit	338.71 degrees Kelvin
Exhaust temperature of fan duct blower/bag filter =	150	degrees Fahrenheit	

[b] Ash loadout emission calculations:

Emission factor from AP-42, Section 13.2.4 based on empirical equation $E = k \times 0.0032 \times (U/5)^{1.3}/(M/2)^{1.4}$ lb/ton transferred where:

k = 0.74 for PM <30 µm

U = mean wind speed = 4.0 mph in Fairbanks, per National Climactic Data Center (https://www.ncdc.noaa.gov/cdo-web/search)

M = ash moisture content = 27 percent (AP-42, Table 13.2.4-1)

Ash loadout emissions based on maximum coal consumption limit of	336,000	tpy
Ash content of coal per Usibelli Coal Mine website	7	percent by weight
Operations, ash tons/yr = coal consumption x (0.085 ash content)	23,520	tpy

Ash loadout emissions, tons/yr = (emission factor, lb/ton) x (ash loading, ton/yr) / (2,000 lb/ton)

[c] Manufacturer's guarantee for particle sizes over 5 microns in diameter

[d] Average run time for DC-1 and DC-2 is 12 hours/day per reasonable inquiry of plant operations

[e] Operation of ash bin vent filter assumed to be the same as the dust collectors

Table D-1.19b. Assessable Potential to Emit Calculations - Emergency Coal Storage Pile PM Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added (to Table 1.7c) for the January 2021 Amendment.

Emission Unit		Factor Reference	PM Emission Factor	Annual Operation[b]	Potential PM Emissions
Permit ID	Description				
	Coal chute to coal pile	AP-42, Section 13.2.4	5.20E-04 lb/ton[a]	45,845 tpy	1.2E-02 tpy
	Front end loader drop onto stockpile	AP-42, Section 13.2.4	5.20E-04 lb/ton[a]	45,845 tpy	1.2E-02 tpy
	Front end loader movement - chute to coal pile	AP-42, Section 13.2.2	10.26 lb/VMT[c]	386 VMT	1.98 tpy
	Front end loader movement - coal pile to South grizzly	AP-42, Section 13.2.2	10.26 lb/VMT[c]	534 VMT	2.74 tpy
	Front end loader movement - coal pile to North grizzly	AP-42, Section 13.2.2	10.26 lb/VMT[c]	44 VMT	0.22 tpy
	Stockpile wind erosion	AP-42, Section 13.2.5	0.00 g/m^2-yr[d]	3,370 m^2	0.00 tpy
	Front end loader drop into grizzly	AP-42, Section 13.2.4	5.20E-04 lb/ton[a]	38,831 tpy	1.0E-02 tpy
52	Coal Storage Pile			**Total PM Emissions**	**4.98 tpy**

Notes:

[a]Coal transfer emission factor from AP-42, Section 13.2.4 based on empirical equation E = k x 0.0032 x $(U/5)^{1.3}/(M/2)^{1.4}$ lb/ton transferred where:

k	0.74	PM <30 µm	
U = mean wind speed	4.0	miles/hr	Average value from September 2017 to October 2018 per NOAA NCDC.
M = coal moisture content	4.8	percent	

[b]Annual stockpile throughput:

	Coal moved to coal pile	Coal moved from coal pile	
FY 2014	21,996 tpy	11,786 tpy	
FY 2015	26,888 tpy	38,831 tpy	
FY 2016	45,845 tpy	25,773 tpy	
FY 2017	41,172 tpy	24,529 tpy	
Maximum Annual Throughput	45,845 tpy	38,831 tpy	Use maximum recorded annual throughputs to determine potentials

[c]Front end loader movement emission factor from AP-42, Section 13.2.2, Empirical Equation 1a, E = k x $(s/12)^a$ x $(W/3)^b$ lb/VMT where:

k	4.9	for PM_{30}
s = surface material silt content (haul road)	8.4	percent, from AP-42, Table 13.2.2-1
W = mean vehicle weight	27	tons, estimate
Size of load bucket	5	yd^3
Density of coal	50	lb/ft^3
Coal moved per trip	3.375	tons (Density of coal x 27 ft3/yd3 x bucket size / 2000 lb/ton)
a (empirical constant)	0.7	from AP-42, Table 13.2.2-2 for PM_{30}
b (empirical constant)	0.45	from AP-42, Table 13.2.2-2
Approximate distance from coal chute to coal pile (round trip)	150	feet
Approximate distance from coal pile to South grizzly (round trip)	250	feet
Approximate distance from coal pile to North grizzly (round trip)	1,000	feet
Percent of annual coal transferred to South grizzly	98	percent, primary coal handling system
Percent of annual coal transferred to North grizzly	2	percent, North handling system is emergency backup to South handling system
VMT = vehicles miles traveled per year		VMT = annual stockpile throughput/coal moved per trip x distanced traveled per round trip in feet / 5,280 ft/mi

[d]From AP-42, Section 13.2.5, Industrial Wind Erosion

Coal Pile at FWA CHPP (*source: Ft WW Coal Pile 2018 Volume Summary, October 2, 2018, 3-TIER Alaska LLC.*)

Average Height =	40	ft	
Width at Base =	205	ft	The minimum width (south face) of the coal pile is used as a conservative approach
Height-to-Base Ratio =	0.195		< 0.2. FWA CHPP coal pile can therefore be considered a large relatively flat pile with little penetration into the surface wind layer and a single friction velocity (using Equation (1)) can be used to for the entire surface of the coal pile. Friction velocity is a measure of wind shear stress on the erodible surface.
Surface Area of Active (North) Face =	3,370	m^2	Calculated from survey using Computer Aided Design (CAD) software in 2012. Height and width of the pile were comparable in 2018 and 2012.

AP-42 Section 13.2.5, Equation (2)

Emission factor for wind-generated particulate emissions from mixtures of erodible and nonerodible surface material subject to disturbance, EF

$$EF\ (g/m^2\text{-}yr) = k \sum_{i=1}^{N} P_i$$

where

k = particle size multiplier (1.0 for particle size 30 microns, per table on page 13.2.5-3)
N = number of disturbances per year
P_i = erosion potential corresponding to the fastest mile of wind for the ith period between disturbances, g/m^2

AP-42 Section 13.2.5, Equation (3)

Erosion potential function for a dry exposed surface, P

$$P = 58\ (u^* - u_t^*)^2 + 25\ (u^* - u_t^*)$$
$$P = 0 \text{ for } u^* \leq u_t^*$$

where

u^* = friction velocity (m/s)
u_t = threshold friction velocity (m/s)

AP-42 Section 13.2.5, Equation (1)

Friction velocity, u^*

$$u^* = 0.4 \times u(z) / \ln(z/z_o) \quad \text{when } z > z_o$$

where

u^* = friction velocity (cm/s)
u(z) = wind speed at height z above test surface (cm/s)
z = height above test surface (cm)
z_o = roughness height, cm

Data:

u(z)		Use maximum wind gust speed recorded at Fairbanks International Airport for each of the previous 12 months (see table below)
z	10	meters
N	204	disturbances/year for active face, as determined from 2017 records
	17	average disturbances/month

Month-Year	Maximum Wind Speed (u(10))[1]		Wind Direction	Uncrusted coal pile[2] (Table 13.2.5-2)				Scraper tracks on coal pile (Table 13.2.5-2)						
				Roughness Height (z_o)	Threshold Friction Velocity (u_t)	Calculated Friction Velocity (u*)	Erosion potential function, P	Roughness Height (z_o)	Threshold Friction Velocity (u_t)	Calculated Friction Velocity (u*)	Erosion potential function, P	P x N	k	Emission Factor, EF
	mph	m/s	deg	cm	m/s	m/s		cm	m/s	m/s				g/m^2-yr
Oct-17	17	7.6	060	0.3	1.12	0.37	0	0.06	0.62	0.31	0	0		
Nov-17	20	8.9	270	0.3	1.12	0.44	0	0.06	0.62	0.37	0	0		
Dec-17	15	6.7	070	0.3	1.12	0.33	0	0.06	0.62	0.28	0	0		
Jan-18	17	7.6	200	0.3	1.12	0.37	0	0.06	0.62	0.31	0	0		
Feb-18	29	13.0	270	0.3	1.12	0.64	0	0.06	0.62	0.53	0	0		
Mar-18	25	11.2	270	0.3	1.12	0.55	0	0.06	0.62	0.46	0	0		
Apr-18	26	11.6	040	0.3	1.12	0.57	0	0.06	0.62	0.48	0	0		
May-18	25	11.2	300	0.3	1.12	0.55	0	0.06	0.62	0.46	0	0		
Jun-18	25	11.2	090	0.3	1.12	0.55	0	0.06	0.62	0.46	0	0		
Jul-18	22	9.8	300	0.3	1.12	0.48	0	0.06	0.62	0.40	0	0		
Aug-18	26	11.6	250	0.3	1.12	0.57	0	0.06	0.62	0.48	0	0		
Sep-18	22	9.8	260	0.3	1.12	0.48	0	0.06	0.62	0.40	0	0		
Annual Total							0				0.00	0.00	1.0	**0.00**

[1] Maximum wind speed data is from NOAA NCDC. Tower height of 10 meters confirmed by Fairbanks Weather Forecast Office, National Weather Service on 27-March-2013

[2] The erosion potential factor for the uncrusted coal pile is zero for all months. Therefore, wind erosion of the uncrusted coal pile is not a significant source of PM emissions

Table D-2.1. Unlimited Potential Emissions Summary
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added for the January 2021 Amendment.

Emission Unit Type	Regulated Air Pollutant Emissions (tons per year) [1,2]								
	NO_X	CO	PM	PM_{10}	$PM_{2.5}$ [3]	VOC	SO_2	HAP	GHG (CO_2e) [4]
Significant	3,864.0	2,154.3	26,543.8	5,672.3	2,234.7	43.7	5,612.4	74.8	1,328,956
Insignificant	0.0	0.0	19.0	19.0	19.0	0.0	0.0	0.0	0
DU Emission Total	**3,864.0**	**2,154.3**	**26,562.8**	**5,691.3**	**2,253.7**	**43.7**	**5,612.4**	**74.8**	**1,328,956**

Notes:

[1] Emissions are unlimited potential to emit.

[2] Regulated air pollutant calculations based on AP-42 emission factors, manufacturer data, and mass balances as shown in accompanying spreadsheets.

[3] $PM_{2.5}$ emissions are assumed to be equal to PM_{10} emissions except as noted on Table D-2.8.

[4] GHG means greenhouse gases and is the summation of CO_2, CH_4, and N_2O and applying the global warming potential for each pollutant.

[5] Emission Units 1 through 6 at Fort Wainwright (Privatized Emission Units) have baghouses as emission control devices. EU IDs 7a-7c, 51a, 51b, and the ash bin vent filter also have emission controls.

Table D-2.2. Unlimited Potential to Emit Emissions Inventory - Significant Emission Units
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added for the January 2021 Amendment.

Emission Unit				Installation Date	Fuel Type	Rating
ID	Name	Description	Bldg. No.			
1	Coal-Fired Boiler 3	Central Heat and Power Plant (CHPP)	CHPP	1953	Coal	230 MMBtu/hr
2	Coal-Fired Boiler 4	CHPP	CHPP	1953	Coal	230 MMBtu/hr
3	Coal-Fired Boiler 5	CHPP	CHPP	1953	Coal	230 MMBtu/hr
4	Coal-Fired Boiler 6	CHPP	CHPP	1953	Coal	230 MMBtu/hr
5	Coal-Fired Boiler 7	CHPP	CHPP	1953	Coal	230 MMBtu/hr
6	Coal-Fired Boiler 8	CHPP	CHPP	1953	Coal	230 MMBtu/hr
7a	South Coal Handling Dust Collector (DC-01)	Airlanco 169-AST-8	CHPP	2001	N/A	13,150 acfm
7b	South Underbunker Dust Collector (DC-02)	Airlanco 16-AST	CHPP	2005	N/A	884 acfm
7c	North Coal Handling Dust Collector (NDC-1)	Dustex C67-10-547	CHPP	2004	N/A	9,250 acfm
8	Backup Generator Engine	Caterpillar 3516C	CHPP	2009	Distillate	2,937 hp
9	Emergency Generator Engine	Detroit 6V92	1032	1988	Distillate	353 hp
14	Emergency Generator Engine	Cummins QSL-G2 NR3	1563	2008	Distillate	320 hp
22	Emergency Generator Engine	Cummins	3565	1989	Distillate	35 hp
23	Emergency Generator Engine	John Deere 6068HF150	3587	2003	Distillate	155 hp
29a	Emergency Generator Engine	John Deere 4045TF290	1056	2014	Distillate	74 hp
30a	Emergency Generator Engine	Caterpillar C4.4	507	2015	Distillate	91 hp
31a	Emergency Generator Engine	John Deere 4045TF290	3724	2014	Distillate	74 hp
32a	Emergency Generator Engine	Caterpillar C4.4	507	2015	Distillate	91 hp
33	Emergency Generator Engine	Caterpillar C4.4	1002	1994	Distillate	75 hp
34	Emergency Pump Engine	Detroit Diesel 10447000	3405	1995	Distillate	220 hp
35	Emergency Pump Engine	John Deere 4045DF120	4023	2009	Distillate	85 hp
36	Emergency Pump Engine	Detroit Diesel 4031-C	3563	1995	Distillate	220 hp
37	Emergency Generator Engine	Caterpillar C4.4	MH507	2015	Distillate	75 hp
51a	Fly Ash Dust Collector (DC-1)	United Conveyor Corp. 32242	CHPP	1993	N/A	3,620 acfm
51b	Bottom Ash Dust Collector (DC-2)	United Conveyor Corp. 32242	CHPP	1994	N/A	3,620 acfm
52	Coal Storage Pile	CHPP	CHPP	Unknown	N/A	N/A

Table D-2.3. Unlimited Potential to Emit Emissions Inventory - Insignificant Emission Units
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Emission Unit(s)				Installation	Fuel		Basis for
ID	Description	Make/Model	Bldg. No.	Date	Type	Rating	Insignificance
N/A	Fly and Bottom Ash Bin Vent Filter	United Conveyor Corp 96TB-BVT-25:S6	CHPP	1993	N/A	1,460 acfm	18 AAC 50.326(e)
N/A	Ash Loadout to Truck	N/A	CHPP	Unknown	N/A	N/A	18 AAC 50.326(e)
N/A	Aboveground Storage Tank	N/A	1002	2012	Diesel	80 gallons	18 AAC 50.326(g)(1)
N/A	Aboveground Storage Tank	N/A	1032	1993	Diesel	180 gallons	18 AAC 50.326(g)(1)
N/A	Aboveground Storage Tank	N/A	1563	2012	Diesel	100 gallons	18 AAC 50.326(g)(1)
N/A	Aboveground Storage Tank	N/A	3403	2012	Diesel	100 gallons	18 AAC 50.326(g)(1)
N/A	Aboveground Storage Tank	N/A	3405	1995	Diesel	500 gallons	18 AAC 50.326(g)(2)
N/A	Aboveground Storage Tank	N/A	3563	1995	Diesel	275 gallons	18 AAC 50.326(g)(2)
N/A	Aboveground Storage Tank	N/A	3565	1997	Diesel	75 gallons	18 AAC 50.326(g)(1)
N/A	Aboveground Storage Tank	N/A	3587	2002	Diesel	180 gallons	18 AAC 50.326(g)(1)
N/A	Aboveground Storage Tank	N/A	3595	2009	Diesel	1,670 gallons	18 AAC 50.326(g)(3)
N/A	Aboveground Storage Tank	N/A	3598	Unknown	Diesel	1,000 gallons	18 AAC 50.326(g)(2)
N/A	Aboveground Storage Tank	N/A	3724	2012	Diesel	100 gallons	18 AAC 50.326(g)(1)
N/A	Aboveground Storage Tank	N/A	4023	2009	Diesel	275 gallons	18 AAC 50.326(g)(2)
N/A	Aboveground Storage Tank	N/A	4162	2012	Diesel	100 gallons	18 AAC 50.326(g)(1)
N/A	Underground Storage Tank	N/A	1056	1991	Diesel	1,000 gallons	18 AAC 50.326(g)(2)
N/A	Underground Storage Tank	N/A	1563	1995	Diesel	1,000 gallons	18 AAC 50.326(g)(2)
N/A	Underground Storage Tank	N/A	3598	1991	Used oil/water	1,000 gallons	18 AAC 50.326(g)(2)

Note:
Mobile and portable tanks are not included in list because they are insignificant under 18 AAC 50.326(f)(1) and are not required to be listed in the application.

Table D-2.4. Emission Unit Parameters
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Emission Unit			Fuel	Electrical Output	Rating	Unlimited Annual
ID	Name	Description	Type	Rating		Operation
Significant Emission Units						
1	Coal-Fired Boiler 3	Central Heat and Power Plant (CHPP)	Coal	N/A	230 MMBtu/hr	8,760 hr/yr
2	Coal-Fired Boiler 4	CHPP	Coal	N/A	230 MMBtu/hr	8,760 hr/yr
3	Coal-Fired Boiler 5	CHPP	Coal	N/A	230 MMBtu/hr	8,760 hr/yr
4	Coal-Fired Boiler 6	CHPP	Coal	N/A	230 MMBtu/hr	8,760 hr/yr
5	Coal-Fired Boiler 7	CHPP	Coal	N/A	230 MMBtu/hr	8,760 hr/yr
6	Coal-Fired Boiler 8	CHPP	Coal	N/A	230 MMBtu/hr	8,760 hr/yr
7a	South Coal Handling Dust Collector (DC-01)	Airlanco 169-AST-8	N/A	N/A	13,150 acfm[a]	8,585 hr/yr
7b	South Underbunker Dust Collector (DC-02)	Airlanco 16-AST	N/A	N/A	884 acfm[a]	8,760 hr/yr
7c	North Coal Handling Dust Collector (NDC-1)	Dustex C67-10-547	N/A	N/A	9,250 acfm[a]	175 hr/yr[e]
8	Backup Generator Engine	Caterpillar 3516C	Distillate	2,000 kW	2,937 hp[b]	8,760 hr/yr
9	Emergency Generator Engine	Detroit 6V92	Distillate	250 kW	353 hp[c]	8,760 hr/yr
14	Emergency Generator Engine	Cummins QSL-G2 NR3	Distillate	200 kW	320 hp[b]	8,760 hr/yr
22	Emergency Generator Engine	Cummins	Distillate	25 kW	35 hp[c]	8,760 hr/yr
23	Emergency Generator Engine	John Deere 6068HF150	Distillate	110 kW	155 hp[c]	8,760 hr/yr
29a	Emergency Generator Engine	John Deere 4045TF290	Distillate	N/A	74 hp	8,760 hr/yr
30a	Emergency Generator Engine	Caterpillar C4.4	Distillate	60 kW	91 hp[h]	8,760 hr/yr
31a	Emergency Generator Engine	John Deere 4045TF290	Distillate	N/A	74 hp	8,760 hr/yr
32a	Emergency Generator Engine	Caterpillar C4.4	Distillate	60 kW	91 hp[h]	8,760 hr/yr
33a	Emergency Generator Engine	Caterpillar C4.4	Distillate	N/A	75 hp	8,760 hr/yr
34	Emergency Pump Engine	Detroit Diesel 10447000	Distillate	N/A	220 hp	8,760 hr/yr
35	Emergency Pump Engine	John Deere 4045DF120	Distillate	N/A	85 hp[b]	8,760 hr/yr
36	Emergency Pump Engine	Detroit Diesel 4031-C	Distillate	N/A	220 hp	8,760 hr/yr
37	Emergency Generator Engine	Caterpillar C4.4	Distillate	N/A	75 hp	8,760 hr/yr
51a	Fly Ash Dust Collector (DC-1)	United Conveyor Corp. 32242	N/A	N/A	3,620 acfm[a]	8,760 hr/yr
51b	Bottom Ash Dust Collector (DC-2)	United Conveyor Corp. 32242	N/A	N/A	3,620 acfm[a]	8,760 hr/yr
52	Coal Storage Pile	CHPP	N/A	N/A	N/A	165,684 tpy[f]
Insignificant Emission Units						
N/A	Fly and Bottom Ash Bin Vent Filter	United Conveyor Corp 96TB-BVT-25:S6	N/A	N/A	1,460 acfm[a]	8,760 hr/yr
N/A	Ash Loadout to Truck	N/A	N/A	N/A	N/A	55,967 tpy[g]
N/A	Aboveground Storage Tanks	N/A[d]	Diesel	N/A	N/A	N/A
N/A	Underground Storage Tanks	N/A[d]	Diesel	N/A	N/A	N/A

Notes:

[a] Rating for dust collectors and vent filters is the manufacturer's design inlet gas flow rate in cubic feet per minute

[b] Engine rating from vendor data

[c] Engine rating in hp calculated from electrical output assuming 95% efficiency (hp=kW*1.341/.95).

[d] Multiple tanks, see Table D-2.3 for details

[e] As calculated in Table D-2.7a.

[f] Combined amount of coal moved to coal pile and from coal pile as calculated in Table D-2.7c

[g] As calculated in Table D-2.7b

[h] Engine rating in hp calculated from electrical output using the manufacturer provided efficiency of 88%.

Conversion factors:

Engine horsepower	1.341	hp/kw
EU IDs 9, 22, and 23 drive shaft efficiency	95%	Per Alan Schuler at ADEC
EU IDs 30a and 32a drive shaft efficiency	88%	Per vendor information

Table D-2.5. Unlimited Potential to Emit Calculations - Oxides of Nitrogen (NO_X) Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added for the January 2021 Amendment.

Emission Unit ID	Emission Unit Description	Fuel Type	Factor Reference	NO_X Emission Factor	Emission Unit Rating/Capacity	Allowable Annual Operation	Potential NO_X Emissions
Significant Emission Units							
1	Coal-Fired Boiler 3	Coal	AP-42, Table 1.1-3	8.8 lb/ton	230 MMBtu/hr	8,760 hr/yr	586.3 tpy
2	Coal-Fired Boiler 4	Coal	AP-42, Table 1.1-3	8.8 lb/ton	230 MMBtu/hr	8,760 hr/yr	586.3 tpy
3	Coal-Fired Boiler 5	Coal	AP-42, Table 1.1-3	8.8 lb/ton	230 MMBtu/hr	8,760 hr/yr	586.3 tpy
4	Coal-Fired Boiler 6	Coal	AP-42, Table 1.1-3	8.8 lb/ton	230 MMBtu/hr	8,760 hr/yr	586.3 tpy
5	Coal-Fired Boiler 7	Coal	AP-42, Table 1.1-3	8.8 lb/ton	230 MMBtu/hr	8,760 hr/yr	586.3 tpy
6	Coal-Fired Boiler 8	Coal	AP-42, Table 1.1-3	8.8 lb/ton	230 MMBtu/hr	8,760 hr/yr	586.3 tpy
7a	South Coal Handling Dust Collector (DC-01)	N/A	N/A	N /A	13,150 acfm	8,585 hr/yr	0 tpy
7b	South Underbunker Dust Collector (DC-02)	N/A	N/A	N /A	884 acfm	8,760 hr/yr	0 tpy
7c	North Coal Handling Dust Collector (NDC-1)	N/A	N/A	N /A	9,250 acfm	175 hr/yr	0 tpy
8	Backup Generator Engine	Distillate	EPA Tier 2 (NMHC + NOx)	8.0 g/kW-hr[1, 2]	2,937 hp	8,760 hr/yr	169.2 tpy
9	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	0.031 lb/hp-hr	353 hp	8,760 hr/yr	47.9 tpy
14	Emergency Generator Engine	Distillate	EPA Tier 3 (NMHC + NOx)	5.0 g/kW-hr[1, 2]	320 hp	8,760 hr/yr	11.5 tpy
22	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	0.031 lb/hp-hr	35 hp	8,760 hr/yr	4.8 tpy
23	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	0.031 lb/hp-hr	155 hp	8,760 hr/yr	21.1 tpy
29a	Emergency Generator Engine	Distillate	EPA Tier 4i (NMHC + NOx)	5.875 g/kW-hr[1, 2]	74 hp	8,760 hr/yr	3.1 tpy
30a	Emergency Generator Engine	Distillate	EPA Tier 3 (NMHC + NOx)	5.875 g/kW-hr[1]	91 hp	8,760 hr/yr	3.9 tpy
31a	Emergency Generator Engine	Distillate	EPA Tier 4i (NMHC + NOx)	5.875 g/kW-hr[1, 2]	74 hp	8,760 hr/yr	3.1 tpy
32a	Emergency Generator Engine	Distillate	EPA Tier 3 (NMHC + NOx)	5.875 g/kW-hr[1]	91 hp	8,760 hr/yr	3.9 tpy
33a	Emergency Generator Engine	Distillate	EPA Tier 3 (NMHC + NOx)	5.875 g/kW-hr[1]	75 hp	8,760 hr/yr	3.2 tpy
34	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	0.031 lb/hp-hr	220 hp	8,760 hr/yr	29.9 tpy
35	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	0.031 lb/hp-hr	85 hp	8,760 hr/yr	11.5 tpy
36	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	0.031 lb/hp-hr	220 hp	8,760 hr/yr	29.9 tpy
37	Emergency Generator Engine	Distillate	EPA Tier 3 (NMHC + NOx)	5.9 g/kW-hr[1]	75 hp	8,760 hr/yr	3.2 tpy
51a	Fly Ash Dust Collector (DC-1)	N/A	N/A	N/A	3,620 acfm	8,760 hr/yr	0 tpy
51b	Bottom Ash Dust Collector (DC-2)	N/A	N/A	N/A	3,620 acfm	8,760 hr/yr	0 tpy
52	Coal Storage Pile	N/A	N/A	N/A	N/A	165,684 tpy	0 tpy
						Significant Emission Units Total Unlimited Potential to Emit - NO_X	**3,864.0 tpy**
Insignificant Emission Units							
52	Fly and Bottom Ash Bin Vent Filter	N/A	N/A	N/A	1,460 acfm	8,760 hr/yr	0 tpy
52	Ash Loadout to Truck	N/A	N/A	N/A	N/A	55,967 tpy	0 tpy
52	Aboveground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	0 tpy
52	Underground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	0 tpy
						Insignificant Emission Units Total Unlimited Potential to Emit - NO_X	**0 tpy**
						Total Unlimited Potential to Emit - NO_X	**3,864.0 tpy**

Notes:

[1] The Tier 4i, Tier 3, and Tier 2 weighted-cycle emission rates for NO_X have been multiplied by 1.25 to determine the Not-to-Exceed emission factors per 40 CFR 1039.101(e) and ADEC policy (see also 40 CFR 60.4212(c).)

[2] Emission factors for EUs 8, 14, 29a, and 31a have been corrected in this Title V renewal application amendment.

Conversion factors:

Weight	453.6 g/lb	
Weight	2,000 lb/ton	
Coal Heating Value	15.1 MMBtu/ton	*From http://www.usibelli.com/coal/data-sheet*
Engine Horsepower	1.341 hp/kw	

Table D-2.6. Unlimited Potential to Emit Calculations - Carbon Monoxide (CO) Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added for the January 2021 Amendment.

Emission Unit ID	Emission Unit Name	Fuel Type	Factor Reference	CO Emission Factor	Emission Unit Rating/Capacity	Allowable Annual Operation	Potential CO Emissions
Significant Emission Units							
1	Coal-Fired Boiler 3	Coal	AP-42, Table 1.1-3	5 lb/ton	230 MMBtu/hr	8,760 hr/yr	333.1 tpy
2	Coal-Fired Boiler 4	Coal	AP-42, Table 1.1-3	5 lb/ton	230 MMBtu/hr	8,760 hr/yr	333.1 tpy
3	Coal-Fired Boiler 5	Coal	AP-42, Table 1.1-3	5 lb/ton	230 MMBtu/hr	8,760 hr/yr	333.1 tpy
4	Coal-Fired Boiler 6	Coal	AP-42, Table 1.1-3	5 lb/ton	230 MMBtu/hr	8,760 hr/yr	333.1 tpy
5	Coal-Fired Boiler 7	Coal	AP-42, Table 1.1-3	5 lb/ton	230 MMBtu/hr	8,760 hr/yr	333.1 tpy
6	Coal-Fired Boiler 8	Coal	AP-42, Table 1.1-3	5 lb/ton	230 MMBtu/hr	8,760 hr/yr	333.1 tpy
7a	South Coal Handling Dust Collector (DC-01)	N/A	N/A	N/A	13,150 acfm	8,585 hr/yr	0 tpy
7b	South Underbunker Dust Collector (DC-02)	N/A	N/A	N/A	884 acfm	8,760 hr/yr	0 tpy
7c	North Coal Handling Dust Collector (NDC-1)	N/A	N/A	N/A	9,250 acfm	175 hr/yr	0 tpy
8	Backup Generator Engine	Distillate	EPA Tier 2	4.375 g/kW-hr[1, 2]	2,937 hp	8,760 hr/yr	92.5 tpy
9	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	6.68E-03 lb/hp-hr	353 hp	8,760 hr/yr	10.3 tpy
14	Emergency Generator Engine	Distillate	EPA Tier 3	4.375 g/kW-hr[1, 2]	320 hp	8,760 hr/yr	10.1 tpy
22	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	6.68E-03 lb/hp-hr	35 hp	8,760 hr/yr	1.0 tpy
23	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	6.68E-03 lb/hp-hr	155 hp	8,760 hr/yr	4.5 tpy
29a	Emergency Generator Engine	Distillate	EPA Tier 4i	6.25 g/kW-hr[1]	74 hp	8,760 hr/yr	3.3 tpy
30a	Emergency Generator Engine	Distillate	EPA Tier 3	6.25 g/kW-hr[1]	91 hp	8,760 hr/yr	4.1 tpy
31a	Emergency Generator Engine	Distillate	EPA Tier 4i	6.25 g/kW-hr[1]	74 hp	8,760 hr/yr	3.3 tpy
32a	Emergency Generator Engine	Distillate	EPA Tier 3	6.25 g/kW-hr[1]	91 hp	8,760 hr/yr	4.1 tpy
33a	Emergency Generator Engine	Distillate	EPA Tier 3	6.25 g/kW-hr[1]	75 hp	8,760 hr/yr	3.4 tpy
34	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	6.68E-03 lb/hp-hr	220 hp	8,760 hr/yr	6.4 tpy
35	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	6.68E-03 lb/hp-hr	85 hp	8,760 hr/yr	2.5 tpy
36	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	6.68E-03 lb/hp-hr	220 hp	8,760 hr/yr	6.4 tpy
37	Emergency Generator Engine	Distillate	EPA Tier 3	6.25 g/kW-hr[1]	75 hp	8,760 hr/yr	3.4 tpy
51a	Fly Ash Dust Collector (DC-1)	N/A	N/A	N/A	3,620 acfm	8,760 hr/yr	0 tpy
51b	Bottom Ash Dust Collector (DC-2)	N/A	N/A	N/A	3,620 acfm	8,760 hr/yr	0 tpy
52	Coal Storage Pile	N/A	N/A	N/A	N/A	165,684 tpy	0 tpy
					Significant Emission Units Total Unlimited Potential to Emit - CO		**2,154.3 tpy**
Insignificant Emission Units							
N/A	Fly and Bottom Ash Bin Vent Filter	N/A	N/A	N/A	1,460 acfm	8,760 hr/yr	0 tpy
N/A	Ash Loadout to Truck	N/A	N/A	N/A	N/A	55,967 tpy	0 tpy
N/A	Aboveground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	0 tpy
N/A	Underground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	0 tpy
					Insignificant Emission Units Total Unlimited Potential to Emit - CO		**0 tpy**
					Total Unlimited Potential to Emit - CO		**2,154.3 tpy**

Notes:

[1] The Tier 3 and Tier 2 weighted-cycle emission rates for CO have been multiplied by 1.25 to determine the Not-to-Exceed emission factors per 40 CFR 1039.101(e) and ADEC policy (see also 40 CFR 60.4212(c).)

