

Background/Baseline Air Quality Determination and Proposed Interim Baseline NO₂, SO₂ and PM_{2.5} Air Quality Concentrations for Fort McKay “Full Report” (December 2024)



FORT MCKAY
FIRST NATION



**Prepared for the: Fort McKay Sustainability Department
By: David Spink, P.Eng., Danlin Su, P.Eng. & Jeff Brook, Ph.D.**

Contents

1	Executive Summary	A-1
2	Introduction	A-2
3	Baseline Determination Considerations.....	A-2
3.1	Defining “Baseline(s)”	A-3
3.2	Review of Baseline Setting Methods	A-4
4	Estimating Fort McKay’s Baseline: The Approach	A-6
4.1	Overview.....	A-6
4.2	Percentile Analysis.....	A-7
4.3	Wind Direction Analysis.....	A-8
4.4	Temporal and Wind Speed Adjustments.....	A-11
4.5	All WD vs. WD-Screened.....	A-14
4.6	Protocol for Baseline Estimates.....	A-15
4.6.1	Additional Considerations in Applying the Protocol	A-15
4.7	The Selection of NO ₂ , SO ₂ and PM _{2.5} for Interim Baseline Setting	A-16
5	NO₂ Baseline Estimates	A-18
5.1	Literature NO ₂ Baseline Estimates.....	A-18
5.2	Recommendation	A-19
5.3	Supporting Figures and Tables for NO ₂ Baseline Assessment.....	A-20
5.3.1	Characteristics of the Hourly NO ₂ Concentration Distribution	A-22
5.3.2	Temporal Variations in the Fort McKay NO ₂ Percentiles	A-27
5.4	Conclusion	A-32
6	SO₂ Baseline Estimates.....	A-34
6.1	Literature SO ₂ Baseline Estimates	A-34
6.2	Recommendation	A-34
6.3	Supporting Figures and Tables for SO ₂ Baseline Assessment.....	A-37
6.3.1	Characteristics of the Hourly SO ₂ Concentration Distribution.....	A-38
6.3.2	Temporal Variations in the Fort McKay SO ₂ Percentiles.....	A-43
6.4	Conclusion	A-48
7	PM_{2.5} Baseline Estimates.....	A-50
7.1	Literature PM _{2.5} Baseline Estimates	A-50
7.2	Recommendations.....	A-50
7.3	PM _{2.5} Baseline Related Figures and Tables.....	A-53
7.4	Conclusion	A-64

8	References	A-65
9	Appendices.....	A-68
Appendix A	Historical Air Quality Measurement Approaches in the AOSR.....	A-1
A.1	AEOSRP (1981).....	A-1
A.2	CNRL (2002) – A Combined Air Quality Measurement and Modelled Air Quality Prediction Approach.....	A-1
A.3	CEMA TMAC (2005)	A-2
A.4	Teck (2011) - A Combined Air Quality Measurement and Modelled Air Quality Prediction Approach.....	A-2
A.5	(Shell Canada Limited, 2012)- A Non-Emission Influenced Wind Direction Air Quality Data Approach for Natural Baseline and a Community Emission Air Quality Impacted Modelling Approach for Community Only Impacts	A-2
A.6	Summary.....	A-3
A.7	References	A-4
Appendix B	Meteorological, Natural Emission and Atmospheric Chemistry Variability Considerations Relevant to Baseline Estimating	B-1
B.1	References	B-1
Appendix C	Temporal Factor Plots for the 10th percentile “All WD” and 50th percentile “WD Screened” Baseline Setting Approached for Fort McKay for the 2002-2021 Period for Hourly NO₂, SO₂, TRS, THC, NMHC, PM_{2.5} and O₃ Concentrations.....	C-1
C.1	By Hour of the Day Analysis.....	C-1
C.1.1	Hour of the Day “Fractional Contribution” Assessment.....	C-1
C.1.2	“By Hour of the Day” Hourly Concentrations	C-2
C.1.3	“By Hour of the Day” Variable Considerations	C-4
C.2	By Day of the Week Analysis	C-5
C.2.1	Hour of the Day “Fractional Concentration” Assessment	C-5
C.2.2	“By Day of the Week” Hourly Concentrations.....	C-6
C.2.3	“By Day of the Week” Variable Considerations.....	C-8
C.3	“Month of the Year” Variable Assessment	C-9
C.3.1	Month of the Year “Fractional Contribution” Assessment.....	C-9
C.3.2	“By Month of the Year” Hourly Concentrations	C-11
C.3.3	Percentile Approaches “By Month of the Year” Hourly Concentrations.....	C-13
C.4	“Inter-Annual” Analysis.....	C-15
C.4.1	“By Year” “Fractional Contribution” Assessment	C-15
C.4.2	“By Year” Hourly Concentrations	C-17
C.4.3	“By Year” Variable Considerations	C-18
C.5	“Wind Speed” Variable Assessment	C-19
C.6	References	C-29

Appendix D	NO₂	D-1
D.1	The Monthly/Annual Tables used to Estimate the “All-WD” 5 th percentile and 10 th percentile NO ₂ Baselines and the Tables used to Estimate the WD Screened 25 th percentile and 50 th percentile NO ₂ Baselines.....	D-1
Appendix E	SO₂	E-1
E.1	The Monthly/Annual Tables used to Estimate the “All-WD” 5 th percentile and 10 th percentile SO ₂ Baselines and the Tables used to Estimate the WD Screened 25 th percentile and 50 th percentile SO ₂ Baselines.....	E-1
Appendix F	PM_{2.5}	F-1
F.1	The Monthly/Annual Tables used to Estimate the “All-WD” 5 th percentile and 10 th percentile PM _{2.5} Baselines and the Tables used to Estimate the WD Screened 25 th percentile and 50 th percentile PM _{2.5} Baselines.....	F-1

Figures

Figure 1: Proposed Definition for the Baseline Air Quality and Anthropogenic Influences on Air Quality to the OSR	A-3
Figure 2: Methods for estimating baseline air pollutant concentrations categorized by information availability	A-5
Figure 3: Percentile Distribution of Fort McKay Hourly NO ₂ Levels (2014-2021)	A-7
Figure 4: Pollution rose of 2014-2021 hourly SO ₂ concentrations in Fort McKay.	A-9
Figure 5: HYSPLIT Back Trajectory Modelling for the LIWD	A-10
Figure 6: The Annual Average NO ₂ Levels in Fort McKay in the 1999-2020 Period Relative to the revised 2021 WHO AQG Annual NO ₂ Limit.....	A-17
Figure 7: The Average Annual PM _{2.5} in Fort McKay for 2011, 2012, 2013 and 2015-2019 Years.....	A-18
Figure 8: Hourly NO ₂ Percentile Concentration Distribution Plots in Fort McKay for the 2014-2021 period for All Wind Directions and for the WNW Wind Direction	A-23
Figure 9: Histogram of Hourly NO ₂ Concentrations in Fort McKay in the 2014-2021 Period (68,973 hourly values) (0.5 ppb bins with all hours with an NO ₂ concentration >25 ppb put in one bin)	A-24
Figure 10: A Histogram of the Count of Hourly NO ₂ Levels in Fort McKay in the 0-1.5 ppb Concentration Range over the Period 2014-2021	A-25
Figure 11: Histogram of Hourly NO ₂ Concentrations in Fort McKay in the 2014-2021 Period when the Wind was from the WNW (5,116 hourly values) (0.5 ppb bins with all hours with an NO ₂ concentration >15 ppb put in one bin).....	A-25
Figure 12: A Histogram of the Count of Hourly NO ₂ Levels in Fort McKay in the 0-1.5 ppb Concentration Range over the Period 2014-2021	A-26
Figure 13: Cumulative Frequency Percentiles for the “All WD” and WD Screened (WNW WD) Hourly NO ₂ Concentrations.....	A-27
Figure 14: Hourly NO ₂ Concentrations in Fort McKay in the 2014-2021 Period	A-28
Figure 15: Cumulative Frequency Percentiles for the Warm Weather Period (May-September) and the Cold Weather Period (October-April)	A-28
Figure 16: A Comparison of the Different percentile Method NO ₂ Baseline Estimates Considering Temporal Factors (referred to as “Overall”) and the Non-Temporal Factor NO ₂ Baseline Estimates....	A-29
Figure 17 : Average Annual Temporal Adjusted 5 th percentile and 10 th percentile “All WD” NO ₂ Concentrations (ppb) in Fort McKay for the Period (2014-2021) and the Average Annual 5 th percentile and 10 th percentile “All WD” NO ₂ Concentrations for the Entire 2014-2021 Period.....	A-30
Figure 18: Monthly Variation in Percentiles for the “All WD” and “WD Screened” Baseline Estimation Approaches	A-30
Figure 19: Temporal Adjusted 5 th percentile “All WD” Average NO ₂ Concentrations (ppb) by Hour of the Day in Fort McKay for the Period 2014-2021 for Select Months of the Year	A-31

Figure 20: The NO ₂ Baseline Estimates for Each percentile Method by Season (Cold Weather and Warm Weather)	A-32
Figure 21: Hourly SO ₂ Percentile Concentration Distribution Plots in Fort McKay for the 2014-2021 period for All Wind Directions and for the WNW Wind Direction.....	A-38
Figure 22: Histogram of Hourly SO ₂ Concentrations in Fort McKay in the 2014-2021 Period (69,370 hourly values) (0.05 ppb bins with all hours with an SO ₂ concentration >2.5 ppb put in one bin)	A-39
Figure 23: A Histogram of the Count of Hourly SO ₂ Levels in Fort McKay in the 0-1.0 ppb Concentration Range over the Period 2014-2021	A-40
Figure 24: Histogram of Hourly SO ₂ Concentrations in Fort McKay in the 2014-2021 Period when the Wind was from the WNW (5,144 hourly values) (0.05 ppb bins with all hours with SO ₂ concentration >2.5 ppb put in one bin).....	A-41
Figure 25: Cumulative Frequency Percentiles for the “All WD” and WD Screened (WNW WD) Hourly SO ₂ Concentrations in Fort McKay (2014-2021 Period) and the “All WD” 5 th percentile and 10 th percentile SO ₂ Baseline Estimates and WD Screened (WNW WD) 25 th percentile and 50 th percentile SO ₂ Baseline Estimates.....	A-43
Figure 26: Hourly SO ₂ Concentrations in Fort McKay in the 2014-2021 Period	A-44
Figure 27: Cumulative Frequency Percentiles for the Warm Weather Period (May-September) and the Cold Weather Period (October-April) “All WD” and “WD Screened” (WNW WD) Hourly NO ₂ Concentrations in Fort McKay	A-45
Figure 28: A Comparison of the Different percentile Method SO ₂ Baseline Estimates Considering Temporal Factors (referred to as “Overall”) and the Non-Temporal Factor SO ₂ Baseline Estimates	A-45
Figure 29: Temporal Adjusted Average Annual 5 th percentile and 10 th percentile All WD SO ₂ Concentrations (ppb) in Fort McKay for the Period (2014-2021) and the Average Annual 5 th percentile and 10 th percentile All WD SO ₂ Concentrations for the Entire 2014-2021 Period.....	A-46
Figure 30: The Temporal Adjusted SO ₂ Baseline Estimates for Each percentile Method by Month.....	A-47
Figure 31: Temporal Adjusted 5 th percentile “All WD” Average SO ₂ Concentrations (ppb) by Hour of the Day in Fort McKay for the Period 2014-2021 for Select Months of the Year	A-47
Figure 32: The Temporal Adjusted SO ₂ Baseline Estimates for Each percentile Method by Season (Cold Weather and Warm Weather)	A-48
Figure 33: Hourly PM _{2.5} Percentile Concentration Distribution Plots in Fort McKay for the 2014-2021 period for All Wind Directions and for the WNW Wind Direction.....	A-54
Figure 34: Histogram of Hourly PM _{2.5} Concentrations in Fort McKay in the 2014-2021 Period (69,431 hourly values) (0.5 µg/m ³ bins with all hours with an PM _{2.5} concentration >25 µg/m ³ put in one bin). A-55	
Figure 35: A Histogram of the Count of Hourly PM _{2.5} Levels in Fort McKay in 0-5 µg/m ³ Concentration Range over the Period 2014-2021 and the Cumulative Percentile Frequency that the Noted Concentration Range Represents (Total Dataset has 69,431 Hourly PM _{2.5} Values)	A-55
Figure 36: A Histogram of the Count of Hourly PM _{2.5} Levels in Fort McKay in the 0-5.0 µg/m ³ Concentration Range over the Period 2014-2021 when the Wind Direction was from the WNW and the	

Cumulative Percentile Frequency that the Noted Concentration Range Represents (Total Dataset has 5,116 Hourly PM _{2.5} Values)	A-57
Figure 37: Cumulative Frequency Percentiles for the “All WD” and WD Screened (WNW WD) Hourly PM _{2.5} Concentrations in Fort McKay (2014-2021 Period) and the “All WD” 5 th percentile and 10 th percentile PM _{2.5} Baseline Estimates and WD Screened (WNW WD) 25 th percentile and 50 th percentile PM _{2.5} Baseline Estimates.....	A-57
Figure 38: Hourly PM _{2.5} Concentrations in Fort McKay in the 2014-2021 Period	A-58
Figure 39: Cumulative Frequency Percentiles for the Warm Weather Period (May-September) and the Cold Weather Period (October-April) “All WD” and “WD Screened” (WNW WD) Hourly PM _{2.5} Concentrations in Fort McKay (2014-2021 Period) and the “All WD” 5 th percentile and 10 th percentile NO ₂ Baseline Estimates and WD Screened (WNW WD) 25 th percentile and 50 th percentile PM _{2.5} Baseline	A-59
Figure 40: A Comparison of the Different percentile Method PM _{2.5} Baseline Estimates and the Non-Adjusted (Non-Temporal Consideration) PM _{2.5} Baseline Estimates	A-60
Figure 41: Average Annual 5 th percentile and 10 th percentile All WD PM _{2.5} Concentrations (µg/m ³) in Fort McKay for the Period (2014-2021) and the Average Annual 5 th percentile and 10 th percentile All WD PM _{2.5} Concentrations for the Entire 2014-2021 Period.....	A-60
Figure 42: The PM _{2.5} Baseline Estimates for Each Percentile Method by Month.....	A-61
Figure 43: 5 th percentile “All WD” Average PM _{2.5} Concentrations (µg/m ³) by Hour of the Day in Fort McKay for the Period 2014-2021 for Select Months of the Year.....	A-62
Figure 44: The PM _{2.5} Baseline Estimates for Each percentile Method by Season (Cold Weather and Warm Weather)	A-62

Figures in Appendices

Figure C.1: Percent of the Total 10 th percentile "All WD" and 50 th percentile WD Screened Hourly Values in Fort McKay for the Noted Pollutant: a) SO ₂ ; b) TRS; c) NO ₂ ; d) O ₃ ; e) THC; and f) PM _{2.5} , Contributed by the Noted Hour of the Day (2002-2021 Period).....	C-2
Figure C.2: 10 th percentile "All WD" and 50 th percentile WD Screened Hourly Concentrations in Fort McKay for the 2002-2021 Period for the Noted Pollutant (a) SO ₂ ; b) TRS; c) NO ₂ ; d) O ₃ ; e) THC; and f) PM _{2.5}) in the Noted Hour of the Day (Note: the different y-axis scale for each pollutant))	C-4
Figure C.3: Percent of the Total 10 th percentile "All WD" and 50 th percentile "WD Screened" Hourly Values in Fort McKay for the Noted Pollutant Contributed by the Noted Day of the Week (2002-2021 Period).....	C-6
Figure C.4: 10 th percentile "All WD" and 50 th percentile "WD Screened" Hourly Values in Fort McKay for the 2002-2021 Period for the Noted Pollutant: a) SO ₂ ; b) TRS; c) NO ₂ ; d) O ₃ ; e) THC; and f) PM _{2.5} , in the Noted Day of the Week (Note: the different y-axis scale for each pollutant).....	C-8
Figure C.5: Percent of the Total 10 th percentile "All WD" and 50 th percentile WD Screened Hourly Values in Fort McKay for the Noted Pollutant: a) SO ₂ ; b) TRS; c) NO ₂ ; d) O ₃ ; e) THC; and f) PM _{2.5} Contributed by the Noted Month of the Year (2002-2021 Period)	C-11
Figure C.6 10 th percentile "All WD" and 50 th percentile WD Screened Hourly Values in Fort McKay for the 2002-2021 Period for the Noted Pollutant: a) SO ₂ ; b) TRS; c) NO ₂ ; d) O ₃ ; e) THC; and f) PM _{2.5} , in the Noted Month of the Year (Note: the different y-axis scale for each pollutant)).....	C-13
Figure C.7: Percent of the Total 10 th percentile "All WD" and 50 th percentile "WD Screened" Hourly Values in Fort McKay for the Noted Pollutant: a) SO ₂ ; b) TRS; c) NO ₂ ; d) O ₃ ; e) THC; and f) PM _{2.5} , Contributed by the Noted Year (2002-2021 Period).....	C-16
Figure C.8: 10 th percentile "All WD" and 50 th percentile WD Screened Hourly Values in Fort McKay for the 2002-2021 Period for the Noted Pollutant: a) SO ₂ ; b) TRS; c) NO ₂ ; d) O ₃ ; e) THC; and f) PM _{2.5} , in the Noted Year (Note: the different y-axis scale for each pollutant))	C-18
Figure C.9: Histogram of All Wind Direction Hourly Wind Speed Data (170,145 hourly values) in Fort McKay over the 2002-2021 Period with the 0-1 km/h (orange), 1-2 km/h (green) and 2-3 km/h (red) Wind Speeds Highlighted.....	C-21
Figure C.10: Histogram of the Wind Direction Screened (WNW Wind Direction) Hourly Wind Speed Data in Fort McKay (11,617 hourly values) over the 2002-2021 Period with the 0-1 km/h (orange), 1-2 km/h (green) and 2-3 km/h (red) Wind Speeds Highlighted.....	C-22
Figure C.11: The Average Hourly NO ₂ Concentrations in Fort McKay over the Period 2002-2021 Associated with each Wind Speed when the Wind Direction was from the WNW and the Percent Contribution that each Wind Speed made to the 50 th percentile Baseline Dataset (Note: 5,963 hourly NO ₂ values in the no WS removal 50 th percentile dataset; 5,621 hourly NO ₂ values in the <=1 km/h WS removal 50 th percentile dataset; 4,616 hourly NO ₂ values in the <=2 km/h WS removal 50 th percentile dataset; and 3,149 hourly NO ₂ values in <=3 km/h WS removal 50 th percentile dataset)	C-23
Figure C.12: WNW Wind Direction Hourly NO ₂ Frequency-Concentration Plots for Fort McKay (2002-2021 Period) for All Wind Speeds (WSs) and for Datasets with NO ₂ Concentrations Removed when the WSs were: <=1 km/h; <=2 km/h; <=3 km/h; <=4 km/h; <=5 km/h; and <=6 km/h.	C-24

Figure C.13: WNW Wind Direction Hourly NO ₂ Frequency-Concentration Plots for Fort McKay (2002-2021 Period) for All Wind Speeds (WSs) and for Datasets with NO ₂ Concentrations Removed when the WSs were: <=1 km/h; <=2 km/h; <=3 km/h; <=4 km/h; <=5 km/h; and <=6 km/h and for Percentiles Having NO ₂ Concentrations Less than 15 ppb.	C-25
Figure C.14: The Lowest Part of the WNW Wind Direction Hourly NO ₂ Frequency-Concentration Plots for Fort McKay (2002-2021 Period) for All Wind Speeds (WSs) and for Datasets with NO ₂ Concentrations Removed when the WSs were: <=1 km/h; <=2 km/h; <=3 km/h; <=4 km/h; <=5 km/h; and <=6 km/h with the 50 th percentile Baseline Estimates Associated with the noted WSs Removed.....	C-25
Figure C.15: Measure Average Hourly NO ₂ Concentration (ppb) in the Noted Wind Speed Bin and the Wind Speed Dilution Calculated Average Hourly NO ₂ Concentration (ppb) in the Noted Wind Speed Bin and for Noted Reference Concentration (based on Fort McKay Hourly NO ₂ Data for the Period 2002-2021)	C-28

Tables

Table 1: Overview of Methods for Estimating Baseline Air Pollutant Concentrations.....	A-4
Table 2: The 16 Cardinal Wind Directions Used and the Wind Direction Degrees Each Represents	A-5
Table 3: Baseline Estimates for NO ₂ , SO ₂ , TRS, THC, NMHC, PM _{2.5} and O ₃ in Fort McKay Based on Hourly Data for the Period 2002-2021 using an “All WD” 10 th percentile Approach with and without the Noted Temporal and Wind Speed Considerations and the Average and Range of All the Individual Baseline Estimates.....	A-12
Table 4: Baseline Estimates for NO ₂ , SO ₂ , TRS, THC, NMHC, PM _{2.5} and O ₃ in Fort McKay Based on Hourly Data for the Period 2002-2021 using a WD Screened 50 th percentile Approach with and without the Noted Temporal and Wind Speed Considerations and the Average and Range of All the Individual Baseline Estimates	A-13
Table 5: Summary of Non-Adjusted and Temporal Adjusted NO ₂ Baseline Estimates for Fort McKay using “All WD” 5 th percentile and 10 th percentile and WD Screened (the WNW WD) 25 th percentile and 50 th percentile These results are based on Hourly NO ₂ Data from the Fort McKay Bertha Ganter Air Monitoring Station for the Period 2014-2021	A-19
Table 6: NO ₂ Baseline Values (ppb) for the Noted Years by Month and the Average for all Years (2014-2021 Period) Calculated using the "All WD" percentile Method (5 th percentile and 10 th percentile Values Shown) and the WD Screened percentile Method (WNW WD and 25 th percentile and 50 th percentile Values Shown) with Monthly Values based on the Average of by Hour of the Day percentiles for the Noted percentile Method and the Noted percentile Value for that Method.	A-21
Table 7: Non-Temporal Adjusted NO ₂ Baseline Values (ppb) for 2014-2021 Period Calculated using the "All WD" percentile Method (5 th percentile and 10 th percentile Values Highlighted) and the WD Screened percentile Method (WNW WD and 25 th percentile and 50 th percentile Values Highlighted) for the Full Period and for Warm Weather (May-September) and Cold Weather (October-April) Periods.	A-22
Table 8: Example of the “WD Screened” NO ₂ percentile Baseline Estimates (the 25 th percentile and 50 th percentile Estimates Highlighted in Red) (Note: the Tables for all Months are in Appendix D) (Note: a blank cell is the result of using PERCENTILE.EXC algorithm which excludes percentages below 1/(N+1) and above N/(N+1) where N is the number of datapoints which can be quite small when using the WD screened percentile approach and considering “by hour of the day” and “by month” temporal factors) A-	33
Table 9: Example of the “All WD” NO ₂ 5 th percentile Baseline Estimates (Note: the Tables for all Months are in Appendix D)	A-33
Table 10: Example of the “All WD” NO ₂ 10 th percentile Baseline Estimates (Note: the Tables for all Months are in Appendix D)	A-33
Table 11: Summary of Non-Adjusted and Temporal Adjusted SO ₂ Baseline Estimates for Fort McKay using “All WD” 5 th percentile and 10 th percentile and “WD Screened” (the WNW WD) 25 th percentile and 50 th percentile Concentrations based on Hourly SO ₂ Data from the Fort McKay Bertha Ganter Air Monitoring Station for the Period 2014-2021	A-35
Table 12: SO ₂ Baseline Estimates (ppb) for the Noted Years by Month and the Average for all Years (2014-2021 Period) Calculated using the "All WD" percentile Method (5 th percentile and 10 th percentile	