[2] Emission factors for EUs 8 and 14 have been corrected in this Title V renewal application amendment.

Conversion factors:

Weight	453.6	g/lb	
Weight	2,000	lb/ton	
Coal Heating Value	15.1	MMBtu/ton	*From http://www.usibelli.com/coal/data-sheet*
Engine Horsepower	1.341	hp/kw	

Table D-2.7. Unlimited Potential to Emit Calculations - Particulate Matter Less Than 10 Microns (PM_{10}) Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added for the January 2021 Amendment.

Emission Unit ID	Emission Unit Name	Fuel Type	Factor Reference	PM_{10} Emission Factor	Emission Unit Rating/Capacity	Allowable Annual Operation	Potential PM_{10} Emissions
Significant Emission Units							
1	Coal-Fired Boiler 3	Coal	AP-42, Tables 1.1-5 and 1.1-9	13.8 lb/ton	230 MMBtu/hr	8,760 hr/yr	919.8 tpy
2	Coal-Fired Boiler 4	Coal	AP-42, Tables 1.1-5 and 1.1-9	13.8 lb/ton	230 MMBtu/hr	8,760 hr/yr	919.8 tpy
3	Coal-Fired Boiler 5	Coal	AP-42, Tables 1.1-5 and 1.1-9	13.8 lb/ton	230 MMBtu/hr	8,760 hr/yr	919.8 tpy
4	Coal-Fired Boiler 6	Coal	AP-42, Tables 1.1-5 and 1.1-9	13.8 lb/ton	230 MMBtu/hr	8,760 hr/yr	919.8 tpy
5	Coal-Fired Boiler 7	Coal	AP-42, Tables 1.1-5 and 1.1-9	13.8 lb/ton	230 MMBtu/hr	8,760 hr/yr	919.8 tpy
6	Coal-Fired Boiler 8	Coal	AP-42, Tables 1.1-5 and 1.1-9	13.8 lb/ton	230 MMBtu/hr	8,760 hr/yr	919.8 tpy
7a	South Coal Handling Dust Collector (DC-01)	N/A	See detailed calculations in Table D-2.7a		13,150 acfm	8,760 hr/yr	23.4 tpy
7b	South Underbunker Dust Collector (DC-02)	N/A	See detailed calculations in Table D-2.7a		884 acfm	8,760 hr/yr	12.9 tpy
7c	North Coal Handling Dust Collector (NDC-1)	N/A	See detailed calculations in Table D-2.7a		9,250 acfm	8,760 hr/yr	2.7 tpy
8	Backup Generator Engine	Distillate	EPA Tier 2	0.25 g/kW-hr[1, 2]	2,937 hp	8,760 hr/yr	5.3 tpy
9	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	353 hp	8,760 hr/yr	3.4 tpy
14	Emergency Generator Engine	Distillate	EPA Tier 3	0.25 g/kW-hr[1, 2]	320 hp	8,760 hr/yr	0.6 tpy
22	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	35 hp	8,760 hr/yr	0.3 tpy
23	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	155 hp	8,760 hr/yr	1.5 tpy
29a	Emergency Generator Engine	Distillate	EPA Tier 4i	0.375 g/kW-hr[1, 2]	74 hp	8,760 hr/yr	0.2 tpy
30a	Emergency Generator Engine	Distillate	EPA Tier 3	0.5 g/kW-hr[1]	91 hp	8,760 hr/yr	0.3 tpy
31a	Emergency Generator Engine	Distillate	EPA Tier 4i	0.375 g/kW-hr[1, 2]	74 hp	8,760 hr/yr	0.2 tpy
32a	Emergency Generator Engine	Distillate	EPA Tier 3	0.5 g/kW-hr[1]	91 hp	8,760 hr/yr	0.3 tpy
33a	Emergency Generator Engine	Distillate	EPA Tier 3	0.5 g/kW-hr[1]	75 hp	8,760 hr/yr	0.3 tpy
34	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	220 hp	8,760 hr/yr	2.1 tpy
35	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	85 hp	8,760 hr/yr	0.8 tpy
36	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	220 hp	8,760 hr/yr	2.1 tpy
37	Emergency Generator Engine	Distillate	EPA Tier 3	0.5 g/kW-hr[1]	75 hp	8,760 hr/yr	0.3 tpy
51a	Fly Ash Dust Collector (DC-1)	N/A	See detailed calculations in Table D-2.7b		3,620 acfm	8,760 hr/yr	47.1 tpy
51b	Bottom Ash Dust Collector (DC-2)	N/A	See detailed calculations in Table D-2.7b		3,620 acfm	8,760 hr/yr	47.1 tpy
52	Coal Storage Pile	N/A	See detailed calculations in Table D-2.7c		N/A	165,684 tpy	2.9 tpy
						Significant Emission Units Total Unlimited Potential to Emit - PM_{10}	**5,672.3 tpy**
Insignificant Emission Units							
N/A	Fly and Bottom Ash Bin Vent Filter	N/A	See detailed calculations in Table D-2.7b		1,460 acfm	8,760 hr/yr	19.0 tpy
N/A	Ash Loadout to Truck	N/A	See detailed calculations in Table D-2.7b		N/A	55,967 tpy	6.1E-04 tpy
N/A	Aboveground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	0 tpy
N/A	Underground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	0 tpy
						Insignificant Emission Units Total Unlimited Potential to Emit - PM_{10}	**19.0 tpy**
						Total Unlimited Potential to Emit - PM_{10}	**5,691.3 tpy**

Notes:

[1] The Tier 4i, Tier 3, and Tier 2 weighted-cycle emission rates for PM have been multiplied by 1.25 to determine the Not-to-Exceed emission factors per 40 CFR 1039.101(e) and ADEC policy (see also 40 CFR 60.4212(c).)

[2] Emission factors for EUs 8, 14, 29a, and 31a have been corrected in this Title V renewal application amendment.

Conversion factors:

Weight	453.6	g/lb	
Weight	2,000	lb/ton	
Coal Heating Value	15.1	MMBtu/ton	*From http://www.usibelli.com/coal/data-sheet*
Engine Horsepower	1.341	hp/kw	

Table D-2.7a. Unlimited Potential to Emit Calculations - Coal Handling Systems $PM/PM_{10}/PM_{2.5}$ Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added for the January 2021 Amendment.

Emission Unit			Factor Reference	PM Emission Factor[d]	Emission Unit Rating/Capacity	Annual Operation[a]	Potential $PM/PM_{10}/PM_{2.5}$ Emissions[b]
Permit ID	Description	Year Installed					
7a	South Coal Handling Dust Collector (DC-01)	2001	Source Test, 2003	0.0500 gr/dscf	13,150 acfm	8,585 hr/yr	23.44 tpy
7b	South Underbunker Dust Collector (DC-02)	2005	Manufacturer's guarantee[c]	0.4000 gr/dscf	884 acfm	8,760 hr/yr	12.86 tpy
7c	North Coal Handling Dust Collector (NDC-1)	2004	Typical value	0.4000 gr/dscf	9,250 acfm	175 hr/yr	2.69 tpy
						Total $PM/PM_{10}/PM_{2.5}$ Emissions	**38.99 tpy**

Notes:

[a] Time of operation:

Average daily coal handling operations	24	hr/day, 365 operating days per year
Percent of time South coal handling dust collector is in use	98	percent, primary coal handling system
Percent of time North coal handling dust collector is in use	2	percent, North handling system is emergency backup to South handling system
Hours of operation	8,760	hrs/yr

[b] Coal handling dust collection emission calculations:

(exhaust rate, acfm) x (Temp at STP/Temp of exhaust) x (PM exhaust concentration, gr/dscf) x (1 lb/ 7,000 gr) x (1 ton/ 2,000 lb) x (60 min/hr) x (operation, hr/yr)

Temperature at standard conditions =	68	degrees Fahrenheight	293.15 degrees Kelvin
Exhaust temperature dust collectors =	85	degrees Fahrenheight	302.59 degrees Kelvin

[c] Manufacturer's guarantee for particle sizes 2 microns in diameter and larger

[d] To estimate uncontrolled emission factor, an estimate of 95% efficiency for dust collection filters was used. Uncontrolled emissions are expected to be significantly lower than this number.

Table D-2.7b. Unlimited Potential to Emit Calculations - Ash Handling System PM_{10} Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added for the January 2021 Amendment.

Emission Unit							
Permit ID	Description	Year Installed	Factor Reference	PM_{10} Emission Factor[d]	Emission Unit Rating/Capacity	Annual Operation	Potential PM_{10} Emissions[b]
51a	Fly Ash Dust Collector (DC-1)	1993	Typical Value	0.40 gr/dscf	3,620 acfm	8,760 hr/yr	47.05 tpy[a]
51b	Bottom Ash Dust Collector (DC-2)	1994	Typical Value	0.40 gr/dscf	3,620 acfm	8,760 hr/yr	47.05 tpy[a]
N/A	Fly and Bottom Ash Bin Vent Filter	1993	Manufacturer's guarantee[c]	0.40 gr/scfm	1,460 acfm	8,760 hr/yr	18.98 tpy[a]
N/A	Ash Loadout to Truck	Unknown	AP-42, Section 13.2.4	2.19E-05 lb/ton	unknown	55,967 tpy	6.13E-04 tpy[b]
						Total PM_{10} Emissions	**113.08 tpy**

Notes:

[a] Fly and bottom ash dust collector emission calculations:

(exhaust rate, acfm) x (Temp at STP/Temp of exhaust) x (PM_{10} exhaust concentration, gr/dscf) x (1 lb/ 7,000 gr) x (1 ton/ 2,000 lb) x (60 min/hr) x (operation, hr/yr)

Temperature at standard conditions =	68	degrees Fahrenheit	293.15	degrees Kelvin
Exhaust temperature of ash bin vent filter =	150	degrees Fahrenheit	338.71	degrees Kelvin
Exhaust temperature of fan duct blower/bag filter =	150	degrees Fahrenheit		

[b] Ash loadout emission calculations:

Emission factor from AP-42, Section 13.2.4 based on empirical equation E = k x 0.0032 x $(U/5)^{1.3}/(M/2)^{1.4}$ lb/ton transferred where:

k = 0.35 for PM_{10}

U = mean wind speed = 4 mph in Fairbanks, average value from September 2017 to October 2018 per NOAA NCDC.

M = ash moisture content = 27 percent (AP-42, Table 13.2.4-1)

Ash loadout emissions based on maximum possible coal consumption

Boiler Rating	230	MMBtu/hr	
Coal Heating Value	15.1	MMBtu/ton	*From http://www.usibelli.com/coal/data-sheet*
Number of boilers	6		
Maximum possible coal consumption (8,760 hr/yr x Number of boilers x Boiler rating / Coal heating value)	799,524	tpy	
Ash content of coal per Usibelli Coal Mine website	7	percent	
Operations, ash tons/yr = coal consumption x (0.085 ash content)	55,967	tpy	

Ash loadout emissions, tons/yr = (emission factor, lb/ton) x (ash loading, ton/yr) / (2,000 lb/ton)

[c] Manufacturer's guarantee for particle sizes over 5 microns in diameter

[d] To estimate uncontrolled emission factor, an estimate of 95% efficiency for dust collection filters was used. Uncontrolled emissions are expected to be significantly lower than this number.

Table D-2.7c. Unlimited Potential to Emit Calculations - Emergency Coal Storage Pile PM_{10} Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Emission Unit					
Permit ID	**Description**	**Factor Reference**	**PM_{10} Emission Factor**	**Annual Operation[b]**	**Potential PM_{10} Emissions**
	Coal chute to coal pile	AP-42, Section 13.2.4	2.46E-04 lb/ton[a]	82,842 tpy	1.02E-02 tpy
	Front end loader drop onto stockpile	AP-42, Section 13.2.4	2.46E-04 lb/ton[a]	82,842 tpy	1.02E-02 tpy
	Front end loader movement - chute to coal pile	AP-42, Section 13.2.2	2.92 lb/VMT[c]	697 VMT	1.02 tpy
	Front end loader movement - coal pile to South grizzly	AP-42, Section 13.2.2	2.92 lb/VMT[c]	1,139 VMT	1.67 tpy
	Front end loader movement - coal pile to North grizzly	AP-42, Section 13.2.2	2.92 lb/VMT[c]	93 VMT	0.14 tpy
	Stockpile wind erosion	AP-42, Section 13.2.5	0.00 g/m^2-yr[d]	3,370 m^2	0.00 tpy
	Front end loader drop into grizzly	AP-42, Section 13.2.4	2.46E-04 lb/ton[a]	82,842 tpy	1.02E-02 tpy
52	Coal Storage Pile			**Total PM_{10} Emissions**	**2.85 tpy**

Notes:

[a]Coal transfer emission factor from AP-42, Section 13.2.4 based on empirical equation E = k x 0.0032 x $(U/5)^{1.3}/(M/2)^{1.4}$ lb/ton transferred where:

k	0.35	for PM_{10}	
U = mean wind speed	4.0	miles/hr	Average value from September 2017 to October 2018 per NOAA NCDC.
M = coal moisture content	4.8	percent	

[b]For unlimited potential assume entire coal pile is turned over in one year:

Coal pile volume	122,729	yd^3	per September 29, 2017 survey
Density of coal	50	lb/ft^3	
Coal pile weight	82,842	tons	
Coal moved to coal pile	82,842	tpy	
Coal moved from coal pile	82,842	tpy	

[c]Front end loader movement emission factor from AP-42, Section 13.2.2, Empirical Equation 1a, E = k x $(s/12)^a$ x $(W/3)^b$ lb/VMT where:

k	1.5	for PM_{10}	
s = surface material silt content (haul road)	8.4	percent,	from AP-42, Table 13.2.2-1
W = mean vehicle weight	27	tons,	estimate
Size of load bucket	5	yd^3	
Density of coal	50	lb/ft^3	
Coal moved per trip	3.375	tons	(Density of coal x 27 ft3/yd3 x bucket size / 2000 lb/ton)
a (empirical constant)	0.9		from AP-42, Table 13.2.2-2
b (empirical constant)	0.45		from AP-42, Table 13.2.2-2
Approximate distance from coal chute to coal pile (round trip)	150	feet	
Approximate distance from coal pile to South grizzly (round trip)	250	feet	
Approximate distance from coal pile to North grizzly (round trip)	1,000	feet	
Percent of annual coal transferred to South grizzly	98	percent,	primary coal handling system
Percent of annual coal transferred to North grizzly	2	percent,	North handling system is emergency backup to South handling system
VMT = vehicles miles traveled per year			VMT = annual stockpile throughput/coal moved per trip x distanced traveled per round trip in feet / 5280 ft/mi

[d]From AP-42, Section 13.2.5, Industrial Wind Erosion

Coal Pile at FWA CHPP (*source: Ft WW Coal Pile 2018 Volume Summary, October 2, 2018, 3-TIER Alaska LLC.*)

Average Height =	40	ft	
Width at Base =	205	ft	The minimum width (south face) of the coal pile is used as a conservative approach
Height-to-Base Ratio =	0.195		< 0.2. FWA CHPP coal pile can therefore be considered a large relatively flat pile with little penetration into the surface wind layer and a single friction velocity (using Equation (1)) can be used to for the entire surface of the coal pile. Friction velocity is a measure of wind shear stress on the erodible surface.
Surface Area of Active (north) Face =	3,370	m^2	Calculated from survey using Computer Aided Design (CAD) software in 2012. Height and width of the pile were comparable in 2018 and 2012.

AP-42 Section 13.2.5, Equation (2)

Emission factor for wind-generated particulate emissions from mixtures of erodible and nonerodible surface material subject to disturbance, EF

$$EF\ (g/m^2\text{-}yr) = k \sum_{i=1}^{N} P_i$$

where k = particle size multiplier (0.5 for particle size < 10 microns, per table on page 13.2.5-3)
N = number of disturbances per year
P_i = erosion potential corresponding to the fastest mile of wind for the ith period between disturbances, g/m^2

AP-42 Section 13.2.5, Equation (3)

Erosion potential function for a dry exposed surface, P

$$P = 58\ (u^* - u_t^*)^2 + 25\ (u^* - u_t^*)$$
$$P = 0 \text{ for } u^* \leq u_t^*$$

where u^* = friction velocity (m/s)
u_t = threshold friction velocity (m/s)

AP-42 Section 13.2.5, Equation (1)

Friction velocity, u^*

$$u^* = 0.4 \times u(z) / \ln(z/z_o) \qquad \text{when } z > z_o$$

where u^* = friction velocity (cm/s)
u(z) = wind speed at height z above test surface (cm/s)
z = height above test surface (cm)
z_o = roughness height, cm

Data:

u(z)		Use maximum wind gust speed recorded at Fairbanks International Airport for each of the previous 12 months (see table below)
z	10	meters
N	204	disturbances/year for active face, as determined from 2017 records
	17	average disturbances/month

				Uncrusted coal pile[2] (Table 13.2.5-2)				Scraper tracks on coal pile (Table 13.2.5-2)						
Month-Year	Maximum Wind Speed (u(10))[1]		Wind Direction	Roughness Height (z_o)	Threshold Friction Velocity (u_t)	Calculated Friction Velocity (u*)	Erosion potential function, P	Roughness Height (z_o)	Threshold Friction Velocity (u_t)	Calculated Friction Velocity (u*)	Erosion potential function, P	P x N	k	Emission Factor, EF
	mph	m/s	deg	cm	m/s	m/s		cm	m/s	m/s				g/m^2-yr
Oct-17	17	7.6	250	0.3	1.12	0.37	0	0.06	0.62	0.31	0	0		
Nov-17	20	8.9	320	0.3	1.12	0.44	0	0.06	0.62	0.37	0	0		
Dec-17	15	6.7	140	0.3	1.12	0.33	0	0.06	0.62	0.28	0	0		
Jan-18	17	7.6	110	0.3	1.12	0.37	0	0.06	0.62	0.31	0	0		
Feb-18	29	13.0	320	0.3	1.12	0.64	0	0.06	0.62	0.53	0	0		
Mar-18	25	11.2	260	0.3	1.12	0.55	0	0.06	0.62	0.46	0	0		
Apr-18	26	11.6	240	0.3	1.12	0.57	0	0.06	0.62	0.48	0	0		
May-18	25	11.2	060	0.3	1.12	0.55	0	0.06	0.62	0.46	0	0		
Jun-18	25	11.2	030	0.3	1.12	0.55	0	0.06	0.62	0.46	0	0		
Jul-18	22	9.8	270	0.3	1.12	0.48	0	0.06	0.62	0.40	0	0		
Aug-18	26	11.6	270	0.3	1.12	0.57	0	0.06	0.62	0.48	0	0		
Sep-18	22	9.8	280	0.3	1.12	0.48	0	0.06	0.62	0.40	0	0		
Annual Total							0				0.00	0.00	0.5	**0.00**

[1] Maximum wind speed data is from NOAA NCDC. Tower height of 10 meters confirmed by Fairbanks Weather Forecast Office, National Weather Service on 27-March-2013

[2] The erosion potential factor for the uncrusted coal pile is zero for all months. Therefore, wind erosion of the uncrusted coal pile is not a significant source of PM emissions

Table D-2.8. Unlimited Potential to Emit Calculations - Particulate Matter Less Than 2.5 Microns ($PM_{2.5}$) Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added for the January 2021 Amendment.

Emission Unit ID	Emission Unit Name	Fuel Type	Factor Reference	$PM_{2.5}$ Emission Factor	Emission Unit Rating/Capacity	Allowable Annual Operation	Potential $PM_{2.5}$ Emissions
Significant Emission Units							
1	Coal-Fired Boiler 3	Coal	AP-42, Tables 1.1-5 and 1.1-9	5.2 lb/ton	230 MMBtu/hr	8,760 hr/yr	347.3 tpy
2	Coal-Fired Boiler 4	Coal	AP-42, Tables 1.1-5 and 1.1-9	5.2 lb/ton	230 MMBtu/hr	8,760 hr/yr	347.3 tpy
3	Coal-Fired Boiler 5	Coal	AP-42, Tables 1.1-5 and 1.1-9	5.2 lb/ton	230 MMBtu/hr	8,760 hr/yr	347.3 tpy
4	Coal-Fired Boiler 6	Coal	AP-42, Tables 1.1-5 and 1.1-9	5.2 lb/ton	230 MMBtu/hr	8,760 hr/yr	347.3 tpy
5	Coal-Fired Boiler 7	Coal	AP-42, Tables 1.1-5 and 1.1-9	5.2 lb/ton	230 MMBtu/hr	8,760 hr/yr	347.3 tpy
6	Coal-Fired Boiler 8	Coal	AP-42, Tables 1.1-5 and 1.1-9	5.2 lb/ton	230 MMBtu/hr	8,760 hr/yr	347.3 tpy
7a	South Coal Handling Dust Collector (DC-01)	N/A	See detailed calculations in Table D-2.7a		13,150 acfm	8,585 hr/yr	23.4 tpy
7b	South Underbunker Dust Collector (DC-02)	N/A	See detailed calculations in Table D-2.7a		884 acfm	8,760 hr/yr	12.9 tpy
7c	North Coal Handling Dust Collector (NDC-1)	N/A	See detailed calculations in Table D-2.7a		9,250 acfm	175 hr/yr	2.7 tpy
8	Backup Generator Engine	Distillate	EPA Tier 2	0.25 g/kW-hr[1, 2]	2,937 hp	8,760 hr/yr	5.3 tpy
9	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	353 hp	8,760 hr/yr	3.4 tpy
14	Emergency Generator Engine	Distillate	EPA Tier 3	0.25 g/kW-hr[2, 3]	320 hp	8,760 hr/yr	0.6 tpy
22	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	35 hp	8,760 hr/yr	0.3 tpy
23	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	155 hp	8,760 hr/yr	1.5 tpy
29a	Emergency Generator Engine	Distillate	EPA Tier 4i	3.75E-01 g/kW-hr[2, 3]	74 hp	8,760 hr/yr	0.2 tpy
30a	Emergency Generator Engine	Distillate	EPA Tier 3	0.5 g/kW-hr[2]	91 hp	8,760 hr/yr	0.3 tpy
31a	Emergency Generator Engine	Distillate	EPA Tier 4i	3.75E-01 g/kW-hr[2, 3]	74 hp	8,760 hr/yr	0.2 tpy
32a	Emergency Generator Engine	Distillate	EPA Tier 3	0.5 g/kW-hr[2]	91 hp	8,760 hr/yr	0.3 tpy
33a	Emergency Generator Engine	Distillate	EPA Tier 3	0.5 g/kW-hr[2]	75 hp	8,760 hr/yr	0.3 tpy
34	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	220 hp	8,760 hr/yr	2.1 tpy
35	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	85 hp	8,760 hr/yr	0.8 tpy
36	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	220 hp	8,760 hr/yr	2.1 tpy
37	Emergency Generator Engine	Distillate	EPA Tier 3	0.5 g/kW-hr[2]	75 hp	8,760 hr/yr	0.3 tpy
51a	Fly Ash Dust Collector (DC-1)	N/A	See detailed calculations in Table D-2.8a		3,620 acfm	8,760 hr/yr	47.1 tpy
51b	Bottom Ash Dust Collector (DC-2)	N/A	See detailed calculations in Table D-2.8a		3,620 acfm	8,760 hr/yr	47.1 tpy
52	Coal Storage Pile	N/A	See detailed calculations in Table D-2.8b		N/A	165,684 tpy	0.3 tpy
						Significant Emission Units Total Unlimited Potential to Emit - $PM_{2.5}$	**2,234.7 tpy**
Insignificant Emission Units							
N/A	Fly and Bottom Ash Bin Vent Filter	N/A	See detailed calculations in Table D-2.8a		1,460 acfm	8,760 hr/yr	19.0 tpy
N/A	Ash Loadout to Truck	N/A	See detailed calculations in Table D-2.8a		N/A	55,967 tpy	9.3E-05 tpy
N/A	Aboveground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	0 tpy
N/A	Underground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	0 tpy
						Insignificant Emission Units Total Unlimited Potential to Emit - $PM_{2.5}$	**19.0 tpy**
						Total Unlimited Potential to Emit - $PM_{2.5}$	**2,253.7 tpy[1]**

Notes:

[1] $PM_{2.5}$ potential to emit calculations for all emission units other than 1 through 6, 51a, 51b, and 52 conservatively assume that $PM_{2.5}$ emissions are equal to PM_{10} emissions.

[2] The Tier 4i, Tier 3, and Tier 2 weighted-cycle emission rates for PM have been multiplied by 1.25 to determine the Not-to-Exceed emission factors per 40 CFR 1039.101(e) and ADEC policy (see also 40 CFR 60.4212(c).)

[3] Emission factors for EUs 8, 14, 29a, 31a, 51a, 51b, and 52 have been corrected in this Title V renewal application amendment.

Conversion factors:

Weight	453.6	g/lb	
Weight	2,000	lb/ton	
Engine horsepower	1.341	hp/kw	
Coal Heating Value	15.1	MMBtu/ton	*From http://www.usibelli.com/coal/data-sheet*

Table D-2.8a. Unlimited Potential to Emit Calculations - Ash Handling System $PM_{2.5}$ Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added (to Table 2.7b) for the January 2021 Amendment.

Emission Unit							
Permit ID	Description	Year Installed	Factor Reference	$PM_{2.5}$ Emission Factor[d]	Emission Unit Rating/Capacity	Annual Operation	Potential $PM_{2.5}$ Emissions[b]
51a	Fly Ash Dust Collector (DC-1)	1993	Typical Value	0.40 gr/dscf	3,620 acfm	8,760 hr/yr	47.05 tpy[a]
51b	Bottom Ash Dust Collector (DC-2)	1994	Typical Value	0.40 gr/dscf	3,620 acfm	8,760 hr/yr	47.05 tpy[a]
N/A	Fly and Bottom Ash Bin Vent Filter	1993	Manufacturer's guarantee[c]	0.40 gr/scfm	1,460 acfm	8,760 hr/yr	18.98 tpy[a]
N/A	Ash Loadout to Truck	Unknown	AP-42, Section 13.2.4	3.32E-06 lb/ton	unknown	55,967 tpy	9.29E-05 tpy[b]
						Total $PM_{2.5}$ Emissions	**113.08 tpy**

Notes:

[a] Fly and bottom ash dust collector emission calculations:

(exhaust rate, acfm) x (Temp at STP/Temp of exhaust) x (PM_{10} exhaust concentration, gr/dscf) x (1 lb/ 7,000 gr) x (1 ton/ 2,000 lb) x (60 min/hr) x (operation, hr/yr)

Temperature at standard conditions =	68	degrees Fahrenheit	293.15	degrees Kelvin
Exhaust temperature of ash bin vent filter =	150	degrees Fahrenheit	338.71	degrees Kelvin
Exhaust temperature of fan duct blower/bag filter =	150	degrees Fahrenheit		

[b] Ash loadout emission calculations:

Emission factor from AP-42, Section 13.2.4 based on empirical equation E = k x 0.0032 x $(U/5)^{1.3}/(M/2)^{1.4}$ lb/ton transferred where:

k = 0.053 for $PM_{2.5}$

U = mean wind speed = 4.0 mph in Fairbanks, average value from September 2017 to October 2018 per NOAA NCDC.

M = ash moisture content = 27 percent (AP-42, Table 13.2.4-1)

Ash loadout emissions based on maximum possible coal consumption

Boiler Rating	230	MMBtu/hr	
Coal Heating Value	15.1	MMBtu/ton	*From http://www.usibelli.com/coal/data-sheet*
Number of boilers	6		
Maximum possible coal consumption (8,760 hr/yr x Number of boilers x Boiler rating / Coal heating value)	799,524	tpy	
Ash content of coal per Usibelli Coal Mine website	7	percent	
Operations, ash tons/yr = coal consumption x (0.085 ash content)	55,967	tpy	
Ash loadout emissions, tons/yr = (emission factor, lb/ton) x (ash loading, ton/yr) / (2,000 lb/ton)			

[c] Manufacturer's guarantee for particle sizes over 5 microns in diameter

[d] To estimate uncontrolled emission factor, an estimate of 95% efficiency for dust collection filters was used. Uncontrolled emissions are expected to be significantly lower than this number.

Table D-2.8b. Unlimited Potential to Emit Calculations - Emergency Coal Storage Pile $PM_{2.5}$ Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added (to Table 2.7c) for the January 2021 Amendment.