Values Shown) and the WD Screened percentile Method (WNW WD and 25 th percentile and 50 th percentile Values Shown) with Monthly Values based on the Average of by Hour of the Day percentiles for the Noted percentile Method and the Noted percentile.....	A-36
Table 13: Non-Temporal Adjusted SO ₂ Baseline Values (ppb) for 2014-2021 Period Calculated using the "All WD" percentile Method (5 th percentile and 10 th percentile Values Highlighted) and the WD Screened percentile Method (WNW WD and 25 th percentile and 50 th percentile Values Highlighted) for the Full Period and for Warm Weather (May-September) and Cold Weather (October-April) Periods.	A-37
Table 14: Example of the WD Screened SO ₂ percentile Baseline Estimates (the 25 th percentile and 50 th percentile Estimates Highlighted in Red) (Note: the Tables for all Months are in Appendix E)	A-49
Table 15: Example of the "All WD" SO ₂ 5 th percentile Baseline Estimates (Note: the Tables for all Months are in Appendix E)	A-49
Table 16: Example of the "All WD" SO ₂ 10 th percentile Baseline Estimates (Note: the Tables for all Months are in Appendix E)	A-49
Table 17: Summary of Non-Adjusted and Temporal Adjusted PM _{2.5} Baseline Estimates for Fort McKay using "All WD" 5 th percentile and 10 th percentile and "WD Screened" (the WNW WD) 25 th percentile and 50 th percentile Concentrations based on Hourly SO ₂ Data from the Fort McKay Bertha Ganter Air Monitoring Station for the Period 2014-2021	A-51
Table 18: PM _{2.5} Baseline Estimates (µg/m ³) for the Noted Years by Month and the Average for all Years (2014-2021 Period) Calculated using the "All WD" percentile Method (5 th percentile and 10 th percentile Values Shown) and the WD Screened percentile Method (WNW WD and 25 th percentile and 50 th percentile Values Shown) with Monthly Values based on the Average of by Hour of the Day percentiles for the Noted percentile Method and the Noted percentile.....	A-52
Table 19: Non-Temporal Adjusted SO ₂ Baseline Values (ppb) for 2014-2021 Period Calculated using the "All WD" percentile Method (5 th percentile and 10 th percentile Values Highlighted) and the WD Screened percentile Method (WNW WD and 25 th percentile and 50 th percentile Values Highlighted) for the Full Period and for Warm Weather (May-September) and Cold Weather (October-April) Periods.	A-53
Table 20: Example of the WD Screened PM _{2.5} percentile Baseline Estimates (the 25 th percentile and 50 th percentile Estimates Highlighted in Red) (Note: the Tables for all Months are in Appendix F)	A-63
Table 21: Example of the "All WD" PM _{2.5} percentile Baseline Estimates (Note: the Tables for all Months are in Appendix F))	A-63
Table 22: Example of the "All WD" PM _{2.5} 10 th percentile Baseline Estimates (Note: the Tables for all Months are in Appendix F))	A-64

Tables in Appendices

Table C.1: “By hour of the Day” Average NO ₂ , SO ₂ , TRS, THC, NMHC, PM _{2.5} and O ₃ Concentrations in Fort McKay for the 2002-2021 Period	C-3
Table C.2: Estimated Baseline Concentrations of SO ₂ , TRS, NO ₂ , THC, NMHC, PM _{2.5} and O ₃ based on a “By Hour of Day” “all WD” 10 th percentile and “WD screened” 50 th percentile Baseline Estimating Approaches and a Comparison of these “By Hour of Day” Baseline Estimates to the “No Variable Consideration” Baseline	C-5
Table C.3: “By Day of the Week” Average NO ₂ , SO ₂ , TRS, THC, NMHC, PM _{2.5} and O ₃ Concentrations in Fort McKay for the 2002-2021 Period	C-6
Table C.4: Estimated Baseline Concentrations of SO ₂ , TRS, NO ₂ , THC, NMHC, PM _{2.5} and O ₃ based on a “By Day of Week” “all WD” 10 th percentile and “WD screened” 50 th percentile Baseline Estimating Approaches and a Comparison of these “By Day of Week” Baseline Estimates to the “No Day of the Week Variable Consideration” Baseline	C-9
Table C.5: “All WD” 10 th percentile and WD Screened 50 th percentile “by Month of the Year” Hourly Concentrations for SO ₂ , TRS, NO ₂ , THC, NMHC, O ₃ and PM _{2.5}	C-12
Table C.6: Estimated Baseline Concentrations of SO ₂ , TRS, NO ₂ , THC, NMHC, PM _{2.5} and O ₃ based on a “By Month of Year” “all WD” 10 th percentile and “WD screened” 50 th percentile Baseline Estimating Approaches and a Comparison of these Baseline Estimates to the “No Month of Year Consideration” Baseline estimates with the Range of Monthly Baseline Estimates and the Standard Deviation of this Range	C-14
Table C.7: “All WD” 10 th percentile and WD screened 50 th percentile “by Year” hourly concentrations for SO ₂ , TRS, NO ₂ , THC, NMHC, O ₃ and PM _{2.5}	C-17
Table C.8: Estimated Baseline Concentrations of SO ₂ , TRS, NO ₂ , THC, NMHC, PM _{2.5} and O ₃ based on a “By Year” “all WD” 10 th percentile and WD screened 50 th percentile Baseline Estimating Approaches and a Comparison of these Baseline Estimates to the “No by Year Consideration” Baseline estimates with the Range of Monthly Baseline Estimates and the Standard Deviation of this Range	C-19
Table C.9: The “All Wind” Direction 10th Percentile and the Wind Direction Screened (WNW) 50 th Percentile Baseline Estimated Concentrations for the Noted Pollutant and the Noted Wind Speed Removed (Fort McKay Hourly Data for Period 2002-2021) (Note: the change in the baseline concentration estimate associated with each wind screening is noted in last 3 rows)	C-20
Table C.10: A Comparison between the 50 th percentile NO ₂ Baseline Estimates using the WD screened Approach (WNW WD) with Certain Wind Speeds Removed and Baselines Estimated using a Wind Speed Dilution Approach	C-27
Table D.1: The 5 th percentile “All-WD” Monthly/Annual Tables (January to March 2014-2021)	D-2
Table D.2: The 5 th percentile “All-WD” Monthly/Annual Tables (April to June 2014-2021)	D-3
Table D.3: The 5 th percentile “All-WD” Monthly/Annual Tables (July to September 2014-2021)	D-4
Table D.4: The 5 th percentile “All-WD” Monthly/Annual Tables (October to December 2014-2021)	D-5
Table D.5: The 10 th percentile “All-WD” Monthly/Annual Tables (January to March 2014-2021)	D-6

Table D.6: The 10 th percentile “All-WD” Monthly/Annual Tables (April to June 2014-2021).....	D-7
Table D.7: The 10 th percentile “All-WD” Monthly/Annual Tables (July to September 2014-2021)	D-8
Table D.8: The 10 th percentile “All-WD” Monthly/Annual Tables (July to September 2014-2021)	D-9
Table D.9: The Wind Direction Screened NO ₂ Percentile by Hour of the Day and by Month Tables (January and February for entire 2014-2021 Period) with 25 th percentile and 50 th percentile Values Highlighted in “Red”	D-10
Table D.10: The Wind Direction Screened NO ₂ Percentile by Hour of the Day and by Month Tables (March and April for entire 2014-2021 Period) with 25 th percentile and 50 th percentile Values Highlighted in “Red”	D-11
Table D.11: The Wind Direction Screened NO ₂ Percentile by Hour of the Day and by Month Tables (May and June for entire 2014-2021 Period) with 25 th percentile and 50 th percentile Values Highlighted in “Red”	D-12
Table D.12: The Wind Direction Screened NO ₂ Percentile by Hour of the Day and by Month Tables (July and August for entire 2014-2021 Period) with 25 th percentile and 50 th percentile Values Highlighted in “Red”	D-13
Table D.13: The Wind Direction Screened NO ₂ Percentile by Hour of the Day and by Month Tables (September and October for entire 2014-2021 Period) with 25 th percentile and 50 th percentile Values Highlighted in “Red”	D-14
Table D.14: The Wind Direction Screened NO ₂ Percentile by Hour of the Day and by Month Tables (November and December for entire 2014-2021 Period) with 25 th percentile and 50 th percentile Values Highlighted in “Red”	D-15
Table E.1: The 5 th percentile “All-WD” SO ₂ Monthly/Annual Tables (January to March 2014-2021).....	E-2
Table E.2: The 5 th percentile “All-WD” SO ₂ Monthly/Annual Tables (April to June 2014-2021).....	E-3
Table E.3: The 5 th percentile “All-WD” SO ₂ Monthly/Annual Tables (July to September 2014-2021).....	E-4
Table E.4: The 5 th percentile “All-WD” SO ₂ Monthly/Annual Tables (October to December 2014-2021).....	E-5
Table E.5: The 10 th percentile “All-WD” SO ₂ Monthly/Annual Tables (January to March 2014-2021).....	E-6
Table E.6: The 10 th percentile “All-WD” SO ₂ Monthly/Annual Tables (April to June 2014-2021).....	E-7
Table E.7: The 10 th percentile “All-WD” SO ₂ Monthly/Annual Tables (July to September 2014-2021)....	E-8
Table E.8: The 10 th percentile “All-WD” SO ₂ Monthly/Annual Tables (October to December 2014-2021) E- 9	
Table E.9: The Wind Direction Screened SO ₂ Percentile by Hour of the Day and by Month Tables (January and February for entire 2014-2021 Period) with 25 th percentile and 50 th percentile Values Highlighted in “Red”	E-11
Table E.10: The Wind Direction Screened SO ₂ Percentile by Hour of the Day and by Month Tables (March and April for entire 2014-2021 Period) with 25 th percentile and 50 th percentile Values Highlighted in “Red”	E-12

Table E.11: The Wind Direction Screened SO ₂ Percentile by Hour of the Day and by Month Tables (May and June for entire 2014-2021 Period) with 25 th percentile and 50 th percentile Values Highlighted in “Red”	E-13
Table E.12: The Wind Direction Screened SO ₂ Percentile by Hour of the Day and by Month Tables (July and August for entire 2014-2021 Period) with 25 th percentile and 50 th percentile Values Highlighted in “Red”	E-14
Table E.13: The Wind Direction Screened SO ₂ Percentile by Hour of the Day and by Month Tables (September and October for entire 2014-2021 Period) with 25 th percentile and 50 th percentile Values Highlighted in “Red”	E-15
Table E.14: The Wind Direction Screened SO ₂ Percentile by Hour of the Day and by Month Tables (September and October for entire 2014-2021 Period) with 25 th percentile and 50 th percentile Values Highlighted in “Red”	E-16
Table F.1: The 5 th percentile PM _{2.5} “All-WD” Monthly/Annual Tables (January to March 2014-2021)	F-2
Table F.2: The 5 th percentile PM _{2.5} “All-WD” Monthly/Annual Tables (April to June 2014-2021)	F-3
Table F.3: The 5 th percentile PM _{2.5} “All-WD” Monthly/Annual Tables (July to September 2014-2021) ...	F-4
Table F.4: The 5 th percentile PM _{2.5} “All-WD” Monthly/Annual Tables (October to December 2014-2021)F-5	
Table F.5: The 10 th percentile PM _{2.5} “All-WD” Monthly/Annual Tables (January to March)	F-6
Table F.6: The 10 th percentile PM _{2.5} “All-WD” Monthly/Annual Tables (April to June)	F-7
Table F.7: The 10 th percentile PM _{2.5} “All-WD” Monthly/Annual Tables (July to September)	F-8
Table F.8: The 10 th percentile PM _{2.5} “All-WD” Monthly/Annual Tables (October to December)	F-9
Table F.9: The Wind Direction Screened PM _{2.5} Percentile by Hour of the Day and by Month Tables (January and February for entire 2014-2021 Period) with 25 th percentile and 50 th percentile Values Highlighted in “Red”	F-10
Table F.10: The Wind Direction Screened PM _{2.5} Percentile by Hour of the Day and by Month Tables (March and April for entire 2014-2021 Period) with 25 th percentile and 50 th percentile Values Highlighted in “Red”	F-11
Table F.11: The Wind Direction Screened PM _{2.5} Percentile by Hour of the Day and by Month Tables (May and June for entire 2014-2021 Period) with 25 th percentile and 50 th percentile Values Highlighted in “Red”	F-12
Table F.12: The Wind Direction Screened PM _{2.5} Percentile by Hour of the Day and by Month Tables (July and August for entire 2014-2021 Period) with 25 th percentile and 50 th percentile Values Highlighted in “Red”	F-13
Table F.13: The Wind Direction Screened PM _{2.5} Percentile by Hour of the Day and by Month Tables (September and October for entire 2014-2021 Period) with 25 th percentile and 50 th percentile Values Highlighted in “Red”	F-15

Table F.14: The Wind Direction Screened PM _{2.5} Percentile by Hour of the Day and by Month Tables (November and December for entire 2014-2021 Period) with 25 th percentile and 50 th percentile Values Highlighted in “Red”	F-16
--	------

1 Executive Summary

Fort McKay undertook a study to identify and apply methodologies to estimate the baseline air quality that would exist in the community in the absence of oil sands development emission influences. Nine baseline estimating methodologies were identified and two methodologies were selected for use in baseline estimating. Both these methodologies used air quality data from the Fort McKay Bertha Ganter air monitoring station with one involving wind direction (WD) screening to select WDs with no to minimum oil sands emission influences and the other using all WDs but selecting lower air quality percentile values to reflect periods when oil sands emission influences were absent or very low. For each method, temporal variability factors i.e. hour of the day, day of the week, month, season (warm weather and cold weather, and by year variability, were assessed and, when applicable, considered in the baseline estimates. Wind speed as a variable was also assessed but ultimately not used in baseline estimating.

SO₂, PM_{2.5} and NO₂ were the parameters selected for baseline setting as ambient levels of these criteria air contaminants are significantly impacted by oil sands emissions and the impact of oil sands emissions on these parameters are part of almost all regional air quality modelling and environmental impact assessments. To ensure the datasets used in the analysis reflected the use of current air quality measurement technologies and associated QA/QC practices, 2014 to 2021 data was used. The analysis approach used resulted in datasets that show the impact that temporal variability factors have on baseline estimates and the variability in each of the datasets used to estimate baseline values.

The following Table summarizes the proposed interim baselines for SO₂, PM_{2.5} and NO₂ and the basis for the estimate. The range of baselines for each parameter reported in the literature are also shown as are the results of a very recent modelling of “no oil sands emission” SO₂, PM_{2.5} and NO₂ ambient levels in the oil sands region and in Fort McKay which was conducted under the Oil Sands Monitoring Program. The data in this Table would indicate that the proposed interim baseline levels for SO₂, PM_{2.5} and NO₂ are supported by the literature and modelling estimates of baselines.

Baseline Estimate Approach	Baseline Estimate for Noted Parameter		
	PM _{2.5} (µg/m ³)	SO ₂ (ppb)	NO ₂ (ppb)
Low Percentile All Wind Direction (“All WD”)	1.80	0.09	0.45
Literature	1-4	0.03-0.16	0.02-0.7
Modelling	2.15	0.08	0.42
Comment	The 10%ile “All WD” is proposed and is consistent with a recent Health Canada “background” PM _{2.5} estimate	The 5 %ile “All WD” was used which is consistent with both modelling and literature estimates	The 5 %ile “All WD” was used which is consistent with modelling and in the range of literature estimates

The following “full report” summarizes in detail the approaches considered for baseline estimating, the evaluation and assessment of the temporal and wind speed factors that were evaluated and the results of all these assessments and the final by hour of day, by month and by year baseline estimates that were

used to estimate single hourly baselines and seasonal (warm and cold) baseline hourly estimates. Summaries of literature based baseline estimates are also outlined. The basis for selecting the proposed baseline estimates from the four separate baseline estimates that were calculated is also provided.

2 Introduction

Baseline air quality or background pollutant levels and the natural range of variability associated with these baselines is an essential concept for assessing the direction and magnitude that certain influences have on air quality. Quantifying the magnitude of baseline levels is challenging. Certain oil sands (OS) projects have been required (CNRL, 2002; Shell, 2012; Teck Resource Limited, 2011), and continue to be required (IAAC, 2022), to assess project and cumulative air emission impacts relative to a pre-oil sands development air quality baseline. Recently, pursuant to the Impact Assessment Act, the Impact Assessment Agency of Canada's (IAAC) Tailored Impact Statement Guidelines for the Suncor Base Mine Extension Project (IAAC, 2022) required that Suncor: *"...utilize Indigenous knowledge and input to establish baseline conditions"*. In this regard Suncor has requested that Fort McKay provide input/suggestions on setting air quality baseline conditions.

To date, there has been no "official" or "formally recognized" pre-oil sands development air quality baseline or any agreed to approach(es) for setting such a baseline or for setting any type of temporal and/or spatial air quality baselines for the OSR. Several different approaches have been used in the past to establish a pre-oil sands development air quality baseline for Fort McKay and the oil sands region (OSR).

In response to Suncor, and to build consensus on baseline levels and community pre-oil sands development ambient air quality levels, the Fort McKay Sustainability Department (FMSD), through its air consultants, has examined possible approaches that consider and represent Fort McKay's perspectives. In this document, "baseline" refers to pre-oil sands development, i.e. circa 1965, community air quality conditions.

The proposed interim SO₂, NO₂ and PM_{2.5} air quality baselines for Fort McKay presented in this document are based on the work to date on baselines. FMSD's consultants attempted to identify, at a conceptual level, some of the factors that need to be considered in the development and application of baseline setting approaches. Several approaches that have been or are being used to set baselines were reviewed. These are outlined in this report as well as other approaches identified for possible use in the oil sands region (OSR). Based on this assessment, specific baseline setting methods were then selected and applied to develop baseline SO₂, NO₂ and PM_{2.5} air quality levels for Fort McKay. The results of this application are provided in this report. They are considered by Fort McKay to represent interim baselines for the purpose of motivating and informing discussion among stakeholders to formally establish a OSR baseline setting methodology and address Suncor's baseline input request to Fort McKay.

3 Baseline Determination Considerations

Air quality at a location is a function of:

- the magnitude of local, regional and/or global natural and anthropogenic emission sources influencing air quality at that location, and
- the physical and chemical nature of these sources,

with meteorology and atmospheric transport and chemical and physical processes ultimately determining the magnitude and the nature of these emission influences (Finlayson-Pitts & Pitts, 2000; Wallace & Hobbs, 2006).

In the determination or setting of baseline air quality, these factors need to be identified, evaluated and considered. Also, the intended purpose(s) and uses of “baseline” air quality estimates need to be defined as these will determine which emission sources are included and/or excluded and the spatial and/or temporal limits that need to be considered.

3.1 Defining “Baseline(s)”

A review of some literature that included “baseline” definitions indicated that all “baseline” definitions include a natural background but that this natural background, in some cases, has certain natural influences removed (e.g. wildfires). The anthropogenic influences that are included in setting a “baseline” also varied, reflecting the purpose/use of the “baseline.” For the purposes of establishing “interim” baseline air quality levels for Fort McKay, the following definition of “baseline” was adopted:

- *“air quality arising from local natural processes together with those transported from outside the OSR into the OSR airshed (which may be both natural or anthropogenic in origin) as well as including normal regional human activity in the OSR but not specific community (i.e., Fort McKay) influences.”*

This “baseline” definition is consistent with the “natural background” definition used in a CEMA Trace Metal and Air Contaminants (TMAC) commissioned study which, as noted in Appendix 1, had the objective of developing “... a transparent, defensible methodology for generating representative background concentrations for communities in the Oil Sands Region, with the focus being on the community of Fort McKay.” (Golder Associates, 2005).

The proposed “baseline” air quality definition is depicted in Figure 1. Error! Reference source not found.. Of note is that it excludes community air quality influences and therefore represents air quality that would exist in the area where the Fort McKay Community is located in the absence of community influences. The advantage of excluding community influences, which are continually changing as a function of community size and activities, changing vehicle emission requirements, home heating methods, etc., is that the “baseline” then remains somewhat constant over time, recognizes that community/urban development is at least partially driven by OS growth, and that it can also support evaluation of the community’s impact on air quality relative to the “baseline.”

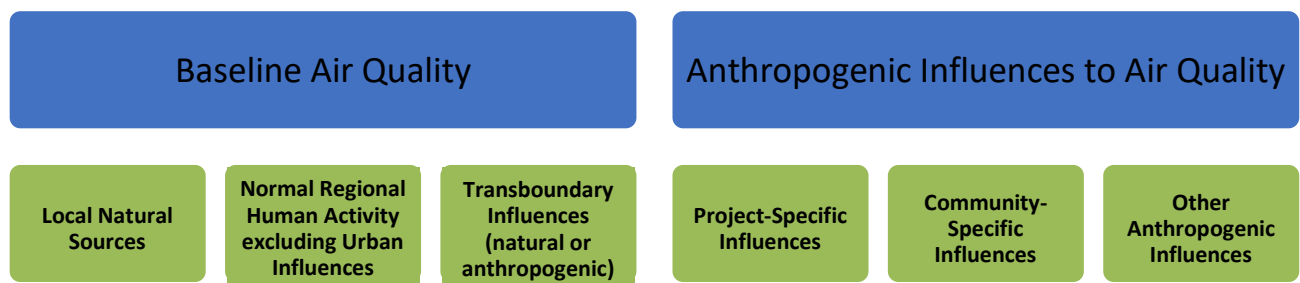


Figure 1: Proposed Definition for the Baseline Air Quality and Anthropogenic Influences on Air Quality to the OSR

3.2 Review of Baseline Setting Methods

Table 1 summarizes a range of methods that can be considered for use in determining air pollutant concentrations representative of “baseline” air quality. Figure 2 categorizes these methods based on information availability. **Appendix A** summarizes some of these approaches in more detail.

Table 1: Overview of Methods for Estimating Baseline Air Pollutant Concentrations.