Emission Unit		Factor Reference	$PM_{2.5}$ Emission Factor	Annual Operation[b]	Potential $PM_{2.5}$ Emissions
Permit ID	Description				
	Coal chute to coal pile	AP-42, Section 13.2.4	3.73E-05 lb/ton[a]	82,842 tpy	1.54E-03 tpy
	Front end loader drop onto stockpile	AP-42, Section 13.2.4	3.73E-05 lb/ton[a]	82,842 tpy	1.54E-03 tpy
	Front end loader movement - chute to coal pile	AP-42, Section 13.2.2	0.29 lb/VMT[c]	697 VMT	0.10 tpy
	Front end loader movement - coal pile to South grizzly	AP-42, Section 13.2.2	0.29 lb/VMT[c]	1,139 VMT	0.17 tpy
	Front end loader movement - coal pile to North grizzly	AP-42, Section 13.2.2	0.29 lb/VMT[c]	93 VMT	1.4E-02 tpy
	Stockpile wind erosion	AP-42, Section 13.2.5	0.00 g/m^2-yr[d]	3,370 m^2	0.00 tpy
	Front end loader drop into grizzly	AP-42, Section 13.2.4	3.73E-05 lb/ton[a]	82,842 tpy	1.54E-03 tpy
52	Coal Storage Pile			**Total $PM_{2.5}$ Emissions**	**0.29 tpy**

Notes:

[a]Coal transfer emission factor from AP-42, Section 13.2.4 based on empirical equation E = k x 0.0032 x $(U/5)^{1.3}/(M/2)^{1.4}$ lb/ton transferred where:

k	0.053	for $PM_{2.5}$	
U = mean wind speed	4.0	miles/hr	Average value from September 2017 to October 2018 per NOAA NCDC.
M = coal moisture content	4.8	percent	

[b]For unlimited potential assume entire coal pile is turned over in one year:

Coal pile volume	122,729	yd^3	per September 29, 2017 survey
Density of coal	50	lb/ft^3	
Coal pile weight	82,842	tons	
Coal moved to coal pile	82,842	tpy	
Coal moved from coal pile	82,842	tpy	

[c]Front end loader movement emission factor from AP-42, Section 13.2.2, Empirical Equation 1a, E = k x $(s/12)^a$ x $(W/3)^b$ lb/VMT where:

k	0.15	for $PM_{2.5}$
s = surface material silt content (haul road)	8.4	percent, from AP-42, Table 13.2.2-1
W = mean vehicle weight	27	tons, estimate
Size of load bucket	5	yd^3
Density of coal	50	lb/ft^3
Coal moved per trip	3.375	tons (Density of coal x 27 ft3/yd3 x bucket size / 2000 lb/ton)
a (empirical constant)	0.9	from AP-42, Table 13.2.2-2 for $PM_{2.5}$
b (empirical constant)	0.45	from AP-42, Table 13.2.2-2
Approximate distance from coal chute to coal pile (round trip)	150	feet
Approximate distance from coal pile to South grizzly (round trip)	250	feet
Approximate distance from coal pile to North grizzly (round trip)	1,000	feet
Percent of annual coal transferred to South grizzly	98	percent, primary coal handling system
Percent of annual coal transferred to North grizzly	2	percent, North handling system is emergency backup to South handling system
VMT = vehicles miles traveled per year		VMT = annual stockpile throughput/coal moved per trip x distanced traveled per round trip in feet / 5280 ft/mi

[d]From AP-42, Section 13.2.5, Industrial Wind Erosion

Coal Pile at FWA CHPP (*source: Ft WW Coal Pile 2018 Volume Summary, October 2, 2018, 3-TIER Alaska LLC.*)

Average Height =	40	ft	
Width at Base =	205	ft	The minimum width (south face) of the coal pile is used as a conservative approach
Height-to-Base Ratio =	0.195		< 0.2. FWA CHPP coal pile can therefore be considered a large relatively flat pile with little penetration into the surface wind layer and a single friction velocity (using Equation (1)) can be used to for the entire surface of the coal pile. Friction velocity is a measure of wind shear stress on the erodible surface.
Surface Area of Active (north) Face =	3,370	m^2	Calculated from survey using Computer Aided Design (CAD) software in 2012. Height and width of the pile were comparable in 2018 and 2012.

AP-42 Section 13.2.5, Equation (2)

Emission factor for wind-generated particulate emissions from mixtures of erodible and nonerodible surface material subject to disturbance, EF

$$EF\ (g/m^2\text{-}yr) = k \sum_{i=1}^{N} P_i$$

where k = particle size multiplier (0.075 for particle size < 2.5 microns, per table on page 13.2.5-3)
N = number of disturbances per year
P_i = erosion potential corresponding to the fastest mile of wind for the ith period between disturbances, g/m^2

AP-42 Section 13.2.5, Equation (3)

Erosion potential function for a dry exposed surface, P

$$P = 58\ (u^* - u_t^*)^2 + 25\ (u^* - u_t^*)$$
$$P = 0 \text{ for } u^* \leq u_t^*$$

where u^* = friction velocity (m/s)
u_t = threshold friction velocity (m/s)

AP-42 Section 13.2.5, Equation (1)

Friction velocity, u^*

$$u^* = 0.4 \times u(z) / \ln(z/z_o) \qquad \text{when } z > z_o$$

where u^* = friction velocity (cm/s)
u(z) = wind speed at height z above test surface (cm/s)
z = height above test surface (cm)
z_o = roughness height, cm

Data:

u(z)		Use maximum wind gust speed recorded at Fairbanks International Airport for each of the previous 12 months (see table below)
z	10	meters
N	204	disturbances/year for active face, as determined from 2017 records
	17	average disturbances/month

Month-Year	Maximum Wind Speed (u(10))[1]		Wind Direction	Uncrusted coal pile[2] (Table 13.2.5-2)				Scraper tracks on coal pile (Table 13.2.5-2)						
				Roughness Height (z_o)	Threshold Friction Velocity (u_t)	Calculated Friction Velocity (u*)	Erosion potential function, P	Roughness Height (z_o)	Threshold Friction Velocity (u_t)	Calculated Friction Velocity (u*)	Erosion potential function, P	P x N	k	Emission Factor, EF
	mph	m/s	deg	cm	m/s	m/s		cm	m/s	m/s				g/m^2-yr
Oct-17	17	7.6	250	0.3	1.12	0.37	0	0.06	0.62	0.31	0	0		
Nov-17	20	8.9	320	0.3	1.12	0.44	0	0.06	0.62	0.37	0	0		
Dec-17	15	6.7	140	0.3	1.12	0.33	0	0.06	0.62	0.28	0	0		
Jan-18	17	7.6	110	0.3	1.12	0.37	0	0.06	0.62	0.31	0	0		
Feb-18	29	13.0	320	0.3	1.12	0.64	0	0.06	0.62	0.53	0	0		
Mar-18	25	11.2	260	0.3	1.12	0.55	0	0.06	0.62	0.46	0	0		
Apr-18	26	11.6	240	0.3	1.12	0.57	0	0.06	0.62	0.48	0	0		
May-18	25	11.2	060	0.3	1.12	0.55	0	0.06	0.62	0.46	0	0		
Jun-18	25	11.2	030	0.3	1.12	0.55	0	0.06	0.62	0.46	0	0		
Jul-18	22	9.8	270	0.3	1.12	0.48	0	0.06	0.62	0.40	0	0		
Aug-18	26	11.6	270	0.3	1.12	0.57	0	0.06	0.62	0.48	0	0		
Sep-18	22	9.8	280	0.3	1.12	0.48	0	0.06	0.62	0.40	0	0		
Annual Total							0				0.00	0.00	0.075	**0.00**

[1] Maximum wind speed data is from NOAA NCDC. Tower height of 10 meters confirmed by Fairbanks Weather Forecast Office, National Weather Service on 27-March-2013

[2] The erosion potential factor for the uncrusted coal pile is zero for all months. Therefore, wind erosion of the uncrusted coal pile is not a significant source of PM emissions

Table D-2.9. Unlimited Potential to Emit Calculations - Volatile Organic Compounds (VOC) Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Emission Unit ID	Emission Unit Name	Fuel Type	Factor Reference	VOC Emission Factor	Emission Unit Rating/Capacity	Allowable Annual Operation	Potential VOC Emissions
Significant Emission Units							
1	Coal-Fired Boiler 3	Coal	AP-42, Table 1.1-19	0.05 lb/ton	230 MMBtu/hr	8,760 hr/yr	3.3 tpy
2	Coal-Fired Boiler 4	Coal	AP-42, Table 1.1-19	0.05 lb/ton	230 MMBtu/hr	8,760 hr/yr	3.3 tpy
3	Coal-Fired Boiler 5	Coal	AP-42, Table 1.1-19	0.05 lb/ton	230 MMBtu/hr	8,760 hr/yr	3.3 tpy
4	Coal-Fired Boiler 6	Coal	AP-42, Table 1.1-19	0.05 lb/ton	230 MMBtu/hr	8,760 hr/yr	3.3 tpy
5	Coal-Fired Boiler 7	Coal	AP-42, Table 1.1-19	0.05 lb/ton	230 MMBtu/hr	8,760 hr/yr	3.3 tpy
6	Coal-Fired Boiler 8	Coal	AP-42, Table 1.1-19	0.05 lb/ton	230 MMBtu/hr	8,760 hr/yr	3.3 tpy
7a	South Coal Handling Dust Collector (DC-01)	N/A	N/A	N/A	13,150 acfm	8,585 hr/yr	0 tpy
7b	South Underbunker Dust Collector (DC-02)	N/A	N/A	N/A	884 acfm	8,760 hr/yr	0 tpy
7c	North Coal Handling Dust Collector (NDC-1)	N/A	N/A	N/A	9,250 acfm	175 hr/yr	0 tpy
8	Backup Generator Engine	Distillate	Vendor	0.11 g/hp-hr	2,937 hp	8,760 hr/yr	3.1 tpy
9	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	353 hp	8,760 hr/yr	3.9 tpy
14	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	320 hp	8,760 hr/yr	3.5 tpy
22	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	35 hp	8,760 hr/yr	0.4 tpy
23	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	155 hp	8,760 hr/yr	1.7 tpy
29a	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	74 hp	8,760 hr/yr	0.8 tpy
30a	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	91 hp	8,760 hr/yr	1.0 tpy
31a	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	74 hp	8,760 hr/yr	0.8 tpy
32a	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	91 hp	8,760 hr/yr	1.0 tpy
33a	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	75 hp	8,760 hr/yr	0.8 tpy
34	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	220 hp	8,760 hr/yr	2.4 tpy
35	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	85 hp	8,760 hr/yr	0.9 tpy
36	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	220 hp	8,760 hr/yr	2.4 tpy
37	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	75 hp	8,760 hr/yr	0.8 tpy
51a	Fly Ash Dust Collector (DC-1)	N/A	N/A	N /A	3,620 acfm	8,760 hr/yr	0 tpy
51b	Bottom Ash Dust Collector (DC-2)	N/A	N/A	N /A	3,620 acfm	8,760 hr/yr	0 tpy
52	Coal Storage Pile	N/A	N/A	N /A	N/A	165,684 tpy	0 tpy
Significant Emission Units Total Unlimited Potential to Emit - VOC							**43.7 tpy**
Insignificant Emission Units							
52	Fly and Bottom Ash Bin Vent Filter	N/A	N/A	N/A	1,460 acfm	8,760 hr/yr	0 tpy
52	Ash Loadout to Truck	N/A	N/A	N/A	N/A	55,967 tpy	0 tpy
52	Aboveground Storage Tanks	Diesel	N/A	N/A[1]	N/A	N/A	0 tpy
52	Underground Storage Tanks	Diesel	N/A	N/A[1]	N/A	N/A	0 tpy
Insignificant Emission Units Total Unlimited Potential to Emit - VOC							**0 tpy**
Total Unlimited Potential to Emit - VOC							**43.7 tpy**

[1] VOC emissions from storage tanks are negligible since the tanks are small, store only diesel, and have a low tank turnover rate.

Conversion factors:

Weight	2,000 lb/ton	
Weight	453.6 grams per pound	
Coal Heating Value	15.1 MMBtu/ton	*From http://www.usibelli.com/coal/data-sheet*

Table D-2.10. Unlimited Potential to Emit Calculations - Sulfur Dioxide (SO_2) Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Emission Unit ID	Emission Unit Name	Fuel Type	Fuel Sulfur Content	Factor Reference	SO_2 Emission Factor	Emission Unit Rating/Capacity	Allowable Annual Operation	Potential SO_2 Emissions
Significant Emission Units								
1	Coal-Fired Boiler 3	Coal	0.40 wt. pct.[a]	AP-42 Table 1.1-3	14 lb/ton-coal	230 MMBtu/hr	8,760 hr/yr	932.8 tpy
2	Coal-Fired Boiler 4	Coal	0.40 wt. pct.[a]	AP-42 Table 1.1-3	14 lb/ton-coal	230 MMBtu/hr	8,760 hr/yr	932.8 tpy
3	Coal-Fired Boiler 5	Coal	0.40 wt. pct.[a]	AP-42 Table 1.1-3	14 lb/ton-coal	230 MMBtu/hr	8,760 hr/yr	932.8 tpy
4	Coal-Fired Boiler 6	Coal	0.40 wt. pct.[a]	AP-42 Table 1.1-3	14 lb/ton-coal	230 MMBtu/hr	8,760 hr/yr	932.8 tpy
5	Coal-Fired Boiler 7	Coal	0.40 wt. pct.[a]	AP-42 Table 1.1-3	14 lb/ton-coal	230 MMBtu/hr	8,760 hr/yr	932.8 tpy
6	Coal-Fired Boiler 8	Coal	0.40 wt. pct.[a]	AP-42 Table 1.1-3	14 lb/ton-coal	230 MMBtu/hr	8,760 hr/yr	932.8 tpy
7a	South Coal Handling Dust Collector (DC-01)	N/A	N/A	N/A	N/A	13,150 acfm	8,585 hr/yr	0 tpy
7b	South Underbunker Dust Collector (DC-02)	N/A	N/A	N/A	N/A	884 acfm	8,760 hr/yr	0 tpy
7c	North Coal Handling Dust Collector (NDC-1)	N/A	N/A	N/A	N/A	9,250 acfm	175 hr/yr	0 tpy
8	Backup Generator Engine	Distillate	0.0015 wt. pct.[b]	Mass balance	0.2 lb/1000 gal	2,937 hp	8,760 hr/yr	0.1 tpy
9	Emergency Generator Engine	Distillate	0.50 wt. pct.	Mass balance	70.5 lb/1000 gal	353 hp	8,760 hr/yr	5.6 tpy
14	Emergency Generator Engine	Distillate	0.0015 wt. pct.[b]	Mass balance	0.2 lb/1000 gal	320 hp	8,760 hr/yr	1.5E-02 tpy
22	Emergency Generator Engine	Distillate	0.50 wt. pct.	Mass balance	70.5 lb/1000 gal	35 hp	8,760 hr/yr	0.6 tpy
23	Emergency Generator Engine	Distillate	0.50 wt. pct.	Mass balance	70.5 lb/1000 gal	155 hp	8,760 hr/yr	2.4 tpy
29a	Emergency Generator Engine	Distillate	0.0015 wt. pct.[b]	Mass balance	0.2 lb/1000 gal	74 hp	8,760 hr/yr	3.5E-03 tpy
30a	Emergency Generator Engine	Distillate	0.0015 wt. pct.[b]	Mass balance	0.2 lb/1000 gal	91 hp	8,760 hr/yr	4.6E-03 tpy
31a	Emergency Generator Engine	Distillate	0.0015 wt. pct.[b]	Mass balance	0.2 lb/1000 gal	74 hp	8,760 hr/yr	3.5E-03 tpy
32a	Emergency Generator Engine	Distillate	0.0015 wt. pct.[b]	Mass balance	0.2 lb/1000 gal	91 hp	8,760 hr/yr	4.6E-03 tpy
33a	Emergency Generator Engine	Distillate	0.0015 wt. pct.[b]	Mass balance	0.2 lb/1000 gal	75 hp	8,760 hr/yr	4.1E-03 tpy
34	Emergency Pump Engine	Distillate	0.50 wt. pct.	Mass balance	70.5 lb/1000 gal	220 hp	8,760 hr/yr	3.5 tpy
35	Emergency Pump Engine	Distillate	0.0015 wt. pct.[b]	Mass balance	0.2 lb/1000 gal	85 hp	8,760 hr/yr	4.0E-03 tpy
36	Emergency Pump Engine	Distillate	0.50 wt. pct.	Mass balance	70.5 lb/1000 gal	220 hp	8,760 hr/yr	3.5 tpy
37	Emergency Generator Engine	Distillate	0.0015 wt. pct.[b]	Mass balance	0.2 lb/1000 gal	75 hp	8,760 hr/yr	4.1E-03 tpy
51a	Fly Ash Dust Collector (DC-1)	N/A	N/A	N/A	N/A	3,620 acfm	8,760 hr/yr	0 tpy
51b	Bottom Ash Dust Collector (DC-2)	N/A	N/A	N/A	N/A	3,620 acfm	8,760 hr/yr	0 tpy
52	Coal Storage Pile	N/A	N/A	N/A	N/A	N/A	165,684 tpy	0 tpy
						Significant Emission Units Total Unlimited Potential to Emit - SO_2		**5,612.4 tpy**
Insignificant Emission Units								
N/A	Fly and Bottom Ash Bin Vent Filter	N/A	N/A	N/A	N/A	1,460 acfm	8,760 hr/yr	0 tpy
N/A	Ash Loadout to Truck	N/A	N/A	N/A	N/A	N/A	55,967 tpy	0 tpy
N/A	Aboveground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	N/A	0 tpy
N/A	Underground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	N/A	0 tpy
						Insignificant Emission Units Total Unlimited Potential to Emit - SO_2		**0 tpy**
						Total Unlimited Potential to Emit - SO_2		**5,612.4 tpy**

Notes:

[a] Maximum sulfur content based on the coal contract between the U.S. Army Garrison Fort Wainwright and Usibelli Coal Mine.

[b] For engines subject to 40 CFR 60 Subpart IIII, fuel used must meet the requirements of 40 CFR 80.510(b).

Conversion factors:

Diesel Heating Value	137,000	Btu/gal	*From AP 42, Appendix A, Page A-5*
Density of Diesel	7.05	lb/gal	*From AP 42, Appendix A, Page A-7, density for Distillate Oil*
Engine Heat Rate	7,000	Btu/hp-hr	*Average brake-specific fuel consumption (BSFC) from AP 42, Table 3.3-1, footnote a*
EU IDs 30a and 32a Fuel Consumption Rate	5.0	gal/hr	*From vendor information.*
EU IDs 33a and 37 Fuel Consumption Rate	4.4	gal/hr	*From vendor information.*
Weight	2,000	lb/ton	
Coal Heating Value	15.1	MMBtu/ton	*From http://www.usibelli.com/coal/data-sheet*

Table D-2.11. Summary of Estimated Unlimited Potential Hazardous Air Pollutants (HAP) Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Hazardous Air Pollutant	HAP Emissions by Emission Unit Category (tons per year)[a,c]					Total HAP Emissions
	Coal-Fired Boilers	Diesel Engines <600 hp	Diesel Engines >600 hp	Coal Preparation and Ash Handling[b]	Insignificant Units[b]	
Acetaldehyde	2.28E-01	4.40E-02	2.27E-03	----	----	2.74E-01
Acetophenone	6.00E-03	----	----	----	----	6.00E-03
Acrolein	1.16E-01	5.30E-03	7.10E-04	----	----	1.22E-01
Benzene	5.20E-01	5.35E-02	6.99E-02	----	----	6.43E-01
Benzyl chloride	2.80E-01	----	----	----	----	2.80E-01
Biphenyl	6.80E-04	----	----	----	----	6.80E-04
Bis(2-ethylhexyl)phthalate (DEHP)	2.92E-02	----	----	----	----	2.92E-02
Bromoform	1.56E-02	----	----	----	----	1.56E-02
1,3 Butadiene	----	2.24E-03	----	----	----	2.24E-03
Carbon disulfide	5.20E-02	----	----	----	----	5.20E-02
2-Chloroacetophenone	2.80E-03	----	----	----	----	2.80E-03
Chlorobenzene	8.79E-03	----	----	----	----	8.79E-03
Chloroform	2.36E-02	----	----	----	----	2.36E-02
Cumene	2.12E-03	----	----	----	----	2.12E-03
Dibenzofurans	4.36E-07	----	----	----	----	4.36E-07
Dimethyl sulfate	1.92E-02	----	----	----	----	1.92E-02
2,4-Dinitrotoluene	1.12E-04	----	----	----	----	1.12E-04
Ethyl benzene	3.76E-02	----	----	----	----	3.76E-02
Ethyl chloride (Chloroethane)	1.68E-02	----	----	----	----	1.68E-02
Ethylene dibromide (Dibromoethane)	4.80E-04	----	----	----	----	4.80E-04
Ethylene dichloride (1,2-Dichloroethane)	1.60E-02	----	----	----	----	1.60E-02
Formaldehyde	9.59E-02	6.76E-02	7.10E-03	----	----	1.71E-01
Hexane	2.68E-02	----	----	----	----	2.68E-02
Hydrochloric acid	5.50E+00	----	----	----	----	5.50E+00
Hydrogen fluoride (Hydrofluoric acid)	6.00E+01	----	----	----	----	6.00E+01
Isophorone	2.32E-01	----	----	----	----	2.32E-01
Methyl bromide (Bromomethane)	6.40E-02	----	----	----	----	6.40E-02
Methyl chloride (chloromethane)	2.12E-01	----	----	----	----	2.12E-01
Methyl hydrazine	6.80E-02	----	----	----	----	6.80E-02
Methyl methacrylate	8.00E-03	----	----	----	----	8.00E-03
Methyl tert butyl ether	1.40E-02	----	----	----	----	1.40E-02
Methylene chloride (Dichloromethane)	1.16E-01	----	----	----	----	1.16E-01
Phenol	6.40E-03	----	----	----	----	6.40E-03
Polycyclic Organic Matter (POM)	7.62E-03	1.92E-02	1.90E-02	----	----	4.59E-02
Propionaldehyde	1.52E-01	----	----	----	----	1.52E-01
Styrene	9.99E-03	----	----	----	----	9.99E-03
Chlorinated dibenzo-p-dioxins (Total)	5.60E-09	----	----	----	----	5.60E-09
Tetrachloroethylene (Perchloroethylene)	1.72E-02	----	----	----	----	1.72E-02
Toluene	9.59E-02	2.34E-02	2.53E-02	----	----	1.45E-01
1,1,2-Trichloroethane	8.00E-03	----	----	----	----	8.00E-03
Vinyl acetate	3.04E-03	----	----	----	----	3.04E-03
Xylenes (isomers and mixture)	1.48E-02	1.63E-02	1.74E-02	----	----	4.85E-02
Antimony Compounds	7.20E-03	----	----	----	----	7.20E-03
Arsenic Compounds (inorganic including arsine)	1.64E-01	----	----	----	----	1.64E-01
Beryllium Compounds	8.40E-03	----	----	----	----	8.40E-03
Cadmium Compounds	2.04E-02	----	----	----	----	2.04E-02
Chromium Compounds	1.36E-01	----	----	----	----	1.36E-01
Cobalt Compounds	4.00E-02	----	----	----	----	4.00E-02
Cynaide Compounds	9.99E-01	----	----	----	----	9.99E-01
Lead Compounds	1.68E-01	----	----	----	----	1.68E-01
Magnesium Compounds	4.40E+00	----	----	----	----	4.40E+00
Manganese Compounds	1.96E-01	----	----	----	----	1.96E-01
Mercury Compounds	5.51E-03	----	----	----	----	5.51E-03
Nickel Compounds	1.12E-01	----	----	----	----	1.12E-01
Selenium Compounds	5.20E-01	----	----	----	----	5.20E-01
Total HAPs - Maximum Individual HAP	**60.0**	**0.07**	**0.07**	**0.0**	**0.0**	**60.0**
Total HAPs - Unit Category/Source	**74.8**	**0.23**	**0.14**	**0.0**	**0.0**	**75.1**

Notes:

[a] See individual emissions unit category emissions calculations for details on methodology and assumptions.

[b] Emission units in the coal preparation and handling, ash handling and coal storage pile systems do not have HAP emissions.

[c] HAP emissions from the fuel storage tanks are negligible.

Table D-2.12. Estimated Unlimited Potential HAP Emissions - Coal-Fired Boilers
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

		Maximum Total Fuel Input:	799,524 Tons of Coal/yr
		Source Category Emission Calculations	
CAS No.	Chemical Name	Emission Factor [1]	Estimated Emissions
79005	1,1,2-Trichloroethane	2.00E-05 lb/ton	8.00E-03 tpy
1746016	2,3,7,8-Tetrachlorodibenzo-p-dioxin	1.40E-11 lb/ton	5.60E-09 tpy
121142	2,4-Dinitrotoluene	2.80E-07 lb/ton	1.12E-04 tpy
532274	2-Chloroacetophenone	7.00E-06 lb/ton	2.80E-03 tpy
75-07-0	Acetaldehyde	5.70E-04 lb/ton	0.23 tpy
98862	Acetophenone	1.50E-05 lb/ton	6.00E-03 tpy
107-02-8	Acrolein	2.90E-04 lb/ton	0.12 tpy
N/A	Antimony Compounds	1.80E-05 lb/ton	7.20E-03 tpy
N/A	Arsenic Compounds	4.10E-04 lb/ton	0.16 tpy
71-43-2	Benzene	1.30E-03 lb/ton	0.52 tpy
100447	Benzyl chloride	7.00E-04 lb/ton	0.28 tpy
N/A	Beryllium Compounds	2.10E-05 lb/ton	8.40E-03 tpy
92524	Biphenyl	1.70E-06 lb/ton	6.80E-04 tpy
117817	Bis(2-ethylhexyl)phthalate (DEHP)	7.30E-05 lb/ton	2.92E-02 tpy
75252	Bromoform	3.90E-05 lb/ton	1.56E-02 tpy
N/A	Cadmium Compounds	5.10E-05 lb/ton	2.04E-02 tpy
75150	Carbon disulfide	1.30E-04 lb/ton	5.20E-02 tpy
108907	Chlorobenzene	2.20E-05 lb/ton	8.79E-03 tpy
67663	Chloroform	5.90E-05 lb/ton	2.36E-02 tpy
N/A	Chromium Compounds	3.39E-04 lb/ton	0.14 tpy
N/A	Cobalt Compounds	1.00E-04 lb/ton	4.00E-02 tpy
98828	Cumene	5.30E-06 lb/ton	2.12E-03 tpy
N/A	Cyanide Compounds	2.50E-03 lb/ton	1.00 tpy
132649	Dibenzofurans	1.09E-09 lb/ton	4.36E-07 tpy
77781	Dimethyl sulfate	4.80E-05 lb/ton	1.92E-02 tpy
100-41-4	Ethyl benzene	9.40E-05 lb/ton	3.76E-02 tpy
75003	Ethyl chloride (Chloroethane)	4.20E-05 lb/ton	1.68E-02 tpy
1006934	Ethylene dibromide (Dibromoethane)	1.20E-06 lb/ton	4.80E-04 tpy
107062	Ethylene dichloride (1,2-Dichloroethane)	4.00E-05 lb/ton	1.60E-02 tpy
50-00-0	Formaldehyde	2.40E-04 lb/ton	9.59E-02 tpy
110543	Hexane	6.70E-05 lb/ton	2.68E-02 tpy
7647010	Hydrochloric acid[2]	1.38E-02 lb/ton	5.50 tpy
7664393	Hydrogen fluoride (Hydrofluoric acid)	0.15 lb/ton	59.96 tpy
78591	Isophorone	5.80E-04 lb/ton	0.23 tpy
N/A	Lead Compounds	4.20E-04 lb/ton	0.17 tpy
N/A	Magnesium Compounds	1.10E-02 lb/ton	4.40 tpy
N/A	Manganese Compounds	4.90E-04 lb/ton	0.20 tpy
N/A	Mercury Compounds[3]	1.38E-05 lb/ton	5.51E-03 tpy
74839	Methyl bromide(Bromomethane)	1.60E-04 lb/ton	6.40E-02 tpy
60344	Methyl hydrazine	1.70E-04 lb/ton	6.80E-02 tpy
80626	Methyl methacrylate	2.00E-05 lb/ton	8.00E-03 tpy
1634044	Methyl tert butyl ether	3.50E-05 lb/ton	1.40E-02 tpy
74873	Methylchloride (chloromethane)	5.30E-04 lb/ton	0.21 tpy
75092	Methylene chloride (Dichloromethane)	2.90E-04 lb/ton	0.12 tpy
N/A	Nickel Compounds	2.80E-04 lb/ton	0.11 tpy
108952	Phenol	1.60E-05 lb/ton	6.40E-03 tpy
N/A	Polycylic Organic Matter	1.91E-05 lb/ton	7.62E-03 tpy
123386	Propionaldehyde	3.80E-04 lb/ton	0.15 tpy
N/A	Selenium Compounds	1.30E-03 lb/ton	0.52 tpy
100425	Styrene	2.50E-05 lb/ton	9.99E-03 tpy
127184	Tetrachloroethylene (Perchloroethylene)	4.30E-05 lb/ton	1.72E-02 tpy
108-88-3	Toluene	2.40E-04 lb/ton	9.59E-02 tpy
108054	Vinyl acetate	7.60E-06 lb/ton	3.04E-03 tpy
1330-20-7	Xylenes (isomers and mixture)	3.70E-05 lb/ton	1.48E-02 tpy
		Total HAP Emissions	**74.76 tpy**

Notes:
[1] Reference: AP-42, Tables 1.1-12, 1.1-13, 1.1-14, 1.1-18
[2] Maximum 1-hour emission rate measured during April 2017 source test (0.00091 lb/MMBtu, Run 1, EU 4).
[3] Maximum 1-hour emission rate measured during April 2017 source test (9.12E-07 lb/MMBtu, Run 1, EU 4).

Conversion Factors:

Coal Heating Value 15.1 MMBtu/ton *From http://www.usibelli.com/coal/data-sheet*

Table D-2.13. Estimated Unlimited Potential HAP Emissions - Diesel-Fired Engines Greater Than 600 Horsepower
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

CAS No.	Chemical Name	HAP Emission Calculations	
		Emission Factor[a]	All Emission Units > 600 hp
75-07-0	Acetaldehyde	2.52E-05 lb/MMBtu	2.27E-03 tpy
107-02-8	Acrolein	7.88E-06 lb/MMBtu	7.10E-04 tpy
71-43-2	Benzene	7.76E-04 lb/MMBtu	6.99E-02 tpy
50-00-0	Formaldehyde	7.89E-05 lb/MMBtu	7.10E-03 tpy
108-88-3	Toluene	2.81E-04 lb/MMBtu	2.53E-02 tpy
1330-20-7	Xylenes (isomers and mixture)	1.93E-04 lb/MMBtu	1.74E-02 tpy
N/A	Polycylic Organic Matter (PAH)	2.12E-04 lb/MMBtu	1.90E-02 tpy
		TOTAL	**0.14 tpy**

Notes:
[a] Reference: AP-42, Tables 3.3-3 and 3.4-4.