Method	Description
1 historical monitoring data	Using historical ambient air quality monitoring data from relevant geographic location(s) that were obtained within time period(s) prior to OS development and prior to emissions from other sources that should be excluded based on Figure 1 (i.e., no AQ impacts from anthropogenic influences as defined in Fig. 1).
2 current monitoring data background	Using more-recent air quality data that were obtained at relevant location(s) which are not impacted by local/regional anthropogenic influences (Error! Reference source not found.)
3 wind direction-air quality analysis	Isolating portions of more-recent air quality data from relevant location(s) that are minimally impacted by anthropogenic influences because these locations have air concentrations from certain wind directions that indicate no to minimal air quality influences from sources that are intended to be excluded from the “baseline.” The upwind spatial area of interest is defined by at least one or more wind direction arcs which are likely to have no or minimal local or regional anthropogenic source influences. In this assessment 16 cardinal wind point directions (i.e. 22.5° wind direction arcs) were used (see Table 2).
4 percentile air quality analysis	Isolating portions of more-recent air quality data from relevant location(s) from the lower end of the concentration distribution which is expected to be indicative of periods that represent no to minimal anthropogenic influences. Practically, this involves identifying a lower percentile air quality concentration, e.g. 5 th percentile or 10 th percentile, from relevant air quality monitoring site data.
5 wind direction – percentile air quality analysis	Isolating portions of data by combining methods 3 & 4. Practically, the data associated with wind directions of minimal impact are first selected and then the baseline is estimated from a certain percentile value from this portion of the data.
6 air quality data – model prediction	Using the remainder of the difference between observed air pollutant concentrations at locations in the relevant geographic area and air quality model predictions for these locations that only include an emission inventory of the OS related activities. This method would be impacted by community emission influences if the location(s) used is/are within or nearby to a community.
7 modelling only	Air quality model prediction estimates for the relevant geographic area where the emission inventory used, which is on a continental scale, does not include OS and community emissions from the OSR with the estimates of “background” air quality coming from the model predictions at locations around the perimeter of the OSR.

Method	Description
8 satellite air quality analysis	Using satellite data products representing air pollutant concentrations over regions that are around the perimeter of the OSR and are shown to be indicative of regional background conditions (i.e., minimal OS emission impacts). Once the relevant geographic regions are identified then either monitoring station data from locations in this region or surface concentration estimates from the satellite are used to estimate baseline.
9 literature/other source baseline	Using literature reports or other publications with estimated or measured “baseline” levels that can be shown to be, or are assumed to be, a reasonable estimate of the “baseline” in the OS area and for the time period of interest.

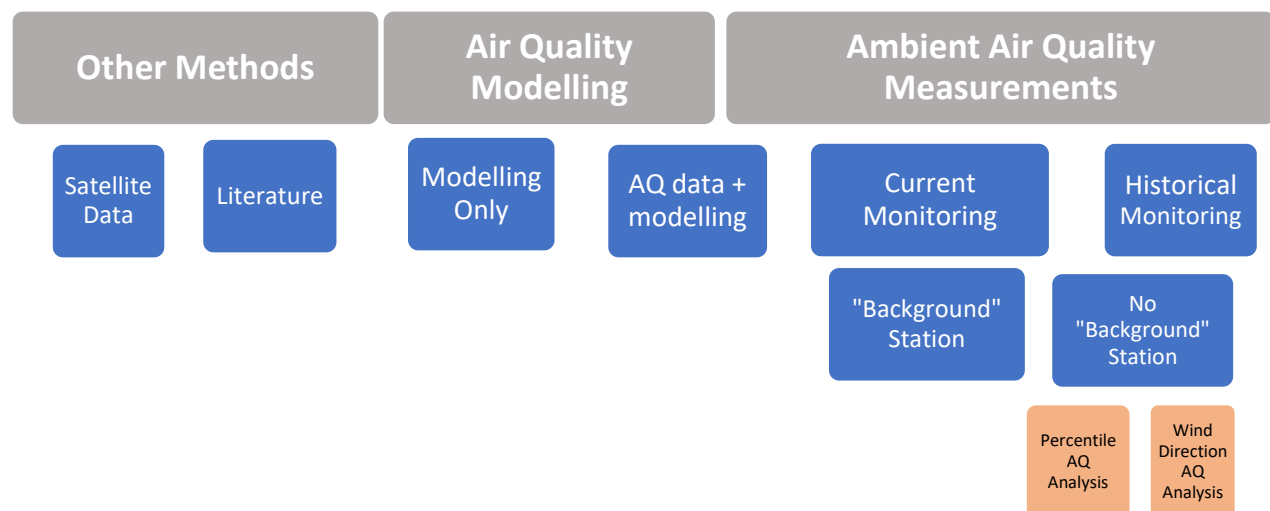


Figure 2: Methods for estimating baseline air pollutant concentrations categorized by information availability

In terms of method 2 outlined in Table 1, the air quality in the indigenous community of Fort Chipewyan, which is approximately 140 km north of the nearest oil sands emission source, is often considered as a background air quality station in project air assessments. Fort McKay has conducted data analysis that show this station, despite being in the northern edge of the AOSR airshed, is influenced by air emissions from the south (i.e., oil sands operations). Therefore, air quality monitoring data from this station, like those from the other stations, is not considered an appropriate baseline without the proper analysis applied to remove observations that reflect regional influences from the oil sands development.

Table 2: The 16 Cardinal Wind Directions Used and the Wind Direction Degrees Each Represents

Cardinal Wind Direction	Wind Degree Range
N (North)	$348.75^{\circ} \leq WD < 11.25^{\circ}$
NNE (North-northeast)	$11.25^{\circ} \leq WD < 33.75^{\circ}$
NE (Northeast)	$33.75^{\circ} \leq WD < 56.25^{\circ}$
ENE (East-northeast)	$56.25^{\circ} \leq WD < 78.75^{\circ}$
E (East)	$78.75^{\circ} \leq WD < 101.25^{\circ}$

Cardinal Wind Direction	Wind Degree Range
ESE (East-southeast)	$101.25^{\circ} \leq \text{WD} < 123.75^{\circ}$
SE (Southeast)	$123.75^{\circ} \leq \text{WD} < 146.25^{\circ}$
SSE (South-southeast)	$146.25^{\circ} \leq \text{WD} < 168.75^{\circ}$
S (South)	$168.75^{\circ} \leq \text{WD} < 191.25^{\circ}$
SSW (South-southwest)	$191.25^{\circ} \leq \text{WD} < 213.75^{\circ}$
SW (Southwest)	$213.75^{\circ} \leq \text{WD} < 236.25^{\circ}$
WSW (West-southwest)	$236.25^{\circ} \leq \text{WD} < 258.75^{\circ}$
W (West)	$258.75^{\circ} \leq \text{WD} < 281.25^{\circ}$
WNW (West-northwest)	$281.25^{\circ} \leq \text{WD} < 303.75^{\circ}$
NW (Northwest)	$303.75^{\circ} \leq \text{WD} < 326.25^{\circ}$
NNW (North-northwest)	$326.25^{\circ} \leq \text{WD} < 348.75^{\circ}$

4 Estimating Fort McKay's Baseline: The Approach

4.1 Overview

An assessment of the methods in **Table 1** was undertaken based on the available information and historical data to determine the most viable options. The main assessment criteria were: practicality; how the method might be applied in an OSR context; and the integrity and reliability of the resultant “baseline” values. The conclusion from this assessment was that methods based on actual ground-level air quality measurements, where such measurements were available, and which had the requisite detection limits, represent the most-appropriate methods and can yield “baseline” estimates consistent with the definition based upon **Error! Reference source not found.** The two baseline setting methods meeting these criteria were the:

- ***“wind direction-air quality analysis method”***; and
- ***“percentile air quality analysis method”***.

These two methods were assessed for possible use in establishing interim NO₂, SO₂, TRS, THC, NMHC, PM_{2.5} and O₃ baseline concentrations for Fort McKay. While these seven pollutants were initially assessed, it was decided to focus on baseline estimates for SO₂, NO₂ and PM_{2.5} and the basis for this decision is discussed in Section 4.7.

Narrowing down this assessment to the two observation-based methods was not intended to entirely discount the use of modelling as a baseline setting tool. However, the resources required to employ the appropriate models, including development of multiple detailed emission inventories, particularly for non-point sources, was deemed to be impractical and likely too dependent upon multiple layers of assumptions that would be difficult to evaluate. Satellite data were considered too limited in terms of spatial and temporal resolution for the pollutants that can be measured accurately by instrumentation at continuous air monitoring stations. Nonetheless, both these methods could lead to valuable temporal and spatial insight on site-specific measurement-based “baseline” estimates if applied to complement what the measurement-based methods show.

The wind direction and percentile methods are conceptually similar, in that they are based on finding the portion of the selected air quality dataset that is representative of “background” air quality, either

based on wind direction (WD) and/or concentration level. Physically, for the oil sands region, these approaches select the periods, from the entire measurement period, when the observations represent the conditions when the emissions from the oil sands development had minimal impact on air quality in Fort McKay. Using percentiles and/or wind directions can provide an objective way of selecting potentially relevant time periods or portions of the data from which to estimate the baseline concentration. However, both approaches have limitations.

4.2 Percentile Analysis

With the percentile method, the critical question is: what percentile is representative of “baseline” conditions? An example of a percentile distribution is shown in Figure 3 which shows the percentile distribution of hourly NO₂ levels recorded in Fort McKay from 2014 to 2021. Of note is the smooth increase from lowest to highest values indicating there is no obvious threshold. However, the increase at the lower percentiles is gradual suggesting that the resulting baseline concentration is less sensitive to selection of percentile at the lower end of the distribution. A percentile from the lower end of the distribution is likely to be most appropriate, but the percentile value selected is nonetheless arbitrary and potentially time period and location specific.

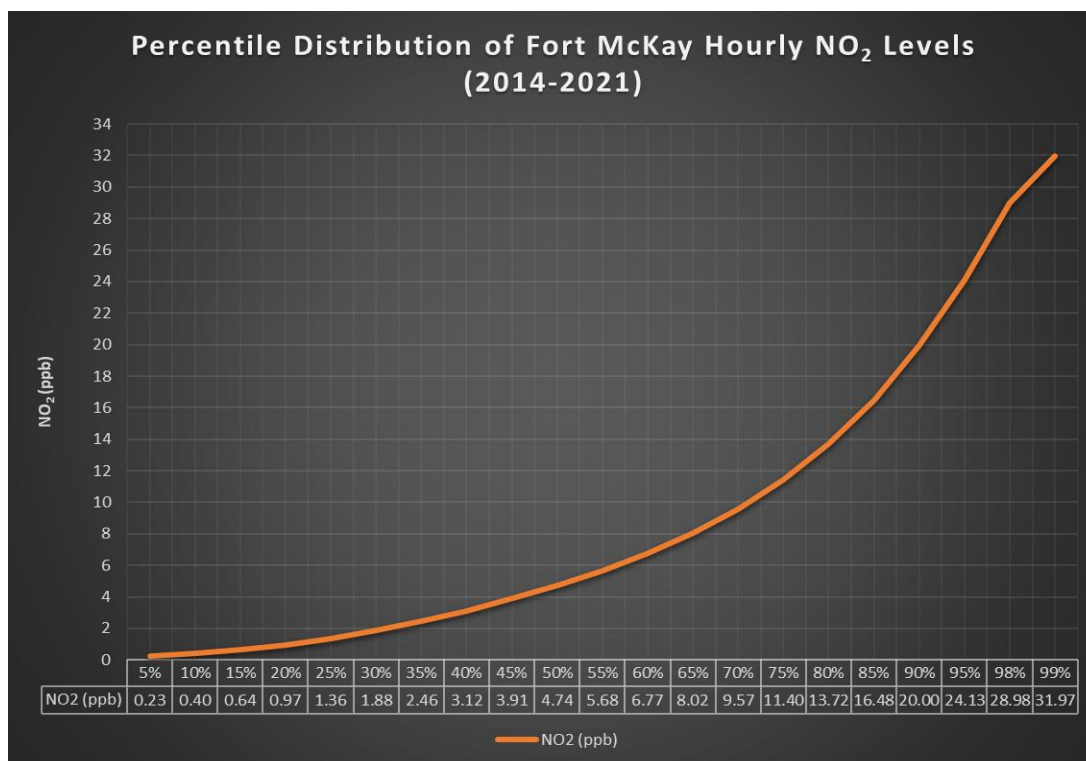


Figure 3: Percentile Distribution of Fort McKay Hourly NO₂ Levels (2014-2021)

A 10th percentile concentration was used by Health Canada (1999) to define a “clean air” day. Vingarzan (2007) compared mean 10th percentile and 30th percentile PM₁₀ and PM_{2.5} concentrations at several minimally anthropogenically influenced monitoring stations in Canada to estimate “background” concentrations. This was undertaken in the context of health impacts and to help identify priority areas for PM management. Vingarzan (2007) found that there are some limitations in using broadly derived

background PM levels versus location specific background PM concentrations based on airshed measurement data.

Another consideration in the application of the percentile method is temporal variability within air quality datasets. For example, if the method is used to directly screen an entire multi-year dataset of hourly observations, the lower percentile values may more frequently represent certain times of year and/or times of day, depending upon natural seasonal and diurnal patterns in the levels of the pollutant being studied. This could lead to an estimated baseline that is biased towards the cleanest times which systematically occur within known “cleaner periods of time” resulting in a baseline value that is not representative of background conditions during other parts of the year or times of the day when natural variations lead to higher levels, even when no pollutant sources are impacting the measurements. An approach to assess this temporal issue, and adjust for it, is described below. Essentially, stratified analyses based upon temporal indicator variables for season (month), time of day, day of week and year were undertaken to assess the extent that these factors could influence the resulting baseline estimates.

In evaluating the percentile analysis method it became apparent that the percentile algorithm used in the software could affect baseline estimates. In this analysis Microsoft Excel was used which has two percentile algorithms (i.e., percentile.exc and percentile.inc). Each algorithm uses a slightly different approach for assigning a percentile rank and therefore a percentile value to each data point in the dataset. Both algorithms interpolate between the ranked values to give the desired percentile values (e.g. the 5th percentile, 10th percentile, 25th percentile etc.). In analyzing the datasets resulting from the temporal consideration outlined in Section 4.4, it became apparent that, under certain dataset conditions, algorithm selection significantly influences the resultant percentile value. For small datasets and small percentiles, the percentile.exc algorithm was used as it gives what are considered more representative 5th percentile and 10th percentile values. The percentile.inc algorithm essentially excludes the lowest dataset point from the dataset percentile determination (i.e. it treats this datapoint as a 0th percentile). In a small dataset (e.g. 30 datapoints), the lowest datapoint represents 3.3% of the dataset. For larger datasets and/or higher percentile values, both percentile approaches give very similar values and therefore the percentile.exc algorithm was used for all the percentile data analysis. See Hyndman and Fan (1996) and Wikipedia (2023) for more information on the different approaches for estimating percentiles and the algorithm differences between percentile.inc and percentile.exc.

4.3 Wind Direction Analysis

Wind direction (WD) analysis of air quality data is frequently used to locate emission sources and to identify the wind direction(s) resulting in the highest ambient pollutant at a location (Henry, 2008). Pollution roses are a common data analysis tool used to study air quality as they pictorially show what wind directions are associated with higher and lower pollutant levels. Figure 4 is an example of a pollution rose for the Bertha Ganter air monitoring station (AMS) in Fort McKay which shows the prevailing wind directions (North-South) over the period 2014-2021 and that the highest SO₂ levels in the community (yellow colours on the plot) are associated with winds from the SSE-SSW. This finding is as expected as the two oil sands facilities with the largest oil sands SO₂ emissions are located SSE-SSW of Fort McKay.

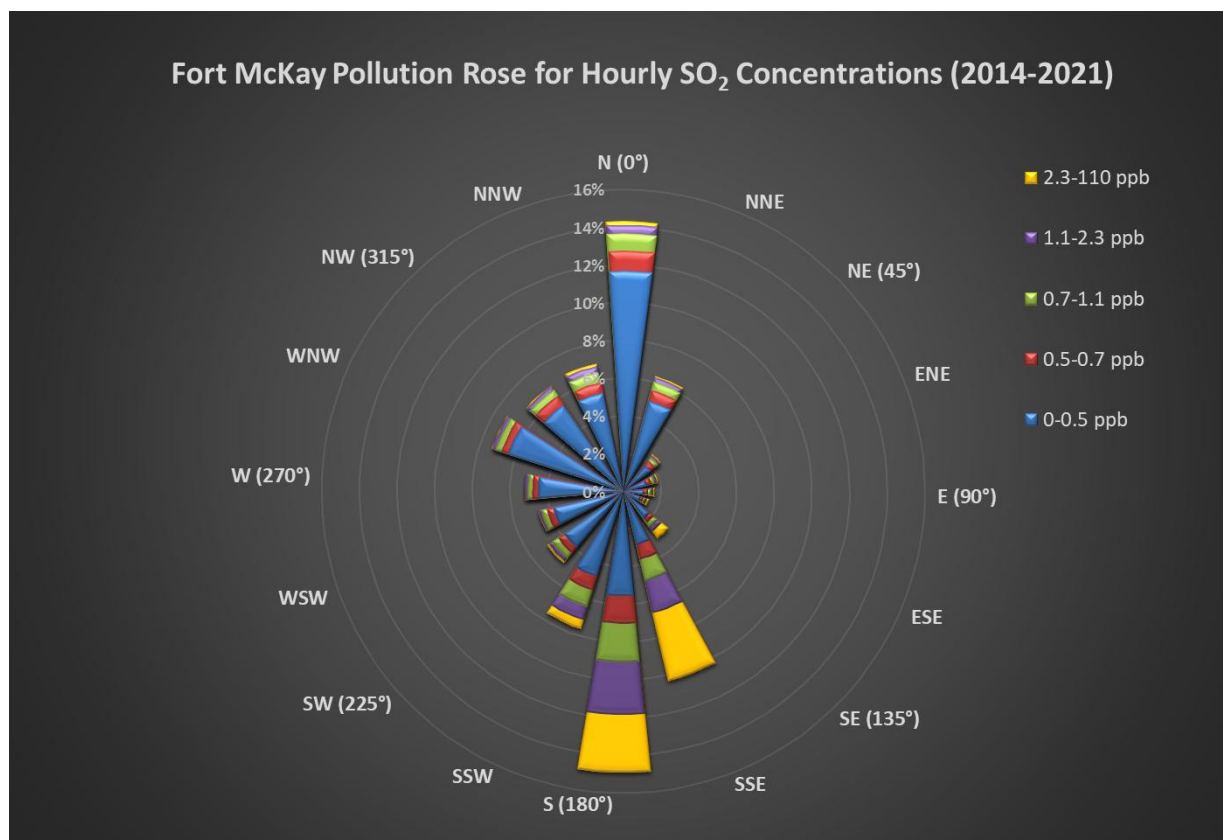


Figure 4: Pollution rose of 2014-2021 hourly SO₂ concentrations in Fort McKay. The longer the bars (i.e., slices of the 'pie') the more common the wind direction. The more prominent the yellow shaded sections are relative to the other colours, the more common are higher SO₂ concentrations when that wind direction occurs.

Logically, the wind directions associated with the lowest pollutant concentrations should provide an indication of the characteristics of baseline AQ. There are limitations associated with employing wind roses in this manner to identify (screen) wind directions (WD) with baseline concentrations. This approach uses WD from a ground-level (10 meter) monitoring station where pollutant observations and wind direction and wind speed data are obtained, but wind data from a single station may not be representative of WDs further upwind or aloft. The actual path pollutants follow once emitted can be complex depending upon terrain and meteorological conditions which change over time. As a result, observations that are selected because they are associated with winds from within a directional sector with no expected anthropogenic source may still have been impacted by anthropogenic sources. Limitations in using single station wind roses are also more significant under low wind speed (WS) conditions and thus these periods are often excluded from consideration, which may bias the resulting baseline AQ estimates.

Back-trajectories can be a better tool to characterize wind flow paths and the potential impact of upwind sources. Figure 5, a HYSPLIT (Stein et al., 2015) back trajectory analysis for the January 5-6, 2020 period, is an example of the variability in the wind flow pattern occurring when a single station (i.e., Fort McKay) data indicated the air was coming from a low impact wind direction (LIWD), in this case W to WNW, the entire time. The back trajectories show that farther upwind for some of this LIWD period the wind had curved with the wind flow path potentially crossed areas with emissions from the oil sands.

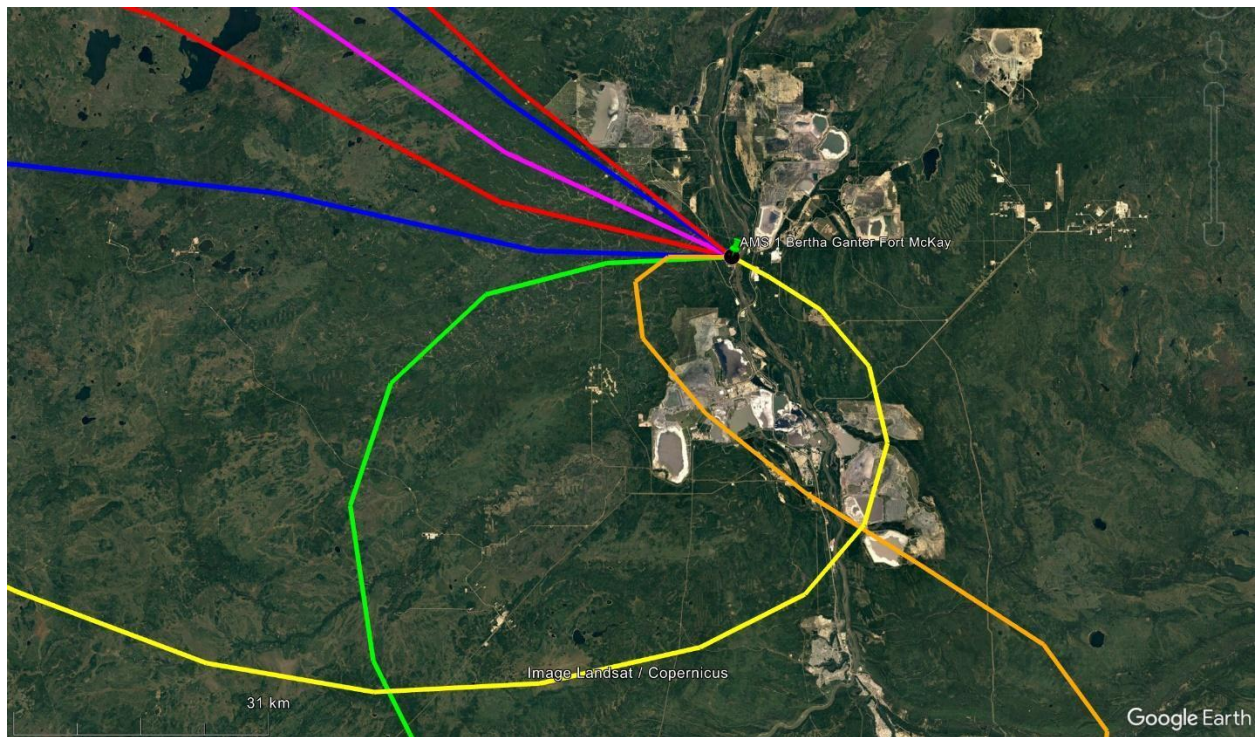


Figure 5: HYSPLIT Back Trajectory Modelling for the LIWD starting January 5th at 14:00 hrs and finishing on January 6th at 03:00 hrs. Each coloured line is a back trajectory arriving at Fort McKay and estimates the wind flow path bringing air parcels and the pollutants contained in them to Fort McKay at a different time point during this 13-hour period (approx. one trajectory per 2 hours). Of note is that for most of this period the Fort McKay WD was from the WNW (i.e., a low concentration direction based upon the wind rose) yet some of the hourly air pollutant levels were high. Although the WD gradually changed based ground-level measurements in Fort McKay, it remained mostly from the westerly direction. However, in also accounting for wind direction changes upwind the group of trajectories shows a possible explanation for the high pollutant concentration hours. The orange trajectory had a westerly WD in its last hour (the path nearest Fort McKay) but with the trajectory covering the period (upwind) of 16:00 hrs January 5th to 02:00 hrs January 6th the path of the wind curved counterclockwise upwind passing over areas with facility emissions. Once the wind pattern over the region stabilized there was a longer period (approximately 16 hours) when the winds all along the trajectory paths (blue, red and pink) were from the WNW and pollutants levels were low reflecting this absence of upwind emission sources.

Given the two limitations discussed above, it is not surprising that analyses using the single station WD approach on Fort McKay data were not able to produce a reasonable background estimate. Therefore, a hybrid approach was assessed whereby observations from the clean wind direction sector(s) are first identified and then a percentile criterion is set that serves to exclude the higher concentrations that are potentially influenced by anthropogenic sources (“WD screened” percentile method). Since data used here have first been WD screened to minimize the likelihood of local/regional anthropogenic influences, the percentile value in this hybrid approach does not need to be as low as when the percentile method is applied to the entire or “all WD” dataset. However, setting the appropriate percentile in this approach is still arbitrary and hence must be selected based upon the judgment of the analyst.

As with the “all WD” percentile method, temporal variations in the background can also influence the resulting baseline values determined from the “WD screened” percentile method. However, once the dataset is reduced to the LIWD further stratification to assess temporal effects is more sensitive to uncertainties due to the smaller amount of data available. As a result, inter-annual temporal variability cannot be assessed using the “WD screened” percentile method unless LIWDs cover a large wind degree range e.g. 67.5° or 90° and/or a large number of data years e.g. 15 to 20. The dataset used in this analysis was not large enough to assess inter-annual temporal variability but despite this limitation, “WD screened” percentile method should lead to potentially useful baseline estimates and thus, was fully assessed in this report.

In the sections below, results from applying these two approaches, with and without temporal factors being considered, provide insight regarding the baseline determination methodology most appropriate for Fort McKay. In the case of the first approach, 5th percentile and 10th percentiles were selected, while for the “WD Screened” percentile method, 25th percentile and 50th percentiles were considered. The rationale for selecting and using the hourly, monthly and annual temporal factors is outlined in the next section.

For the bulk of the analyses presented, hourly air quality data from the Fort McKay Bertha-Ganter air monitoring station (AMS 1) covering the period 2014-2021 are used. This eight-year period was used because it is more recent and because there was a general consistency in the air pollutant measurement technologies in operation at the WBEA sites, including Fort McKay.

4.4 Temporal and Wind Speed Adjustments

Temporal variability in background air quality can result from variability in the natural emissions of trace gases and particles, in solar radiation and in meteorology. The latter two factors can also influence natural emission rates and atmospheric processing, which in turn can have a significant impact on ambient concentrations of the naturally occurring trace gases and particles (Colls, 2002). These processes are discussed further in Appendix B and, due to their potential influence, temporal variations in baseline values were explored using hourly NO₂, SO₂, TRS, THC, NMHC, PM_{2.5} and O₃ in Fort McKay (AMS1) for the 2002-2021 period.

The temporal and WS factors/impacts considered for both the ‘all WD’ and the ‘WD screened’ percentile approaches were:

- hour of the day;
- day of the week;
- month of the year;
- year; and
- low wind speed.

Specifically, the 10th percentile “all WD” and the 50th percentile WD screened baseline estimates were done separately for each hour of the day, for each day of the week, for each month of year and for each year in the 2002-2021 period. Windspeeds thresholds of >1 km/h, >2 km/h and >3 km/h were also applied. A more detailed analysis of the possible impacts of WS on baselines estimates was undertaken which considered WSs up to 6 km/h (**Appendix C.5**).

After the baseline value is determined separately for the temporal stratification of interest each value is averaged (i.e., an average of 24 or 12 estimates in the case of hour and seasonal influences,

respectively) to produce an overall temporally *adjusted* baseline estimate. This value is then compared to the no temporal/WS consideration estimates to assess the impact of accounting for temporal factors. In the case of the hour of the day temporal consideration, this gives equal weight to the baseline determined for each hour of the day. In contrast, if all the same data are used, without the hour stratification (referred to as no temporal strata in **Tables 3** and **4**), then the resulting baseline estimate may be weighted towards certain hours when concentrations tend to be less.

The results of the assessments of each of the temporal variables and of the wind speed variable, are presented in **Appendix C** for the 10th percentile “all WD” and 50th percentile “WD screened” approaches for SO₂, NO₂ and PM_{2.5}. **Table 3** (the 10th percentile “all WD”) and

Table 4 (the 50th percentile “WD screened”) summarize the results. (Note: While the focus of the proposed interim baseline setting was on SO₂, NO₂ and PM_{2.5}, this temporal adjustment assessment was also done for TRS, THC, NMHC and O₃)

Overall, the results indicate that considering temporal and WS factors can lead to significantly different percentile-based baseline estimates compared to exclusion of these factors, but with the significance of each factor being somewhat pollutant specific. The two factors that had the largest influence on baseline estimates were month of the year (i.e., seasonality) and dataset year. For example, if the “all WD” baseline NO₂ estimate using the 10th percentile is adjusted for monthly variations then the value increases from 0.27 ppb to 0.42 ppb (**Table 3**). Adjusting for interannual variability (“by year”) increases the value from 0.27 ppb to 0.35 ppb. Overall, among the pollutants, interannual variability in the baseline tended to have the greatest range of baseline estimates, which would indicate that the selection of the period/years to be used for baseline setting is most important. Although, for NO₂ and O₃, the seasonal variability (“by month”) was more important.

Table 3: Baseline Estimates for NO₂, SO₂, TRS, THC, NMHC, PM_{2.5} and O₃ in Fort McKay Based on Hourly Data for the Period 2002-2021 using an “All WD” 10th percentile Approach with and without the Noted Temporal and Wind Speed Considerations and the Average and Range of All the Individual Baseline Estimates

Parameter	Baseline Approach	No Temporal Strata	Hour of Day			Day of week			Month of the Year			By Year (2002-2021)			Wind Speed Screening			Average of all Estimates	Range of Averages	No Temporal Strata
			Hour of Day Based Baseline	Std. Dev.	Range	Day of the Wk Based Baseline	Std. Dev.	Range	Month of the Yr Based Baseline	Std. Dev.	Range	By Year Based Baseline	Std. Dev.	Range	Winds >1 km/h	Winds >2 km/h	Winds >3 km/h			
NO ₂ (ppb)	10 th ile all WDs	0.27	0.28	0.10	(0.15-0.46)	0.26	0.02	(0.24-0.3)	0.42	0.33	(0.11-0.99)	0.35	0.23	(0-0.95)	0.25	0.24	0.20	0.28	(0.20-0.42)	0.27
SO ₂ (ppb)	10 th ile all WDs	0	0.001	0	(0-0.005)	0	0	(0-0)	0.02	0.04	(0-0.1)	0.05	0.04	(0-0.10)	0	0	0	0.009	(0-0.05)	0
TRS (ppb)	10 th ile all WDs	0.24	0.24	0	(0.23-0.26)	0.24	0	(0.22-0.25)	0.25	0.04	(0.2-0.32)	0.28	0.04	(0.2-0.32)	0.24	0.24	0.24	0.25	(0.24-0.28)	0.24
THC (ppm)	10 th ile all WDs	1.79	1.8	0	(1.71-1.8)	1.8	0	(1.8-1.85)	1.8	0.04	(1.72-1.87)	1.8	0.04	(1.72-1.88)	1.8	1.8	1.78	1.79	(1.78-1.82)	1.792
NMHC (ppm)	10 th ile all WDs	0	0	0	(0-0)	0.000	0	(0-0)	0.000	0.000	(0-0)	0.000	0.000	(0-0)	0	0	0	0.000	(0-0)	0
PM _{2.5} (µg/m ³)	10 th ile all WDs	0.92	0.93	0.09	(0.80-1.1)	0.92	0.04	(0.88-1)	0.97	0.20	(0.6-1.3)	1.1	0.20	(0.6-1.3)	0.93	0.9	0.88	0.95	(0.88-1.14)	0.92
O ₃ (ppb)	10 th ile all WDs	3.4	4.8	3.58	(1.4-11.8)	3.4	0.27	(3.05-4.00)	5.5	4.3	(1-14.5)	3.5	4.3	(1-14.5)	3.8	4.5	5.6	4.3	(3.4-5.6)	3.4

Table 4: Baseline Estimates for NO₂, SO₂, TRS, THC, NMHC, PM_{2.5} and O₃ in Fort McKay Based on Hourly Data for the Period 2002-2021 using a WD Screened 50th percentile Approach with and without the Noted Temporal and Wind Speed Considerations and the Average and Range of All the Individual Baseline Estimates

Parameter	Baseline Approach	No Temporal Strata	Hour of Day			Day of week			Month of the Year			By Year (2002-2021)			Wind Speed Screening			Average of all Estimates	Range of Averages	No Temporal Strata
			Hour of Day Based Baseline	Std. Dev.	Range	Day of the Wk Based Baseline	Std. Dev.	Range	Month of the Yr Based Baseline	Std. Dev.	Range	By Year Based Baseline	Std. Dev.	Range	Winds >1 km/h	Winds >2 km/h	Winds >3 km/h			
NO ₂ (ppb)	50 th ile WNW WD	0.90	0.96	0.62	(0.26-2.4)	0.90	0.08	(0.79-1)	1.52	1.267	(0.46-4.5)	1.07	0.91	(0.1-4.5)	0.82	0.67	0.50	0.92	(0.5-1.52)	0.90
SO ₂ (ppb)	50 th ile WNW WD	0.18	0.18	0	(0.156-0.2)	0.18	0	(0.15-0.20)	0.18	0.07	(0.11-0.34)	0.21	0.07	(0.11-0.34)	0.3	0.3	0.3	0.23	(0.18-0.3)	0.18
TRS (ppb)	50 th ile WNW WD	0.39	0.38	0	(0.35-0.41)	0.39	0	(0.38-0.40)	0.39	0.04	(0.31-0.45)	0.39	0.04	(0.31-0.45)	0.45	0.45	0.445	0.41	(0.38-0.45)	0.39
THC (ppm)	50 th ile WNW WD	1.92	1.9	0	(1.89-1.96)	1.9	0	(1.91-1.93)	1.9	0.03	(1.9-2.0)	1.9	0.03	(1.9-2.0)	2.0	2.0	1.96	1.94	(1.91-1.97)	1.92
NMHC (ppm)	50 th ile WNW WD	0	0	0	(0-0)	0.000	0	(0-0)	0.000	0.000	(0-0.0005)	0.001	0.000	(0-0.0005)	0	0	0	0.000	(0-0.001)	0
PM _{2.5} (µg/m ³)	50 th ile WNW WD	2.94	2.8	0.71	(1.76-3.97)	2.97	0.22	(2.7-3.3)	3.1	0.80	(1.84-4.60)	2.9	0.80	(1.8-4.6)	4.32	4.25	4.11	3.4	(2.8-4.3)	2.94
O ₃ (ppb)	50 th ile WNW WD	18.7	20.5	6.84	(11.4-30.18)	18.8	0.95	(17.8-20.6)	19.8	6.7	(13.3-37.4)	18.9	6.7	(13.3-37.4)	20.2	21.0	22.2	20.0	(18.7-22.2)	18.7

Day of the week and hour of the day factors had the least impact on baseline estimates. For example, for the “all WD” baseline for NO₂, the estimate increases from 0.27 ppb to 0.28 ppb when hour of the day is considered and decreases from 0.27 ppb to 0.26 ppb when day of the week is considered. Not surprisingly, the hour of day adjustment impacts O₃ the most given this pollutant’s well-known diurnal behaviour. The small impacts of the day of the week factor was expected based on the lack of an underlying physically based reason for baselines to vary by day of week. Furthermore, the nature of oil sands operations (i.e., 24-7 year-round operation) and associated activities (e.g., traffic, which does not have a large weekday vs. weekend pattern) and the relatively small size of Fort McKay, suggest that significant intra-weekly air pollutant levels and associated baseline concentrations would not be expected.

The minimal impact of the by hour of the day factor was not expected since, as shown in **Appendix C.1**, there are clear and strong diurnal patterns for many of pollutants. This would indicate that certain temporal factors may be countering the influence of other factors potentially highlighting the need to consider temporal factors collectively, which this analysis did.

While the temporal adjustments appear to have less impact for the 50th percentile “WD-screened” approach compared to the “all-WD” approach, the results are consistent. In both cases seasonal and interannual variability adjustments tend to have larger impacts on the baseline. The seasonal adjustment of the “WD-screened” approach has the largest impact for NO₂, increasing the baseline from 0.9 ppb to 1.5 ppb.

The WS factor also had a significant influence on baseline estimates, particularly for NO₂, TRS and PM_{2.5}. However, while removing low wind speeds addresses the issue of the uncertainties in WD measurement and wind patterns associated with low WSs, it also results in removing or eliminating calm periods when local natural emission source impacts on ground-level concentrations could be highest. Also, removing

low wind speed data from a dataset inherently removes higher data values in that higher wind speeds result in lower pollutant concentrations through dilution and increased ground-level turbulence and dispersion. Since wind characteristics (i.e. speed and direction) vary seasonally, it can be assumed that, to a degree, the influence of WS variation on baseline estimates is incorporated through the consideration of the temporal variability of pollutant ground level concentrations and is further addressed by selecting lower percentile criteria that may exclude underrepresented wind related influences. An examination of the issues related to removing WD uncertainties through WS screening is challenging and this issue is discussed further in **Appendix C**.

The conclusion from the temporal and WS factor analyses in this section is that all of the factors analyzed, with the exception of “by day of the week” and WS, need to be considered collectively. Among the factors, “by year” consistently has a relatively large influence on baseline estimates. There are multiple reasons for this impact, including longer term trends in regional pollutant levels and related emissions and changes in the monitoring technology used (e.g., improving instrument detection limits). This information is considered below in determining the monitoring time period to use for baseline estimates.

4.5 All WD vs. WD-Screened

Comparing **Tables 3** and **4** shows that greater differences in the baseline estimates result from the approach used as opposed to the impacts of temporal or WS factors. The “all WD” 10th percentile approach consistently leads to lower baseline estimates than the “WD screened” 50th percentile approach. However, as noted previously, there are two issues that need to be considered in this regard, which are:

- Whether the “all WD” approach is better than a “WD screened” approach in terms of estimating baselines. The “all WD” approach considers a full 360° of wind directions in the baseline estimate but is more likely to be affected by local/regional emissions (e.g. NO_x scavenging of O₃, or potentially underestimating the variability in non-local/non-regional air quality influences).
 - It is important to be aware that for the period 2002-2021 the “all WD” approach considers ~17,000 hourly readings in determining the 10th percentile whereas the “WD screened” approach, since it is limited to WNW WDs, has only ~5,500 hourly readings from which to obtain the 50th percentile value.
- The selection of the percentile values for each approach. In the comparisons in **Tables 3** and **4**, larger values were used (i.e., 10th and 50th vs. 5th and 25th), but in practice the optimal value is somewhat arbitrary and likely dependent upon location.
 - For a community like Fort Chipewyan, which is subject to some, but relatively minimal community and OS emission influences, higher percentiles could be sufficient when applying either approach. For example, the “all WD” 10th percentile NO₂ concentration for Fort McKay for the period 2002-2021 is 0.27 ppb, while in Fort Chipewyan the 10th percentile is lower and a NO₂ concentration of 0.27 ppb occurs near the 35th percentile. Similarly, in comparing these two locations based upon the “WD screened” approach the 50th percentile NO₂ concentration is ~0.9 ppb in Fort McKay for the period 2002-2021 while this concentration occurs at the 75th percentile in the Fort Chipewyan data.

These two issues imply that both percentile-based approaches require judgement in their application and that sensitivity analyses are required during of the estimation of the baseline to justify the

recommended approach and percentile criteria. Ultimately, the percentile criteria used is a function of the degree to which the location(s) of interest is (are) influenced by local or regional emissions.

4.6 Protocol for Baseline Estimates

Based on the results above, the approach or **protocol** for obtaining preliminary estimates of baseline values in Fort McKay involved the following steps:

- For the “All WD” approach both the 5th and 10th percentiles were determined and compared.
- For the “WD screened” approach both the 25th and 50th percentiles were determined for comparison.
- Yearly datasets covering the 2014-2021 period were used to ensure that baseline estimates are relevant for current air quality conditions and that the highest quality data are used in terms of measurement technology and QA/QC practices.
- Baselines were estimated with and without temporal adjustments.
 - For the “all WD” direction approach all three influential temporal factors are considered whereby:
 - 5th and 10th percentiles were determined separately for each year in the 8-year period, with the by hour of the day percentiles averaged for each month and then these 12 separate monthly baselines averaged to give the yearly average baseline;
 - The eight separate average baselines, one per year, were then averaged to give an overall average baseline estimate, one from the 5th percentiles and one from the 10th percentiles;
 - In each of these baseline generation steps standard deviations and ranges were calculated to provide basic statistics useful to define and/or understand the range variability in the baseline estimates.
 - For the “WD screened” approach, hourly and monthly stratifications were considered but the data were not broken into separate years.
 - Combining years ensured that the dataset was of sufficient size to allow more-robust estimates of the 25th and 50th percentiles by hour of day and month of year.
 - Then for the eight-year period the 12 separate monthly and 24 separate hourly percentiles, separately for the 25th and 50th percentile, were averaged and other basic statistics determined.

This procedure yielded four baseline values for each air pollutant. In addition, for each baseline estimating approach, seasonal estimates were generated with May through September considered the warm weather period and October through April considered the cold weather period.

The sensitivity analysis involved comparison among all the values to provide a range of potential baseline values to consider for the location of interest (e.g., Fort McKay).

Tables in subsequent sections demonstrate how this protocol was used to estimate baselines. Further evaluation of these estimates involved comparison with baseline estimates reported in the literature.

4.6.1 Additional Considerations in Applying the Protocol

As indicated above, for the Fort McKay baseline estimates presented here, the air quality dataset for the period 2014-2021 (8 years) was used on the basis that more recent datasets should in general reflect the most reliable and accurate data in terms of measurement technology, detection levels and instrument operation/calibration. In working with this dataset, which could have a maximum of 8x365x24 (N=70,080) hourly readings, several other steps needed to be considered:

- For the “all WD” 5th percentile and 10th percentile approaches, baselines were estimated for each of the eight years in the period by taking the average of each hour of day percentile for each month to give the baseline for that year. There is a dataset size challenge with this approach in that the number of hourly values in an annual dataset are approximately 8200 and analyzing such a dataset on a combined hour of the day and by month basis translates to the “all WD” 5th percentile and 10th percentile values being determined from 24-30 hourly value datasets, i.e. the 5th percentile would be based on the 1st and/or 2nd lowest value from an ~30 hour hourly values dataset, and the 10th percentile would be based on the 3rd lowest value in an ~30 hourly values dataset. As noted in Section 4.1 the Excel percentile.exc function was used to determine the 5th percentile and 10th percentile values.
- For the 25th percentile and 50th percentile WD screened baseline approach the dataset size limitation problem is magnified. For 16 cardinal wind directions, each wind direction would be expected to, on average, have in the range of 400-600 hourly readings annually. Analyzing such a dataset on a combined hour of the day and by month basis results in approximately only 2 readings for each hour in a month. Therefore, for the 25th percentile and 50th percentile WD screened baseline approach, the entire 8-year dataset, i.e. 2014-2021, needed to be treated as single dataset i.e. ~4000 hourly readings, which meant inter-annual variability could not be considered. With ~4000 hourly readings and using the by hour of the day and month approach, the 25th percentile and 50th percentile were selected from ~14 values. As noted in Section 4.1 the Excel percentile.exc function was also used to determine the 25th percentile and 50th percentile values. For small datasets at larger percentile levels the Excel percentile.exc and percentile.inc algorithms give slightly different values although both algorithms always give the same 50th percentile value regardless of the size of the dataset.
- Instrument daily zero-spans (Z/S) for some pollutants occurred in the same hour everyday over an extended number of years, particularly in the earlier years in the datasets considered. This created some analyses challenges and Z/S dataset entries were replaced with a numerical value calculated by averaging the concentration in the hour before and hour after the Z/S, or if there were two or three consecutive hourly Z/Ss then the concentrations in these hours was based on equal hourly stepwise increases or decreases in pollutant concentration based on the concentration in the hour before and the hour after the Z/S periods.
- The 2014-2021 datasets were analyzed by two of the analysts independently using different Excel spreadsheet approaches. One analysis approach used Excel Pivot Tables and the other used excel functions to develop the formulae to conduct the factors analysis. These independent analyses produced the same baseline estimates providing an important QA/QC check.

4.7 The Selection of NO₂, SO₂ and PM_{2.5} for Interim Baseline Setting

For the purposes of developing interim baseline values for Fort McKay it was decided to focus on NO₂, SO₂ and PM_{2.5}. The rationale for this was:

- Oil sands development emissions of these three air quality pollutants are significant.
- Air modelling of these three pollutants are part of all oil sands project EIAs.
- Alberta, Canada, and the WHO all have air quality criteria for these pollutants.
- These pollutants are monitored continuously at almost all WBEA air monitoring stations.
- There are elevated levels of these pollutants in Fort McKay because of oil sands emissions. and
- NO₂ and PM_{2.5} are of particular importance to Fort McKay in terms of health risk.

In terms of the health risk concerns with respect to PM_{2.5} and NO₂, Fort McKay recently undertook a review of its air quality relative to the Alberta Ambient Air Quality Objectives (AAAQOs) (AEP, 2019), the Canadian Ambient Air Quality Standards (CAAQS) CCME (2019) and the WHO Air Quality Guidelines (AQGs) WHO (2021). The 2021 WHO AQGs were ultimately used to assess the health risk associated with air quality in Fort McKay because these guidelines are based on:

“... the lowest levels of exposure for which there is evidence of adverse health effects.”

This means that the WHO AQGs represent health-based “near-safe” ambient air quality levels as supported by up-to-date scientific evidence. **Figures 6 and 7** were produced for that review and show that the WHO Guidelines are being exceeded in Fort McKay, thus highlighting the basis for the community’s health risk concerns for NO₂ and PM_{2.5}. The following sections present the results from applying the protocol proposed above for estimating baseline levels for NO₂, SO₂ and PM_{2.5} of relevance to Fort McKay.