Conversion Factors:

Engine Heat Rate	7,000	Btu/hp-hr	*Average brake-specific fuel consumption (BSFC) from AP 42, Table 3.3-1, footnote a*
Weight	2,000	lb/ton	

Calculations:

Maximum Heat Input (MMBtu/yr) = Engine Rating (hp) x Engine Heat Rate (Btu/hp-hr) x Allowable Annual Operation (hr/yr) / 1E6 (Btu/MMBtu)

Diesel-Fired Engines Greater Than 600 Horsepower:			
Emission Unit	Engine Rating (hp)	Allowable Annual Operation (hr/yr)	Maximum Heat Input (MMBtu/yr)
8	2,937	8,760	180,097
TOTAL Heat Input (MMBtu/yr)			**180,097**

Table D-2.14. Estimated Unlimited Potential HAP Emissions - Diesel-Fired Engines Less Than 600 Horsepower
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

CAS No.	Chemical Name	HAP Emission Calculations	
		Emission Factor [a]	All Emission Units < 600 hp
75-07-0	Acetaldehyde	7.67E-04 lb/MMBtu	4.40E-02 tpy
107-02-8	Acrolein	9.25E-05 lb/MMBtu	5.30E-03 tpy
71-43-2	Benzene	9.33E-04 lb/MMBtu	5.35E-02 tpy
106-99-0	1,3-Butadiene	3.91E-05 lb/MMBtu	2.24E-03 tpy
50-00-0	Formaldehyde	1.18E-03 lb/MMBtu	6.76E-02 tpy
108-88-3	Toluene	4.09E-04 lb/MMBtu	2.34E-02 tpy
1330-20-7	Xylenes (isomers and mixture)	2.85E-04 lb/MMBtu	1.63E-02 tpy
N/A	Polycylic Organic Matter	3.36E-04 lb/MMBtu	1.92E-02 tpy
		TOTAL	**0.23 tpy**

Diesel-Fired Engines Less Than 600 Horsepower:			
Emission Unit	Engine Rating (hp)	Allowable Annual Operation (hr/yr)	Maximum Heat Input (MMBtu/yr)
9	353	8,760	21,640
14	320	8,760	19,622
22	35	8,760	2,164
23	155	8,760	9,521
29a	74	8,760	4,538
30a	91	8,760	5,600
31a	74	8,760	4,538
32a	91	8,760	5,600
33a	75	8,760	4,599
34	220	8,760	13,490
35	85	8,760	5,212
36	220	8,760	13,490
37	75	8,760	4,599
		TOTAL Heat Input (MMBtu/yr)	**114,614**

Notes:
[a] Reference: AP-42, Table 3.3-2.

Conversion Factors:

Engine Heat Rate	7,000	Btu/hp-hr
Weight	2,000	lb/ton

Calculations:

Maximum Heat Input (MMBtu/yr) = Engine Rating (hp) x Engine Heat Rate (Btu/hp-hr) x Allowable Annual Operation (hr/yr) / 1E6 (Btu/MMBtu)

Table D-2.15. Summary of Estimated Unlimited Potential Greenhouse Gas (GHG) Emissions [a]
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

GHG Pollutant	GHG Emissions (tons per year) [b]			
	Significant Emission Units	Insignificant Emission Units	Global Warming Potential	Total
Carbon Dioxide	1,318,855	0	1	**1,318,855**
Methane	147.6	0	25	**3,689**
Nitrous Oxide	21.5	0	298	**6,412**
Hydrofluorocarbons	0	0	Multiple	**0**
Perfluorocarbons	0	0	Multiple	**0**
Sulfur hexafluoride	0	0	22,800	**0**
			Total - GHG (CO_2e) [c]	**1,328,956**

Notes:

[a] GHG are the aggregate group of six greenhouse gases defined under 40 CFR 52.21(b)(49)(i) and 40 CFR 71.2.

[b] See individual emissions unit category emissions calculations for details on methodology and assumptions.

[c] GHG (CO_2e) emissions = CO_2 emissions + (25 * CH_4 emissions) + (298 * N_2O emissions).

Table D-2.16. Unlimited Potential Greenhouse Gases (GHG) Calculations - Carbon Dioxide (CO_2) Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Emission Unit ID	Emission Unit Name	Fuel Type	Factor Reference	CO_2 Emission Factor	Emission Unit Rating/Capacity	Allowable Annual Operation	Maximum Heat Input	Potential CO_2 Emissions
Significant Emission Units								
1	Coal-Fired Boiler 3	Coal	40 CFR 98 Table C-1	97.17 kg/MMBtu	230 MMBtu/hr	8,760 hr/yr	2,014,800 MMBtu/yr	215,805 tpy
2	Coal-Fired Boiler 4	Coal	40 CFR 98 Table C-1	97.17 kg/MMBtu	230 MMBtu/hr	8,760 hr/yr	2,014,800 MMBtu/yr	215,805 tpy
3	Coal-Fired Boiler 5	Coal	40 CFR 98 Table C-1	97.17 kg/MMBtu	230 MMBtu/hr	8,760 hr/yr	2,014,800 MMBtu/yr	215,805 tpy
4	Coal-Fired Boiler 6	Coal	40 CFR 98 Table C-1	97.17 kg/MMBtu	230 MMBtu/hr	8,760 hr/yr	2,014,800 MMBtu/yr	215,805 tpy
5	Coal-Fired Boiler 7	Coal	40 CFR 98 Table C-1	97.17 kg/MMBtu	230 MMBtu/hr	8,760 hr/yr	2,014,800 MMBtu/yr	215,805 tpy
6	Coal-Fired Boiler 8	Coal	40 CFR 98 Table C-1	97.17 kg/MMBtu	230 MMBtu/hr	8,760 hr/yr	2,014,800 MMBtu/yr	215,805 tpy
7a	South Coal Handling Dust Collector (DC-01)	N/A	N/A	N/A	13,150 acfm	8,585 hr/yr	N/A	0 tpy
7b	South Underbunker Dust Collector (DC-02)	N/A	N/A	N/A	884 acfm	8,760 hr/yr	N/A	0 tpy
7c	North Coal Handling Dust Collector (NDC-1)	N/A	N/A	N/A	9,250 acfm	175 hr/yr	N/A	0 tpy
8	Backup Generator Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	2,937 hp	8,760 hr/yr	180,097 MMBtu/yr	14,682 tpy
9	Emergency Generator Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	353 hp	8,760 hr/yr	21,640 MMBtu/yr	1,764 tpy
14	Emergency Generator Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	320 hp	8,760 hr/yr	19,622 MMBtu/yr	1,600 tpy
22	Emergency Generator Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	35 hp	8,760 hr/yr	2,164 MMBtu/yr	176 tpy
23	Emergency Generator Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	155 hp	8,760 hr/yr	9,521 MMBtu/yr	776 tpy
29a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	74 hp	8,760 hr/yr	4,538 MMBtu/yr	370 tpy
30a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	91 hp	8,760 hr/yr	5,600 MMBtu/yr	457 tpy
31a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	74 hp	8,760 hr/yr	4,538 MMBtu/yr	370 tpy
32a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	91 hp	8,760 hr/yr	5,600 MMBtu/yr	457 tpy
33a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	75 hp	8,760 hr/yr	4,599 MMBtu/yr	375 tpy
34	Emergency Pump Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	220 hp	8,760 hr/yr	13,490 MMBtu/yr	1,100 tpy
35	Emergency Pump Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	85 hp	8,760 hr/yr	5,212 MMBtu/yr	425 tpy
36	Emergency Pump Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	220 hp	8,760 hr/yr	13,490 MMBtu/yr	1,100 tpy
37	Emergency Generator Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	75 hp	8,760 hr/yr	4,599 MMBtu/yr	375 tpy
51a	Fly Ash Dust Collector (DC-1)	N/A	N/A	N/A	3,620 acfm	8,760 hr/yr	N/A	0 tpy
51b	Bottom Ash Dust Collector (DC-2)	N/A	N/A	N/A	3,620 acfm	8,760 hr/yr	N/A	0 tpy
52	Coal Storage Pile	N/A	N/A	N/A	N/A	165,684 tpy	N/A	0 tpy
						Significant Emission Units Total Unlimited Potential to Emit - CO_2		**1,318,855 tpy**
Insignificant Emission Units								
N/A	Fly and Bottom Ash Bin Vent Filter	N/A	N/A	N/A	1,460 acfm	8,760 hr/yr	N/A	0 tpy
N/A	Ash Loadout to Truck	N/A	N/A	N/A	N/A	55,967 tpy	N/A	0 tpy
N/A	Aboveground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	N/A	0 tpy
N/A	Underground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	N/A	0 tpy
						Insignificant Emission Units Total Unlimited Potential to Emit - CO_2		**0 tpy**
						Total Unlimited Potential to Emit - CO_2		**1,318,855 tpy**

Calculations:

Maximum heat input, coal (MMBtu/yr) = Allowable annual operation (tons/yr) x Coal Heating Value (MMBtu/ton)
Maximum heat input, engines (MMBtu/yr) = Engine Rating (hp) x Engine Heat Rate (Btu/hp-hr) x Allowable Annual Operation (hr/yr) / 1E6 (Btu/MMBtu)

Conversion factors:

Engine Heat Rate	7,000 Btu/hp-hr	*Average brake-specific fuel consumption (BSFC) from AP 42, Table 3.3-1, footnote a*
Mass:	907.2 kg/ton	
Coal Heating Value	15.1 MMBtu/ton	*From http://www.usibelli.com/coal/data-sheet*

Table D-2.17. Unlimited Potential Greenhouse Gases (GHG) Calculations - Methane (CH_4) Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Emission Unit ID	Emission Unit Name	Fuel Type	Factor Reference	CH_4 Emission Factor	Emission Unit Rating/Capacity	Allowable Annual Operation [1]	Maximum Heat Input	Potential CH_4 Emissions
Significant Emission Units								
1	Coal-Fired Boiler 3	Coal	40 CFR 98 Table C-2	1.1E-02 kg/MMBtu	230 MMBtu/hr	8,760 hr/yr	2,014,800 MMBtu/yr	24 tpy
2	Coal-Fired Boiler 4	Coal	40 CFR 98 Table C-2	1.1E-02 kg/MMBtu	230 MMBtu/hr	8,760 hr/yr	2,014,800 MMBtu/yr	24 tpy
3	Coal-Fired Boiler 5	Coal	40 CFR 98 Table C-2	1.1E-02 kg/MMBtu	230 MMBtu/hr	8,760 hr/yr	2,014,800 MMBtu/yr	24 tpy
4	Coal-Fired Boiler 6	Coal	40 CFR 98 Table C-2	1.1E-02 kg/MMBtu	230 MMBtu/hr	8,760 hr/yr	2,014,800 MMBtu/yr	24 tpy
5	Coal-Fired Boiler 7	Coal	40 CFR 98 Table C-2	1.1E-02 kg/MMBtu	230 MMBtu/hr	8,760 hr/yr	2,014,800 MMBtu/yr	24 tpy
6	Coal-Fired Boiler 8	Coal	40 CFR 98 Table C-2	1.1E-02 kg/MMBtu	230 MMBtu/hr	8,760 hr/yr	2,014,800 MMBtu/yr	24 tpy
7a	South Coal Handling Dust Collector (DC-01)	N/A	N/A	N/A	13,150 acfm	8,585 hr/yr	N/A	0 tpy
7b	South Underbunker Dust Collector (DC-02)	N/A	N/A	N/A	884 acfm	8,760 hr/yr	N/A	0 tpy
7c	North Coal Handling Dust Collector (NDC-1)	N/A	N/A	N/A	9,250 acfm	175 hr/yr	N/A	0 tpy
8	Backup Generator Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	2,937 hp	8,760 hr/yr	180,097 MMBtu/yr	6.0E-01 tpy
9	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	353 hp	8,760 hr/yr	21,640 MMBtu/yr	7.2E-02 tpy
14	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	320 hp	8,760 hr/yr	19,622 MMBtu/yr	6.5E-02 tpy
22	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	35 hp	8,760 hr/yr	2,164 MMBtu/yr	7.2E-03 tpy
23	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	155 hp	8,760 hr/yr	9,521 MMBtu/yr	3.1E-02 tpy
29a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	74 hp	8,760 hr/yr	4,538 MMBtu/yr	1.5E-02 tpy
30a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	91 hp	8,760 hr/yr	5,600 MMBtu/yr	1.9E-02 tpy
31a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	74 hp	8,760 hr/yr	4,538 MMBtu/yr	1.5E-02 tpy
32a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	91 hp	8,760 hr/yr	5,600 MMBtu/yr	1.9E-02 tpy
33a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	75 hp	8,760 hr/yr	4,599 MMBtu/yr	1.5E-02 tpy
34	Emergency Pump Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	220 hp	8,760 hr/yr	13,490 MMBtu/yr	4.5E-02 tpy
35	Emergency Pump Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	85 hp	8,760 hr/yr	5,212 MMBtu/yr	1.7E-02 tpy
36	Emergency Pump Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	220 hp	8,760 hr/yr	13,490 MMBtu/yr	4.5E-02 tpy
37	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	75 hp	8,760 hr/yr	4,599 MMBtu/yr	1.5E-02 tpy
51a	Fly Ash Dust Collector (DC-1)	N/A	N/A	N/A	3,620 acfm	8,760 hr/yr	N/A	0 tpy
51b	Bottom Ash Dust Collector (DC-2)	N/A	N/A	N/A	3,620 acfm	8,760 hr/yr	N/A	0 tpy
52	Coal Storage Pile	N/A	N/A	N/A	N/A	165,684 tpy	N/A	0 tpy
							Significant Emission Units Total Unlimited Potential to Emit - CH_4	**147.6 tpy**
Insignificant Emission Units								
N/A	Fly and Bottom Ash Bin Vent Filter	N/A	N/A	N/A	1,460 acfm	8,760 hr/yr	N/A	0 tpy
N/A	Ash Loadout to Truck	N/A	N/A	N/A	N/A	55,967 tpy	N/A	0 tpy
N/A	Aboveground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	N/A	0 tpy
N/A	Underground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	N/A	0 tpy
							Insignificant Emission Units Total Unlimited Potential to Emit - CH_4	**0 tpy**
							Total Unlimited Potential to Emit - CH_4	**147.6 tpy**

Calculations:

Maximum heat input, coal (MMBtu/yr) = Allowable annual operation (tons/yr) x Coal Heating Value (MMBtu/ton)
Maximum heat input, engines (MMBtu/yr) = Engine Rating (hp) x Engine Heat Rate (Btu/hp-hr) x Allowable Annual Operation (hr/yr) / 1E6 (Btu/MMBtu)

Conversion factors:

Engine Heat Rate	7,000 Btu/hp-hr	*Average brake-specific fuel consumption (BSFC) from AP 42, Table 3.3-1, footnote a*
Mass:	907.2 kg/ton	
Coal Heating Value	15.1 MMBtu/ton	*From http://www.usibelli.com/coal/data-sheet*

Table D-2.18. Unlimited Potential Greenhouse Gases (GHG) Calculations - Nitrous Oxide (N_2O) Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Emission Unit ID	Emission Unit Name	Fuel Type	Factor Reference	N_2O Emission Factor	Emission Unit Rating/Capacity	Allowable Annual Operation [1]	Maximum Heat Input	Potential N_2O Emissions
Significant Emission Units								
1	Coal-Fired Boiler 3	Coal	40 CFR 98 Table C-2	1.6E-03 kg/MMBtu	230 MMBtu/hr	8,760 hr/yr	2,014,800 MMBtu/yr	3.6 tpy
2	Coal-Fired Boiler 4	Coal	40 CFR 98 Table C-2	1.6E-03 kg/MMBtu	230 MMBtu/hr	8,760 hr/yr	2,014,800 MMBtu/yr	3.6 tpy
3	Coal-Fired Boiler 5	Coal	40 CFR 98 Table C-2	1.6E-03 kg/MMBtu	230 MMBtu/hr	8,760 hr/yr	2,014,800 MMBtu/yr	3.6 tpy
4	Coal-Fired Boiler 6	Coal	40 CFR 98 Table C-2	1.6E-03 kg/MMBtu	230 MMBtu/hr	8,760 hr/yr	2,014,800 MMBtu/yr	3.6 tpy
5	Coal-Fired Boiler 7	Coal	40 CFR 98 Table C-2	1.6E-03 kg/MMBtu	230 MMBtu/hr	8,760 hr/yr	2,014,800 MMBtu/yr	3.6 tpy
6	Coal-Fired Boiler 8	Coal	40 CFR 98 Table C-2	1.6E-03 kg/MMBtu	230 MMBtu/hr	8,760 hr/yr	2,014,800 MMBtu/yr	3.6 tpy
7a	South Coal Handling Dust Collector (DC-01)	N/A	N/A	N/A	13,150 acfm	8,585 hr/yr	N/A	0 tpy
7b	South Underbunker Dust Collector (DC-02)	N/A	N/A	N/A	884 acfm	8,760 hr/yr	N/A	0 tpy
7c	North Coal Handling Dust Collector (NDC-1)	N/A	N/A	N/A	9,250 acfm	175 hr/yr	N/A	0 tpy
8	Backup Generator Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	2,937 hp	8,760 hr/yr	180,097 MMBtu/yr	1.2E-01 tpy
9	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	353 hp	8,760 hr/yr	21,640 MMBtu/yr	1.4E-02 tpy
14	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	320 hp	8,760 hr/yr	19,622 MMBtu/yr	1.3E-02 tpy
22	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	35 hp	8,760 hr/yr	2,164 MMBtu/yr	1.4E-03 tpy
23	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	155 hp	8,760 hr/yr	9,521 MMBtu/yr	6.3E-03 tpy
29a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	74 hp	8,760 hr/yr	4,538 MMBtu/yr	3.0E-03 tpy
30a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	91 hp	8,760 hr/yr	5,600 MMBtu/yr	3.7E-03 tpy
31a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	74 hp	8,760 hr/yr	4,538 MMBtu/yr	3.0E-03 tpy
32a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	91 hp	8,760 hr/yr	5,600 MMBtu/yr	3.7E-03 tpy
33a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	75 hp	8,760 hr/yr	4,599 MMBtu/yr	3.0E-03 tpy
34	Emergency Pump Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	220 hp	8,760 hr/yr	13,490 MMBtu/yr	8.9E-03 tpy
35	Emergency Pump Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	85 hp	8,760 hr/yr	5,212 MMBtu/yr	3.4E-03 tpy
36	Emergency Pump Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	220 hp	8,760 hr/yr	13,490 MMBtu/yr	8.9E-03 tpy
37	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	75 hp	8,760 hr/yr	4,599 MMBtu/yr	3.0E-03 tpy
51a	Fly Ash Dust Collector (DC-1)	N/A	N/A	N/A	3,620 acfm	8,760 hr/yr	N/A	0 tpy
51b	Bottom Ash Dust Collector (DC-2)	N/A	N/A	N/A	3,620 acfm	8,760 hr/yr	N/A	0 tpy
52	Coal Storage Pile	N/A	N/A	N/A	N/A	165,684 tpy	N/A	0 tpy
							Significant Emission Units Total Unlimited Potential to Emit - N_2O	**21.5 tpy**
Insignificant Emission Units								
N/A	Fly and Bottom Ash Bin Vent Filter	N/A	N/A	N/A	1,460 acfm	8,760 hr/yr	N/A	0 tpy
N/A	Ash Loadout to Truck	N/A	N/A	N/A	N/A	55,967 tpy	N/A	0 tpy
N/A	Aboveground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	N/A	0 tpy
N/A	Underground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	N/A	0 tpy
							Insignificant Emission Units Total Unlimited Potential to Emit - N_2O	**0 tpy**
							Total Unlimited Potential to Emit - N_2O	**21.5 tpy**

Calculations:

Maximum heat input, coal (MMBtu/yr) = Allowable annual operation (tons/yr) x Coal Heating Value (MMBtu/ton)
Maximum heat input, engines (MMBtu/yr) = Engine Rating (hp) x Engine Heat Rate (Btu/hp-hr) x Allowable Annual Operation (hr/yr) / 1E6 (Btu/MMBtu)

Conversion factors:

Engine Heat Rate	7,000	Btu/hp-hr	*Average brake-specific fuel consumption (BSFC) from AP 42, Table 3.3-1, footnote a*
Mass:	907.2	kg/ton	
Coal Heating Value	15.1	MMBtu/ton	From http://www.usibelli.com/coal/data-sheet

Table D-2.19. Unlimited Potential to Emit Calculations - Particulate Matter (PM) Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Emission Unit ID	Emission Unit Name	Fuel Type	Factor Reference	PM Emission Factor	Emission Unit Rating/Capacity	Allowable Annual Operation	Potential PM Emissions
Significant Emission Units							
1	Coal-Fired Boiler 3	Coal	AP-42, Tables 1.1-5 and 1.1-9	66.0 lb/ton	230 MMBtu/hr	8,760 hr/yr	4,397.4 tpy
2	Coal-Fired Boiler 4	Coal	AP-42, Tables 1.1-5 and 1.1-9	66.0 lb/ton	230 MMBtu/hr	8,760 hr/yr	4,397.4 tpy
3	Coal-Fired Boiler 5	Coal	AP-42, Tables 1.1-5 and 1.1-9	66.0 lb/ton	230 MMBtu/hr	8,760 hr/yr	4,397.4 tpy
4	Coal-Fired Boiler 6	Coal	AP-42, Tables 1.1-5 and 1.1-9	66.0 lb/ton	230 MMBtu/hr	8,760 hr/yr	4,397.4 tpy
5	Coal-Fired Boiler 7	Coal	AP-42, Tables 1.1-5 and 1.1-9	66.0 lb/ton	230 MMBtu/hr	8,760 hr/yr	4,397.4 tpy
6	Coal-Fired Boiler 8	Coal	AP-42, Tables 1.1-5 and 1.1-9	66.0 lb/ton	230 MMBtu/hr	8,760 hr/yr	4,397.4 tpy
7a	South Coal Handling Dust Collector (DC-01)	N/A	See detailed calculations in Table D-2.7a		13,150 acfm	8,760 hr/yr	23.4 tpy
7b	South Underbunker Dust Collector (DC-02)	N/A	See detailed calculations in Table D-2.7a		884 acfm	8,760 hr/yr	12.9 tpy
7c	North Coal Handling Dust Collector (NDC-1)	N/A	See detailed calculations in Table D-2.7a		9,250 acfm	8,760 hr/yr	2.7 tpy
8	Backup Generator Engine	Distillate	EPA Tier 2	0.25 g/kW-hr[1, 2]	2,000 kW	8,760 hr/yr	4.8 tpy
9	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	353 hp	8,760 hr/yr	3.4 tpy
14	Emergency Generator Engine	Distillate	EPA Tier 3	0.25 g/kW-hr[1, 2]	200 kW	8,760 hr/yr	0.5 tpy
22	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	35 hp	8,760 hr/yr	0.3 tpy
23	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	155 hp	8,760 hr/yr	1.5 tpy
29a	Emergency Generator Engine	Distillate	EPA Tier 4i	0.375 g/kW-hr[1]	74 hp	8,760 hr/yr	0.2 tpy
30a	Emergency Generator Engine	Distillate	EPA Tier 3	0.5 g/kW-hr[1]	60 kW	8,760 hr/yr	0.3 tpy
31a	Emergency Generator Engine	Distillate	EPA Tier 4i	0.375 g/kW-hr[1]	74 hp	8,760 hr/yr	0.2 tpy
32a	Emergency Generator Engine	Distillate	EPA Tier 3	0.5 g/kW-hr[1]	60 kW	8,760 hr/yr	0.3 tpy
33a	Emergency Generator Engine	Distillate	EPA Tier 3	0.5 g/kW-hr[1]	75 hp	8,760 hr/yr	0.3 tpy
34	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	220 hp	8,760 hr/yr	2.1 tpy
35	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	85 hp	8,760 hr/yr	0.8 tpy
36	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	220 hp	8,760 hr/yr	2.1 tpy
37	Emergency Generator Engine	Distillate	EPA Tier 3	0.5 g/kW-hr[1]	75 hp	8,760 hr/yr	0.3 tpy
51a	Fly Ash Dust Collector (DC-1)	N/A	See detailed calculations in Table D-2.19a		3,620 acfm	8,760 hr/yr	47.1 tpy
51b	Bottom Ash Dust Collector (DC-2)	N/A	See detailed calculations in Table D-2.19a		3,620 acfm	8,760 hr/yr	47.1 tpy
52	Coal Storage Pile	N/A	See detailed calculations in Table D-2.19b		N/A	165,684 tpy	9.3 tpy
Significant Emission Units Total Unlimited Potential to Emit - PM							**26,543.8 tpy**
Insignificant Emission Units							
N/A	Fly and Bottom Ash Bin Vent Filter	N/A	See detailed calculations in Table D-2.19a		1,460 acfm	8,760 hr/yr	19.0 tpy
N/A	Ash Loadout to Truck	N/A	See detailed calculations in Table D-2.19a		N/A	55,967 tpy	1.3E-03 tpy
N/A	Aboveground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	0 tpy
N/A	Underground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	0 tpy
Insignificant Emission Units Total Unlimited Potential to Emit - PM							**19.0 tpy**
Total Unlimited Potential to Emit - PM							**26,562.8 tpy**

Notes:

[1] The Tier 4i, Tier 3, and Tier 2 weighted-cycle emission rates for PM have been multiplied by 1.25 to determine the Not-to-Exceed emission factors per 40 CFR 1039.101(e) and ADEC policy (see also 40 CFR 60.4212(c).)

Conversion factors:

Weight	453.6	g/lb	
Weight	2,000	lb/ton	
Coal Heating Value	15.1	MMBtu/ton	*From http://www.usibelli.com/coal/data-sheet*
Engine Horsepower	1.341	hp/kw	

Table D-2.19a. Unlimited Potential to Emit Calculations - Ash Handling System PM Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added (to Table 2.7b) for the January 2021 Amendment.

Emission Unit			Factor Reference	PM Emission Factor[d]	Emission Unit Rating/Capacity	Annual Operation	Potential PM Emissions[b]
Permit ID	Description	Year Installed					
51a	Fly Ash Dust Collector (DC-1)	1993	Typical Value	0.40 gr/dscf	3,620 acfm	8,760 hr/yr	47.05 tpy[a]
51b	Bottom Ash Dust Collector (DC-2)	1994	Typical Value	0.40 gr/dscf	3,620 acfm	8,760 hr/yr	47.05 tpy[a]
N/A	Fly and Bottom Ash Bin Vent Filter	1993	Manufacturer's guarantee[c]	0.40 gr/scfm	1,460 acfm	8,760 hr/yr	18.98 tpy[a]
N/A	Ash Loadout to Truck	Unknown	AP-42, Section 13.2.4	4.63E-05 lb/ton	unknown	55,967 tpy	1.3E-03 tpy[b]
						Total PM Emissions	**113.08 tpy**

Notes:

[a] Fly and bottom ash dust collector emission calculations:

(exhaust rate, acfm) x (Temp at STP/Temp of exhaust) x (PM exhaust concentration, gr/dscf) x (1 lb/ 7,000 gr) x (1 ton/ 2,000 lb) x (60 min/hr) x (operation, hr/yr)

Temperature at standard conditions =	68	degrees Fahrenheit	293.15	degrees Kelvin
Exhaust temperature of ash bin vent filter =	150	degrees Fahrenheit	338.71	degrees Kelvin
Exhaust temperature of fan duct blower/bag filter =	150	degrees Fahrenheit		

[b] Ash loadout emission calculations:

Emission factor from AP-42, Section 13.2.4 based on empirical equation $E = k \times 0.0032 \times (U/5)^{1.3}/(M/2)^{1.4}$ lb/ton transferred where:

k = 0.74 for PM <30 μm

U = mean wind speed = 4 mph in Fairbanks, average value from September 2017 to October 2018 per NOAA NCDC.

M = ash moisture content = 27 percent (AP-42, Table 13.2.4-1)

Ash loadout emissions based on maximum possible coal consumption

Boiler Rating	230	MMBtu/hr	
Coal Heating Value	15.1	MMBtu/ton	*From http://www.usibelli.com/coal/data-sheet*
Number of boilers	6		
Maximum possible coal consumption (8,760 hr/yr x Number of boilers x Boiler rating / Coal heating value)	799,524	tpy	
Ash content of coal per Usibelli Coal Mine website	7	percent	
Operations, ash tons/yr = coal consumption x (0.085 ash content)	55,967	tpy	

Ash loadout emissions, tons/yr = (emission factor, lb/ton) x (ash loading, ton/yr) / (2,000 lb/ton)

[c] Manufacturer's guarantee for particle sizes over 5 microns in diameter

[d] To estimate uncontrolled emission factor, an estimate of 95% efficiency for dust collection filters was used. Uncontrolled emissions are expected to be significantly lower than this number.

Table D-2.19b. Unlimited Potential to Emit Calculations - Emergency Coal Storage Pile PM Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added (to Table 2.7c) for the January 2021 Amendment.

Emission Unit					
Permit ID	Description	Factor Reference	PM Emission Factor	Annual Operation[b]	Potential PM Emissions
	Coal chute to coal pile	AP-42, Section 13.2.4	5.20E-04 lb/ton[a]	82,842 tpy	2.2E-02 tpy
	Front end loader drop onto stockpile	AP-42, Section 13.2.4	5.20E-04 lb/ton[a]	82,842 tpy	2.2E-02 tpy
	Front end loader movement - chute to coal pile	AP-42, Section 13.2.2	9.55 lb/VMT[c]	697 VMT	3.33 tpy
	Front end loader movement - coal pile to South grizzly	AP-42, Section 13.2.2	9.55 lb/VMT[c]	1,139 VMT	5.44 tpy
	Front end loader movement - coal pile to North grizzly	AP-42, Section 13.2.2	9.55 lb/VMT[c]	93 VMT	0.44 tpy
	Stockpile wind erosion	AP-42, Section 13.2.5	0.00 g/m^2-yr[d]	3,370 m^2	0.00 tpy
	Front end loader drop into grizzly	AP-42, Section 13.2.4	5.20E-04 lb/ton[a]	82,842 tpy	2.2E-02 tpy
52	Coal Storage Pile			**Total PM Emissions**	**9.28 tpy**

Notes:

[a]Coal transfer emission factor from AP-42, Section 13.2.4 based on empirical equation E = k x 0.0032 x $(U/5)^{1.3}/(M/2)^{1.4}$ lb/ton transferred where:

k	0.74	PM <30 µm	
U = mean wind speed	4.0	miles/hr	Average value from September 2017 to October 2018 per NOAA NCDC.
M = coal moisture content	4.8	percent	

[b]For unlimited potential assume entire coal pile is turned over in one year:

Coal pile volume	122,729	yd^3	per September 29, 2017 survey
Density of coal	50	lb/ft^3	
Coal pile weight	82,842	tons	
Coal moved to coal pile	82,842	tpy	
Coal moved from coal pile	82,842	tpy	

[c]Front end loader movement emission factor from AP-42, Section 13.2.2, Empirical Equation 1a, E = k x $(s/12)^a$ x $(W/3)^b$ lb/VMT where:

k	4.9	for PM_{30}
s = surface material silt content (haul road)	8.4	percent, from AP-42, Table 13.2.2-1
W = mean vehicle weight	27	tons, estimate
Size of load bucket	5	yd^3
Density of coal	50	lb/ft^3
Coal moved per trip	3.375	tons (Density of coal x 27 ft3/yd3 x bucket size / 2000 lb/ton)
a (empirical constant)	0.9	from AP-42, Table 13.2.2-2 for PM_{30}
b (empirical constant)	0.45	from AP-42, Table 13.2.2-2 for PM_{30}
Approximate distance from coal chute to coal pile (round trip)	150	feet
Approximate distance from coal pile to South grizzly (round trip)	250	feet
Approximate distance from coal pile to North grizzly (round trip)	1,000	feet
Percent of annual coal transferred to South grizzly	98	percent, primary coal handling system
Percent of annual coal transferred to North grizzly	2	percent, North handling system is emergency backup to South handling system
VMT = vehicles miles traveled per year		VMT = annual stockpile throughput/coal moved per trip x distanced traveled per round trip in feet / 5280 ft/mi

[d]From AP-42, Section 13.2.5, Industrial Wind Erosion

Coal Pile at FWA CHPP (*source: Ft WW Coal Pile 2018 Volume Summary, October 2, 2018, 3-TIER Alaska LLC.*)

Average Height =	40	ft	
Width at Base =	205	ft	The minimum width (south face) of the coal pile is used as a conservative approach
Height-to-Base Ratio =	0.195		< 0.2. FWA CHPP coal pile can therefore be considered a large relatively flat pile with little penetration into the surface wind layer and a single friction velocity (using Equation (1)) can be used to for the entire surface of the coal pile. Friction velocity is a measure of wind shear stress on the erodible surface.
Surface Area of Active (north) Face =	3,370	m^2	Calculated from survey using Computer Aided Design (CAD) software in 2012. Height and width of the pile were comparable in 2018 and 2012.