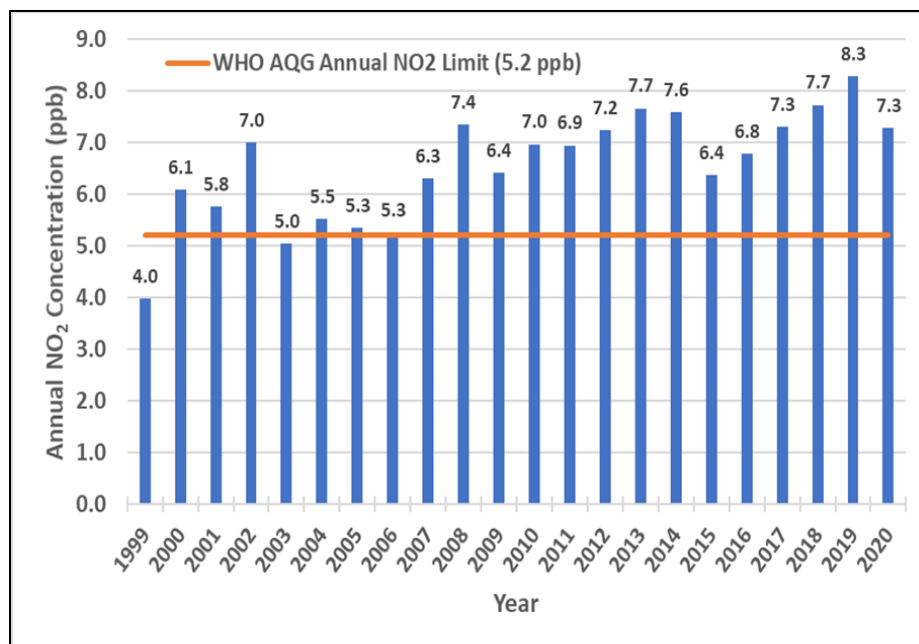


Figure 6: The Annual Average NO₂ Levels in Fort McKay in the 1999-2020 Period Relative to the revised 2021 WHO AQG Annual NO₂ Limit

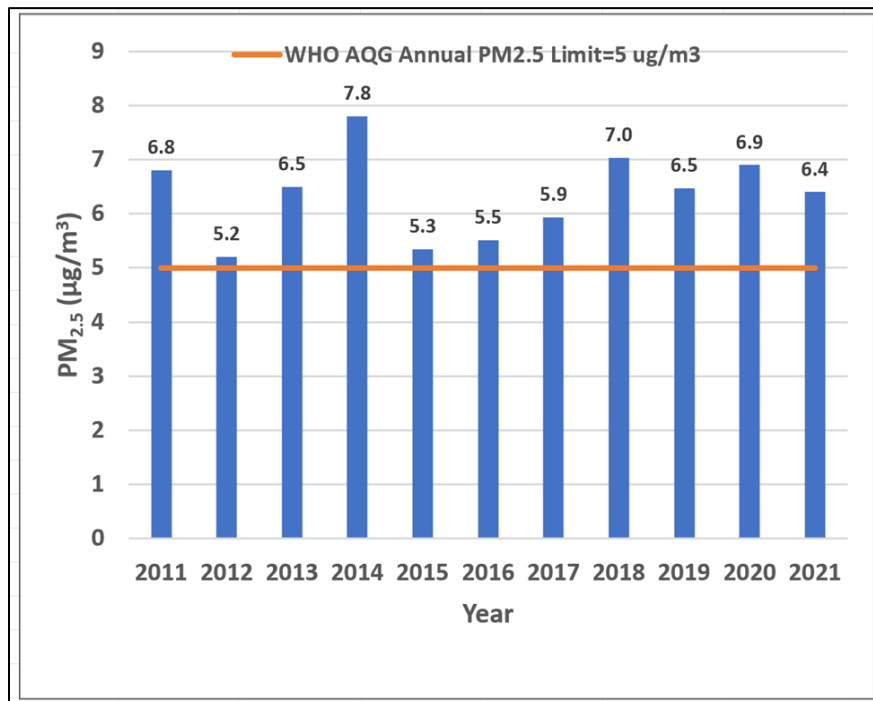


Figure 7: The Average Annual PM_{2.5} in Fort McKay for 2011, 2012, 2013 and 2015-2019 Years with TF/EE Influences Removed in Relation to the 2021 WHO AQG Annual PM_{2.5} Limit of 5 µg/m³ (Note: A specific value for 2014 could not be obtained from the Province's CAAQS determination datasets).

5 NO₂ Baseline Estimates

5.1 Literature NO₂ Baseline Estimates

There is limited information in the literature on natural background NO₂ levels based upon the scan conducted for this assessment. One reference noted that the lifetime of NO₂ in the troposphere is a few days and remote locations are reported to have background NO₂ levels in the approximate range of 0.02-0.3 ppb (Crutzen, 1979). Another reference (Cox, 1977) reported a geometric mean of the daily average NO₂ concentrations at a remote maritime site in Ireland of 0.34 ppb. A study on the spatial and temporal variability of NO₂ concentration in the U.K found that remote locations in Scotland had minimum hourly NO₂ concentrations in the approximate range of 0.2-0.7 ppb (Atkins & Lee, 1995). In the context of setting a NO₂ CAAQS level, a baseline annual NO₂ level in Fort Chipewyan of 0.54 ppb was estimated (Air Management Committee of the Canadian Council of Ministers of the Environment, 2016).

To set background air quality levels for the purpose of assessing air pollutant health impacts, Health Canada (2021) used a NO₂ concentration of 0.15 ppb by volume for annual average. Their rationale for this value was stated to be:

“Background concentrations of PM_{2.5}, NO₂ and ozone were estimated in collaboration with Environment and Climate Change Canada (Judek et al. 2004). This complex initiative involved a combination of qualitative (i.e. expert judgment) and quantitative (i.e. data-driven) approaches to evaluate concentration measurements at rural and remote monitoring sites.”

Thus, background or baseline NO₂ is very low, which is consistent with its short atmospheric lifetime.

5.2 Recommendation

Table 5 shows the baseline estimates for NO₂ following the protocol outlined in Section 4.6. The main observations are:

- There is a significant difference in baseline values between the “non-adjusted” and “temporal adjusted” approaches which highlights the need for considering temporal variables when developing baseline values.
- For the “temporal adjusted” approach there is a significant difference in the baseline values between the warm weather and cold weather periods with the latter being 2 to 4 times higher than the former, but there is little seasonal difference in baseline values using the “non-adjusted” approach.
- The “all WD” 5th percentile and 25th percentile WD screened (the WNW WD) baseline values are similar for the entire year period and the cold and warm weather periods for both the “non-adjusted” and “temporal adjusted” approaches with, as noted above, the “non-adjusted” being much lower than the “temporal adjusted” values except for the warm weather period.
- The warm weather “non-adjusted” NO₂ baseline values being higher than “temporal adjusted” baseline can be attributed to the lower warm weather period NO₂ levels and the small “by hour of the day for each month” datasets associated with the “temporal adjusted” approach, which, using the percentile.exe method can give percentile values that are less than the equivalent full dataset percentile values (see **Section 4.6.1**); and
- The 50th percentile WD screened approach results in much higher NO₂ baseline values than the other percentile criteria.

Table 5: Summary of Non-Adjusted and Temporal Adjusted NO₂ Baseline Estimates for Fort McKay using “All WD” 5th percentile and 10th percentile and WD Screened (the WNW WD) 25th percentile and 50th percentile These results are based on Hourly NO₂ Data from the Fort McKay Bertha Ganter Air Monitoring Station for the Period 2014-2021

Summary of NO ₂ Baseline Estimates using the Noted Metric, Period and Approach						
%ile Metric	NO ₂ (ppb) for Noted Period and for Non-Adjusted (NA) and Temporal Adjusted (TA) Approaches					
	Full Year		Warm Weather (May-September)		Cold Weather (October- April)	
	NA	TA	NA	TA	NA	TA
Overall "All WD" 5%ile	0.23	0.45	0.25	0.18	0.22	0.63
Overall "All WD" 10%ile	0.41	0.88	0.41	0.31	0.39	1.29
Overall WD Screened 25%ile	0.26	0.51	0.28	0.26	0.25	0.69
Overall WD Screened 50%ile	0.92	2.29	0.98	0.86	0.84	3.3

Comparing the values in

Table 5 and considering information from the literature, **the proposed interim NO₂ baseline for Fort McKay is 0.45 ppb.**

If the seasonal differences in baseline are to be distinguished, the warm weather baseline would be 0.18 ppb and the cold weather baseline would be larger at 0.63 ppb. These recommended values are in the general range of, but slightly higher than, the literature values above. Based on its colder climate, and the associated effect that temperature has on ground-level NO₂ levels, the proposed interim baseline appears reasonable and is consistent with the ECCC estimate for Fort Chipewyan which shares the same climatic conditions as Fort McKay.

In addition to comparison of the values in

Table 5, which serves as some level of sensitivity analysis, Tables 6 and 7 provide further sensitivity analyses showing the monthly and annual NO₂ baseline values that were used to generate the annual and seasonal NO₂ baseline temporal adjusted values and no temporal adjustment, respectively, in

Table 5. The data in Table 6 can be used to generate basic statistics on the inter-annual variability of the “by month” baseline values and also for the inter-annual baseline values. Table 7 shows how sensitive the baseline value is to the percentile used to define it.

Table 6 shows that regardless of year there is seasonality in the baseline value using the methods proposed here. Furthermore, there is considerable interannual variability in the value but no consistent trend can be seen.

5.3 Supporting Figures and Tables for NO₂ Baseline Assessment

In this section additional results based upon the analyses that led to the temporal adjusted baseline estimation protocol and the NO₂ recommendations above are provided. The figures and tables shown are intended to provide insights into the patterns of NO₂ levels in Fort McKay and associated influential factors. **Note: Except when noted all these Tables and Figures are based on distributions for the entire 2014-2021 dataset and not the temporal factor adjusted NO₂ baseline estimate datasets. As noted these non-temporal adjusted figures and tables are intended to provide information on the variability within the dataset.**

Month	%ile Metric	Year								
		2014	2015	2016	2017	2018	2019	2020	2021	Average
January	All WD 5%ile	0.58	0.50	0.75	0.63	1.10	1.24	0.80	1.47	0.88
	All WD 10%ile	1.06	1.15	1.94	0.96	2.22	2.82	2.66	2.25	1.88
	WD Screened 25%ile	2014-2021 Period as One Dataset								0.62
	WD Screened 50%ile	2014-2021 Period as One Dataset								4.63
February	All WD 5%ile	0.71	1.35	2.27	0.38	0.29	1.20	0.63	0.51	0.92
	All WD 10%ile	1.49	2.61	3.83	0.77	0.46	2.66	0.85	1.67	1.79
	WD Screened 25%ile	2014-2021 Period as One Dataset								0.81
	WD Screened 50%ile	2014-2021 Period as One Dataset								5.48
March	All WD 5%ile	0.42	0.69	0.84	0.94	0.66	0.57	0.73	0.63	0.68
	All WD 10%ile	0.69	1.42	1.33	1.91	1.56	0.81	1.19	1.29	1.27
	WD Screened 25%ile	2014-2021 Period as One Dataset								0.94
	WD Screened 50%ile	2014-2021 Period as One Dataset								3.53
April	All WD 5%ile	0.48	0.12	0.50	0.57	0.26	0.26	0.37	0.32	0.36
	All WD 10%ile	0.80	0.26	1.11	1.11	0.54	0.38	0.56	0.56	0.67
	WD Screened 25%ile	2014-2021 Period as One Dataset								0.39
	WD Screened 50%ile	2014-2021 Period as One Dataset								1.53
May	All WD 5%ile	0.15	0.43	0.15	0.13	0.00	0.40	0.35	0.41	0.25
	All WD 10%ile	0.39	0.72	0.23	0.30	0.02	0.71	0.53	0.66	0.44
	WD Screened 25%ile	2014-2021 Period as One Dataset								0.41
	WD Screened 50%ile	2014-2021 Period as One Dataset								1.45
June	All WD 5%ile	0.23	0.17	0.15	0.08	0.16	0.17	0.19	0.23	0.17
	All WD 10%ile	0.37	0.34	0.24	0.19	0.25	0.25	0.28	0.32	0.28
	WD Screened 25%ile	2015-2021 Period as One Dataset								0.32
	WD Screened 50%ile	2015-2021 Period as One Dataset								1
July	All WD 5%ile	0.13	0.09	0.25	0.14	0.17	0.17	0.12	0.32	0.17
	All WD 10%ile	0.27	0.18	0.35	0.20	0.30	0.38	0.17	0.42	0.28
	WD Screened 25%ile	2014-2021 Period as One Dataset								0.24
	WD Screened 50%ile	2014-2021 Period as One Dataset								0.71
August	All WD 5%ile	0.27	0.02	0.11	0.17	0.27	0.20	0.13	0.19	0.17
	All WD 10%ile	0.50	0.07	0.25	0.25	0.43	0.33	0.17	0.30	0.29
	WD Screened 25%ile	2014-2021 Period as One Dataset								0.17
	WD Screened 50%ile	2014-2021 Period as One Dataset								0.55
September	All WD 5%ile	0.34	0.01	0.08	0.21	0.10	0.21	0.14	0.13	0.15
	All WD 10%ile	0.55	0.02	0.14	0.31	0.18	0.38	0.22	0.20	0.25
	WD Screened 25%ile	2014-2021 Period as One Dataset								0.16
	WD Screened 50%ile	2014-2021 Period as One Dataset								0.6
October	All WD 5%ile	0.18	0.23	0.24	0.18	0.22	0.20	0.11	0.19	0.19
	All WD 10%ile	0.35	0.39	0.46	0.28	0.45	0.32	0.15	0.36	0.34
	WD Screened 25%ile	2014-2021 Period as One Dataset								0.19
	WD Screened 50%ile	2014-2021 Period as One Dataset								0.62
November	All WD 5%ile	0.66	0.55	0.20	0.23	0.81	0.43	0.62	0.33	0.48
	All WD 10%ile	1.09	0.85	0.44	0.50	1.45	0.75	1.20	0.70	0.87
	WD Screened 25%ile	2014-2021 Period as One Dataset								0.47
	WD Screened 50%ile	2014-2021 Period as One Dataset								1.98
December	All WD 5%ile	0.99	1.04	0.31	0.47	0.73	2.77	0.61	0.51	0.93
	All WD 10%ile	3.25	1.87	0.93	1.58	1.96	5.07	1.27	1.49	2.18
	WD Screened 25%ile	2014-2021 Period as One Dataset								1.39
	WD Screened 50%ile	2014-2021 Period as One Dataset								5.34
Overall "All WD" 5%ile Ave.										0.45
Overall "All WD" 10%ile Ave.										0.88
Overall WD Screened 25%ile Ave.										0.51
Overall WD Screened 50%ile Ave.										2.29

Month	%ile Metric	Year								
		2014	2015	2016	2017	2018	2019	2020	2021	Average
January	All WD 5%ile	0.58	0.50	0.75	0.63	1.10	1.24	0.80	1.47	0.88
	All WD 10%ile	1.06	1.15	1.94	0.96	2.22	2.82	2.66	2.25	1.88
	WD Screened 25%ile	2014-2021 Period as One Dataset								0.62
	WD Screened 50%ile	2014-2021 Period as One Dataset								4.63
February	All WD 5%ile	0.71	1.35	2.27	0.38	0.29	1.20	0.63	0.51	0.92
	All WD 10%ile	1.49	2.61	3.83	0.77	0.46	2.66	0.85	1.67	1.79
	WD Screened 25%ile	2014-2021 Period as One Dataset								0.81
	WD Screened 50%ile	2014-2021 Period as One Dataset								5.48
March	All WD 5%ile	0.42	0.69	0.84	0.94	0.66	0.57	0.73	0.63	0.68
	All WD 10%ile	0.69	1.42	1.33	1.91	1.56	0.81	1.19	1.29	1.27
	WD Screened 25%ile	2014-2021 Period as One Dataset								0.94
	WD Screened 50%ile	2014-2021 Period as One Dataset								3.53
April	All WD 5%ile	0.48	0.12	0.50	0.57	0.26	0.26	0.37	0.32	0.36
	All WD 10%ile	0.80	0.26	1.11	1.11	0.54	0.38	0.56	0.56	0.67
	WD Screened 25%ile	2014-2021 Period as One Dataset								0.39
	WD Screened 50%ile	2014-2021 Period as One Dataset								1.53
May	All WD 5%ile	0.15	0.43	0.15	0.13	0.00	0.40	0.35	0.41	0.25
	All WD 10%ile	0.39	0.72	0.23	0.30	0.02	0.71	0.53	0.66	0.44
	WD Screened 25%ile	2014-2021 Period as One Dataset								0.41
	WD Screened 50%ile	2014-2021 Period as One Dataset								1.45
June	All WD 5%ile	0.23	0.17	0.15	0.08	0.16	0.17	0.19	0.23	0.17
	All WD 10%ile	0.37	0.34	0.24	0.19	0.25	0.25	0.28	0.32	0.28
	WD Screened 25%ile	2015-2021 Period as One Dataset								0.32
	WD Screened 50%ile	2015-2021 Period as One Dataset								1
July	All WD 5%ile	0.13	0.09	0.25	0.14	0.17	0.17	0.12	0.32	0.17
	All WD 10%ile	0.27	0.18	0.35	0.20	0.30	0.38	0.17	0.42	0.28
	WD Screened 25%ile	2014-2021 Period as One Dataset								0.24
	WD Screened 50%ile	2014-2021 Period as One Dataset								0.71
August	All WD 5%ile	0.27	0.02	0.11	0.17	0.27	0.20	0.13	0.19	0.17
	All WD 10%ile	0.50	0.07	0.25	0.25	0.43	0.33	0.17	0.30	0.29
	WD Screened 25%ile	2014-2021 Period as One Dataset								0.17
	WD Screened 50%ile	2014-2021 Period as One Dataset								0.55
September	All WD 5%ile	0.34	0.01	0.08	0.21	0.10	0.21	0.14	0.13	0.15
	All WD 10%ile	0.55	0.02	0.14	0.31	0.18	0.38	0.22	0.20	0.25
	WD Screened 25%ile	2014-2021 Period as One Dataset								0.16
	WD Screened 50%ile	2014-2021 Period as One Dataset								0.6
October	All WD 5%ile	0.18	0.23	0.24	0.18	0.22	0.20	0.11	0.19	0.19
	All WD 10%ile	0.35	0.39	0.46	0.28	0.45	0.32	0.15	0.36	0.34
	WD Screened 25%ile	2014-2021 Period as One Dataset								0.19
	WD Screened 50%ile	2014-2021 Period as One Dataset								0.62
November	All WD 5%ile	0.66	0.55	0.20	0.23	0.81	0.43	0.62	0.33	0.48
	All WD 10%ile	1.09	0.85	0.44	0.50	1.45	0.75	1.20	0.70	0.87
	WD Screened 25%ile	2014-2021 Period as One Dataset								0.47
	WD Screened 50%ile	2014-2021 Period as One Dataset								1.98
December	All WD 5%ile	0.99	1.04	0.31	0.47	0.73	2.77	0.61	0.51	0.93
	All WD 10%ile	3.25	1.87	0.93	1.58	1.96	5.07	1.27	1.49	2.18
	WD Screened 25%ile	2014-2021 Period as One Dataset								1.39
	WD Screened 50%ile	2014-2021 Period as One Dataset								5.34
Overall "All WD" 5%ile Ave.										0.45
Overall "All WD" 10%ile Ave.										0.88
Overall WD Screened 25%ile Ave.										0.51
Overall WD Screened 50%ile Ave.										2.29

Table 7: Distribution (i.e., percentile values) in NO₂ in Fort McKay using all data from 2014-2021 and data only associated with WNW wind directions. The 5th percentile and 10th percentile values are highlighted) for all WD data and the 25th percentile and 50th percentile values highlighted in the WD-screened data. Separate warm weather (May-September) and cold weather (October-April) results are also shown.

Percentile	Wind Direction (WD) and Parameter					
	Full Period		Warm Weather (May-September)		Cold Weather (October-April)	
	All WD	WNW WD	All WD	WNW WD	All WD	WNW WD
	NO ₂ (ppb)	NO ₂ (ppb)	NO ₂ (ppb)	NO ₂ (ppb)	NO ₂ (ppb)	NO ₂ (ppb)
5%	0.23	0.08	0.25	0.10	0.22	0.06
10%	0.41	0.13	0.43	0.14	0.39	0.12
15%	0.65	0.17	0.68	0.19	0.63	0.16
20%	0.96	0.21	0.99	0.23	0.94	0.20
25%	1.35	0.26	1.36	0.28	1.35	0.25
30%	1.83	0.32	1.83	0.34	1.84	0.31
35%	2.41	0.39	2.39	0.43	2.42	0.38
40%	3.06	0.52	3.02	0.56	3.09	0.49
45%	3.79	0.67	3.73	0.75	3.84	0.64
50%	4.61	0.92	4.51	1.03	4.68	0.84
55%	5.53	1.30	5.41	1.49	5.62	1.18
60%	6.57	1.83	6.42	2.05	6.68	1.71
65%	7.84	2.60	7.64	2.97	7.98	2.38
70%	9.28	3.60	9.02	4.05	9.49	3.31
75%	11.02	4.80	10.71	5.32	11.22	4.48
80%	13.15	6.47	12.94	7.13	13.30	6.02
85%	15.82	9.24	15.58	9.99	16.00	8.79
90%	19.37	12.96	19.11	13.77	19.57	12.72
95%	24.72	19.48	24.36	19.97	24.89	18.68
100%	53.7	43.1	47.4	43.1	53.7	42.5

5.3.1 Characteristics of the Hourly NO₂ Concentration Distribution

Figure 8 shows cumulative percentile concentration distribution plots for hourly NO₂ values in Fort McKay for the 2014-2021 period for “all WD” directions and for the “WD screened” (WNW) wind direction. The WNW WD, as the low to non-anthropogenic influenced WD, has very low NO₂ hourly concentrations until approximately the 25th percentile after which concentrations start to increase and then rapidly increase above the 65th percentile. The “all WD” percentile concentration plot indicates that there is as steady increase in concentration starting in the 5th-10th percentile range. Furthermore, the slope also increases more rapidly at the higher percentiles. These patterns reflect the frequency at

which Fort McKay is subject to some anthropogenic NO₂ emission influence with a right-skewed distribution indicating levels are often low to moderate and then there are hours with significantly higher concentrations when Fort McKay is heavily impacted by oils sands related activities. Most importantly these patterns indicate that to eliminate oils sands and other anthropogenic impacts on the “all WD” baseline estimates, it is necessary to consider rather low percentile values. In contrast, by first excluding certain wind directions the “WD screened” approach is less sensitive to which percentile is used when comparing options below the median.