AP-42 Section 13.2.5, Equation (2)

Emission factor for wind-generated particulate emissions from mixtures of erodible and nonerodible surface material subject to disturbance, EF

$$EF\ (g/m^2\text{-}yr) = k \sum_{i=1}^{N} P_i$$

where k = particle size multiplier (1.0 for particle size 30 microns, per table on page 13.2.5-3)
N = number of disturbances per year
P_i = erosion potential corresponding to the fastest mile of wind for the ith period between disturbances, g/m^2

AP-42 Section 13.2.5, Equation (3)

Erosion potential function for a dry exposed surface, P

$$P = 58\ (u^* - u_t^*)^2 + 25\ (u^* - u_t^*)$$
$$P = 0 \text{ for } u^* \leq u_t^*$$

where u^* = friction velocity (m/s)
u_t = threshold friction velocity (m/s)

AP-42 Section 13.2.5, Equation (1)

Friction velocity, u^*

$$u^* = 0.4 \times u(z) / \ln(z/z_o) \qquad \text{when } z > z_o$$

where u^* = friction velocity (cm/s)
u(z) = wind speed at height z above test surface (cm/s)
z = height above test surface (cm)
z_o = roughness height, cm

Data:

u(z)		Use maximum wind gust speed recorded at Fairbanks International Airport for each of the previous 12 months (see table below)
z	10	meters
N	204	disturbances/year for active face, as determined from 2017 records
	17	average disturbances/month

Month-Year	Maximum Wind Speed (u(10))[1]		Wind Direction	Uncrusted coal pile[2] (Table 13.2.5-2)				Scraper tracks on coal pile (Table 13.2.5-2)						
				Roughness Height (z_o)	Threshold Friction Velocity (u_t)	Calculated Friction Velocity (u*)	Erosion potential function, P	Roughness Height (z_o)	Threshold Friction Velocity (u_t)	Calculated Friction Velocity (u*)	Erosion potential function, P	P x N	k	Emission Factor, EF
	mph	m/s	deg	cm	m/s	m/s		cm	m/s	m/s				g/m^2-yr
Oct-17	17	7.6	250	0.3	1.12	0.37	0	0.06	0.62	0.31	0	0		
Nov-17	20	8.9	320	0.3	1.12	0.44	0	0.06	0.62	0.37	0	0		
Dec-17	15	6.7	140	0.3	1.12	0.33	0	0.06	0.62	0.28	0	0		
Jan-18	17	7.6	110	0.3	1.12	0.37	0	0.06	0.62	0.31	0	0		
Feb-18	29	13.0	320	0.3	1.12	0.64	0	0.06	0.62	0.53	0	0		
Mar-18	25	11.2	260	0.3	1.12	0.55	0	0.06	0.62	0.46	0	0		
Apr-18	26	11.6	240	0.3	1.12	0.57	0	0.06	0.62	0.48	0	0		
May-18	25	11.2	060	0.3	1.12	0.55	0	0.06	0.62	0.46	0	0		
Jun-18	25	11.2	030	0.3	1.12	0.55	0	0.06	0.62	0.46	0	0		
Jul-18	22	9.8	270	0.3	1.12	0.48	0	0.06	0.62	0.40	0	0		
Aug-18	26	11.6	270	0.3	1.12	0.57	0	0.06	0.62	0.48	0	0		
Sep-18	22	9.8	280	0.3	1.12	0.48	0	0.06	0.62	0.40	0	0		
Annual Total							0				0.00	0.00	1.0	**0.00**

[1] Maximum wind speed data is from NOAA NCDC. Tower height of 10 meters confirmed by Fairbanks Weather Forecast Office, National Weather Service on 27-March-2013

[2] The erosion potential factor for the uncrusted coal pile is zero for all months. Therefore, wind erosion of the uncrusted coal pile is not a significant source of PM emissions

Table D-3.1. Estimated Actual Emissions Summary
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added for the January 2021 Amendment.

Emission Unit Type	Regulated Air Pollutant Emissions (tons per year) [1,2]								
	NO_X	CO	PM	PM_{10}	$PM_{2.5}$ [3]	VOC	SO_2	HAP	GHG (CO_2e) [4]
Significant	578.4	143.4	11.0	8.5	7.2	5.8	442.2	21.5	374,921
Insignificant	0.0	0.0	0.5	0.5	0.5	0.0	0.0	0.0	0
DU Emission Total	**578.4**	**143.4**	**11.5**	**9.0**	**7.6**	**5.8**	**442.2**	**21.5**	**374,921**

Notes:

[1] Emissions are estimated actual emissions based on operations during 2016 and 2017.

[2] Regulated air pollutant calculations based on AP-42 emission factors, manufacturer data, and mass balances as shown in accompanying spreadsheets.

[3] $PM_{2.5}$ emissions are assumed to be equal to PM_{10} emissions except as noted on Table D-3.8.

[4] GHG means greenhouse gases and is the summation of CO_2, CH_4, and N_2O and applying the global warming potential for each pollutant.

[5] Emission Units (EU) 1 through 6 at Fort Wainwright (Privatized Emission Units) have baghouses as emission control devices. EU IDs 7a-7c, 51a, 51b, and the ash bin vent filter also have emission controls.

Table D-3.2. Estimated Actual Emissions Inventory - Significant Emission Units
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added for the January 2021 Amendment.

Emission Unit				Installation Date	Fuel Type	Rating
ID	Name	Description	Bldg. No.			
1	Coal-Fired Boiler 3	Central Heat and Power Plant (CHPP)	CHPP	1953	Coal	230 MMBtu/hr
2	Coal-Fired Boiler 4	CHPP	CHPP	1953	Coal	230 MMBtu/hr
3	Coal-Fired Boiler 5	CHPP	CHPP	1953	Coal	230 MMBtu/hr
4	Coal-Fired Boiler 6	CHPP	CHPP	1953	Coal	230 MMBtu/hr
5	Coal-Fired Boiler 7	CHPP	CHPP	1953	Coal	230 MMBtu/hr
6	Coal-Fired Boiler 8	CHPP	CHPP	1953	Coal	230 MMBtu/hr
7a	South Coal Handling Dust Collector (DC-01)	Airlanco 169-AST-8	CHPP	2001	N/A	13,150 acfm
7b	South Underbunker Dust Collector (DC-02)	Airlanco 16-AST	CHPP	2005	N/A	884 acfm
7c	North Coal Handling Dust Collector (NDC-1)	Dustex C67-10-547	CHPP	2004	N/A	9,250 acfm
8	Backup Generator Engine	Caterpillar 3516C	CHPP	2009	Distillate	2,937 hp
9	Emergency Generator Engine	Detroit 6V92	1032	1988	Distillate	353 hp
14	Emergency Generator Engine	Cummins QSL-G2 NR3	1563	2008	Distillate	320 hp
22	Emergency Generator Engine	Cummins	3565	1989	Distillate	35 hp
23	Emergency Generator Engine	John Deere 6068HF150	3587	2003	Distillate	155 hp
29a	Emergency Generator Engine	John Deere 4045TF290	1056	2014	Distillate	74 hp
30a	Emergency Generator Engine	Caterpillar C4.4	507	2015	Distillate	91 hp
31a	Emergency Generator Engine	John Deere 4045TF290	3724	2014	Distillate	74 hp
32a	Emergency Generator Engine	Caterpillar C4.4	507	2015	Distillate	91 hp
33a	Emergency Generator Engine	Caterpillar C4.4	1002	1994	Distillate	75 hp
34	Emergency Pump Engine	Detroit Diesel 10447000	3405	1995	Distillate	220 hp
35	Emergency Pump Engine	John Deere 4045DF120	4023	2009	Distillate	85 hp
36	Emergency Pump Engine	Detroit Diesel 4031-C	3563	1995	Distillate	220 hp
37	Emergency Generator Engine	Caterpillar C4.4	MH507	2015	Distillate	75 hp
51a	Fly Ash Dust Collector (DC-1)	United Conveyor Corp. 32242	CHPP	1993	N/A	3,620 acfm
51b	Bottom Ash Dust Collector (DC-2)	United Conveyor Corp. 32242	CHPP	1994	N/A	3,620 acfm
52	Coal Storage Pile	CHPP	CHPP	Unknown	N/A	N/A

Table D-3.3. Estimated Actual Emissions Inventory - Insignificant Emission Units
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Emission Unit(s)				Installation	Fuel		Basis for
ID	Description	Make/Model	Bldg. No.	Date	Type	Rating	Insignificance
N/A	Fly and Bottom Ash Bin Vent Filter	United Conveyor Corp 96TB-BVT-25:S6	CHPP	1993	N/A	1,460 acfm	18 AAC 50.326(e)
N/A	Ash Loadout to Truck	N/A	CHPP	Unknown	N/A	N/A	18 AAC 50.326(e)
N/A	Aboveground Storage Tank	N/A	1002	2012	Diesel	80 gallons	18 AAC 50.326(g)(1)
N/A	Aboveground Storage Tank	N/A	1032	1993	Diesel	180 gallons	18 AAC 50.326(g)(1)
N/A	Aboveground Storage Tank	N/A	1563	2012	Diesel	100 gallons	18 AAC 50.326(g)(1)
N/A	Aboveground Storage Tank	N/A	3403	2012	Diesel	100 gallons	18 AAC 50.326(g)(1)
N/A	Aboveground Storage Tank	N/A	3405	1995	Diesel	500 gallons	18 AAC 50.326(g)(2)
N/A	Aboveground Storage Tank	N/A	3563	1995	Diesel	275 gallons	18 AAC 50.326(g)(2)
N/A	Aboveground Storage Tank	N/A	3565	1997	Diesel	75 gallons	18 AAC 50.326(g)(1)
N/A	Aboveground Storage Tank	N/A	3587	2002	Diesel	180 gallons	18 AAC 50.326(g)(1)
N/A	Aboveground Storage Tank	N/A	3595	2009	Diesel	1,670 gallons	18 AAC 50.326(g)(3)
N/A	Aboveground Storage Tank	N/A	3598	Unknown	Diesel	1,000 gallons	18 AAC 50.326(g)(2)
N/A	Aboveground Storage Tank	N/A	3724	2012	Diesel	100 gallons	18 AAC 50.326(g)(1)
N/A	Aboveground Storage Tank	N/A	4023	2009	Diesel	275 gallons	18 AAC 50.326(g)(2)
N/A	Aboveground Storage Tank	N/A	4162	2012	Diesel	100 gallons	18 AAC 50.326(g)(1)
N/A	Underground Storage Tank	N/A	1060	1991	Diesel	1,000 gallons	18 AAC 50.326(g)(2)
N/A	Underground Storage Tank	N/A	1563	1995	Diesel	1,000 gallons	18 AAC 50.326(g)(2)
N/A	Underground Storage Tank	N/A	3598	1991	Used oil/water	1,000 gallons	18 AAC 50.326(g)(2)

Note:
Mobile and portable tanks are not included in list because they are insignificant under 18 AAC 50.326(f)(1) and are not required to be listed in the application.

Table D-3.4. Emission Unit Parameters
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Emission Unit			Fuel	Electrical Output	Rating	Average Actual
ID	Name	Description	Type	Rating		Operation
Significant Emission Units						
1	Coal-Fired Boiler 3	Central Heat and Power Plant (CHPP)	Coal	N/A	230 MMBtu/hr	37,872 tpy[d]
2	Coal-Fired Boiler 4	CHPP	Coal	N/A	230 MMBtu/hr	40,648 tpy[d]
3	Coal-Fired Boiler 5	CHPP	Coal	N/A	230 MMBtu/hr	38,262 tpy[d]
4	Coal-Fired Boiler 6	CHPP	Coal	N/A	230 MMBtu/hr	38,842 tpy[d]
5	Coal-Fired Boiler 7	CHPP	Coal	N/A	230 MMBtu/hr	47,507 tpy[d]
6	Coal-Fired Boiler 8	CHPP	Coal	N/A	230 MMBtu/hr	26,567 tpy[d]
7a	South Coal Handling Dust Collector (DC-01)	Airlanco 169-AST-8	N/A	N/A	13,150 acfm[a]	1,501 hr/yr[g]
7b	South Underbunker Dust Collector (DC-02)	Airlanco 16-AST	N/A	N/A	884 acfm[a]	100 hr/yr[g]
7c	North Coal Handling Dust Collector (NDC-1)	Dustex C67-10-547	N/A	N/A	9,250 acfm[a]	31 hr/yr[g]
8	Backup Generator Engine	Caterpillar 3516C	Distillate	2,000 kW	2,937 hp[b]	20.65 hr/yr[e]
9	Emergency Generator Engine	Detroit 6V92	Distillate	250 kW	353 hp[c]	8.6 hr/yr[f]
14	Emergency Generator Engine	Cummins QSL-G2 NR3	Distillate	200 kW	320 hp[b]	11.8 hr/yr[f]
22	Emergency Generator Engine	Cummins	Distillate	25 kW	35 hp[c]	0.0 hr/yr[f]
23	Emergency Generator Engine	John Deere 6068HF150	Distillate	110 kW	155 hp[c]	9.1 hr/yr[f]
29a	Emergency Generator Engine	John Deere 4045TF290	Distillate	N/A	74 hp	17.2 hr/yr[f]
30a	Emergency Generator Engine	Caterpillar C4.4	Distillate	60 kW	91 hp[l]	26.1 hr/yr[m]
31a	Emergency Generator Engine	John Deere 4045TF290	Distillate	N/A	74 hp	29.9 hr/yr[f]
32a	Emergency Generator Engine	Caterpillar C4.4	Distillate	60 kW	91 hp[l]	7.6 hr/yr[m]
33a	Emergency Generator Engine	Caterpillar C4.4	Distillate	N/A	75 hp	11.1 hr/yr[f]
34	Emergency Pump Engine	Detroit Diesel 10447000	Distillate	N/A	220 hp	5.4 hr/yr[f]
35	Emergency Pump Engine	John Deere 4045DF120	Distillate	N/A	85 hp[b]	6.4 hr/yr[f]
36	Emergency Pump Engine	Detroit Diesel 4031-C	Distillate	N/A	220 hp	18.7 hr/yr[f]
37	Emergency Generator Engine	Caterpillar C4.4	Distillate	N/A	75 hp	10.4 hr/yr[f]
51a	Fly Ash Dust Collector (DC-1)	United Conveyor Corp. 32242	N/A	N/A	3,620 acfm[a]	4,380 hr/yr[h]
51b	Bottom Ash Dust Collector (DC-2)	United Conveyor Corp. 32242	N/A	N/A	3,620 acfm[a]	4,380 hr/yr[h]
52	Coal Storage Pile	CHPP	N/A	N/A	N/A	68,660 tpy[j]
Insignificant Emission Units						
N/A	Fly and Bottom Ash Bin Vent Filter	United Conveyor Corp 96TB-BVT-25:S6	N/A	N/A	1,460 acfm[a]	4,380 hr/yr[h]
N/A	Ash Loadout to Truck	N/A	N/A	N/A	N/A	16,079 tpy[k]
N/A	Aboveground Storage Tanks	N/A[i]	Diesel	N/A	N/A	N/A
N/A	Underground Storage Tanks	N/A[i]	Diesel	N/A	N/A	N/A

Notes:
[a] Rating for dust collectors and vent filters is the manufacturer's design inlet gas flow rate in cubic feet per minute.
[b] Engine rating from vendor data.
[c] Engine rating in hp calculated from electrical output assuming 95% efficiency (hp=kW*1.341/.95).
[d] Average annual coal consumption during 2016 and 2017.
[e] Average annual operation for Emission Unit 8 during 2016 and 2017.
[f] Average annual operation during 2016 and 2017.
[g] Annual operation based on average annual coal consumption divided by coal handling conveyor capacity.
[h] Annual operation based on reasonable inquiry operation of 12 hours/day, 365 days/year.
[i] Multiple tanks, see Table D-3.3 for details.
[j] As calculated in Table D-3.7c.
[k] As calculated in Table D-3.7b
[l] Engine rating in hp calculated from electrical output using the manufacturer provided efficiency of 88%.
[m] Hours for EU IDs 30a and 32a are estimated using actual hours of operation of the engines that they replaced, EU IDs 30 and 32 averaged over 2016 and 2017. Hours of operation of the replacement engines are expected to be similar to the engines that were replaced.

Conversion factors:

Engine horsepower	1.341	hp/kw
EU IDs 9, 22, and 23 drive shaft efficiency	95%	Per Alan Schuler at ADEC
EU IDs 30a and 32a drive shaft efficiency	88%	Per vendor information

Table D-3.5. Estimated Actual Emissions Calculations - Oxides of Nitrogen (NO_X) Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added for the January 2021 Amendment.

Emission Unit ID	Emission Unit Description	Fuel Type	Factor Reference	NO_X Emission Factor	Emission Unit Rating/Capacity	Estimated Actual Operation	Estimated Actual NO_X Emissions
Significant Emission Units							
1	Coal-Fired Boiler 3	Coal	Source Test, 2004	0.29 lb/MMBtu	230 MMBtu/hr	37,872 tpy	83.0 tpy
2	Coal-Fired Boiler 4	Coal	Source Test, 2004	0.32 lb/MMBtu	230 MMBtu/hr	40,648 tpy	98.3 tpy
3	Coal-Fired Boiler 5	Coal	Source Test, 2004	0.29 lb/MMBtu	230 MMBtu/hr	38,262 tpy	83.9 tpy
4	Coal-Fired Boiler 6	Coal	Source Test, 2004	0.33 lb/MMBtu	230 MMBtu/hr	38,842 tpy	96.9 tpy
5	Coal-Fired Boiler 7	Coal	Source Test, 2004	0.36 lb/MMBtu	230 MMBtu/hr	47,507 tpy	129.3 tpy
6	Coal-Fired Boiler 8	Coal	Source Test, 2004	0.43 lb/MMBtu	230 MMBtu/hr	26,567 tpy	86.4 tpy
7a	South Coal Handling Dust Collector (DC-01)	N/A	N/A	N /A	13,150 acfm	1,501 hr/yr	0 tpy
7b	South Underbunker Dust Collector (DC-02)	N/A	N/A	N /A	884 acfm	100 hr/yr	0 tpy
7c	North Coal Handling Dust Collector (NDC-1)	N/A	N/A	N /A	9,250 acfm	31 hr/yr	0 tpy
8	Backup Generator Engine	Distillate	EPA Tier 2 (NMHC + NOx)	8.0 g/kW-hr[1, 2]	2,937 hp	21 hr/yr	0.40 tpy
9	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	0.031 lb/hp-hr	353 hp	9 hr/yr	4.7E-02 tpy
14	Emergency Generator Engine	Distillate	EPA Tier 3 (NMHC + NOx)	5.0 g/kW-hr[1, 2]	320 hp	12 hr/yr	1.5E-02 tpy
22	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	0.031 lb/hp-hr	35 hp	0 hr/yr	0 tpy
23	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	0.031 lb/hp-hr	155 hp	9 hr/yr	2.2E-02 tpy
29a	Emergency Generator Engine	Distillate	EPA Tier 4i (NMHC + NOx)	5.9 g/kW-hr[1, 2]	74 hp	17 hr/yr	6.1E-03 tpy
30a	Emergency Generator Engine	Distillate	EPA Tier 3 (NMHC + NOx)	5.9 g/kW-hr[1]	91 hp	26 hr/yr	1.2E-02 tpy
31a	Emergency Generator Engine	Distillate	EPA Tier 4i (NMHC + NOx)	5.9 g/kW-hr[1, 2]	74 hp	30 hr/yr	1.1E-02 tpy
32a	Emergency Generator Engine	Distillate	EPA Tier 3 (NMHC + NOx)	5.9 g/kW-hr[1]	91 hp	8 hr/yr	3.4E-03 tpy
33a	Emergency Generator Engine	Distillate	EPA Tier 3 (NMHC + NOx)	5.9 g/kW-hr[1]	75 hp	11 hr/yr	4.0E-03 tpy
34	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	0.031 lb/hp-hr	220 hp	5 hr/yr	1.8E-02 tpy
35	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	0.031 lb/hp-hr	85 hp	6 hr/yr	8.4E-03 tpy
36	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	0.031 lb/hp-hr	220 hp	19 hr/yr	6.4E-02 tpy
37	Emergency Generator Engine	Distillate	EPA Tier 3 (NMHC + NOx)	5.9 g/kW-hr[1]	75 hp	10 hr/yr	3.8E-03 tpy
51a	Fly Ash Dust Collector (DC-1)	N/A	N/A	N/A	3,620 acfm	4,380 hr/yr	0 tpy
51b	Bottom Ash Dust Collector (DC-2)	N/A	N/A	N/A	3,620 acfm	4,380 hr/yr	0 tpy
52	Coal Storage Pile	N/A	N/A	N/A	N/A	68,660 tpy	0 tpy
						Significant Emission Units Estimated Actual Emissions - NO_X	**578.4 tpy**
Insignificant Emission Units							
N/A	Fly and Bottom Ash Bin Vent Filter	N/A	N/A	N/A	1,460 acfm	4,380 hr/yr	0 tpy
N/A	Ash Loadout to Truck	N/A	N/A	N/A	N/A	16,079 tpy	0 tpy
N/A	Aboveground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	0 tpy
N/A	Underground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	0 tpy
						Insignificant Emission Units Estimated Actual Emissions - NO_X	**0 tpy**
						Total Estimated Actual Emissions - NO_X	**578.4 tpy**

Notes:

[1] The Tier 4i, Tier 3, and Tier 2 weighted-cycle emission rates for NO_X have been multiplied by 1.25 to determine the Not-to-Exceed emission factors per 40 CFR 1039.101(e) and ADEC policy (see also 40 CFR 60.4212(c).)

[2] Emission factors for EUs 8, 14, 29a, and 31a have been corrected in this Title V renewal application amendment.

Conversion factors:

Weight	453.6	g/lb	
Weight	2,000	lb/ton	
Coal Heating Value	15.1	MMBtu/ton	*From http://www.usibelli.com/coal/data-sheet*
Engine horsepower	1.341	hp/kw	

Table D-3.6. Estimated Actual Emissions Calculations - Carbon Monoxide (CO) Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added for the January 2021 Amendment.

Emission Unit ID	Emission Unit Name	Fuel Type	Factor Reference	CO Emission Factor	Emission Unit Rating/Capacity	Estimated Actual Operation	Estimated Actual CO Emissions
Significant Emission Units							
1	Coal-Fired Boiler 3	Coal	Source Test, 17-Apr-18	0.073 lb/MMBtu[1]	230 MMBtu/hr	37,872 tpy	21.0 tpy
2	Coal-Fired Boiler 4	Coal	Source Test, 19-Apr-18	0.079 lb/MMBtu[1]	230 MMBtu/hr	40,648 tpy	24.2 tpy
3	Coal-Fired Boiler 5	Coal	Source Test, 17-Apr-18	0.087 lb/MMBtu[1]	230 MMBtu/hr	38,262 tpy	25.2 tpy
4	Coal-Fired Boiler 6	Coal	Source Test, 18-Apr-18	0.094 lb/MMBtu[1]	230 MMBtu/hr	38,842 tpy	27.7 tpy
5	Coal-Fired Boiler 7	Coal	Source Test, 20-Apr-18	0.075 lb/MMBtu[1]	230 MMBtu/hr	47,507 tpy	26.8 tpy
6	Coal-Fired Boiler 8	Coal	Source Test, 23-Apr-18	0.090 lb/MMBtu[1]	230 MMBtu/hr	26,567 tpy	18.2 tpy
7a	South Coal Handling Dust Collector (DC-01)	N/A	N/A	N/A	13,150 acfm	1,501 hr/yr	0 tpy
7b	South Underbunker Dust Collector (DC-02)	N/A	N/A	N/A	884 acfm	100 hr/yr	0 tpy
7c	North Coal Handling Dust Collector (NDC-1)	N/A	N/A	N/A	9,250 acfm	31 hr/yr	0 tpy
8	Backup Generator Engine	Distillate	EPA Tier 2	4.375 g/kW-hr[1, 2]	2,937 hp	21 hr/yr	0.22 tpy
9	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	6.68E-03 lb/hp-hr	353 hp	9 hr/yr	1.0E-02 tpy
14	Emergency Generator Engine	Distillate	EPA Tier 3	4.38 g/kW-hr[2, 3]	320 hp	12 hr/yr	1.4E-02 tpy
22	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	6.68E-03 lb/hp-hr	35 hp	0 hr/yr	0 tpy
23	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	6.68E-03 lb/hp-hr	155 hp	9 hr/yr	4.7E-03 tpy
29a	Emergency Generator Engine	Distillate	EPA Tier 4i	6.25 g/kW-hr[2]	74 hp	17 hr/yr	6.5E-03 tpy
30a	Emergency Generator Engine	Distillate	EPA Tier 3	6.25 g/kW-hr[2]	91 hp	26 hr/yr	1.2E-02 tpy
31a	Emergency Generator Engine	Distillate	EPA Tier 4i	6.25 g/kW-hr[2]	74 hp	30 hr/yr	1.1E-02 tpy
32a	Emergency Generator Engine	Distillate	EPA Tier 3	6.25 g/kW-hr[2]	91 hp	8 hr/yr	3.6E-03 tpy
33a	Emergency Generator Engine	Distillate	EPA Tier 3	6.25 g/kW-hr[2]	75 hp	11 hr/yr	4.3E-03 tpy
34	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	6.68E-03 lb/hp-hr	220 hp	5 hr/yr	4.0E-03 tpy
35	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	6.68E-03 lb/hp-hr	85 hp	6 hr/yr	1.8E-03 tpy
36	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	6.68E-03 lb/hp-hr	220 hp	19 hr/yr	1.4E-02 tpy
37	Emergency Generator Engine	Distillate	EPA Tier 3	6.25 g/kW-hr[2]	75 hp	10 hr/yr	4.0E-03 tpy
51a	Fly Ash Dust Collector (DC-1)	N/A	N/A	N/A	3,620 acfm	4,380 hr/yr	0 tpy
51b	Bottom Ash Dust Collector (DC-2)	N/A	N/A	N/A	3,620 acfm	4,380 hr/yr	0 tpy
52	Coal Storage Pile	N/A	N/A	N/A	N/A	68,660 tpy	0 tpy
						Significant Emission Units Estimated Actual Emissions - CO	**143.4 tpy**
Insignificant Emission Units							
N/A	Fly and Bottom Ash Bin Vent Filter	N/A	N/A	N/A	1,460 acfm	4,380 hr/yr	0 tpy
N/A	Ash Loadout to Truck	N/A	N/A	N/A	N/A	16,079 tpy	0 tpy
N/A	Aboveground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	0 tpy
N/A	Underground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	0 tpy
						Insignificant Emission Units Estimated Actual Emissions - CO	**0 tpy**
						Total Estimated Actual Emissions - CO	**143.4 tpy**

Notes:

[1] Emission factor, lb CO/MMBtu = (source test emission concentration, ppmvd @ 3%O_2)*(7.27E-8 lb CO/scf-ppm) * (9,780 dscf/MMBtu) * (20.9/(20.9-3))

[2] The Tier 4i, Tier 3, and Tier 2 weighted-cycle emission rates for CO have been multiplied by 1.25 to determine the Not-to-Exceed emission factors per 40 CFR 1039.101(e) and ADEC policy (see also 40 CFR 60.4212(c).)

[3] Emission factors for EUs 8 and 14 have been corrected in this Title V renewal application amendment.

Conversion factors:

Weight	453.6	g/lb	
Weight	2,000	lb/ton	
Engine horsepower	1.341	hp/kw	
Coal Heating Value	15.1	MMBtu/ton	*From http://www.usibelli.com/coal/data-sheet*
CO f-factor	9,780	dscf/MMBtu	*From 40 CFR 60 Appendix A, Method 19*
CO conversion factor	7.27E-08	lb CO/scf-ppm	*Derived from 40 CFR 60 Appendix A, Method 19*

Table D-3.7. Estimated Actual Emissions Calculations - Particulate Matter Less Than 10 Microns (PM_{10}) Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added for the January 2021 Amendment.