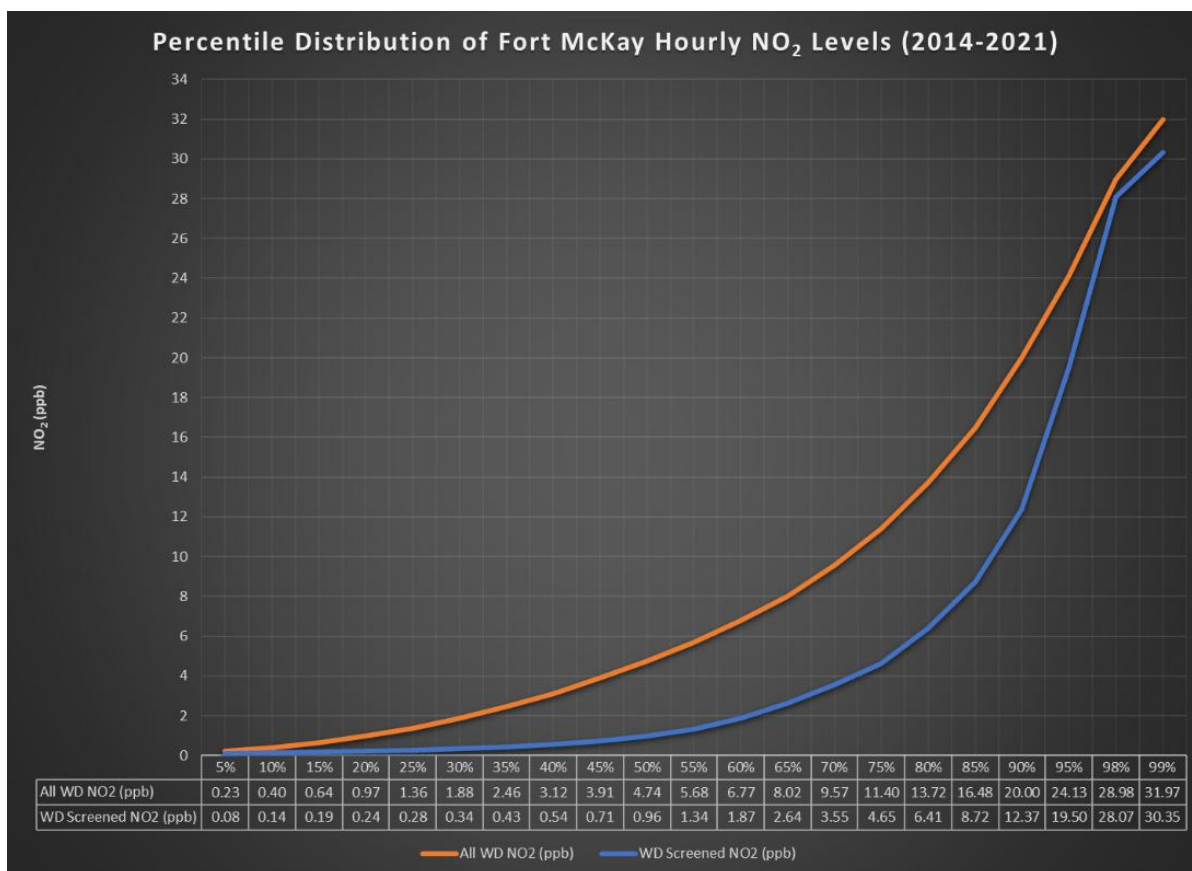


Figure 8: Hourly NO₂ Percentile Concentration Distribution Plots in Fort McKay for the 2014-2021 period for All Wind Directions and for the WNW Wind Direction

Figure 9 is a histogram of all the hourly NO₂ concentrations in the 2014-2021 period for all wind directions (i.e., summarizes the “all WD” dataset used in the analysis (68,973 hourly values)). This “all WD” histogram gives an NO₂ concentration distribution that indicates that a large fraction of hourly NO₂ concentrations fall in the <1.5 ppb range (~ 30%) and therefore estimated baseline NO₂ levels would be expected to be within the 0-1.5 ppb range. The increase in frequency for the >25 ppb NO₂ concentrations is consistent with the right-skewed distribution noted above.

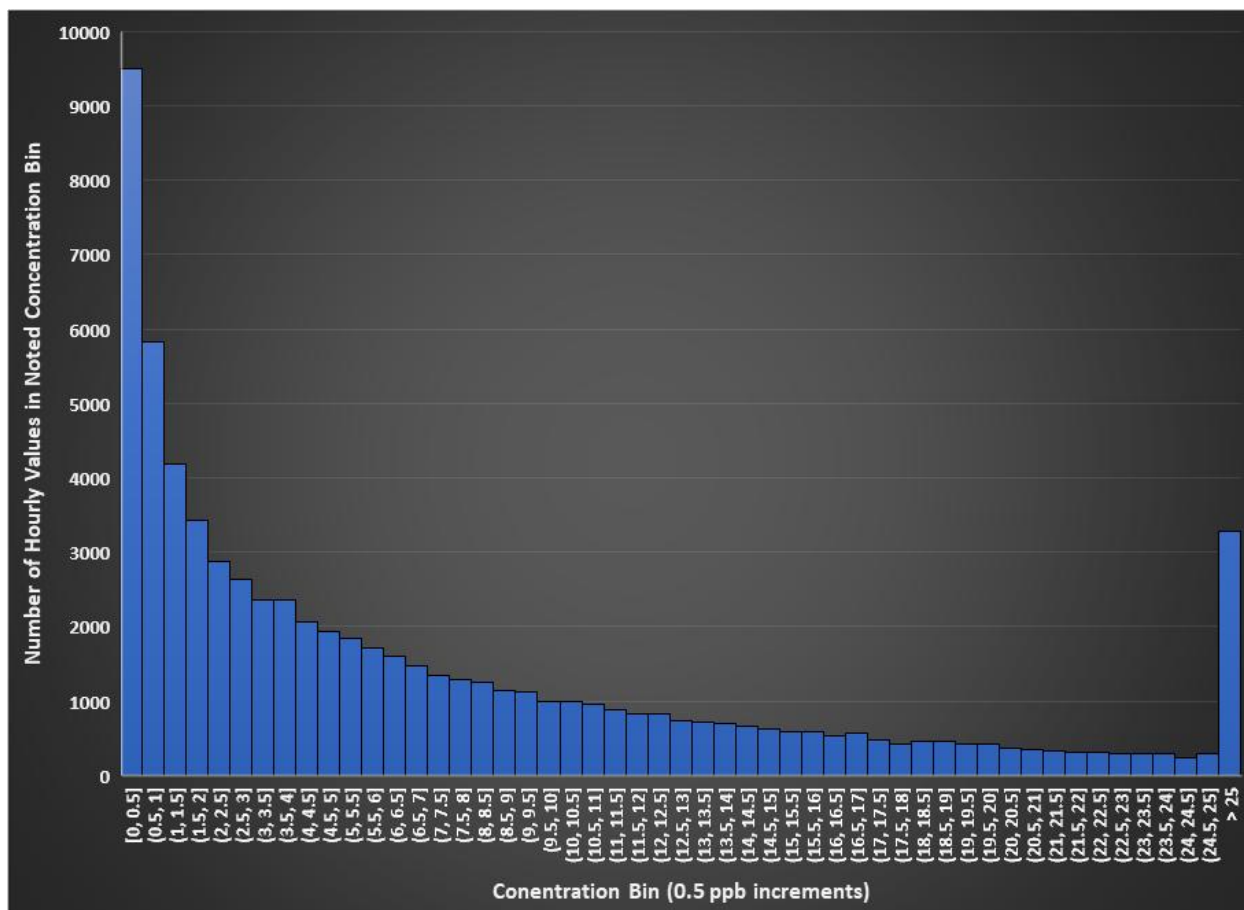


Figure 9: Histogram of Hourly NO₂ Concentrations in Fort McKay in the 2014-2021 Period (68,973 hourly values) (0.5 ppb bins with all hours with an NO₂ concentration >25 ppb put in one bin).

Figure 10 is a histogram of only the 0-1.5 ppb “all WD” NO₂ concentrations with the cumulative percentile NO₂ concentrations within this 0-1.5 ppb range plotted. Although not normally distributed, there is a clear mode in the lower end of the distribution around 0.25 ppb with the shoulder of a normal curve fit to this mode clearly encompassing the 0.45 ppb recommended baseline value. The cumulative percentile NO₂ concentrations plot in **Figure 10** provides a general indication of how the selection of different “all WD” baseline estimating percentiles changes baseline estimates.

Figure 11 is a histogram of all the hourly NO₂ concentrations in the 2014-2021 period when the wind was from the WNW which is the WD screened wind direction used in the analysis (5,116 hourly values). Similar to the “all WD” histogram, stratifying by WNW gives a NO₂ concentration distribution that indicates a very large fraction of WNW WD hourly NO₂ concentrations falling in the <1.5 ppb range (~ 60%) and therefore baseline NO₂ levels would be expected to be within the 0-1.5 ppb range. The fact that NO₂ concentrations above 10 ppb (i.e., relatively large) still occur with this wind direction clearly indicates that wind direction screening alone is not sufficient to characterize the baseline.

Figure 12 is a histogram of only the 0-1.5 ppb WD screened (WNW WD) NO₂ concentrations with the cumulative percentile NO₂ concentrations within this 0-1.5 ppb range plotted. The cumulative percentile NO₂ concentrations plot provides a general indication of how the selection of different WD screened baseline estimating percentiles changes baseline estimates.

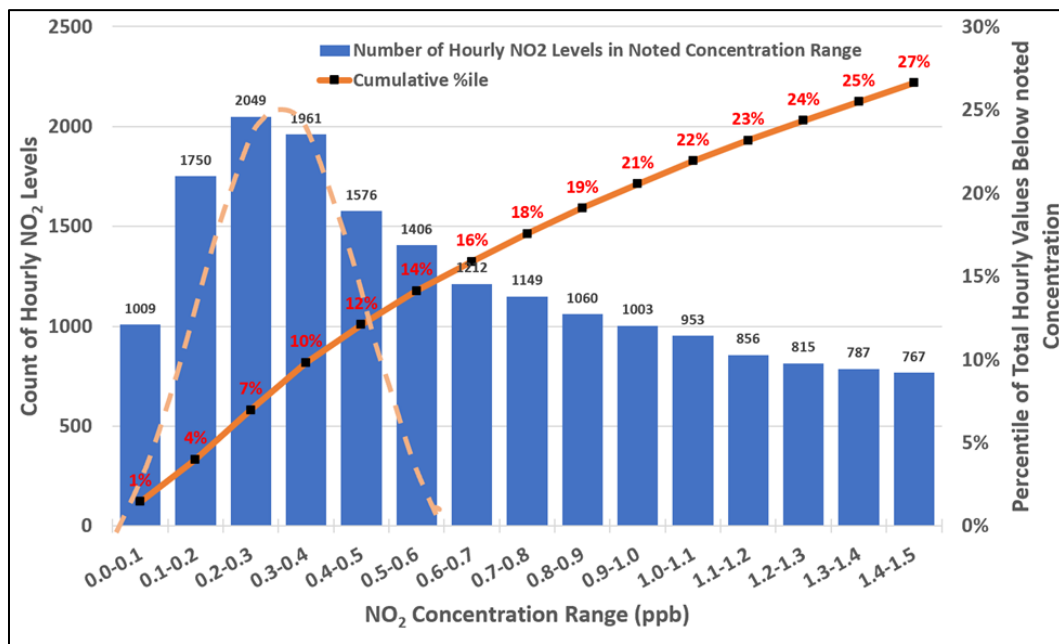


Figure 10: A Histogram of the Count of Hourly NO₂ Levels in Fort McKay in the 0-1.5 ppb Concentration Range over the Period 2014-2021 and the Cumulative Percentile Frequency that the Noted Concentration Range Represents (Total Dataset has 68,973 Hourly NO₂ Values) with the Normal Distribution Curve for the 0.0-0.6 ppb Data Shown (Dashed Line)

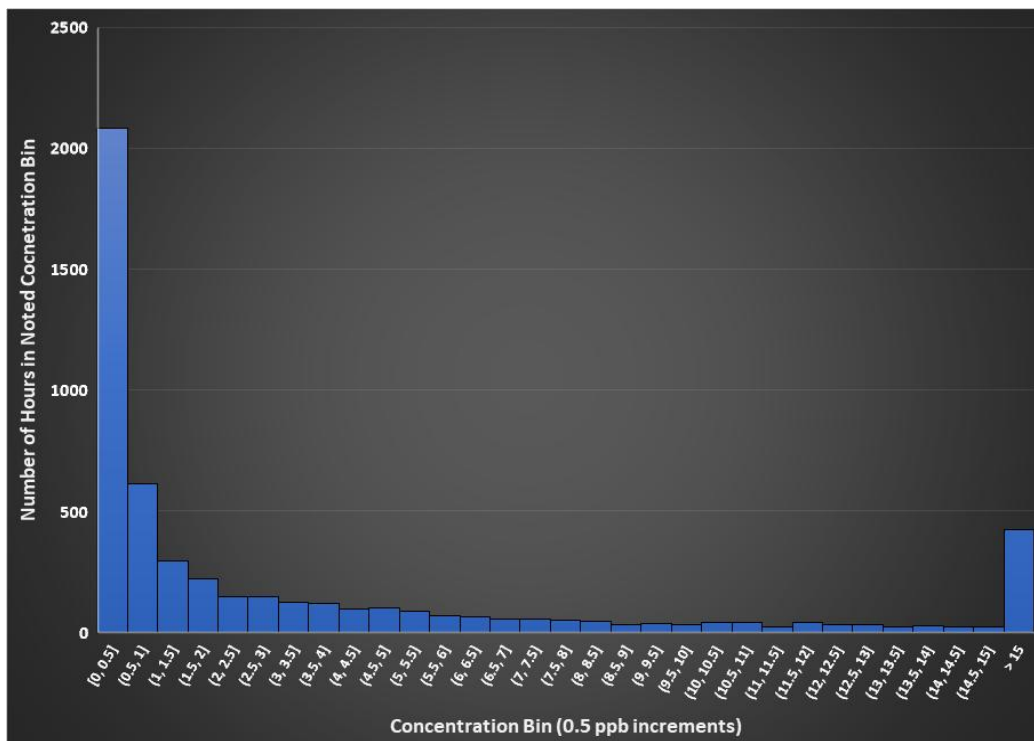


Figure 11: Histogram of Hourly NO₂ Concentrations in Fort McKay in the 2014-2021 Period when the Wind was from the WNW (5,116 hourly values) (0.5 ppb bins with all hours with an NO₂ concentration >15 ppb put in one bin)

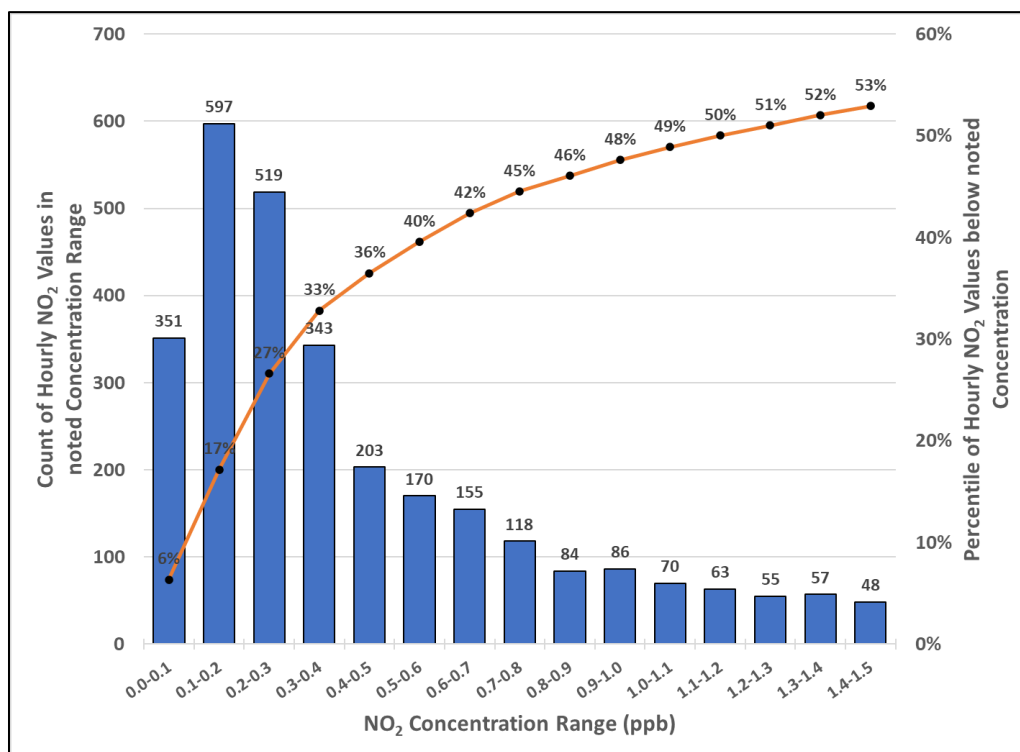


Figure 12: A Histogram of the Count of Hourly NO₂ Levels in Fort McKay in the 0-1.5 ppb Concentration Range over the Period 2014-2021 when the Wind Direction was from the WNW and the Cumulative Percentile Frequency that the Noted Concentration Range Represents (Total Dataset has 5,116 Hourly NO₂ Values)

Figure 13 is a plot of both the “all WD” and “WD screened” (WNW WD) NO₂ frequency percentiles over the percentile ranges that were used in the analysis. **Figure 13** shows the shapes of the frequency percentile curves for the “all WD” and “WD screened” NO₂ datasets and also how the “all WD” 5th percentile and 10th percentile baseline estimates compare to the “WD screened” 25th percentile and 50th percentile baseline estimates. A key feature of this plot is the consistency in results when the 5th percentile of the “all WD” data and 25th percentile of the “WD screened” data are compared. In contrast there is considerably less consistency using the 10th and 25th percentile values from these two datasets. This suggests that **a more-representative estimate of the baseline is likely to come from using these lower percentile values**. It is also important to note that in using these values the resulting baseline estimates are more consistent with what has been reported in the literature.

Looking more closely at **Figure 13**, it can be seen that at lower percentile values: (0.0 ~15th percentile for the “all WD” plot and 0.0 ~30th percentile for the “WD screened” plot), the percentile-concentration relations are approximately linear after which the rate of percentile concentrations increases, e.g. for the “all WD” plot the concentration difference between the 5th percentile and 10th percentile is ~0.17 ppb, between the 20th percentile and 25th percentile is ~0.4 ppb and between the 45th percentile and 50th percentile is ~0.8 ppb. For the “WD screened” plot, the concentration difference between the 5th percentile and 25th percentile is ~0.19 ppb and between the 25th percentile and 50th percentile is ~0.66 ppb. In general, the linear relationships at the lower percentile values would indicate somewhat constant influences, and natural variability in these influences, with the curvature after this linearity reflecting additional influences which could be natural but in the context of Fort McKay’s location would

likely be attributable to anthropogenic emission influences. This hypothesis would support selecting percentiles for baseline setting that fall within the low percentile linear ranges which for the “all WD” approach would be in the 5th percentile to 15th percentile range and for the “WD screened” approach would be in the percentile range up to 30th or 35th. It needs to be stressed that these percentiles are based on non-temporal adjustment considerations. **Figure 15** shows how temporal adjusted percentile estimates differ from those **Figure 13**.

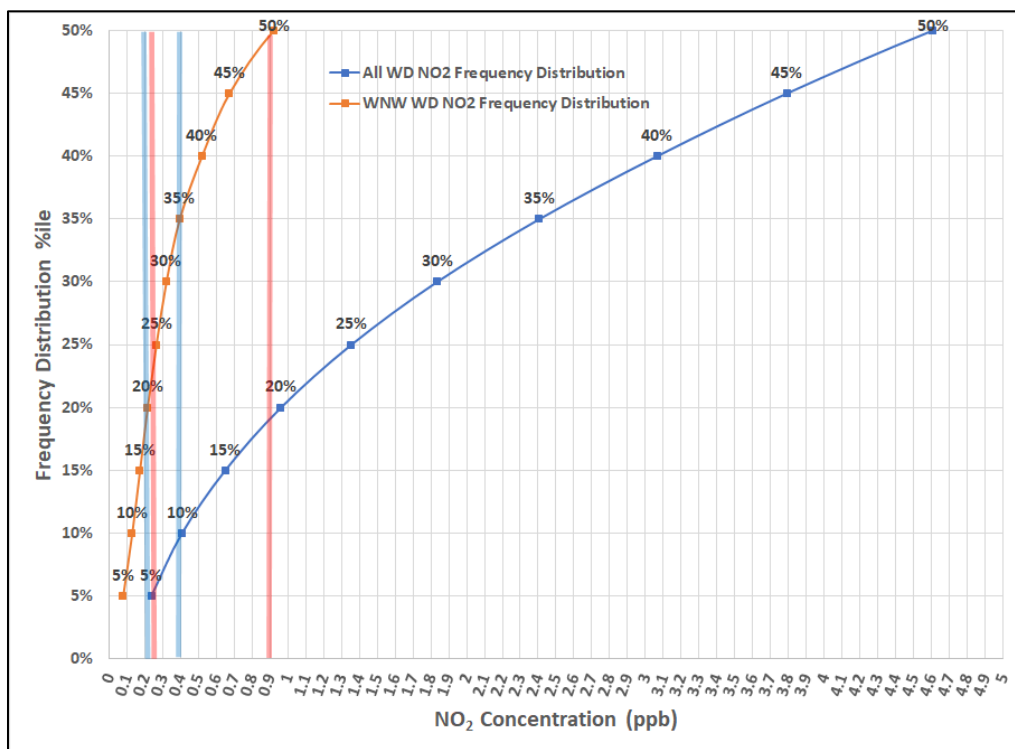


Figure 13: Cumulative Frequency Percentiles for the “All WD” and WD Screened (WNW WD) Hourly NO₂ Concentrations in Fort McKay (2014-2021 Period) and the “All WD” 5th percentile and 10th percentile NO₂ Baseline Estimates and WD Screened (WNW WD) 25th percentile and 50th percentile NO₂ Baseline Estimates

5.3.2 Temporal Variations in the Fort McKay NO₂ Percentiles

As proposed above, Fort McKay recommends taking into consideration temporal adjustments in determining the baseline values. The results in this section show how the different temporal strata of importance influence the NO₂ distributions and the resulting baseline estimate.

Figure 14 is a time series plot of hourly NO₂ levels in Fort McKay over the 2014-2021 period. There is clearly significant seasonal variability in peak NO₂ levels, although it is difficult to see the extent that the lower end of the NO₂ distribution shifts up from the warmer to the colder months as results in

Table 5, Table 6 and Table 7 indicate. Figure 15, which is like Figure 13, but for the warm and cold weather periods, show the seasonal difference in the lower end of the distribution, and highlights the need to consider seasonal variability when estimating and establishing NO₂ baseline values.

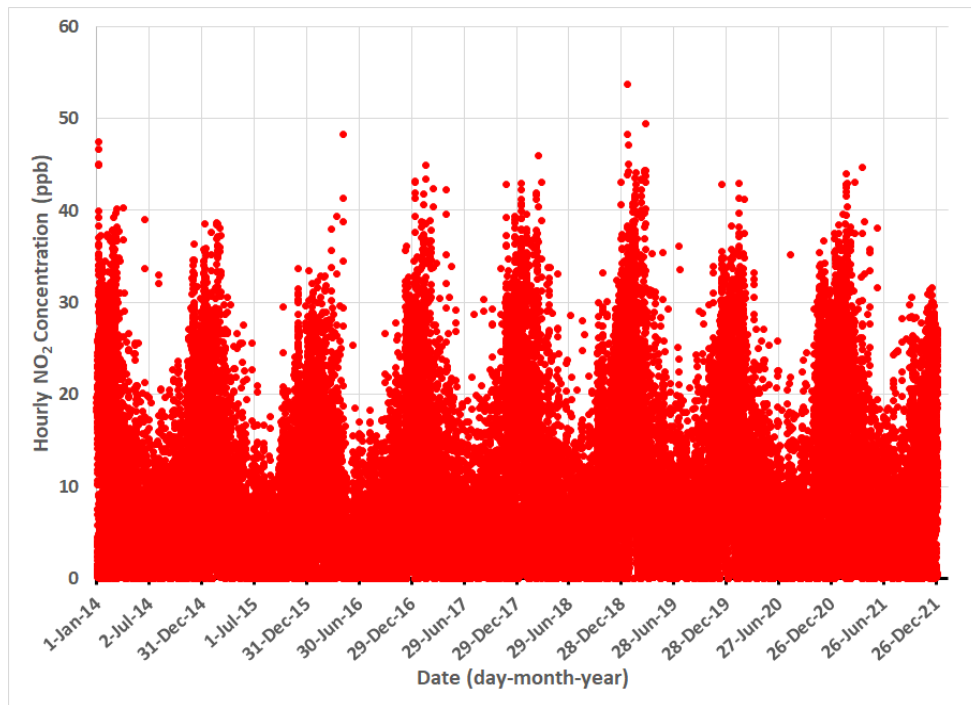


Figure 14: Hourly NO₂ Concentrations in Fort McKay in the 2014-2021 Period

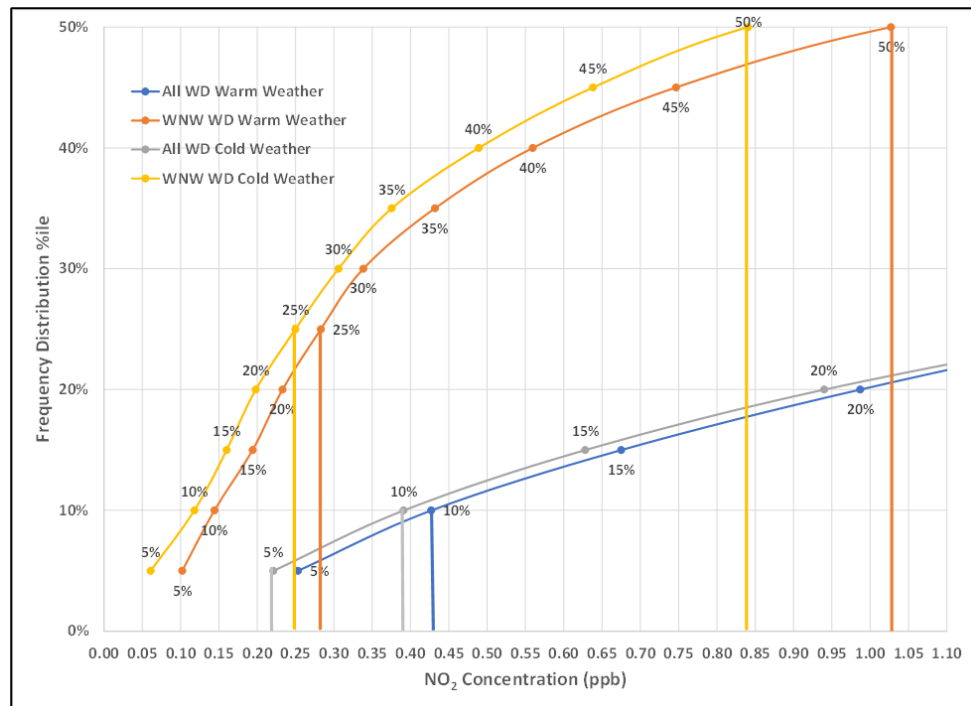


Figure 15: Cumulative Frequency Percentiles for the Warm Weather Period (May-September) and the Cold Weather Period (October-April) “All WD” and “WD Screened” (WNW WD) Hourly NO₂ Concentrations in Fort McKay (2014-2021 Period) and the “All WD” 5th percentile and 10th percentile NO₂ Baseline Estimates and WD Screened (WNW WD) 25th percentile and 50th percentile NO₂ Baseline Estimates for Each Period.

Figure 16 compares the different NO₂ baseline estimates for each percentile approach with full temporal adjustment vs. if the hour of day, month and year are not considered. The non-temporal factor adjusted NO₂ baseline estimates (yellow bars), which are much lower than the temporal factor adjusted NO₂ baseline estimates (blue bars), highlights how considering certain temporal variables influences the baselines.

Figure 17 is a plot of the annual “All WD” 5th percentile and 10th percentile “All WD” NO₂ concentrations (ppb) in Fort McKay in each year of the 2014-2021 period and the overall average 5th percentile and 10th percentile NO₂ concentrations for the entire 2014-2021 period. This plot shows that there is considerable inter-annual variability in the estimated NO₂ baselines associated with the “All WD” 5th percentile and 10th percentile baseline setting approach, although no clear trend over time. This random interannual variability highlights the potential importance of using multi-year datasets when assessing baselines as done in this report. The data for this plot comes from **Table 6**.

Figure 18 highlights the significant inter-monthly variability in terms of NO₂ baseline estimates and therefore the need to consider this monthly variability when estimating NO₂ baselines. The data for this plot comes from Table 6.

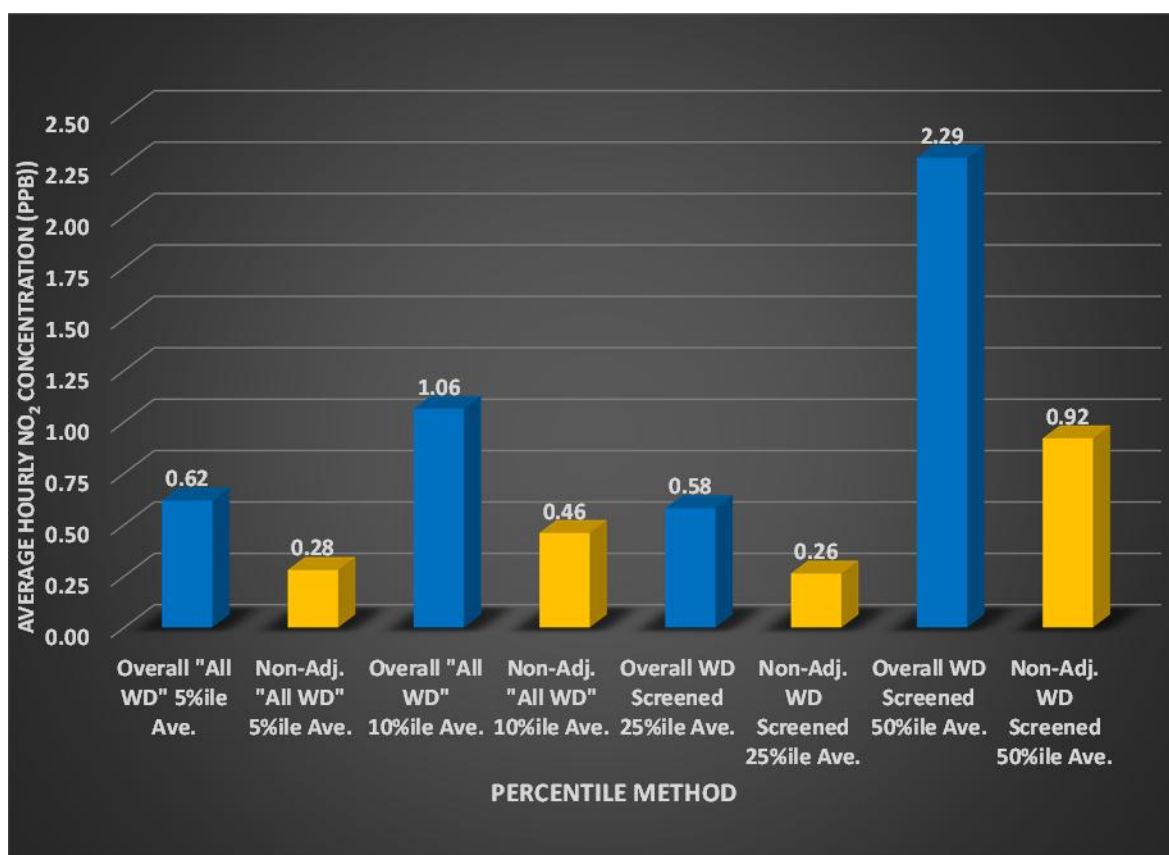


Figure 16: A Comparison of the Different percentile Method NO₂ Baseline Estimates Considering Temporal Factors (referred to as “Overall”) and the Non-Temporal Factor NO₂ Baseline Estimates

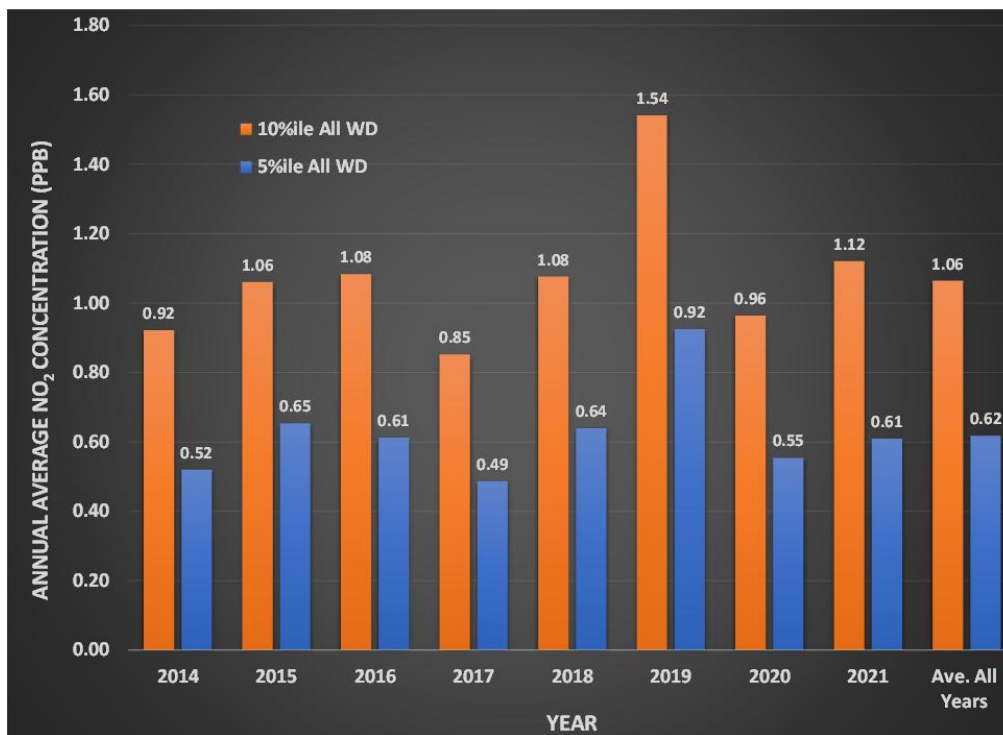


Figure 17 : Average Annual Temporal Adjusted 5th percentile and 10th percentile “All WD” NO₂ Concentrations (ppb) in Fort McKay for the Period (2014-2021) and the Average Annual 5th percentile and 10th percentile “All WD” NO₂ Concentrations for the Entire 2014-2021 Period.

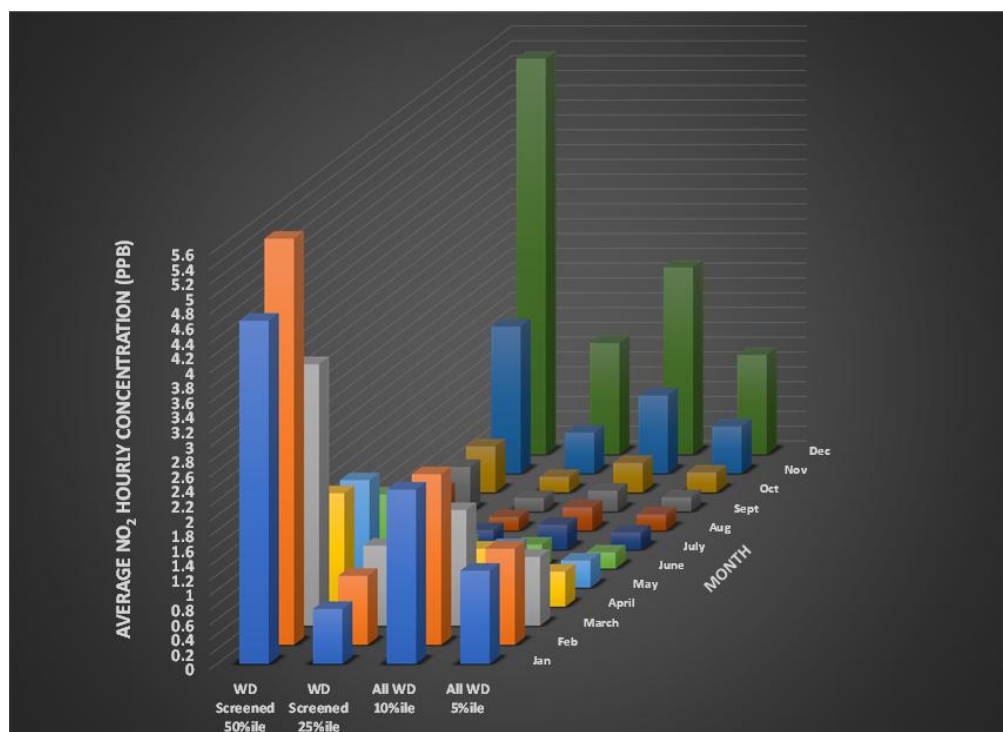


Figure 18: Monthly Variation in Percentiles for the “All WD” and “WD Screened” Baseline Estimation Approaches.

Figure 20 shows the monthly 5th percentile NO₂ concentrations for January, March, June, September and November averaged for the entire 2014-2021 period. This plot illustrates both the inter-daily and inter-monthly NO₂ distribution variations demonstrating that there is less inter-hourly variability (vs. seasonal variability). In Fort McKay there are much lower NO₂ concentrations in the warmer months (June and September) than in the cooler/colder months (January, March and November) with the coldest month shown (i.e. January) having both the highest 5th percentile NO₂ concentrations and the greatest inter-hourly variability. This highlights the need to consider inter-hour variability in baseline estimating. The data for this plot comes from the Tables in **Appendix D**.

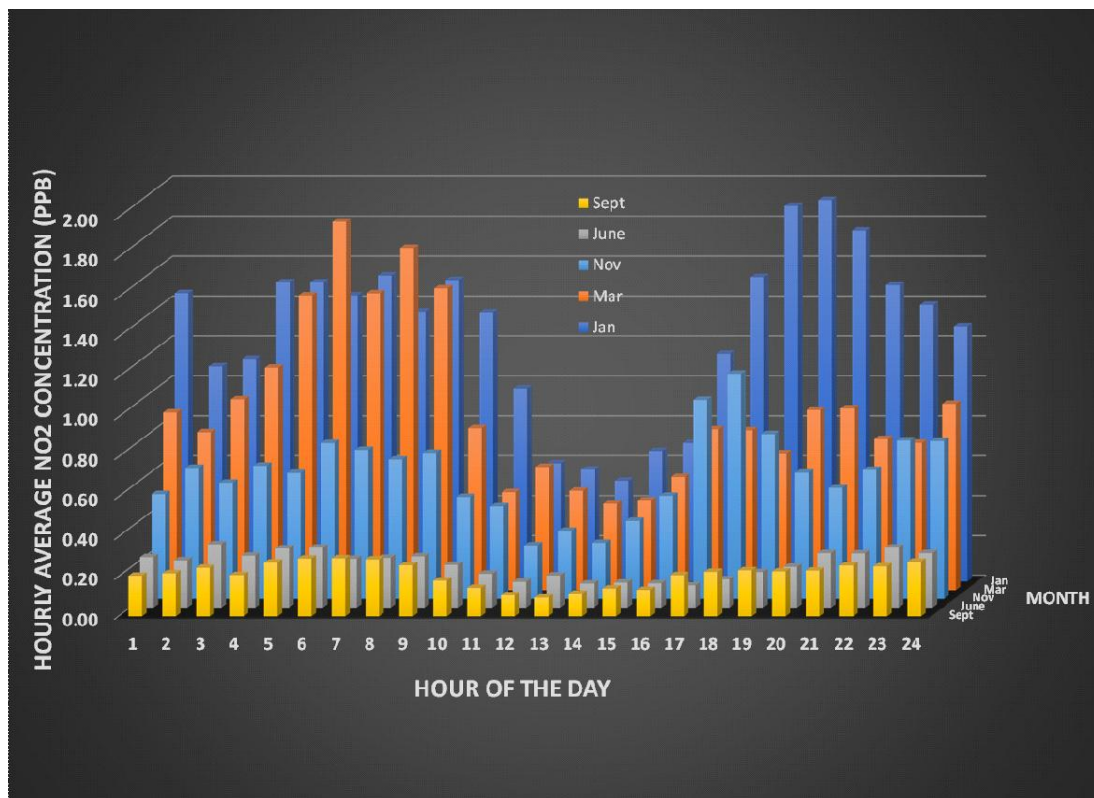


Figure 19: Temporal Adjusted 5th percentile "All WD" Average NO₂ Concentrations (ppb) by Hour of the Day in Fort McKay for the Period 2014-2021 for Select Months of the Year.

Figure 20 groups the monthly NO₂ baseline estimates into cold weather (October – April) and warm weather (May – September) periods which further highlights monthly/seasonal variability in NO₂ concentrations in Fort McKay. The data for this plot comes from Table 6.

Tables 8 to 10 are examples of the monthly tables that were generated and used to generate the above figures and to generate the NO₂ baseline estimates. All additional tables generated in the NO₂ baseline analysis are provided in **Appendix D**. These tables also provide data that can be used to generate distribution statistics for the temporal factors that were considered in this assessment (i.e. hour of the day, month of the year and year).

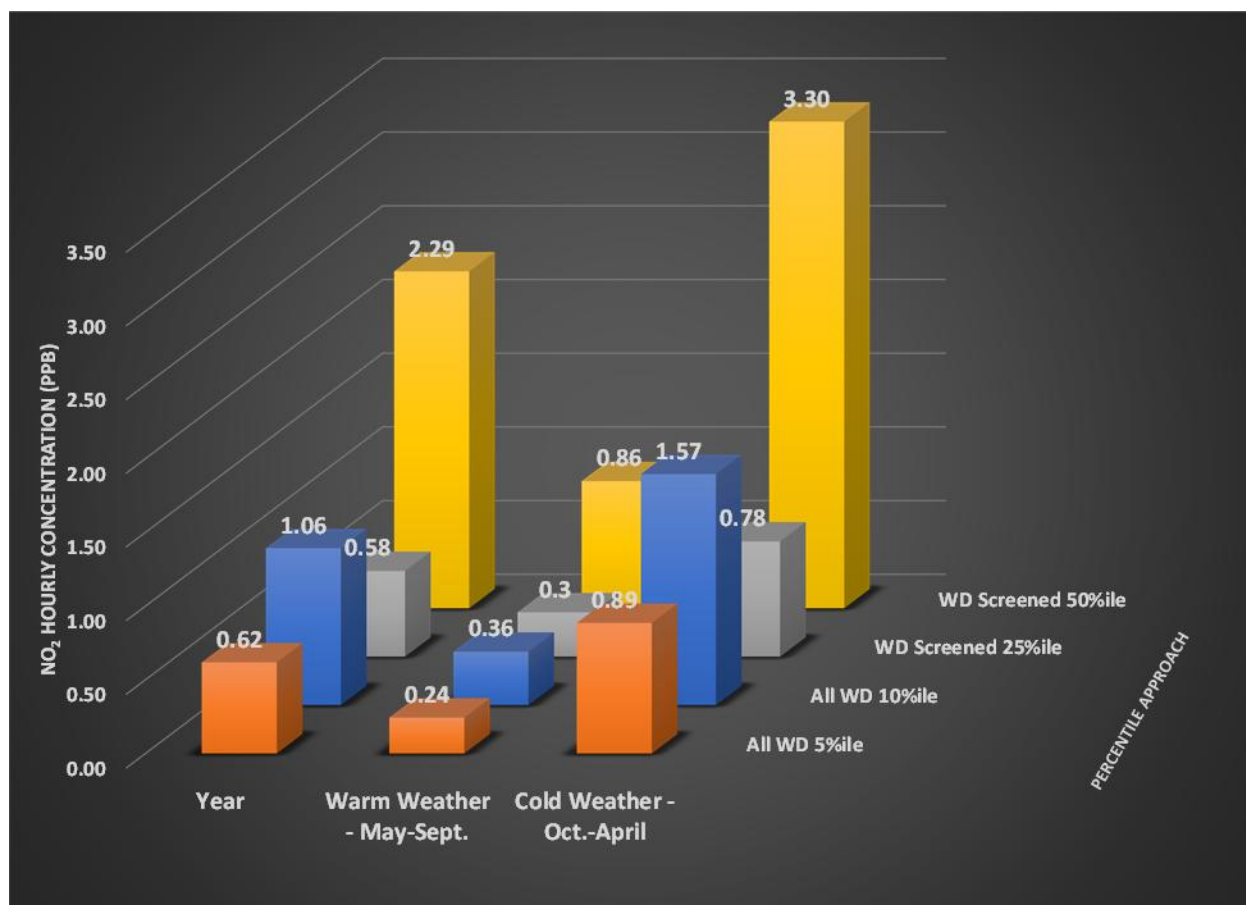


Figure 20: The NO₂ Baseline Estimates for Each percentile Method by Season (Cold Weather and Warm Weather).

5.4 Conclusion

The proposed interim NO₂ baseline for Fort McKay of 0.45 ppb with a warm weather baseline of 0.18 ppb and cold weather baseline of 0.63 ppb are in the general range of, but slightly higher than, literature-based baseline estimates and consistent with the ECCC estimate for Fort Chipewyan which shares the same climatic conditions as Fort McKay. Based on its colder climate, and the associated effect that temperature has on ground-level NO₂ levels, the proposed interim baseline appears reasonable.