Emission Unit ID	Emission Unit Name	Fuel Type	Factor Reference	PM_{10} Emission Factor	Emission Unit Rating/Capacity	Estimated Actual Operation	Estimated Actual PM_{10} Emissions
Significant Emission Units							
1	Coal-Fired Boiler 3	Coal	Source Test, 25-Apr-17	0.00551 lb/MMBtu	230 MMBtu/hr	37,872 tpy	1.58 tpy
2	Coal-Fired Boiler 4	Coal	Source Test, 19-Apr-17	0.00525 lb/MMBtu	230 MMBtu/hr	40,648 tpy	1.61 tpy
3	Coal-Fired Boiler 5	Coal	Source Test, 20-Apr-17	0.00179 lb/MMBtu	230 MMBtu/hr	38,262 tpy	0.52 tpy
4	Coal-Fired Boiler 6	Coal	Source Test, 24-Apr-17	0.00059 lb/MMBtu	230 MMBtu/hr	38,842 tpy	0.17 tpy
5	Coal-Fired Boiler 7	Coal	Source Test, 21-Apr-17	0.00129 lb/MMBtu	230 MMBtu/hr	47,507 tpy	0.46 tpy
6	Coal-Fired Boiler 8	Coal	Source Test, 22-Apr-17	0.00048 lb/MMBtu	230 MMBtu/hr	26,567 tpy	0.10 tpy
7a	South Coal Handling Dust Collector (DC-01)	N/A	See detailed calculations in Table D-3.7a		13,150 acfm	1,501 hr/yr	0.20 tpy
7b	South Underbunker Dust Collector (DC-02)	N/A	See detailed calculations in Table D-3.7a		884 acfm	100 hr/yr	7.3E-03 tpy
7c	North Coal Handling Dust Collector (NDC-1)	N/A	See detailed calculations in Table D-3.7a		9,250 acfm	31 hr/yr	2.4E-02 tpy
8	Backup Generator Engine	Distillate	EPA Tier 2	0.25 g/kW-hr[1, 2]	2,937 hp	21 hr/yr	0.37 tpy
9	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	353 hp	9 hr/yr	3.3E-03 tpy
14	Emergency Generator Engine	Distillate	EPA Tier 3	0.25 g/kW-hr[1, 2]	320 hp	12 hr/yr	1.0E-03 tpy
22	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	35 hp	0 hr/yr	0.0 tpy
23	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	155 hp	9 hr/yr	1.5E-03 tpy
29a	Emergency Generator Engine	Distillate	EPA Tier 4i	0.375 g/kW-hr[1, 2]	74 hp	17 hr/yr	5.3E-04 tpy
30a	Emergency Generator Engine	Distillate	EPA Tier 3	0.5 g/kW-hr[1]	91 hp	26 hr/yr	9.8E-04 tpy
31a	Emergency Generator Engine	Distillate	EPA Tier 4i	0.375 g/kW-hr[1, 2]	74 hp	30 hr/yr	9.1E-04 tpy
32a	Emergency Generator Engine	Distillate	EPA Tier 3	0.5 g/kW-hr[1]	91 hp	8 hr/yr	2.9E-04 tpy
33a	Emergency Generator Engine	Distillate	EPA Tier 3	0.5 g/kW-hr[1]	75 hp	11 hr/yr	3.4E-04 tpy
34	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	220 hp	5 hr/yr	1.3E-03 tpy
35	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	85 hp	6 hr/yr	6.0E-04 tpy
36	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	220 hp	19 hr/yr	4.5E-03 tpy
37	Emergency Generator Engine	Distillate	EPA Tier 3	0.5 g/kW-hr[1]	75 hp	10 hr/yr	3.2E-04 tpy
51a	Fly Ash Dust Collector (DC-1)	N/A	See detailed calculations in Table D-3.7b		3,620 acfm	4,380 hr/yr	1.18 tpy
51b	Bottom Ash Dust Collector (DC-2)	N/A	See detailed calculations in Table D-3.7b		3,620 acfm	4,380 hr/yr	1.18 tpy
52	Coal Storage Pile	N/A	See detailed calculations in Table D-3.7c		N/A	68,660 tpy	1.10 tpy
						Significant Emission Units Estimated Actual Emissions - PM_{10}	**8.5 tpy**
Insignificant Emission Units							
N/A	Fly and Bottom Ash Bin Vent Filter	N/A	See detailed calculations in Table D-3.7b		1,460 acfm	4,380 hr/yr	0.47 tpy
N/A	Ash Loadout to Truck	N/A	See detailed calculations in Table D-3.7b		N/A	16,079 tpy	1.8E-04 tpy
N/A	Aboveground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	0 tpy
N/A	Underground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	0 tpy
						Insignificant Emission Units Estimated Actual Emissions - PM_{10}	**0.5 tpy**
						Total Estimated Actual Emissions - PM_{10}	**9.0 tpy**

Notes:

[1] The Tier 4i, Tier 3, and Tier 2 weighted-cycle emission rates for NO_X, CO, PM_{10}, and $PM_{2.5}$ have been multiplied by 1.25 to determine the Not-to-Exceed emission factors per 40 CFR 1039.101(e) and ADEC policy (see also 40 CFR 60.4212(c).)

[2] Emission factors for EUs 8, 14, 29a, and 31a have been corrected in this Title V renewal application amendment.

Conversion factors:

Weight	453.6	g/lb	
Weight	2,000	lb/ton	
Coal Heating Value	15.1	MMBtu/ton	*From http://www.usibelli.com/coal/data-sheet*
Engine horsepower	1.341	hp/kw	

Table D-3.7a. Estimated Actual Emissions Calculations - Coal Handling Systems $PM/PM_{10}/PM_{2.5}$ Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added for the January 2021 Amendment.

Emission Unit							
Permit ID	Description	Year Installed	Factor Reference	PM Emission Factor	Emission Unit Rating/Capacity	Annual Operation[a]	Estimated Actual $PM/PM_{10}/PM_{2.5}$ Emissions[b]
7a	South Coal Handling Dust Collector (DC-01)	2001	Source Test, 2003	0.0025 gr/dscf	13,150 acfm	1,501 hr/yr	0.20 tpy
7b	South Underbunker Dust Collector (DC-02)	2005	Manufacturer's guarantee[c]	0.02 gr/dscf	884 acfm	100 hr/yr	7.3E-03 tpy
7c	North Coal Handling Dust Collector (NDC-1)	2004	Typical value	0.02 gr/dscf	9,250 acfm	31 hr/yr	2.4E-02 tpy
						Total $PM/PM_{10}/PM_{2.5}$ Emissions	**0.24 tpy**

Notes:

[a] Time of operation:

Average annual coal consumption for 2016 and 2017	229,697	tpy
Conveyor operation rate	150	tph
Time of operation	1,531	hrs/yr
Average daily coal handling operations	4.20	hr/day, 365 operating days per year
Percent of time South coal handling dust collector is in use	98	percent, primary coal handling system
Percent of time North coal handling dust collector is in use	2	percent, North handling system is emergency backup to South handling system
Underbunker dust collector	100	hrs/yr, used only when emptying coal bunker for unscheduled boiler shutdown or bunker fire

[b] Coal handling dust collection emission calculations:

(exhaust rate, acfm) x (Temp at STP/Temp of exhaust) x (PM_{10} exhaust concentration, gr/dscf) x (1 lb/ 7,000 gr) x (1 ton/ 2,000 lb) x (60 min/hr) x (operation, hr/yr)

Temperature at standard conditions =	68	degrees Fahrenheit	293.15	degrees Kelvin
Exhaust temperature dust collectors =	85	degrees Fahrenheit	302.59	degrees Kelvin

[c] Manufacturer's guarantee for particle sizes 2 microns in diameter and larger

Table D-3.7b. Estimated Actual Emissions Calculations - Ash Handling System PM_{10} Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added for the January 2021 Amendment.

Emission Unit							
Permit ID	Description	Year Installed	Factor Reference	PM_{10} Emission Factor	Emission Unit Rating/Capacity	Annual Operation	Estimated Actual PM_{10} Emissions[b]
51a	Fly Ash Dust Collector (DC-1)	1993	Typical Value	0.02 gr/dscf	3,620 acfm	4,380 hr/yr[d]	1.18 tpy[a]
51b	Bottom Ash Dust Collector (DC-2)	1994	Typical Value	0.02 gr/dscf	3,620 acfm	4,380 hr/yr[d]	1.18 tpy[a]
N/A	Fly and Bottom Ash Bin Vent Filter	1993	Manufacturer's guarantee[c]	0.02 gr/scfm	1,460 acfm	4,380 hr/yr[e]	0.47 tpy[a]
N/A	Ash Loadout to Truck	Unknown	AP-42, Section 13.2.4	2.19E-05 lb/ton	N/A	16,079 tpy	1.76E-04 tpy[b]
						Total PM_{10} Emissions	**2.83 tpy**

Notes:

[a] Fly and bottom ash dust collector emission calculations:

(exhaust rate, acfm) x (Temp at STP/Temp of exhaust) x (PM_{10} exhaust concentration, gr/dscf) x (1 lb/ 7,000 gr) x (1 ton/ 2,000 lb) x (60 min/hr) x (operation, hr/yr)

Temperature at standard conditions =	68	degrees Fahrenheit	293.15	degrees Kelvin
Exhaust temperature of ash bin vent filter =	150	degrees Fahrenheit	338.71	degrees Kelvin
Exhaust temperature of fan duct blower/bag filter =	150	degrees Fahrenheit		

[b] Ash loadout emission calculations:

Emission factor from AP-42, Section 13.2.4 based on empirical equation $E = k \times 0.0032 \times (U/5)^{1.3}/(M/2)^{1.4}$ lb/ton transferred where:
k = 0.35 for PM_{10}
U = mean wind speed = 4.0 mph in Fairbanks, per National Climactic Data Center (https://www.ncdc.noaa.gov/cdo-web/search)
M = ash moisture content = 27 percent (AP-42, Table 13.2.4-1)

Ash loadout emissions based on average annual coal consumption	229,697	tpy
Ash content of coal per Usibelli Coal Mine website	7	percent
Operations, ash tons/yr = coal consumption x (0.085 ash content)	16,079	tpy

Ash loadout emissions, tons/yr = (emission factor, lb/ton) x (ash loading, ton/yr) / (2,000 lb/ton)

[c] Manufacturer's guarantee for particle sizes over 5 microns in diameter

[d] Average run time for DC-1 and DC-2 is 12 hours/day per reasonable inquiry of plant operations

[e] Operation of ash bin vent filter assumed to be the same as the dust collectors

Table D-3.7c. Estimated Actual Emissions Calculations - Emergency Coal Storage Pile PM_{10} Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Emission Unit		Factor Reference	PM_{10} Emission Factor	Annual Operation[b]	Estimated Actual PM_{10} Emissions
Permit ID	Description				
	Coal chute to coal pile	AP-42, Section 13.2.4	2.46E-04 lb/ton[a]	43,509 tpy	5.35E-03 tpy
	Front end loader drop onto stockpile	AP-42, Section 13.2.4	2.46E-04 lb/ton[a]	43,509 tpy	5.35E-03 tpy
	Front end loader movement - chute to coal pile	AP-42, Section 13.2.2	2.92 lb/VMT[c]	366 VMT	0.54 tpy
	Front end loader movement - coal pile to South grizzly	AP-42, Section 13.2.2	2.92 lb/VMT[c]	346 VMT	0.51 tpy
	Front end loader movement - coal pile to North grizzly	AP-42, Section 13.2.2	2.92 lb/VMT[c]	28 VMT	4.1.E-02 tpy
	Stockpile wind erosion	AP-42, Section 13.2.5	0.00 g/m^2-yr[d]	3,370 m^2	0.00 tpy
	Front end loader drop into grizzly	AP-42, Section 13.2.4	2.46E-04 lb/ton[a]	25,151 tpy	3.09E-03 tpy
52	Coal Storage Pile			**Total PM_{10} Emissions**	**1.10 tpy**

Notes:

[a]Coal transfer emission factor from AP-42, Section 13.2.4 based on empirical equation $E = k \times 0.0032 \times (U/5)^{1.3}/(M/2)^{1.4}$ lb/ton transferred where:

k	0.35	for PM_{10}	
U = mean wind speed	4	miles/hr	Average value from September 2017 to October 2018 per NOAA NCDC.
M = coal moisture content	4.8	percent	

[b]Average Annual stockpile throughput based on 2016 and 2017 records:

Coal moved to coal pile	43,509	tpy
Coal moved from coal pile	25,151	tpy

[c]Front end loader movement emission factor from AP-42, Section 13.2.2, Empirical Equation 1a, $E = k \times (s/12)^a \times (W/3)^b$ lb/VMT where:

k	1.5	for PM_{10}
s = surface material silt content (haul road)	8.4	%
W = mean vehicle weight	27	percent, from AP-42, Table 13.2.2-1
Size of load bucket	5	tons, estimate
Density of coal	50	lb/ft^3
Coal moved per trip	3.375	tons (Density of coal x 27 ft3/yd3 x bucket size / 2000 lb/ton)
a (empirical constant)	0.9	from AP-42, Table 13.2.2-2
b (empirical constant)	0.45	from AP-42, Table 13.2.2-2
Approximate distance from coal chute to coal pile (round trip)	150	feet
Approximate distance from coal pile to South grizzly (round trip)	250	feet
Approximate distance from coal pile to North grizzly (round trip)	1,000	feet
Percent of annual coal transferred to South grizzly	98	percent, primary coal handling system
Percent of annual coal transferred to North grizzly	2	percent, North handling system is emergency backup to South handling system
VMT = vehicles miles traveled per year		VMT = annual stockpile throughput/coal moved per trip x distanced traveled per round trip in feet / 5280 ft/mi

[d]From AP-42, Section 13.2.5, Industrial Wind Erosion

Coal Pile at FWA CHPP (*source: Ft WW Coal Pile 2018 Volume Summary, October 2, 2018, 3-TIER Alaska LLC.*)

Average Height =	40	ft	
Width at Base =	205	ft	The minimum width (south face) of the coal pile is used as a conservative approach
Height-to-Base Ratio =	0.195		< 0.2. FWA CHPP coal pile can therefore be considered a large relatively flat pile with little penetration into the surface wind layer and a single friction velocity (using Equation (1)) can be used to for the entire surface of the coal pile. Friction velocity is a measure of wind shear stress on the erodible surface.
Surface Area of Active (north) Face =	3,370	m^2	Calculated from survey using Computer Aided Design (CAD) software in 2012. Height and width of the pile were comparable in 2018 and 2012.

AP-42 Section 13.2.5, Equation (2)

Emission factor for wind-generated particulate emissions from mixtures of erodible and nonerodible surface material subject to disturbance, EF

$$EF\ (g/m^2\text{-}yr) = k \sum_{i=1}^{N} P_i$$

where k = particle size multiplier (0.5 for particle size < 10 microns, per table on page 13.2.5-3)
N = number of disturbances per year
P_i = erosion potential corresponding to the fastest mile of wind for the ith period between disturbances, g/m^2

AP-42 Section 13.2.5, Equation (3)

Erosion potential function for a dry exposed surface, P

$$P = 58\ (u^* - u_t^*)^2 + 25\ (u^* - u_t^*)$$
$$P = 0 \text{ for } u^* \leq u_t^*$$

where u^* = friction velocity (m/s)
u_t = threshold friction velocity (m/s)

AP-42 Section 13.2.5, Equation (1)

Friction velocity, u^*

$$u^* = 0.4 \times u(z) / \ln(z/z_o) \qquad \text{when } z > z_o$$

where u^* = friction velocity (cm/s)
u(z) = wind speed at height z above test surface (cm/s)
z = height above test surface (cm)
z_o = roughness height, cm

Data:

u(z)		Use maximum wind gust speed recorded at Fairbanks International Airport for each of the previous 12 months (see table below)
z	10	meters
N	204	disturbances/year for active face, as determined from 2017 records
	17	average disturbances/month

Month-Year	Maximum Wind Speed (u(10))[1]		Wind Direction	Uncrusted coal pile[2] (Table 13.2.5-2)				Scraper tracks on coal pile (Table 13.2.5-2)						
				Roughness Height (z_o)	Threshold Friction Velocity (u_t)	Calculated Friction Velocity (u*)	Erosion potential function, P	Roughness Height (z_o)	Threshold Friction Velocity (u_t)	Calculated Friction Velocity (u*)	Erosion potential function, P	P x N	k	Emission Factor, EF
	mph	m/s	deg	cm	m/s	m/s		cm	m/s	m/s				g/m^2-yr
Oct-17	17	7.6	060	0.3	1.12	0.37	0	0.06	0.62	0.31	0	0		
Nov-17	20	8.9	270	0.3	1.12	0.44	0	0.06	0.62	0.37	0	0		
Dec-17	15	6.7	070	0.3	1.12	0.33	0	0.06	0.62	0.28	0	0		
Jan-18	17	7.6	200	0.3	1.12	0.37	0	0.06	0.62	0.31	0	0		
Feb-18	29	13.0	270	0.3	1.12	0.64	0	0.06	0.62	0.53	0	0		
Mar-18	25	11.2	270	0.3	1.12	0.55	0	0.06	0.62	0.46	0	0		
Apr-18	26	11.6	040	0.3	1.12	0.57	0	0.06	0.62	0.48	0	0		
May-18	25	11.2	300	0.3	1.12	0.55	0	0.06	0.62	0.46	0	0		
Jun-18	25	11.2	090	0.3	1.12	0.55	0	0.06	0.62	0.46	0	0		
Jul-18	22	9.8	300	0.3	1.12	0.48	0	0.06	0.62	0.40	0	0		
Aug-18	26	11.6	250	0.3	1.12	0.57	0	0.06	0.62	0.48	0	0		
Sep-18	22	9.8	260	0.3	1.12	0.48	0	0.06	0.62	0.40	0	0		
Annual Total							0				0.00	0.00	0.5	**0.00**

[1] Maximum wind speed data is from NOAA NCDC. Tower height of 10 meters confirmed by Fairbanks Weather Forecast Office, National Weather Service on 27-March-2013

[2] The erosion potential factor for the uncrusted coal pile is zero for all months. Therefore, wind erosion of the uncrusted coal pile is not a significant source of PM emissions

Table D-3.8. Estimated Actual Emissions Calculations - Particulate Matter Less Than 2.5 Microns ($PM_{2.5}$) Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added for the January 2021 Amendment.

Emission Unit ID	Emission Unit Name	Fuel Type	Factor Reference	$PM_{2.5}$ Emission Factor	Emission Unit Rating/Capacity	Estimated Actual Operation	Estimated Actual $PM_{2.5}$ Emissions
Significant Emission Units							
1	Coal-Fired Boiler 3	Coal	Source Test, 25-Apr-17	0.00551 lb/MMBtu	230 MMBtu/hr	37,872 tpy	1.6 tpy
2	Coal-Fired Boiler 4	Coal	Source Test, 19-Apr-17	0.00525 lb/MMBtu	230 MMBtu/hr	40,648 tpy	1.6 tpy
3	Coal-Fired Boiler 5	Coal	Source Test, 20-Apr-17	0.00179 lb/MMBtu	230 MMBtu/hr	38,262 tpy	0.5 tpy
4	Coal-Fired Boiler 6	Coal	Source Test, 24-Apr-17	0.00059 lb/MMBtu	230 MMBtu/hr	38,842 tpy	0.2 tpy
5	Coal-Fired Boiler 7	Coal	Source Test, 21-Apr-17	0.00129 lb/MMBtu	230 MMBtu/hr	47,507 tpy	0.5 tpy
6	Coal-Fired Boiler 8	Coal	Source Test, 22-Apr-17	0.00048 lb/MMBtu	230 MMBtu/hr	26,567 tpy	0.1 tpy
7a	South Coal Handling Dust Collector (DC-01)	N/A	See detailed calculations in Table D-3.7a		13,150 acfm	1,501 hr/yr	0.20 tpy
7b	South Underbunker Dust Collector (DC-02)	N/A	See detailed calculations in Table D-3.7a		884 acfm	100 hr/yr	7.3E-03 tpy
7c	North Coal Handling Dust Collector (NDC-1)	N/A	See detailed calculations in Table D-3.7a		9,250 acfm	31 hr/yr	2.4E-02 tpy
8	Backup Generator Engine	Distillate	EPA Tier 2	0.25 g/kW-hr[1, 2]	2,937 hp	21 hr/yr	1.2E-02 tpy
9	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	353 hp	9 hr/yr	3.3E-03 tpy
14	Emergency Generator Engine	Distillate	EPA Tier 3	0.25 g/kW-hr[2, 3]	320 hp	12 hr/yr	7.7E-04 tpy
22	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	35 hp	0 hr/yr	0 tpy
23	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	155 hp	9 hr/yr	1.5E-03 tpy
29a	Emergency Generator Engine	Distillate	EPA Tier 4i	3.75E-01 g/kW-hr[2, 3]	74 hp	17 hr/yr	3.9E-04 tpy
30a	Emergency Generator Engine	Distillate	EPA Tier 3 (NMHC + NOx)	0.5 g/kW-hr[2]	91 hp	26 hr/yr	9.8E-04 tpy
31a	Emergency Generator Engine	Distillate	EPA Tier 4i	3.75E-01 g/kW-hr[2, 3]	74 hp	30 hr/yr	6.8E-04 tpy
32a	Emergency Generator Engine	Distillate	EPA Tier 3 (NMHC + NOx)	0.5 g/kW-hr[2]	91 hp	8 hr/yr	2.9E-04 tpy
33a	Emergency Generator Engine	Distillate	EPA Tier 3 (NMHC + NOx)	0.5 g/kW-hr[2]	75 hp	11 hr/yr	3.4E-04 tpy
34	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	220 hp	5 hr/yr	1.3E-03 tpy
35	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	85 hp	6 hr/yr	6.0E-04 tpy
36	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	220 hp	19 hr/yr	4.5E-03 tpy
37	Emergency Generator Engine	Distillate	EPA Tier 3 (NMHC + NOx)	0.5 g/kW-hr[2]	75 hp	10 hr/yr	3.2E-04 tpy
51a	Fly Ash Dust Collector (DC-1)	N/A	See detailed calculations in Table D-3.8a		3,620 acfm	4,380 hr/yr	1.2 tpy
51b	Bottom Ash Dust Collector (DC-2)	N/A	See detailed calculations in Table D-3.8a		3,620 acfm	4,380 hr/yr	1.2 tpy
52	Coal Storage Pile	N/A	See detailed calculations in Table D-3.8b		N/A	68,660 tpy	0.1 tpy
						Significant Emission Units Estimated Actual Emissions - $PM_{2.5}$	**7.2 tpy**
Insignificant Emission Units							
N/A	Fly and Bottom Ash Bin Vent Filter	N/A	See detailed calculations in Table D-3.8a		1,460 acfm	4,380 hr/yr	0.47 tpy
N/A	Ash Loadout to Truck	N/A	See detailed calculations in Table D-3.8a		N/A	16,079 tpy	2.7E-05 tpy
N/A	Aboveground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	0 tpy
N/A	Underground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	0 tpy
						Insignificant Emission Units Estimated Actual Emissions - $PM_{2.5}$	**0.5 tpy**
						Total Estimated Actual Emissions - $PM_{2.5}$	**7.6 tpy[1]**

Notes:

[1] $PM_{2.5}$ emission calculations for all emission units other than 1 through 6, 51a, 51b, and 52 conservatively assume that $PM_{2.5}$ emissions are equal to PM_{10} emissions.

[2] The Tier 4i, Tier 3, and Tier 2 weighted-cycle emission rates for PM have been multiplied by 1.25 to determine the Not-to-Exceed emission factors per 40 CFR 1039.101(e) and ADEC policy (see also 40 CFR 60.4212(c).)

[3] Emission factors for EUs 8, 14, 29a, 31a, 51a, 51b, and 52 have been corrected in this Title V renewal application amendment.

Conversion factors:

Weight	453.6	g/lb	
Weight	2,000	lb/ton	
Coal Heating Value	15.1	MMBtu/ton	*From http://www.usibelli.com/coal/data-sheet*
Engine horsepower	1.341	hp/kw	

Table D-3.8a. Estimated Actual Emissions Calculations - Ash Handling System $PM_{2.5}$ Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added (to Table 3.7b) for the January 2021 Amendment.

Emission Unit			Factor Reference	$PM_{2.5}$ Emission Factor	Emission Unit Rating/Capacity	Annual Operation	Estimated Actual $PM_{2.5}$ Emissions[b]
Permit ID	Description	Year Installed					
51a	Fly Ash Dust Collector (DC-1)	1993	Typical Value	0.02 gr/dscf	3,620 acfm	4,380 hr/yr[d]	1.18 tpy[a]
51b	Bottom Ash Dust Collector (DC-2)	1994	Typical Value	0.02 gr/dscf	3,620 acfm	4,380 hr/yr[d]	1.18 tpy[a]
N/A	Fly and Bottom Ash Bin Vent Filter	1993	Manufacturer's guarantee[c]	0.02 gr/scfm	1,460 acfm	4,380 hr/yr[e]	0.47 tpy[a]
N/A	Ash Loadout to Truck	Unknown	AP-42, Section 13.2.4	3.32E-06 lb/ton	N/A	16,079 tpy	2.67E-05 tpy[b]
						Total $PM_{2.5}$ Emissions	**2.83 tpy**

Notes:

[a] Fly and bottom ash dust collector emission calculations:

(exhaust rate, acfm) x (Temp at STP/Temp of exhaust) x (PM_{10} exhaust concentration, gr/dscf) x (1 lb/ 7,000 gr) x (1 ton/ 2,000 lb) x (60 min/hr) x (operation, hr/yr)

Temperature at standard conditions =	68	degrees Fahrenheit	293.15 degrees Kelvin
Exhaust temperature of ash bin vent filter =	150	degrees Fahrenheit	338.71 degrees Kelvin
Exhaust temperature of fan duct blower/bag filter =	150	degrees Fahrenheit	

[b] Ash loadout emission calculations:

Emission factor from AP-42, Section 13.2.4 based on empirical equation $E = k \times 0.0032 \times (U/5)^{1.3}/(M/2)^{1.4}$ lb/ton transferred where:

k = 0.053 for $PM_{2.5}$

U = mean wind speed = 4.0 mph in Fairbanks, per National Climactic Data Center (https://www.ncdc.noaa.gov/cdo-web/search)

M = ash moisture content = 27 percent (AP-42, Table 13.2.4-1)

Ash loadout emissions based on average annual coal consumption	229,697	tpy
Ash content of coal per Usibelli Coal Mine website	7	percent
Operations, ash tons/yr = coal consumption x (0.085 ash content)	16,079	tpy

Ash loadout emissions, tons/yr = (emission factor, lb/ton) x (ash loading, ton/yr) / (2,000 lb/ton)

[c] Manufacturer's guarantee for particle sizes over 5 microns in diameter

[d] Average run time for DC-1 and DC-2 is 12 hours/day per reasonable inquiry of plant operations

[e] Operation of ash bin vent filter assumed to be the same as the dust collectors

Table D-3.8b. Estimated Actual Emissions Calculations - Emergency Coal Storage Pile $PM_{2.5}$ Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added (to Table 3.7c) for the January 2021 Amendment.

Emission Unit		Factor Reference	$PM_{2.5}$ Emission Factor	Annual Operation[b]	Estimated Actual $PM_{2.5}$ Emissions
Permit ID	Description				
	Coal chute to coal pile	AP-42, Section 13.2.4	3.73E-05 lb/ton[a]	43,509 tpy	8.1E-04 tpy
	Front end loader drop onto stockpile	AP-42, Section 13.2.4	3.73E-05 lb/ton[a]	43,509 tpy	8.1E-04 tpy
	Front end loader movement - chute to coal pile	AP-42, Section 13.2.2	0.29 lb/VMT[c]	366 VMT	5.4E-02 tpy
	Front end loader movement - coal pile to South grizzly	AP-42, Section 13.2.2	0.29 lb/VMT[c]	346 VMT	5.1E-02 tpy
	Front end loader movement - coal pile to North grizzly	AP-42, Section 13.2.2	0.29 lb/VMT[c]	28 VMT	4.1E-03 tpy
	Stockpile wind erosion	AP-42, Section 13.2.5	0.00 g/m^2-yr[d]	3,370 m^2	0.00 tpy
	Front end loader drop into grizzly	AP-42, Section 13.2.4	3.73E-05 lb/ton[a]	25,151 tpy	4.68E-04 tpy
52	Coal Storage Pile			**Total $PM_{2.5}$ Emissions**	**0.11 tpy**

Notes:

[a]Coal transfer emission factor from AP-42, Section 13.2.4 based on empirical equation $E = k \times 0.0032 \times (U/5)^{1.3}/(M/2)^{1.4}$ lb/ton transferred where:

k	0.053	for $PM_{2.5}$	
U = mean wind speed	4.0	miles/hr	Average value from September 2017 to October 2018 per NOAA NCDC.
M = coal moisture content	4.8	percent	

[b]Average Annual stockpile throughput based on 2016 and 2017 records:

Coal moved to coal pile	43,509	tpy
Coal moved from coal pile	25,151	tpy

[c]Front end loader movement emission factor from AP-42, Section 13.2.2, Empirical Equation 1a, $E = k \times (s/12)^a \times (W/3)^b$ lb/VMT where:

k	0.15	for $PM_{2.5}$
s = surface material silt content (haul road)	8.4	%
W = mean vehicle weight	27	percent, from AP-42, Table 13.2.2-1
Size of load bucket	5	tons, estimate
Density of coal	50	lb/ft^3
Coal moved per trip	3.375	tons (Density of coal x 27 ft3/yd3 x bucket size / 2000 lb/ton)
a (empirical constant)	0.9	from AP-42, Table 13.2.2-2 for $PM_{2.5}$
b (empirical constant)	0.45	from AP-42, Table 13.2.2-2
Approximate distance from coal chute to coal pile (round trip)	150	feet
Approximate distance from coal pile to South grizzly (round trip)	250	feet
Approximate distance from coal pile to North grizzly (round trip)	1,000	feet
Percent of annual coal transferred to South grizzly	98	percent, primary coal handling system
Percent of annual coal transferred to North grizzly	2	percent, North handling system is emergency backup to South handling system
VMT = vehicles miles traveled per year		VMT = annual stockpile throughput/coal moved per trip x distanced traveled per round trip in feet / 5280 ft/mi

[d]From AP-42, Section 13.2.5, Industrial Wind Erosion

Coal Pile at FWA CHPP (*source: Ft WW Coal Pile 2018 Volume Summary, October 2, 2018, 3-TIER Alaska LLC.*)

Average Height =	40	ft	
Width at Base =	205	ft	The minimum width (south face) of the coal pile is used as a conservative approach
Height-to-Base Ratio =	0.195		< 0.2. FWA CHPP coal pile can therefore be considered a large relatively flat pile with little penetration into the surface wind layer and a single friction velocity (using Equation (1)) can be used to for the entire surface of the coal pile. Friction velocity is a measure of wind shear stress on the erodible surface.
Surface Area of Active (north) Face =	3,370	m^2	Calculated from survey using Computer Aided Design (CAD) software in 2012. Height and width of the pile were comparable in 2018 and 2012.

AP-42 Section 13.2.5, Equation (2)

Emission factor for wind-generated particulate emissions from mixtures of erodible and nonerodible surface material subject to disturbance, EF

$$EF\ (g/m^2\text{-}yr) = k \sum_{i=1}^{N} P_i$$

where k = particle size multiplier (0.075 for particle size < 2.5 microns, per table on page 13.2.5-3)
N = number of disturbances per year
P_i = erosion potential corresponding to the fastest mile of wind for the ith period between disturbances, g/m^2

AP-42 Section 13.2.5, Equation (3)

Erosion potential function for a dry exposed surface, P

$$P = 58\ (u^* - u_t^*)^2 + 25\ (u^* - u_t^*)$$
$$P = 0 \text{ for } u^* \leq u_t^*$$

where u^* = friction velocity (m/s)
u_t = threshold friction velocity (m/s)

AP-42 Section 13.2.5, Equation (1)

Friction velocity, u^*

$$u^* = 0.4 \times u(z) / \ln(z/z_o) \qquad \text{when } z > z_o$$

where u^* = friction velocity (cm/s)
u(z) = wind speed at height z above test surface (cm/s)
z = height above test surface (cm)
z_o = roughness height, cm

Data:

u(z)		Use maximum wind gust speed recorded at Fairbanks International Airport for each of the previous 12 months (see table below)
z	10	meters
N	204	disturbances/year for active face, as determined from 2017 records
	17	average disturbances/month

				Uncrusted coal pile[2] (Table 13.2.5-2)				Scraper tracks on coal pile (Table 13.2.5-2)						
Month-Year	Maximum Wind Speed (u(10))[1]		Wind Direction	Roughness Height (z_o)	Threshold Friction Velocity (u_t)	Calculated Friction Velocity (u*)	Erosion potential function, P	Roughness Height (z_o)	Threshold Friction Velocity (u_t)	Calculated Friction Velocity (u*)	Erosion potential function, P	P x N	k	Emission Factor, EF
	mph	m/s	deg	cm	m/s	m/s		cm	m/s	m/s				g/m^2-yr
Oct-17	17	7.6	060	0.3	1.12	0.37	0	0.06	0.62	0.31	0	0		
Nov-17	20	8.9	270	0.3	1.12	0.44	0	0.06	0.62	0.37	0	0		
Dec-17	15	6.7	070	0.3	1.12	0.33	0	0.06	0.62	0.28	0	0		
Jan-18	17	7.6	200	0.3	1.12	0.37	0	0.06	0.62	0.31	0	0		
Feb-18	29	13.0	270	0.3	1.12	0.64	0	0.06	0.62	0.53	0	0		
Mar-18	25	11.2	270	0.3	1.12	0.55	0	0.06	0.62	0.46	0	0		
Apr-18	26	11.6	040	0.3	1.12	0.57	0	0.06	0.62	0.48	0	0		
May-18	25	11.2	300	0.3	1.12	0.55	0	0.06	0.62	0.46	0	0		
Jun-18	25	11.2	090	0.3	1.12	0.55	0	0.06	0.62	0.46	0	0		
Jul-18	22	9.8	300	0.3	1.12	0.48	0	0.06	0.62	0.40	0	0		
Aug-18	26	11.6	250	0.3	1.12	0.57	0	0.06	0.62	0.48	0	0		
Sep-18	22	9.8	260	0.3	1.12	0.48	0	0.06	0.62	0.40	0	0		
Annual Total							0				0.00	0.00	0.075	**0.00**

[1] Maximum wind speed data is from NOAA NCDC. Tower height of 10 meters confirmed by Fairbanks Weather Forecast Office, National Weather Service on 27-March-2013

[2] The erosion potential factor for the uncrusted coal pile is zero for all months. Therefore, wind erosion of the uncrusted coal pile is not a significant source of PM emissions

Table D-3.9. Estimated Actual Emissions Calculations - Volatile Organic Compounds (VOC) Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Emission Unit ID	Emission Unit Name	Fuel Type	Factor Reference	VOC Emission Factor	Emission Unit Rating/Capacity	Estimated Actual Operation	Estimated Actual VOC Emissions
Significant Emission Units							
1	Coal-Fired Boiler 3	Coal	AP-42, Table 1.1-19	0.05 lb/ton	230 MMBtu/hr	37,872 tpy	0.9 tpy
2	Coal-Fired Boiler 4	Coal	AP-42, Table 1.1-19	0.05 lb/ton	230 MMBtu/hr	40,648 tpy	1.0 tpy
3	Coal-Fired Boiler 5	Coal	AP-42, Table 1.1-19	0.05 lb/ton	230 MMBtu/hr	38,262 tpy	1.0 tpy
4	Coal-Fired Boiler 6	Coal	AP-42, Table 1.1-19	0.05 lb/ton	230 MMBtu/hr	38,842 tpy	1.0 tpy
5	Coal-Fired Boiler 7	Coal	AP-42, Table 1.1-19	0.05 lb/ton	230 MMBtu/hr	47,507 tpy	1.2 tpy
6	Coal-Fired Boiler 8	Coal	AP-42, Table 1.1-19	0.05 lb/ton	230 MMBtu/hr	26,567 tpy	0.7 tpy
7a	South Coal Handling Dust Collector (DC-01)	N/A	N/A	N/A	13,150 acfm	1,501 hr/yr	0 tpy
7b	South Underbunker Dust Collector (DC-02)	N/A	N/A	N/A	884 acfm	100 hr/yr	0 tpy
7c	North Coal Handling Dust Collector (NDC-1)	N/A	N/A	N/A	9,250 acfm	31 hr/yr	0 tpy
8	Backup Generator Engine	Distillate	Vendor	0.11 g/hp-hr	2,937 hp	21 hr/yr	7.4E-03 tpy
9	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	353 hp	9 hr/yr	3.8E-03 tpy
14	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	320 hp	12 hr/yr	4.7E-03 tpy
22	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	35 hp	0 hr/yr	0 tpy
23	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	155 hp	9 hr/yr	1.8E-03 tpy
29a	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	74 hp	17 hr/yr	1.6E-03 tpy
30a	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	91 hp	26 hr/yr	3.0E-03 tpy
31a	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	74 hp	30 hr/yr	2.8E-03 tpy
32a	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	91 hp	8 hr/yr	8.7E-04 tpy
33a	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	75 hp	11 hr/yr	1.0E-03 tpy
34	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	220 hp	5 hr/yr	1.5E-03 tpy
35	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	85 hp	6 hr/yr	6.8E-04 tpy
36	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	220 hp	19 hr/yr	5.2E-03 tpy
37	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	75 hp	10 hr/yr	9.8E-04 tpy
51a	Fly Ash Dust Collector (DC-1)	N/A	N/A	N/A	3,620 acfm	4,380 hr/yr	0 tpy
51b	Bottom Ash Dust Collector (DC-2)	N/A	N/A	N/A	3,620 acfm	4,380 hr/yr	0 tpy
52	Coal Storage Pile	N/A	N/A	N/A	N/A	68,660 tpy	0 tpy
Significant Emission Units Estimated Actual Emissions - VOC							**5.8 tpy**
Insignificant Emission Units							
N/A	Fly and Bottom Ash Bin Vent Filter	N/A	N/A	N/A	1,460 acfm	4,380 hr/yr	0 tpy
N/A	Ash Loadout to Truck	N/A	N/A	N/A	N/A	16,079 tpy	0 tpy
N/A	Aboveground Storage Tanks	Diesel	N/A	N/A[1]	N/A	N/A	0 tpy
N/A	Underground Storage Tanks	Diesel	N/A	N/A[1]	N/A	N/A	0 tpy
Insignificant Emission Units Estimated Actual Emissions - VOC							**0 tpy**
Total Estimated Actual Emissions - VOC							**5.8 tpy**

[1] VOC emissions from storage tanks are negligible since the tanks are small, store only diesel, and have a low tank turnover rate.

Conversion factors:

Weight	2,000 lb/ton
Weight	453.6 grams per pound

Table D-3.10. Estimated Actual Emissions Calculations - Sulfur Dioxide (SO_2) Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Emission Unit ID	Emission Unit Name	Fuel Type	Fuel Sulfur Content	Factor Reference	SO_2 Emission Factor	Emission Unit Rating/Capacity	Estimated Actual Operation	Estimated Actual SO_2 Emissions
Significant Emission Units								
1	Coal-Fired Boiler 3	Coal	0.11 wt. pct.[a]	AP-42 Table 1.1-3	3.8500 lb/ton-coal	230 MMBtu/hr	37,872 tpy	73 tpy
2	Coal-Fired Boiler 4	Coal	0.11 wt. pct.[a]	AP-42 Table 1.1-3	3.85 lb/ton-coal	230 MMBtu/hr	40,648 tpy	78 tpy
3	Coal-Fired Boiler 5	Coal	0.11 wt. pct.[a]	AP-42 Table 1.1-3	3.85 lb/ton-coal	230 MMBtu/hr	38,262 tpy	74 tpy
4	Coal-Fired Boiler 6	Coal	0.11 wt. pct.[a]	AP-42 Table 1.1-3	3.85 lb/ton-coal	230 MMBtu/hr	38,842 tpy	75 tpy
5	Coal-Fired Boiler 7	Coal	0.11 wt. pct.[a]	AP-42 Table 1.1-3	3.85 lb/ton-coal	230 MMBtu/hr	47,507 tpy	91 tpy
6	Coal-Fired Boiler 8	Coal	0.11 wt. pct.[a]	AP-42 Table 1.1-3	3.85 lb/ton-coal	230 MMBtu/hr	26,567 tpy	51 tpy
7a	South Coal Handling Dust Collector (DC-01)	N/A	N/A	N/A	N/A	13,150 acfm	1,501 hr/yr	0 tpy
7b	South Underbunker Dust Collector (DC-02)	N/A	N/A	N/A	N/A	884 acfm	100 hr/yr	0 tpy
7c	North Coal Handling Dust Collector (NDC-1)	N/A	N/A	N/A	N/A	9,250 acfm	31 hr/yr	0 tpy
8	Backup Generator Engine	Distillate	0.0015 wt. pct.[b]	Mass balance	0.2115 lb/1000 gal	2,937 hp	21 hr/yr	3.3E-04 tpy
9	Emergency Generator Engine	Distillate	0.0015 wt. pct.[b]	Mass balance	0.2 lb/1000 gal	353 hp	9 hr/yr	1.6E-05 tpy
14	Emergency Generator Engine	Distillate	0.0015 wt. pct.[b]	Mass balance	0.2 lb/1000 gal	320 hp	12 hr/yr	2.0E-05 tpy
22	Emergency Generator Engine	Distillate	0.0015 wt. pct.[b]	Mass balance	0.2 lb/1000 gal	35 hp	0 hr/yr	0 tpy
23	Emergency Generator Engine	Distillate	0.0015 wt. pct.[b]	Mass balance	0.2 lb/1000 gal	155 hp	9 hr/yr	7.6E-06 tpy
29a	Emergency Generator Engine	Distillate	0.0015 wt. pct.[b]	Mass balance	0.2 lb/1000 gal	74 hp	17 hr/yr	6.9E-06 tpy
30a	Emergency Generator Engine	Distillate	0.0015 wt. pct.[b]	Mass balance	0.2 lb/1000 gal	91 hp	26 hr/yr	1.4E-05 tpy
31a	Emergency Generator Engine	Distillate	0.0015 wt. pct.[b]	Mass balance	0.2 lb/1000 gal	74 hp	30 hr/yr	1.2E-05 tpy
32a	Emergency Generator Engine	Distillate	0.0015 wt. pct.[b]	Mass balance	0.2 lb/1000 gal	91 hp	8 hr/yr	4.0E-06 tpy
33a	Emergency Generator Engine	Distillate	0.0015 wt. pct.[b]	Mass balance	0.2 lb/1000 gal	75 hp	11 hr/yr	5.2E-06 tpy
34	Emergency Pump Engine	Distillate	0.0015 wt. pct.[b]	Mass balance	0.2 lb/1000 gal	220 hp	5 hr/yr	6.4E-06 tpy
35	Emergency Pump Engine	Distillate	0.0015 wt. pct.[b]	Mass balance	0.2 lb/1000 gal	85 hp	6 hr/yr	2.9E-06 tpy
36	Emergency Pump Engine	Distillate	0.0015 wt. pct.[b]	Mass balance	0.2 lb/1000 gal	220 hp	19 hr/yr	2.2E-05 tpy
37	Emergency Generator Engine	Distillate	0.0015 wt. pct.[b]	Mass balance	0.2 lb/1000 gal	75 hp	10 hr/yr	4.8E-06 tpy
51a	Fly Ash Dust Collector (DC-1)	N/A	N/A	N/A	N/A	3,620 acfm	4,380 hr/yr	0 tpy
51b	Bottom Ash Dust Collector (DC-2)	N/A	N/A	N/A	N/A	3,620 acfm	4,380 hr/yr	0 tpy
52	Coal Storage Pile	N/A	N/A	N/A	N/A	N/A	68,660 tpy	0 tpy
							Significant Emission Units Estimated Actual Emissions - SO_2	**442.2 tpy**
Insignificant Emission Units								
N/A	Fly and Bottom Ash Bin Vent Filter	N/A	N/A	N/A	N/A	1,460 acfm	4,380 hr/yr	0 tpy
N/A	Ash Loadout to Truck	N/A	N/A	N/A	N/A	N/A	16,079 tpy	0 tpy
N/A	Aboveground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	N/A	0 tpy
N/A	Underground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	N/A	0 tpy
							Insignificant Emission Units Estimated Actual Emissions - SO_2	**0 tpy**
							Total Estimated Actual Emissions - SO_2	**442.2 tpy**

Notes:

[a] Weighted average sulfur content of sub-bituminous coal from rail car summaries for 2017.

[b] In 2010 Doyon Utilities, LLC switched to fuel that meets the requirements of 40 CFR 80.510(b) for all diesel-fired engines.

Conversion factors:

Diesel Heating Value	137,000	Btu/gal	*From AP 42, Appendix A, Page A-5*
Density of Diesel	7.05	lb/gal	*From AP 42, Appendix A, Page A-7, density for Distillate Oil*
EU IDs 30a and 32a Fuel Consumption Rate	5.0	gal/hr	*From vendor information.*
EU IDs 33a and 37 Fuel Consumption Rate	4.4	gal/hr	*From vendor information.*
Engine Heat Rate	7,000	Btu/hp-hr	*Average brake-specific fuel consumption (BSFC) from AP 42, Table 3.3-1, footnote a*
Weight	2,000	lb/ton	

Table D-3.11. Summary of Estimated Actual Hazardous Air Pollutants (HAP) Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Hazardous Air Pollutant	HAP Emissions by Emission Unit Category (tons per year)[a,c]					Total HAP Emissions
	Coal-Fired Boilers	Diesel Engines <600 hp	Diesel Engines >600 hp	Coal Preparation and Ash Handling[b]	Insignificant Units[b]	
Acetaldehyde	6.55E-02	5.96E-05	5.35E-06	----	----	6.55E-02
Acetophenone	1.72E-03	----	----	----	----	1.72E-03
Acrolein	3.33E-02	7.19E-06	1.67E-06	----	----	3.33E-02
Benzene	1.49E-01	7.25E-05	1.65E-04	----	----	1.50E-01
Benzyl chloride	8.04E-02	----	----	----	----	8.04E-02
Biphenyl	1.95E-04	----	----	----	----	1.95E-04
Bis(2-ethylhexyl)phthalate (DEHP)	8.38E-03	----	----	----	----	8.38E-03
Bromoform	4.48E-03	----	----	----	----	4.48E-03
1,3 Butadiene	----	3.04E-06	----	----	----	3.04E-06
Carbon disulfide	1.49E-02	----	----	----	----	1.49E-02
2-Chloroacetophenone	8.04E-04	----	----	----	----	8.04E-04
Chlorobenzene	2.53E-03	----	----	----	----	2.53E-03
Chloroform	6.78E-03	----	----	----	----	6.78E-03
Cumene	6.09E-04	----	----	----	----	6.09E-04
Dibenzofurans	1.25E-07	----	----	----	----	1.25E-07
Dimethyl sulfate	5.51E-03	----	----	----	----	5.51E-03
2,4-Dinitrotoluene	3.22E-05	----	----	----	----	3.22E-05
Ethyl benzene	1.08E-02	----	----	----	----	1.08E-02
Ethyl chloride (Chloroethane)	4.82E-03	----	----	----	----	4.82E-03
Ethylene dibromide (Dibromoethane)	1.38E-04	----	----	----	----	1.38E-04
Ethylene dichloride (1,2-Dichloroethane)	4.59E-03	----	----	----	----	4.59E-03
Formaldehyde	2.76E-02	9.17E-05	1.67E-05	----	----	2.77E-02
Hexane	7.69E-03	----	----	----	----	7.69E-03
Hydrochloric acid	1.58E+00	----	----	----	----	1.58E+00
Hydrogen fluoride (Hydrofluoric acid)	1.72E+01	----	----	----	----	1.72E+01
Isophorone	6.66E-02	----	----	----	----	6.66E-02
Methyl bromide (Bromomethane)	1.84E-02	----	----	----	----	1.84E-02
Methyl chloride (chloromethane)	6.09E-02	----	----	----	----	6.09E-02
Methyl hydrazine	1.95E-02	----	----	----	----	1.95E-02
Methyl methacrylate	2.30E-03	----	----	----	----	2.30E-03
Methyl tert butyl ether	4.02E-03	----	----	----	----	4.02E-03
Methylene chloride (Dichloromethane)	3.33E-02	----	----	----	----	3.33E-02
Phenol	1.84E-03	----	----	----	----	1.84E-03
Polycyclic Organic Matter (POM)	2.19E-03	2.61E-05	4.49E-05	----	----	2.26E-03
Propionaldehyde	4.36E-02	----	----	----	----	4.36E-02
Styrene	2.87E-03	----	----	----	----	2.87E-03
Chlorinated dibenzo-p-dioxins (Total)	1.61E-09	----	----	----	----	1.61E-09
Tetrachloroethylene (Perchloroethylene)	4.94E-03	----	----	----	----	4.94E-03
Toluene	2.76E-02	3.18E-05	5.96E-05	----	----	2.77E-02
1,1,2-Trichloroethane	2.30E-03	----	----	----	----	2.30E-03
Vinyl acetate	8.73E-04	----	----	----	----	8.73E-04
Xylenes (isomers and mixture)	4.25E-03	2.21E-05	4.10E-05	----	----	4.31E-03
Antimony Compounds	2.07E-03	----	----	----	----	2.07E-03
Arsenic Compounds (inorganic including arsine)	4.71E-02	----	----	----	----	4.71E-02
Beryllium Compounds	2.41E-03	----	----	----	----	2.41E-03
Cadmium Compounds	5.86E-03	----	----	----	----	5.86E-03
Chromium Compounds	3.89E-02	----	----	----	----	3.89E-02
Cobalt Compounds	1.15E-02	----	----	----	----	1.15E-02
Cyanide Compounds	2.87E-01	----	----	----	----	2.87E-01
Lead Compounds	4.82E-02	----	----	----	----	4.82E-02
Magnesium Compounds	1.26E+00	----	----	----	----	1.26E+00
Manganese Compounds	5.63E-02	----	----	----	----	5.63E-02
Mercury Compounds	1.58E-03	----	----	----	----	1.58E-03
Nickel Compounds	3.22E-02	----	----	----	----	3.22E-02
Selenium Compounds	1.49E-01	----	----	----	----	1.49E-01
Total HAPs - Maximum Individual HAP	**17.2**	**9.2E-05**	**1.6E-04**	**0.0**	**0.0**	**17.2**
Total HAPs - Unit Category/Source	**21.5**	**3.1E-04**	**3.3E-04**	**0.0**	**0.0**	**21.5**

Notes:

[a] See individual emissions unit category emissions calculations for details on methodology and assumptions.

[b] Emission units in the coal preparation and handling, ash handling and coal storage pile systems do not have HAP emissions

[c] HAP emissions from the fuel storage tanks are negligible.

Table D-3.12. Estimated Actual HAP Emissions - Coal-Fired Boilers
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

		Actual Fuel Input:	229,697 Tons of Coal/yr
		Source Category Emission Calculations	
CAS No.	Chemical Name	Emission Factor [1]	Estimated Emissions
79005	1,1,2-Trichloroethane	2.00E-05 lb/ton	2.30E-03 tpy
1746016	2,3,7,8-Tetrachlorodibenzo-p-dioxin	1.40E-11 lb/ton	1.61E-09 tpy
121142	2,4-Dinitrotoluene	2.80E-07 lb/ton	3.22E-05 tpy
532274	2-Chloroacetophenone	7.00E-06 lb/ton	8.04E-04 tpy
75-07-0	Acetaldehyde	5.70E-04 lb/ton	6.55E-02 tpy
98862	Acetophenone	1.50E-05 lb/ton	1.72E-03 tpy
107-02-8	Acrolein	2.90E-04 lb/ton	3.33E-02 tpy
N/A	Antimony Compounds	1.80E-05 lb/ton	2.07E-03 tpy
N/A	Arsenic Compounds	4.10E-04 lb/ton	4.71E-02 tpy
71-43-2	Benzene	1.30E-03 lb/ton	1.49E-01 tpy
100447	Benzyl chloride	7.00E-04 lb/ton	8.04E-02 tpy
N/A	Beryllium Compounds	2.10E-05 lb/ton	2.41E-03 tpy
92524	Biphenyl	1.70E-06 lb/ton	1.95E-04 tpy
117817	Bis(2-ethylhexyl)phthalate (DEHP)	7.30E-05 lb/ton	8.38E-03 tpy
75252	Bromoform	3.90E-05 lb/ton	4.48E-03 tpy
N/A	Cadmium Compounds	5.10E-05 lb/ton	5.86E-03 tpy
75150	Carbon disulfide	1.30E-04 lb/ton	1.49E-02 tpy
108907	Chlorobenzene	2.20E-05 lb/ton	2.53E-03 tpy
67663	Chloroform	5.90E-05 lb/ton	6.78E-03 tpy
N/A	Chromium Compounds	3.39E-04 lb/ton	3.89E-02 tpy
N/A	Cobalt Compounds	1.00E-04 lb/ton	1.15E-02 tpy
98828	Cumene	5.30E-06 lb/ton	6.09E-04 tpy
N/A	Cyanide Compounds	2.50E-03 lb/ton	2.87E-01 tpy
132649	Dibenzofurans	1.09E-09 lb/ton	1.25E-07 tpy
77781	Dimethyl sulfate	4.80E-05 lb/ton	5.51E-03 tpy
100-41-4	Ethyl benzene	9.40E-05 lb/ton	1.08E-02 tpy
75003	Ethyl chloride (Chloroethane)	4.20E-05 lb/ton	4.82E-03 tpy
1006934	Ethylene dibromide (Dibromoethane)	1.20E-06 lb/ton	1.38E-04 tpy
107062	Ethylene dichloride (1,2-Dichloroethane)	4.00E-05 lb/ton	4.59E-03 tpy
50-00-0	Formaldehyde	2.40E-04 lb/ton	2.76E-02 tpy
110543	Hexane	6.70E-05 lb/ton	7.69E-03 tpy
7647010	Hydrochloric acid[2]	1.38E-02 lb/ton	1.58 tpy
7664393	Hydrogen fluoride (Hydrofluoric acid)	0.15 lb/ton	17.23 tpy
78591	Isophorone	5.80E-04 lb/ton	6.66E-02 tpy
N/A	Lead Compounds	4.20E-04 lb/ton	4.82E-02 tpy
N/A	Magnesium Compounds	1.10E-02 lb/ton	1.26 tpy
N/A	Manganese Compounds	4.90E-04 lb/ton	5.63E-02 tpy
N/A	Mercury Compounds[3]	1.38E-05 lb/ton	1.58E-03 tpy
74839	Methyl bromide(Bromomethane)	1.60E-04 lb/ton	1.84E-02 tpy
60344	Methyl hydrazine	1.70E-04 lb/ton	1.95E-02 tpy
80626	Methyl methacrylate	2.00E-05 lb/ton	2.30E-03 tpy
1634044	Methyl tert butyl ether	3.50E-05 lb/ton	4.02E-03 tpy
74873	Methylchloride (chloromethane)	5.30E-04 lb/ton	6.09E-02 tpy
75092	Methylene chloride (Dichloromethane)	2.90E-04 lb/ton	3.33E-02 tpy
N/A	Nickel Compounds	2.80E-04 lb/ton	3.22E-02 tpy
108952	Phenol	1.60E-05 lb/ton	1.84E-03 tpy
N/A	Polycylic Organic Matter	1.91E-05 lb/ton	2.19E-03 tpy
123386	Propionaldehyde	3.80E-04 lb/ton	4.36E-02 tpy
N/A	Selenium Compounds	1.30E-03 lb/ton	1.49E-01 tpy
100425	Styrene	2.50E-05 lb/ton	2.87E-03 tpy
127184	Tetrachloroethylene (Perchloroethylene)	4.30E-05 lb/ton	4.94E-03 tpy
108-88-3	Toluene	2.40E-04 lb/ton	2.76E-02 tpy
108054	Vinyl acetate	7.60E-06 lb/ton	8.73E-04 tpy
1330-20-7	Xylenes (isomers and mixture)	3.70E-05 lb/ton	4.25E-03 tpy
		Total HAP Emissions	**21.48 tpy**

Notes:
[1] Reference: AP-42, Tables 1.1-12, 1.1-13, 1.1-14, 1.1-18
[2] Maximum 1-hour emission rate measured during April 2017 source test (0.00091 lb/MMBtu, Run 1, EU 4).
[3] Maximum 1-hour emission rate measured during April 2017 source test (9.12E-07 lb/MMBtu, Run 1, EU 4).

Conversion Factors:

Coal Heating Value 15.1 MMBtu/ton *From http://www.usibelli.com/coal/data-sheet*

Table D-3.13. Estimated Actual HAP Emissions - Diesel-Fired Engines Greater Than 600 Horsepower
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

CAS No.	Chemical Name	HAP Emission Calculations	
		Emission Factor[a]	All Emission Units > 600 hp
75-07-0	Acetaldehyde	2.52E-05 lb/MMBtu	5.35E-06 tpy
107-02-8	Acrolein	7.88E-06 lb/MMBtu	1.67E-06 tpy
71-43-2	Benzene	7.76E-04 lb/MMBtu	1.65E-04 tpy
50-00-0	Formaldehyde	7.89E-05 lb/MMBtu	1.67E-05 tpy
108-88-3	Toluene	2.81E-04 lb/MMBtu	5.96E-05 tpy
1330-20-7	Xylenes (isomers and mixture)	1.93E-04 lb/MMBtu	4.10E-05 tpy
N/A	Polycylic Organic Matter (PAH)	2.12E-04 lb/MMBtu	4.49E-05 tpy
		TOTAL	**3.34E-04 tpy**

Notes:

[a] Reference: AP-42, Tables 3.3-3 and 3.4-4.

Conversion Factors:

Engine Heat Rate	7,000	Btu/hp-hr	*Average brake-specific fuel consumption (BSFC) from AP 42, Table 3.3-1, footnote a*
Weight	2,000	lb/ton	

Calculations:

Actual Heat Input (MMBtu/yr) = Engine Rating (hp) x Engine Heat Rate (Btu/hp-hr) x Actual Annual Operation (hr/yr) / 1E6 (Btu/MMBtu)

Diesel-Fired Engines Greater Than 600 Horsepower:			
Emission Unit	Engine Rating (hp)	Actual Annual Operation (hr/yr)	Actual Heat Input (MMBtu/yr)
8	2,937	20.7	425
TOTAL Heat Input (MMBtu/yr)			**425**

Table D-3.14. Estimated Actual HAP Emissions - Diesel-Fired Engines Less Than 600 Horsepower
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

CAS No.	Chemical Name	HAP Emission Calculations	
		Emission Factor [a]	All Emission Units < 600 hp
75-07-0	Acetaldehyde	7.67E-04 lb/MMBtu	5.96E-05 tpy
107-02-8	Acrolein	9.25E-05 lb/MMBtu	7.19E-06 tpy
71-43-2	Benzene	9.33E-04 lb/MMBtu	7.25E-05 tpy
106-99-0	1,3-Butadiene	3.91E-05 lb/MMBtu	3.04E-06 tpy
50-00-0	Formaldehyde	1.18E-03 lb/MMBtu	9.17E-05 tpy
108-88-3	Toluene	4.09E-04 lb/MMBtu	3.18E-05 tpy
1330-20-7	Xylenes (isomers and mixture)	2.85E-04 lb/MMBtu	2.21E-05 tpy
N/A	Polycylic Organic Matter	3.36E-04 lb/MMBtu	2.61E-05 tpy
		TOTAL	**3.14E-04 tpy**

Diesel-Fired Engines Less Than 600 Horsepower:			
Emission Unit	Engine Rating (hp)	Actual Annual Operation (hr/yr)	Actual Heat Input (MMBtu/yr)
9	353	8.6	21
14	320	11.8	26
22	35	0.0	0
23	155	9.1	10
29a	74	17.2	9
30a	91	26	17
31a	74	29.9	15
32a	91	8	5
33a	75	11.1	6
34	220	5.4	8
35	85	6.4	4
36	220	18.7	29
37	75	10.4	5
		TOTAL Heat Input (MMBtu/yr)	**155**

Notes:
[a] Reference: AP-42, Table 3.3-2.

Conversion Factors:

Engine Heat Rate	7,000	Btu/hp-hr
Weight	2,000	lb/ton

Calculations:

Actual Heat Input (MMBtu/yr) = Engine Rating (hp) x Engine Heat Rate (Btu/hp-hr) x Actual Annual Operation (hr/yr) / 1E6 (Btu/MMBtu)

Table D-3.15. Summary of Estimated Actual Greenhouse Gas (GHG) Emissions [a]
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

GHG Pollutant	GHG Emissions (tons per year) [b]			
	Significant Emission Units	Insignificant Emission Units	Global Warming Potential	Total
Carbon Dioxide	372,042	0	1	**372,042**
Methane	42.1	0	25	**1,053**
Nitrous Oxide	6.1	0	298	**1,825**
Hydrofluorocarbons	0	0	Multiple	**0**
Perfluorocarbons	0	0	Multiple	**0**
Sulfur hexafluoride	0	0	22,800	**0**
			Total - GHG (CO_2e) [c]	**374,921**

Notes:

[a] GHG are the aggregate group of six greenhouse gases defined under 40 CFR 52.21(b)(49)(i) and 40 CFR 71.2.

[b] See individual emissions unit category emissions calculations for details on methodology and assumptions.

[c] GHG (CO_2e) emissions = CO_2 emissions + (25 * CH_4 emissions) + (298 * N_2O emissions).

Table D-3.16. Estimated Actual Greenhouse Gases (GHG) Calculations - Carbon Dioxide (CO_2) Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Emission Unit ID	Emission Unit Name	Fuel Type	Factor Reference	CO_2 Emission Factor	Emission Unit Rating/Capacity	Estimated Actual Operation	Estimated Actual Heat Input	Estimated Actual CO_2 Emissions
Significant Emission Units								
1	Coal-Fired Boiler 3	Coal	40 CFR 98 Table C-1	97.17 kg/MMBtu	230 MMBtu/hr	37,872 tpy	572,622 MMBtu/yr	61,333 tpy
2	Coal-Fired Boiler 4	Coal	40 CFR 98 Table C-1	97.17 kg/MMBtu	230 MMBtu/hr	40,648 tpy	614,604 MMBtu/yr	65,830 tpy
3	Coal-Fired Boiler 5	Coal	40 CFR 98 Table C-1	97.17 kg/MMBtu	230 MMBtu/hr	38,262 tpy	578,524 MMBtu/yr	61,966 tpy
4	Coal-Fired Boiler 6	Coal	40 CFR 98 Table C-1	97.17 kg/MMBtu	230 MMBtu/hr	38,842 tpy	587,290 MMBtu/yr	62,904 tpy
5	Coal-Fired Boiler 7	Coal	40 CFR 98 Table C-1	97.17 kg/MMBtu	230 MMBtu/hr	47,507 tpy	718,301 MMBtu/yr	76,937 tpy
6	Coal-Fired Boiler 8	Coal	40 CFR 98 Table C-1	97.17 kg/MMBtu	230 MMBtu/hr	26,567 tpy	401,685 MMBtu/yr	43,024 tpy
7a	South Coal Handling Dust Collector (DC-01)	N/A	N/A	N/A	13,150 acfm	1,501 hr/yr	N/A	0 tpy
7b	South Underbunker Dust Collector (DC-02)	N/A	N/A	N/A	884 acfm	100 hr/yr	N/A	0 tpy
7c	North Coal Handling Dust Collector (NDC-1)	N/A	N/A	N/A	9,250 acfm	31 hr/yr	N/A	0 tpy
8	Backup Generator Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	2,937 hp	21 hr/yr	425 MMBtu/yr	34.6 tpy
9	Emergency Generator Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	353 hp	9 hr/yr	21 MMBtu/yr	1.7 tpy
14	Emergency Generator Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	320 hp	12 hr/yr	26 MMBtu/yr	2.1 tpy
22	Emergency Generator Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	35 hp	0 hr/yr	0 MMBtu/yr	0.0 tpy
23	Emergency Generator Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	155 hp	9 hr/yr	10 MMBtu/yr	0.8 tpy
29a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	74 hp	17 hr/yr	9 MMBtu/yr	0.7 tpy
30a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	91 hp	26 hr/yr	17 MMBtu/yr	1.4 tpy
31a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	74 hp	30 hr/yr	15 MMBtu/yr	1.3 tpy
32a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	91 hp	8 hr/yr	5 MMBtu/yr	0.4 tpy
33a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	75 hp	11 hr/yr	6 MMBtu/yr	0.5 tpy
34	Emergency Pump Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	220 hp	5 hr/yr	8 MMBtu/yr	0.7 tpy
35	Emergency Pump Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	85 hp	6 hr/yr	4 MMBtu/yr	0.3 tpy
36	Emergency Pump Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	220 hp	19 hr/yr	29 MMBtu/yr	2.3 tpy
37	Emergency Generator Engine	Distillate	40 CFR 98 Table C-1	73.96 kg/MMBtu	75 hp	10 hr/yr	5 MMBtu/yr	0.4 tpy
51a	Fly Ash Dust Collector (DC-1)	N/A	N/A	N/A	3,620 acfm	4,380 hr/yr	N/A	0 tpy
51b	Bottom Ash Dust Collector (DC-2)	N/A	N/A	N/A	3,620 acfm	4,380 hr/yr	N/A	0 tpy
52	Coal Storage Pile	N/A	N/A	N/A	N/A	68,660 tpy	N/A	0 tpy
							Significant Emission Units Estimated Actual Emissions - CO_2	**372,042 tpy**
Insignificant Emission Units								
N/A	Fly and Bottom Ash Bin Vent Filter	N/A	N/A	N/A	1,460 acfm	4,380 hr/yr	N/A	0 tpy
N/A	Ash Loadout to Truck	N/A	N/A	N/A	N/A	16,079 tpy	N/A	0 tpy
N/A	Aboveground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	N/A	0 tpy
N/A	Underground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	N/A	0 tpy
							Insignificant Emission Units Estimated Actual Emissions - CO_2	**0 tpy**
							Total Estimated Actual Emissions - CO_2	**372,042 tpy**

Calculations:

Actual heat input, coal (MMBtu/yr) = Actual annual operation (tons/yr) x Coal Heating Value (MMBtu/ton)
Actual heat input, engines (MMBtu/yr) = Engine Rating (hp) x Engine Heat Rate (Btu/hp-hr) x Actual Annual Operation (hr/yr) / 1E6 (Btu/MMBtu)

Conversion factors:

Engine Heat Rate	7,000 Btu/hp-hr	*Average brake-specific fuel consumption (BSFC) from AP 42, Table 3.3-1, footnote a*
Mass:	907.2 kg/ton	
Coal Heating Value	15.1 MMBtu/ton	*From http://www.usibelli.com/coal/data-sheet*

Table D-3.17. Estimated Actual Greenhouse Gases (GHG) Calculations - Methane (CH_4) Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Emission Unit ID	Emission Unit Name	Fuel Type	Factor Reference	CH_4 Emission Factor	Emission Unit Rating/Capacity	Estimated Actual Operation	Estimated Actual Heat Input	Estimated Actual CH_4 Emissions
Significant Emission Units								
1	Coal-Fired Boiler 3	Coal	40 CFR 98 Table C-2	1.1E-02 kg/MMBtu	230 MMBtu/hr	37,872 tpy	572,622 MMBtu/yr	6.9 tpy
2	Coal-Fired Boiler 4	Coal	40 CFR 98 Table C-2	1.1E-02 kg/MMBtu	230 MMBtu/hr	40,648 tpy	614,604 MMBtu/yr	7.5 tpy
3	Coal-Fired Boiler 5	Coal	40 CFR 98 Table C-2	1.1E-02 kg/MMBtu	230 MMBtu/hr	38,262 tpy	578,524 MMBtu/yr	7.0 tpy
4	Coal-Fired Boiler 6	Coal	40 CFR 98 Table C-2	1.1E-02 kg/MMBtu	230 MMBtu/hr	38,842 tpy	587,290 MMBtu/yr	7.1 tpy
5	Coal-Fired Boiler 7	Coal	40 CFR 98 Table C-2	1.1E-02 kg/MMBtu	230 MMBtu/hr	47,507 tpy	718,301 MMBtu/yr	8.7 tpy
6	Coal-Fired Boiler 8	Coal	40 CFR 98 Table C-2	1.1E-02 kg/MMBtu	230 MMBtu/hr	26,567 tpy	401,685 MMBtu/yr	4.9 tpy
7a	South Coal Handling Dust Collector (DC-01)	N/A	N/A	N/A	13,150 acfm	1,501 hr/yr	N/A	0 tpy
7b	South Underbunker Dust Collector (DC-02)	N/A	N/A	N/A	884 acfm	100 hr/yr	N/A	0 tpy
7c	North Coal Handling Dust Collector (NDC-1)	N/A	N/A	N/A	9,250 acfm	31 hr/yr	N/A	0 tpy
8	Backup Generator Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	2,937 hp	21 hr/yr	425 MMBtu/yr	1.4E-03 tpy
9	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	353 hp	9 hr/yr	21 MMBtu/yr	7.0E-05 tpy
14	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	320 hp	12 hr/yr	26 MMBtu/yr	8.7E-05 tpy
22	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	35 hp	0 hr/yr	0 MMBtu/yr	0 tpy
23	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	155 hp	9 hr/yr	10 MMBtu/yr	3.3E-05 tpy
29a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	74 hp	17 hr/yr	9 MMBtu/yr	2.9E-05 tpy
30a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	91 hp	26 hr/yr	17 MMBtu/yr	5.5E-05 tpy
31a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	74 hp	30 hr/yr	15 MMBtu/yr	5.1E-05 tpy
32a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	91 hp	8 hr/yr	5 MMBtu/yr	1.6E-05 tpy
33a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	75 hp	11 hr/yr	6 MMBtu/yr	1.9E-05 tpy
34	Emergency Pump Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	220 hp	5 hr/yr	8 MMBtu/yr	2.8E-05 tpy
35	Emergency Pump Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	85 hp	6 hr/yr	4 MMBtu/yr	1.3E-05 tpy
36	Emergency Pump Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	220 hp	19 hr/yr	29 MMBtu/yr	9.5E-05 tpy
37	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	3.0E-03 kg/MMBtu	75 hp	10 hr/yr	5 MMBtu/yr	1.8E-05 tpy
51a	Fly Ash Dust Collector (DC-1)	N/A	N/A	N/A	3,620 acfm	4,380 hr/yr	N/A	0 tpy
51b	Bottom Ash Dust Collector (DC-2)	N/A	N/A	N/A	3,620 acfm	4,380 hr/yr	N/A	0 tpy
52	Coal Storage Pile	N/A	N/A	N/A	N/A	68,660 tpy	N/A	0 tpy
							Significant Emission Units Estimated Actual Emissions - CH_4	**42.1 tpy**
Insignificant Emission Units								
N/A	Fly and Bottom Ash Bin Vent Filter	N/A	N/A	N/A	1,460 acfm	4,380 hr/yr	N/A	0 tpy
N/A	Ash Loadout to Truck	N/A	N/A	N/A	N/A	16,079 tpy	N/A	0 tpy
N/A	Aboveground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	N/A	0 tpy
N/A	Underground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	N/A	0 tpy
							Insignificant Emission Units Estimated Actual Emissions - CH_4	**0 tpy**
							Total Estimated Actual Emissions - CH_4	**42.1 tpy**

Calculations:

Actual heat input, coal (MMBtu/yr) = Actual annual operation (tons/yr) x Coal Heating Value (MMBtu/ton)
Actual heat input, engines (MMBtu/yr) = Engine Rating (hp) x Engine Heat Rate (Btu/hp-hr) x Actual Annual Operation (hr/yr) / 1E6 (Btu/MMBtu)

Conversion factors:

Engine Heat Rate	7,000 Btu/hp-hr	*Average brake-specific fuel consumption (BSFC) from AP 42, Table 3.3-1, footnote a*
Mass:	907.2 kg/ton	
Coal Heating Value	15.1 MMBtu/ton	*From http://www.usibelli.com/coal/data-sheet*

Table D-3.18. Estimated Actual Greenhouse Gases (GHG) Calculations - Nitrous Oxide (N_2O) Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Emission Unit ID	Emission Unit Name	Fuel Type	Factor Reference	N_2O Emission Factor	Emission Unit Rating/Capacity	Estimated Actual Operation	Estimated Actual Heat Input	Estimated Actual N_2O Emissions
Significant Emission Units								
1	Coal-Fired Boiler 3	Coal	40 CFR 98 Table C-2	1.6E-03 kg/MMBtu	230 MMBtu/hr	37,872 tpy	572,622 MMBtu/yr	1.0 tpy
2	Coal-Fired Boiler 4	Coal	40 CFR 98 Table C-2	1.6E-03 kg/MMBtu	230 MMBtu/hr	40,648 tpy	614,604 MMBtu/yr	1.1 tpy
3	Coal-Fired Boiler 5	Coal	40 CFR 98 Table C-2	1.6E-03 kg/MMBtu	230 MMBtu/hr	38,262 tpy	578,524 MMBtu/yr	1.0 tpy
4	Coal-Fired Boiler 6	Coal	40 CFR 98 Table C-2	1.6E-03 kg/MMBtu	230 MMBtu/hr	38,842 tpy	587,290 MMBtu/yr	1.0 tpy
5	Coal-Fired Boiler 7	Coal	40 CFR 98 Table C-2	1.6E-03 kg/MMBtu	230 MMBtu/hr	47,507 tpy	718,301 MMBtu/yr	1.3 tpy
6	Coal-Fired Boiler 8	Coal	40 CFR 98 Table C-2	1.6E-03 kg/MMBtu	230 MMBtu/hr	26,567 tpy	401,685 MMBtu/yr	0.7 tpy
7a	South Coal Handling Dust Collector (DC-01)	N/A	N/A	N/A	13,150 acfm	1,501 hr/yr	N/A	0 tpy
7b	South Underbunker Dust Collector (DC-02)	N/A	N/A	N/A	884 acfm	100 hr/yr	N/A	0 tpy
7c	North Coal Handling Dust Collector (NDC-1)	N/A	N/A	N/A	9,250 acfm	31 hr/yr	N/A	0 tpy
8	Backup Generator Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	2,937 hp	21 hr/yr	425 MMBtu/yr	2.8E-04 tpy
9	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	353 hp	9 hr/yr	21 MMBtu/yr	1.4E-05 tpy
14	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	320 hp	12 hr/yr	26 MMBtu/yr	1.7E-05 tpy
22	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	35 hp	0 hr/yr	0 MMBtu/yr	0 tpy
23	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	155 hp	9 hr/yr	10 MMBtu/yr	6.5E-06 tpy
29a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	74 hp	17 hr/yr	9 MMBtu/yr	5.9E-06 tpy
30a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	91 hp	26 hr/yr	17 MMBtu/yr	1.1E-05 tpy
31a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	74 hp	30 hr/yr	15 MMBtu/yr	1.0E-05 tpy
32a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	91 hp	8 hr/yr	5 MMBtu/yr	3.2E-06 tpy
33a	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	75 hp	11 hr/yr	6 MMBtu/yr	3.9E-06 tpy
34	Emergency Pump Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	220 hp	5 hr/yr	8 MMBtu/yr	5.5E-06 tpy
35	Emergency Pump Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	85 hp	6 hr/yr	4 MMBtu/yr	2.5E-06 tpy
36	Emergency Pump Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	220 hp	19 hr/yr	29 MMBtu/yr	1.9E-05 tpy
37	Emergency Generator Engine	Distillate	40 CFR 98 Table C-2	6.0E-04 kg/MMBtu	75 hp	10 hr/yr	5 MMBtu/yr	3.6E-06 tpy
51a	Fly Ash Dust Collector (DC-1)	N/A	N/A	N/A	3,620 acfm	4,380 hr/yr	N/A	0 tpy
51b	Bottom Ash Dust Collector (DC-2)	N/A	N/A	N/A	3,620 acfm	4,380 hr/yr	N/A	0 tpy
52	Coal Storage Pile	N/A	N/A	N/A	N/A	68,660 tpy	N/A	0 tpy
							Significant Emission Units Estimated Actual Emissions - N_2O	**6.1 tpy**
Insignificant Emission Units								
N/A	Fly and Bottom Ash Bin Vent Filter	N/A	N/A	N/A	1,460 acfm	4,380 hr/yr	N/A	0 tpy
N/A	Ash Loadout to Truck	N/A	N/A	N/A	N/A	16,079 tpy	N/A	0 tpy
N/A	Aboveground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	N/A	0 tpy
N/A	Underground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	N/A	0 tpy
							Insignificant Emission Units Estimated Actual Emissions - N_2O	**0 tpy**
							Total Estimated Actual Emissions - N_2O	**6.1 tpy**

Calculations:

Actual heat input, coal (MMBtu/yr) = Actual annual operation (tons/yr) x Coal Heating Value (MMBtu/ton)
Actual heat input, engines (MMBtu/yr) = Engine Rating (hp) x Engine Heat Rate (Btu/hp-hr) x Actual Annual Operation (hr/yr) / 1E6 (Btu/MMBtu)

Conversion factors:

Engine Heat Rate	7,000	Btu/hp-hr	*Average brake-specific fuel consumption (BSFC) from AP 42, Table 3.3-1, footnote a*
Mass:	907.2	kg/ton	
Coal Heating Value	15.1	MMBtu/ton	*From http://www.usibelli.com/coal/data-sheet*

Table D-3.19. Estimated Actual Emissions Calculations - Particulate Matter (PM) Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added for the January 2021 Amendment.

Emission Unit ID	Emission Unit Name	Fuel Type	Factor Reference	PM Emission Factor	Emission Unit Rating/Capacity	Estimated Actual Operation	Estimated Actual PM Emissions
Significant Emission Units							
1	Coal-Fired Boiler 3	Coal	Source Test, 25-Apr-17	0.00551 lb/MMBtu	230 MMBtu/hr	37,872 tpy	1.58 tpy
2	Coal-Fired Boiler 4	Coal	Source Test, 19-Apr-17	0.00525 lb/MMBtu	230 MMBtu/hr	40,648 tpy	1.61 tpy
3	Coal-Fired Boiler 5	Coal	Source Test, 20-Apr-17	0.00179 lb/MMBtu	230 MMBtu/hr	38,262 tpy	0.52 tpy
4	Coal-Fired Boiler 6	Coal	Source Test, 24-Apr-17	0.00059 lb/MMBtu	230 MMBtu/hr	38,842 tpy	0.17 tpy
5	Coal-Fired Boiler 7	Coal	Source Test, 21-Apr-17	0.00129 lb/MMBtu	230 MMBtu/hr	47,507 tpy	0.46 tpy
6	Coal-Fired Boiler 8	Coal	Source Test, 22-Apr-17	0.00048 lb/MMBtu	230 MMBtu/hr	26,567 tpy	0.10 tpy
7a	South Coal Handling Dust Collector (DC-01)	N/A	See detailed calculations in Table D-3.7a		13,150 acfm	1,501 hr/yr	0.20 tpy
7b	South Underbunker Dust Collector (DC-02)	N/A	See detailed calculations in Table D-3.7a		884 acfm	100 hr/yr	7.3E-03 tpy
7c	North Coal Handling Dust Collector (NDC-1)	N/A	See detailed calculations in Table D-3.7a		9,250 acfm	31 hr/yr	2.4E-02 tpy
8	Backup Generator Engine	Distillate	EPA Tier 2	0.25 g/kW-hr[1, 2]	2,937 hp	21 hr/yr	0.37 tpy
9	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	353 hp	9 hr/yr	3.3E-03 tpy
14	Emergency Generator Engine	Distillate	EPA Tier 3	0.25 g/kW-hr[1, 2]	320 hp	12 hr/yr	1.0E-03 tpy
22	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	35 hp	0 hr/yr	0.0 tpy
23	Emergency Generator Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	155 hp	9 hr/yr	1.5E-03 tpy
29a	Emergency Generator Engine	Distillate	EPA Tier 4i	0.375 g/kW-hr[1, 2]	74 hp	17 hr/yr	5.3E-04 tpy
30a	Emergency Generator Engine	Distillate	EPA Tier 3	0.5 g/kW-hr[1]	91 hp	26 hr/yr	9.8E-04 tpy
31a	Emergency Generator Engine	Distillate	EPA Tier 4i	0.375 g/kW-hr[1, 2]	74 hp	30 hr/yr	9.1E-04 tpy
32a	Emergency Generator Engine	Distillate	EPA Tier 3	0.5 g/kW-hr[1]	91 hp	8 hr/yr	2.9E-04 tpy
33a	Emergency Generator Engine	Distillate	EPA Tier 3	0.5 g/kW-hr[1]	75 hp	11 hr/yr	3.4E-04 tpy
34	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	220 hp	5 hr/yr	1.3E-03 tpy
35	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	85 hp	6 hr/yr	6.0E-04 tpy
36	Emergency Pump Engine	Distillate	AP-42, Table 3.3-1	2.20E-03 lb/hp-hr	220 hp	19 hr/yr	4.5E-03 tpy
37	Emergency Generator Engine	Distillate	EPA Tier 3	0.5 g/kW-hr[1]	75 hp	10 hr/yr	3.2E-04 tpy
51a	Fly Ash Dust Collector (DC-1)	N/A	See detailed calculations in Table D-3.19a		3,620 acfm	4,380 hr/yr	1.18 tpy
51b	Bottom Ash Dust Collector (DC-2)	N/A	See detailed calculations in Table D-3.19a		3,620 acfm	4,380 hr/yr	1.18 tpy
52	Coal Storage Pile	N/A	See detailed calculations in Table D-3.19b		N/A	68,660 tpy	3.57 tpy
						Significant Emission Units Estimated Actual Emissions - PM	**11.0 tpy**
Insignificant Emission Units							
N/A	Fly and Bottom Ash Bin Vent Filter	N/A	See detailed calculations in Table D-3.19a		1,460 acfm	4,380 hr/yr	0.47 tpy
N/A	Ash Loadout to Truck	N/A	See detailed calculations in Table D-3.19a		N/A	16,079 tpy	3.7E-04 tpy
N/A	Aboveground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	0 tpy
N/A	Underground Storage Tanks	Diesel	N/A	N/A	N/A	N/A	0 tpy
						Insignificant Emission Units Estimated Actual Emissions - PM	**0.5 tpy**
						Total Estimated Actual Emissions - PM	**11.5 tpy**

Notes:

[1] The Tier 4i, Tier 3, and Tier 2 weighted-cycle emission rates for PM have been multiplied by 1.25 to determine the Not-to-Exceed emission factors per 40 CFR 1039.101(e) and ADEC policy (see also 40 CFR 60.4212(c).)

Conversion factors:

Weight	453.6	g/lb	
Weight	2,000	lb/ton	
Coal Heating Value	15.1	MMBtu/ton	*From http://www.usibelli.com/coal/data-sheet*
Engine horsepower	1.341	hp/kw	

Table D-3.19a. Estimated Actual Emissions Calculations - Ash Handling System PM Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added (to Table 3.7b) for the January 2021 Amendment.

Emission Unit			Factor Reference	PM Emission Factor	Emission Unit Rating/Capacity	Annual Operation	Estimated Actual PM Emissions[b]
Permit ID	Description	Year Installed					
51a	Fly Ash Dust Collector (DC-1)	1993	Typical Value	0.02 gr/dscf	3,620 acfm	4,380 hr/yr[d]	1.18 tpy[a]
51b	Bottom Ash Dust Collector (DC-2)	1994	Typical Value	0.02 gr/dscf	3,620 acfm	4,380 hr/yr[d]	1.18 tpy[a]
N/A	Fly and Bottom Ash Bin Vent Filter	1993	Manufacturer's guarantee[c]	0.02 gr/scfm	1,460 acfm	4,380 hr/yr[e]	0.47 tpy[a]
N/A	Ash Loadout to Truck	Unknown	AP-42, Section 13.2.4	4.63E-05 lb/ton	N/A	16,079 tpy	3.73E-04 tpy[b]
						Total PM Emissions	**2.83 tpy**

Notes:

[a] Fly and bottom ash dust collector emission calculations:

(exhaust rate, acfm) x (Temp at STP/Temp of exhaust) x (PM_{10} exhaust concentration, gr/dscf) x (1 lb/ 7,000 gr) x (1 ton/ 2,000 lb) x (60 min/hr) x (operation, hr/yr)

Temperature at standard conditions =	68 degrees Fahrenheit	293.15 degrees Kelvin
Exhaust temperature of ash bin vent filter =	150 degrees Fahrenheit	338.71 degrees Kelvin
Exhaust temperature of fan duct blower/bag filter =	150 degrees Fahrenheit	

[b] Ash loadout emission calculations:

Emission factor from AP-42, Section 13.2.4 based on empirical equation $E = k \times 0.0032 \times (U/5)^{1.3}/(M/2)^{1.4}$ lb/ton transferred where:

k = 0.74 for PM <30 μm

U = mean wind speed = 4.0 mph in Fairbanks, per National Climactic Data Center (https://www.ncdc.noaa.gov/cdo-web/search)

M = ash moisture content = 27 percent (AP-42, Table 13.2.4-1)

Ash loadout emissions based on average annual coal consumption	229,697	tpy
Ash content of coal per Usibelli Coal Mine website	7	percent
Operations, ash tons/yr = coal consumption x (0.085 ash content)	16,079	tpy

Ash loadout emissions, tons/yr = (emission factor, lb/ton) x (ash loading, ton/yr) / (2,000 lb/ton)

[c] Manufacturer's guarantee for particle sizes over 5 microns in diameter

[d] Average run time for DC-1 and DC-2 is 12 hours/day per reasonable inquiry of plant operations

[e] Operation of ash bin vent filter assumed to be the same as the dust collectors

Table D-3.19b. Estimated Actual Emissions Calculations - Emergency Coal Storage Pile PM Emissions
Doyon Utilities - Fort Wainwright (Privatized Emission Units)

Blue highlights indicate information revised/added (to Table 3.7c) for the January 2021 Amendment.

Emission Unit		Factor Reference	PM Emission Factor	Annual Operation[b]	Estimated Actual PM Emissions
Permit ID	Description				
	Coal chute to coal pile	AP-42, Section 13.2.4	5.20E-04 lb/ton[a]	43,509 tpy	1.13E-02 tpy
	Front end loader drop onto stockpile	AP-42, Section 13.2.4	5.20E-04 lb/ton[a]	43,509 tpy	1.13E-02 tpy
	Front end loader movement - chute to coal pile	AP-42, Section 13.2.2	9.55 lb/VMT[c]	366 VMT	1.75 tpy
	Front end loader movement - coal pile to South grizzly	AP-42, Section 13.2.2	9.55 lb/VMT[c]	346 VMT	1.65 tpy
	Front end loader movement - coal pile to North grizzly	AP-42, Section 13.2.2	9.55 lb/VMT[c]	28 VMT	0.13 tpy
	Stockpile wind erosion	AP-42, Section 13.2.5	0.00 g/m^2-yr[d]	3,370 m^2	0.00 tpy
	Front end loader drop into grizzly	AP-42, Section 13.2.4	5.20E-04 lb/ton[a]	25,151 tpy	6.54E-03 tpy
52	Coal Storage Pile			**Total PM Emissions**	**3.57 tpy**

Notes:

[a]Coal transfer emission factor from AP-42, Section 13.2.4 based on empirical equation E = k x 0.0032 x $(U/5)^{1.3}/(M/2)^{1.4}$ lb/ton transferred where:

k	0.74	PM <30 µm	
U = mean wind speed	4.0	miles/hr	Average value from September 2017 to October 2018 per NOAA NCDC.
M = coal moisture content	4.8	percent	

[b]Average Annual stockpile throughput based on 2016 and 2017 records:

Coal moved to coal pile	43,509	tpy
Coal moved from coal pile	25,151	tpy

[c]Front end loader movement emission factor from AP-42, Section 13.2.2, Empirical Equation 1a, E = k x $(s/12)^a$ x $(W/3)^b$ lb/VMT where:

k	4.9	for PM_{30}
s = surface material silt content (haul road)	8.4	%
W = mean vehicle weight	27	percent, from AP-42, Table 13.2.2-1
Size of load bucket	5	tons, estimate
Density of coal	50	lb/ft^3
Coal moved per trip	3.375	tons (Density of coal x 27 ft3/yd3 x bucket size / 2000 lb/ton)
a (empirical constant)	0.9	from AP-42, Table 13.2.2-2 for PM_{30}
b (empirical constant)	0.45	from AP-42, Table 13.2.2-2 for PM_{30}
Approximate distance from coal chute to coal pile (round trip)	150	feet
Approximate distance from coal pile to South grizzly (round trip)	250	feet
Approximate distance from coal pile to North grizzly (round trip)	1,000	feet
Percent of annual coal transferred to South grizzly	98	percent, primary coal handling system
Percent of annual coal transferred to North grizzly	2	percent, North handling system is emergency backup to South handling system
VMT = vehicles miles traveled per year		VMT = annual stockpile throughput/coal moved per trip x distanced traveled per round trip in feet / 5280 ft/mi

[d]From AP-42, Section 13.2.5, Industrial Wind Erosion

Coal Pile at FWA CHPP (*source: Ft WW Coal Pile 2018 Volume Summary, October 2, 2018, 3-TIER Alaska LLC.*)

Average Height =	40	ft	
Width at Base =	205	ft	The minimum width (south face) of the coal pile is used as a conservative approach
Height-to-Base Ratio =	0.195		< 0.2. FWA CHPP coal pile can therefore be considered a large relatively flat pile with little penetration into the surface wind layer and a single friction velocity (using Equation (1)) can be used to for the entire surface of the coal pile. Friction velocity is a measure of wind shear stress on the erodible surface.
Surface Area of Active (north) Face =	3,370	m^2	Calculated from survey using Computer Aided Design (CAD) software in 2012. Height and width of the pile were comparable in 2018 and 2012.

AP-42 Section 13.2.5, Equation (2)

Emission factor for wind-generated particulate emissions from mixtures of erodible and nonerodible surface material subject to disturbance, EF

$$EF\ (g/m^2\text{-}yr) = k \sum_{i=1}^{N} P_i$$

where k = particle size multiplier (1.0 for particle size 30 microns, per table on page 13.2.5-3)
N = number of disturbances per year
P_i = erosion potential corresponding to the fastest mile of wind for the ith period between disturbances, g/m^2

AP-42 Section 13.2.5, Equation (3)

Erosion potential function for a dry exposed surface, P

$$P = 58\ (u^* - u_t^*)^2 + 25\ (u^* - u_t^*)$$
$$P = 0 \text{ for } u^* \leq u_t^*$$

where u^* = friction velocity (m/s)
u_t = threshold friction velocity (m/s)

AP-42 Section 13.2.5, Equation (1)

Friction velocity, u^*

$$u^* = 0.4 \times u(z) / \ln(z/z_o) \qquad \text{when } z > z_o$$

where u^* = friction velocity (cm/s)
u(z) = wind speed at height z above test surface (cm/s)
z = height above test surface (cm)
z_o = roughness height, cm

Data:

u(z)		Use maximum wind gust speed recorded at Fairbanks International Airport for each of the previous 12 months (see table below)
z	10	meters
N	204	disturbances/year for active face, as determined from 2017 records
	17	average disturbances/month

				Uncrusted coal pile[2] (Table 13.2.5-2)				Scraper tracks on coal pile (Table 13.2.5-2)						
Month-Year	Maximum Wind Speed (u(10))[1]		Wind Direction	Roughness Height (z_o)	Threshold Friction Velocity (u_t)	Calculated Friction Velocity (u*)	Erosion potential function, P	Roughness Height (z_o)	Threshold Friction Velocity (u_t)	Calculated Friction Velocity (u*)	Erosion potential function, P	P x N	k	Emission Factor, EF
	mph	m/s	deg	cm	m/s	m/s		cm	m/s	m/s				g/m^2-yr
Oct-17	17	7.6	060	0.3	1.12	0.37	0	0.06	0.62	0.31	0	0		
Nov-17	20	8.9	270	0.3	1.12	0.44	0	0.06	0.62	0.37	0	0		
Dec-17	15	6.7	070	0.3	1.12	0.33	0	0.06	0.62	0.28	0	0		
Jan-18	17	7.6	200	0.3	1.12	0.37	0	0.06	0.62	0.31	0	0		
Feb-18	29	13.0	270	0.3	1.12	0.64	0	0.06	0.62	0.53	0	0		
Mar-18	25	11.2	270	0.3	1.12	0.55	0	0.06	0.62	0.46	0	0		
Apr-18	26	11.6	040	0.3	1.12	0.57	0	0.06	0.62	0.48	0	0		
May-18	25	11.2	300	0.3	1.12	0.55	0	0.06	0.62	0.46	0	0		
Jun-18	25	11.2	090	0.3	1.12	0.55	0	0.06	0.62	0.46	0	0		
Jul-18	22	9.8	300	0.3	1.12	0.48	0	0.06	0.62	0.40	0	0		
Aug-18	26	11.6	250	0.3	1.12	0.57	0	0.06	0.62	0.48	0	0		
Sep-18	22	9.8	260	0.3	1.12	0.48	0	0.06	0.62	0.40	0	0		
Annual Total							0				0.00	0.00	1.0	**0.00**

[1] Maximum wind speed data is from NOAA NCDC. Tower height of 10 meters confirmed by Fairbanks Weather Forecast Office, National Weather Service on 27-March-2013

[2] The erosion potential factor for the uncrusted coal pile is zero for all months. Therefore, wind erosion of the uncrusted coal pile is not a significant source of PM emissions