Table 8: Example of the “WD Screened” NO₂ percentile Baseline Estimates (the 25th percentile and 50th percentile Estimates Highlighted in Red) (Note: the Tables for all Months are in Appendix D) (Note: a blank cell is the result of using PERCENTILE.EXC algorithm which excludes percentages below 1/(N+1) and above N/(N+1) where N is the number of datapoints, which can be quite small when using the WD screened percentile approach, and considering “by hour of the day” and “by month” temporal factors)

By Hour of the Day and WD Screened %ile NO ₂ Concentrations (ppb) in Fort McKay for the Month of January for the Period 2014-2021																									
Percentile	Hr of the day																								Ave.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
10%	0.18	0.40	0.27	0.35	0.37	0.45	0.33	0.39	0.46	0.29								0.42	0.30	0.20	0.20	0.46	0.30	0.32	0.33
15%	0.25	0.45	0.37	0.53	0.41	0.81	0.47	0.41	0.48	0.39	0.18			0.20	0.20	0.38	0.38	0.50	0.37	0.24	0.31	0.58	0.31	0.37	0.39
20%	0.31	0.49	0.53	0.53	0.63	1.01	0.62	0.44	0.57	0.49	0.25	0.11	0.34	0.26	0.24	0.41	0.58	0.56	0.45	0.36	0.55	0.69	0.44	0.40	0.47
25%	0.32	0.55	0.76	0.71	0.82	1.70	0.94	0.47	0.71	0.71	0.31	0.16	0.36	0.29	0.28	0.44	0.78	0.61	0.52	0.44	0.65	1.09	0.65	0.56	0.62
30%	0.33	0.60	0.82	1.04	0.95	4.39	1.67	0.53	0.77	0.71	0.36	0.21	0.39	0.30	0.36	0.44	0.78	0.85	0.58	0.52	0.77	2.17	0.73	0.67	0.87
35%	0.34	0.61	0.88	1.61	1.67	8.00	1.80	0.66	0.82	0.77	0.43	0.26	0.45	0.34	0.44	0.44	0.78	1.05	0.61	0.60	4.06	4.50	0.77	0.75	1.36
40%	0.35	0.61	0.92	2.80	2.54	9.90	3.95	1.12	0.82	0.88	0.57	0.32	0.57	0.43	0.52	0.51	0.81	1.17	0.70	1.37	6.58	5.26	0.83	1.22	1.86
45%	0.37	0.80	1.11	5.03	3.49	12.60	10.49	1.51	3.20	1.15	0.74	0.49	0.70	0.51	0.61	0.63	0.87	2.50	0.91	2.05	9.34	8.77	2.46	1.61	3.00
50%	0.39	0.98	1.83	8.50	10.78	15.63	13.90	1.73	6.76	1.81	1.12	0.66	0.82	0.54	0.70	0.75	0.93	4.42	1.34	2.47	13.23	12.60	6.98	2.28	4.63
55%	0.60	5.94	3.30	11.47	18.35	17.36	14.50	2.39	7.04	4.20	1.49	0.83	1.33	0.56	0.72	0.81	1.14	11.35	2.07	2.85	16.05	15.28	10.99	6.76	6.56
60%	0.81	10.90	8.51	14.07	20.52	18.17	15.56	3.04	8.47	7.67	2.91	1.00	1.83	5.73	0.74	0.86	1.34	16.19	3.61	9.17	17.12	17.12	12.66	12.53	8.77
65%	3.40	12.05	12.71	16.27	21.66	22.37	16.74	4.17	12.19	10.38	4.46	4.67	2.34	11.54	0.77	1.14	5.72	16.86	5.56	18.77	17.40	19.77	16.77	14.98	11.36
70%	6.00	13.20	14.84	17.76	22.38	24.65	17.81	8.15	15.22	11.87	6.50	8.34	3.24	14.25	0.82	1.65	14.27	21.47	7.45	21.23	19.61	23.30	18.55	17.11	13.73
75%	10.94	16.12	17.43	18.86	23.29	25.37	20.59	12.74	17.90	13.08	8.79	12.01	4.34	15.40	0.86	2.16	22.82	28.04	8.05	24.49	24.86	24.80	20.57	18.49	16.33
80%	15.88	19.05	19.46	20.91	25.10	25.78	22.28	16.43	20.18	14.46	10.69	15.69	5.44	16.26	3.02	14.15	24.72	31.05	14.20	27.40	26.12	26.99	24.61	20.06	19.16
85%	17.81	25.87	22.36	25.72	27.32	26.84	25.59	17.31	23.07	20.62	12.11			16.76	5.19	26.14	26.63	33.32	23.80	28.63	28.15	28.52	27.68	22.01	23.25
90%	19.75	32.69	27.20	29.42	27.68	29.17	29.29	20.69	27.17	25.20								34.07	33.30	29.26	31.55	29.47	28.65	27.16	28.34

Table 9: Example of the “All WD” NO₂ 5th percentile Baseline Estimates (Note: the Tables for all Months are in Appendix D)

By Hour of the Day and By Year "All WD" 5%ile NO2 Concentration (ppb) in Fort McKay for the Month of January for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	1	1	0.71	1.17	0.66	0.92	0.43	0.32	0.41	0.47	0.15	0.29	0.42	0.46	0.45	0.66	0.7	0.73	0.88	0.32	0.37	0.41	0.54	0.44	0.58	0.26	(0.15-1.17)
	2015	0.28	0.4	0.26	0.49	0.31	0.61	0.58	0.59	0.48	0.77	0.7	0.6	0.73	0.35	0.26	0.5	0.73	0.51	0.34	0.29	0.56	0.69	0.5	0.36	0.50	0.16	(0.26-0.77)
	2016	0.76	0.88	0.92	0.7	0.53	0.84	0.5	1	0.84	2.21	0.66	0.37	0.34	0.35	0.38	0.39	0.4	0.62	1.24	0.79	0.68	0.69	0.83	1.04	0.75	0.40	(0.34-2.21)
	2017	0.56	0.52	0.95	1.1	0.81	0.78	0.55	0.53	0.55	0.53	0.44	0.51	0.51	0.55	0.6	0.51	0.76	0.98	0.82	0.63	0.44	0.51	0.48	0.5	0.63	0.18	(0.44-1.1)
	2018	0.86	0.84	1.14	2.06	1.47	1.63	1.16	1.26	0.56	0.57	0.86	1	0.6	0.39	1.32	1.01	1.23	2.06	1	1.13	1.15	1.22	1.01	0.76	1.10	0.42	(0.39-2.06)
	2019	2.39	1.41	0.82	2.11	1.79	0.53	1	0.69	1.21	1.3	1.05	0.88	0.48	0.57	0.73	0.63	0.6	0.62	1.35	2.39	2.38	1.46	1.86	1.55	1.24	0.63	(0.48-2.39)
	2020	0.32	0.5	0.54	0.44	0.45	0.62	0.56	0.46	0.54	0.6	0.53	0.48	0.47	0.41	0.43	0.48	1.57	1.2	3.11	1.27	1.79	1.45	0.66	0.36	0.80	0.64	(0.32-3.11)
	2021	0.56	0.49	0.38	0.43	1.09	1.98	1.97	2.62	3.78	3.28	3.04	1.33	1.88	1.72	1.37	1.53	1.27	1.23	1.17	1.07	1.13	0.61	0.73	0.56	1.47	0.93	(0.38-3.78)
																										0.88	0.60	(0.15-3.78)
	Average	0.84	0.76	0.72	1.06	0.89	0.99	0.84	0.93	1.05	1.22	0.93	0.68	0.68	0.60	0.69	0.71	0.91	0.99	1.24	0.99	1.06	0.88	0.83	0.70	0.88		
	Std Dev	0.67	0.34	0.30	0.69	0.52	0.53	0.52	0.75	1.13	1.02	0.89	0.36	0.50	0.46	0.43	0.38	0.40	0.51	0.82	0.67	0.71	0.43	0.45	0.41	0.17		
	Range	(0.28-2.39)	(0.4-1.41)	(0.26-1.14)	(0.43-2.11)	(0.31-1.79)	(0.53-1.98)	(0.43-1.97)	(0.32-2.62)	(0.41-3.78)	(0.47-3.28)	(0.15-3.04)	(0.29-1.33)	(0.34-1.88)	(0.35-1.72)	(0.26-1.37)	(0.39-1.53)	(0.4-1.57)	(0.51-2.06)	(0.34-3.11)	(0.29-2.39)	(0.37-2.38)	(0.41-1.46)	(0.48-1.86)	(0.36-1.55)	(0.6-1.24)		

Table 10: Example of the “All WD” NO₂ 10th percentile Baseline Estimates (Note: the Tables for all Months are in Appendix D)

By Hour of the Day and By Year "All WD" 10%ile NO ₂ Concentration (ppb) in Fort McKay for the Month of January for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	1.87	1.52	1.17	1.7	0.97	1.49	2.14	0.81	0.44	0.75	0.17	0.47	0.57	0.5	0.48	0.88	0.92	1.03	0.97	0.62	0.66	0.61	0.78	0.9	0.93	0.49	(0.17-2.14)
	2015	0.81	0.86	0.87	1.04	0.91	2.91	4.08	3.05	2.83	1.1	1.11	1.21	1.05	1.74	0.86	0.84	0.93	1.07	1.27	0.94	1.07	1.41	0.88	0.78	1.40	0.88	(0.78-4.08)
	2016	4.54	4.26	3.41	2.77	3.87	3.43	2.01	1.78	2.43	2.73	0.73	1.37	1.25	0.81	2.14	2.76	2.27	3.83	4.45	6.24	6.36	1.72	1.36	1.65	2.84	1.55	(0.73-6.36)
	2017	1.03	1	1.29	1.62	1.93	0.88	1.04	1.41	2.54	2.87	0.46	0.58	0.6	0.75	0.66	0.94	1.68	1.33	1.96	1.21	0.93	1.02	1.08	0.96	1.24	0.60	(0.46-2.87)
	2018	1.59	1.6	4.19	3.28	4.89	2.87	2.68	3.25	3.4	4.12	2.39	1.72	1.57	0.87	1.84	1.56	2.46	3.6	3.11	1.73	1.7	2.73	2.28	1.65	2.55	1.02	(0.87-4.89)
	2019	4.73	6.42	4.09	4.31	4.8	3.94	5.48	3.48	4.79	5.91	5.61	1.73	1.06	0.77	0.75	1.66	3.13	2.98	3.21	5.24	4.96	3.53	3.82	4.84	3.80	1.64	(0.75-6.42)
	2020	6.22	5.01	4.28	3.2	0.99	1.46	1.25	1.03	0.82	0.99	0.76	0.7	0.66	0.61	0.6	1.75	6.63	5.35	6.21	5.66	7.3	6.4	6.16	6.9	3.37	2.60	(0.6-7.3)
	2021	0.91	0.71	0.66	1.33	3.06	4.02	3.2	4.52	4.91	5.83	4.19	1.95	3.6	2.33	2.73	2.44	2.33	3.12	2.77	1.89	1.72	3.25	1.64	1.08	2.67	1.37	(0.66-5.83)
																										2.35	1.70	(0.17-7.3)
Average		2.71	2.67	2.50	2.41	2.68	2.63	2.74	2.42	2.77	3.04	1.93	1.22	1.30	1.05	1.26	1.60	2.54	2.79	2.99	2.94	3.09	2.58	2.25	2.35	2.35		
Std Dev		2.12	2.22	1.63	1.15	1.71	1.20	1.49	1.34	1.62	2.09	1.99	0.57	0.99	0.64	0.85	0.72	1.82	1.54	1.72	2.35	2.68	1.87	1.86	2.27	0.62		
Range		(0.81-6.22)	(0.71-6.42)	(0.66-4.28)	(1.04-4.31)	(0.91-4.89)	(0.88-4.02)	(1.04-5.48)	(0.81-4.52)	(1.04-4.91)	(0.44-5.91)	(0.17-5.61)	(0.47-1.95)	(0.57-3.6)	(0.5-2.33)	(0.48-2.73)	(0.84-2.76)	(0.92-6.63)	(1.03-5.35)	(0.97-6.21)	(0.62-6.24)	(0.66-7.3)	(0.61-6.4)	(0.78-6.16)	(1.05-7.9)	3.09		

6 SO₂ Baseline Estimates

6.1 Literature SO₂ Baseline Estimates

To assess how the evaluated percentile approaches for baseline SO₂ estimates compare to other SO₂ baseline estimates, a brief review of the literature on background ambient SO₂ levels was undertaken. In Canada, ECCC estimated that in 2011 natural sources of SO₂ (forest fires) emitted approximately 100 tonnes of SO₂ whereas the estimated anthropogenic emissions of SO₂ were 100 million tonnes and therefore overall background SO₂ levels would be expected to be very low.

The residence time of SO₂ in the atmospheric boundary layer is days and in the free troposphere in the order of days to weeks (UNECE, 2010) and remote location are reported to have background SO₂ levels in the approximate range of 0.03-0.16 ppb (Hidy & Blanchard, 2016). Maroulis, Torres, Goldberg, and Bandy (1980) reported background SO₂ levels in the Northern Hemisphere troposphere boundary layer of 0.089 ± 0.069 ppb. Additional U.S. background SO₂ concentration estimates that have been attempted are in the range of ~0.03 ppb (US EPA, 2017). ECCC, in estimating baseline SO₂ concentrations in the context of setting an SO₂ CAAQS level, estimated a baseline annual SO₂ level in Fort Chipewyan of 0.10 ppb and an annual median baseline level of 0.09 ppb based on data from 12 remote NAPS stations in Canada.

A source of SO₂ is the oxidation of carbonyl sulphide (COS) by the hydroxyl radical (OH) (Kettle, Kuhn, von Hobe, Kesselmeier, & Andreae, 2002; Maroulis et al., 1980). The global background of COS is approximately 0.5 ppb (Khalil & Rasmussen, 1984; Rinsland et al., 2002) and using the Maroulis et al. (1980) estimate of a COS to SO₂ ratio of 9 would give a natural SO₂ “background” of ~0.05 ppb. In the AOR an SO₂ background in the range of ~0.05-0.10 ppb would therefore be expected.

6.2 Recommendation

Table 11 shows the baseline estimates for SO₂ following the protocol outlined in Section 4.6. The main observations are:

- There is little difference in the estimates between the warm weather and cold weather periods with the cold weather baseline estimates slightly higher which would be expected based on the difference between winter and summer ground-level mixing;
- The “all WD” 5th percentile and 10th percentile and 25th percentile WD screened (the WNW WD) baseline estimates are similar for the entire year period with the 25th percentile WD screened SO₂ warm weather period estimate the lowest;
- The 50th percentile WD screened approach gives much higher SO₂ baseline estimates than the other percentile criteria;
- Overall all baseline estimates give relatively low baseline SO₂ estimates.

Comparing the values in Table 11 and considering information from the literature, the proposed SO₂ baseline for Fort McKay is 0.09 ppb.

Table 11: Summary of Non-Adjusted and Temporal Adjusted SO₂ Baseline Estimates for Fort McKay using “All WD” 5th percentile and 10th percentile and “WD Screened” (the WNW WD) 25th percentile and 50th percentile Concentrations based on Hourly SO₂ Data from the Fort McKay Bertha Ganter Air Monitoring Station for the Period 2014-2021

Summary of the SO ₂ Baseline Estimates using the Noted Metric, Period and Approach						
%ile Metric	SO ₂ (ppb) for Noted Period and Non-Adjusted (NA) and Temporal Adjusted (TA) Approaches					
	Full Year		Warm Weather (May-September)		Cold Weather (October-April)	
	NA	TA	NA	TA	NA	TA
Overall "All WD" 5%ile Ave.	0.00	0.09	0.00	0.08	0.00	0.10
Overall "All WD" 10%ile Ave.	0.03	0.12	0.03	0.10	0.03	0.13
Overall WD Screened 25%ile Ave.	0.07	0.09	0.07	0.06	0.07	0.12
Overall WD Screened 50%ile Ave.	0.17	0.20	0.18	0.15	0.17	0.24

In addition to comparison of the values in Table 11, which serves as some level of sensitivity analysis, **Tables 12** and **13** provide further sensitivity analyses showing the monthly and annual SO₂ baseline values that were used to generate the annual and seasonal SO₂ baseline temporal adjusted values and no temporal adjustment values, respectively, in Table 11. The data in

Table 12 can be used to generate basic statistics on the inter-annual variability of the “by month” baseline values and also for the inter-annual baseline values. Table 13 shows how sensitive the baseline value is to the percentile used to define it.

Table 12 shows that regardless of year there is seasonality in the baseline value using the methods proposed here. There is considerable interannual variability in the value but no consistent trend although 2014 had the highest levels and 2020 and 2021 fell into the lower range of annual values.

Table 12: SO₂ Baseline Estimates (ppb) for the Noted Years by Month and the Average for all Years (2014-2021 Period) Calculated using the "All WD" percentile Method (5th percentile and 10th percentile Values Shown) and the WD Screened percentile Method (WNW WD and 25th percentile and 50th percentile Values Shown) with Monthly Values based on the Average of by Hour of the Day percentiles for the Noted percentile Method and the Noted percentile.

Month	%ile Metric	Year								
		2014	2015	2016	2017	2018	2019	2020	2021	Average
January	All WD 5%ile	0.21	0.22	0.13	0.00	0.08	0.24	0.10	0.03	0.13
	All WD 10%ile	0.29	0.29	0.17	0.01	0.11	0.27	0.14	0.07	0.17
	WD Screened 25%ile	2014-2021 Period as One Dataset								0.25
	WD Screened 50%ile	2014-2021 Period as One Dataset								0.42
February	All WD 5%ile	0.37	0.18	0.08	0.00	0.14	0.17	0.05	0.00	0.12
	All WD 10%ile	0.43	0.32	0.11	0.01	0.17	0.21	0.11	0.00	0.17
	WD Screened 25%ile	2014-2021 Period as One Dataset								0.09
	WD Screened 50%ile	2014-2021 Period as One Dataset								0.26
March	All WD 5%ile	0.26	0.21	0.11	0.00	0.12	0.15	0.08	0.00	0.12
	All WD 10%ile	0.34	0.27	0.13	0.01	0.15	0.18	0.11	0.01	0.15
	WD Screened 25%ile	2014-2021 Period as One Dataset								0.18
	WD Screened 50%ile	2014-2021 Period as One Dataset								0.31
April	All WD 5%ile	0.20	0.01	0.05	0.00	0.06	0.15	0.10	0.00	0.07
	All WD 10%ile	0.31	0.01	0.08	0.00	0.09	0.18	0.12	0.00	0.10
	WD Screened 25%ile	2014-2021 Period as One Dataset								0.07
	WD Screened 50%ile	2014-2021 Period as One Dataset								0.15
May	All WD 5%ile	0.25	0.00	0.02	0.00	0.00	0.09	0.07	0.00	0.05
	All WD 10%ile	0.32	0.02	0.04	0.00	0.00	0.12	0.09	0.00	0.07
	WD Screened 25%ile	2014-2021 Period as One Dataset								0.05
	WD Screened 50%ile	2014-2021 Period as One Dataset								0.14
June	All WD 5%ile	0.30	0.00	0.02	0.00	0.07	0.11	0.06	0.00	0.07
	All WD 10%ile	0.37	0.00	0.04	0.00	0.10	0.13	0.08	0.00	0.09
	WD Screened 25%ile	2015-2021 Period as One Dataset								0.06
	WD Screened 50%ile	2015-2021 Period as One Dataset								0.14
July	All WD 5%ile	0.31	0.00	0.05	0.10	0.13	0.12	0.03	0.00	0.09
	All WD 10%ile	0.41	0.00	0.07	0.14	0.15	0.14	0.05	0.00	0.12
	WD Screened 25%ile	2014-2021 Period as One Dataset								0.08
	WD Screened 50%ile	2014-2021 Period as One Dataset								0.17
August	All WD 5%ile	0.33	0.00	0.01	0.14	0.17	0.10	0.03	0.00	0.10
	All WD 10%ile	0.42	0.00	0.01	0.16	0.19	0.12	0.06	0.00	0.12
	WD Screened 25%ile	2014-2021 Period as One Dataset								0.07
	WD Screened 50%ile	2014-2021 Period as One Dataset								0.15
September	All WD 5%ile	0.29	0.00	0.00	0.08	0.07	0.08	0.04	0.00	0.07
	All WD 10%ile	0.38	0.00	0.00	0.10	0.11	0.11	0.07	0.00	0.10
	WD Screened 25%ile	2014-2021 Period as One Dataset								0.05
	WD Screened 50%ile	2014-2021 Period as One Dataset								0.13
October	All WD 5%ile	0.27	0.02	0.00	0.07	0.13	0.08	0.02	0.00	0.08
	All WD 10%ile	0.40	0.06	0.00	0.11	0.19	0.11	0.05	0.01	0.12
	WD Screened 25%ile	2014-2021 Period as One Dataset								0.1
	WD Screened 50%ile	2014-2021 Period as One Dataset								0.18
November	All WD 5%ile	0.26	0.15	0.00	0.09	0.08	0.05	0.00	0.00	0.08
	All WD 10%ile	0.31	0.17	0.01	0.11	0.10	0.10	0.01	0.00	0.10
	WD Screened 25%ile	2014-2021 Period as One Dataset								0.08
	WD Screened 50%ile	2014-2021 Period as One Dataset								0.17
December	All WD 5%ile	0.31	0.18	0.00	0.09	0.10	0.15	0.01	0.00	0.10
	All WD 10%ile	0.40	0.20	0.00	0.14	0.12	0.18	0.02	0.01	0.13
	WD Screened 25%ile	2014-2021 Period as One Dataset								0.05
	WD Screened 50%ile	2014-2021 Period as One Dataset								0.19
Overall "All WD" 5%ile Ave.										0.09
Overall "All WD" 10%ile Ave.										0.12
Overall WD Screened 25%ile Ave.										0.09
Overall WD Screened 50%ile Ave.										0.20

Table 13: Distribution (i.e., percentile values) in SO₂ in Fort McKay using all data from 2014-2021 and data only associated with WNW wind directions. The 5th percentile and 10th percentile values are highlighted) for all WD data and the 25th percentile and 50th percentile values highlighted in the WD-screened data. Separate warm weather (May-September) and cold weather (October-April) results are also shown.

Percentile	Wind Direction (WD) and Parameter					
	Full Period		Warm Weather (May-September)		Cold Weather (October-April)	
	All WD	WNW WD	All WD	WNW WD	All WD	WNW WD
	SO ₂ (ppb)	SO ₂ (ppb)	SO ₂ (ppb)	SO ₂ (ppb)	SO ₂ (ppb)	SO ₂ (ppb)
5%	0.00	0.00	0.00	0.00	0.00	0.00
10%	0.03	0.00	0.03	0.00	0.03	0.00
15%	0.07	0.02	0.06	0.02	0.07	0.02
20%	0.10	0.05	0.10	0.05	0.11	0.04
25%	0.13	0.07	0.13	0.07	0.14	0.07
30%	0.16	0.10	0.15	0.10	0.16	0.10
35%	0.19	0.12	0.18	0.12	0.19	0.12
40%	0.21	0.14	0.21	0.14	0.21	0.14
45%	0.24	0.15	0.24	0.16	0.24	0.15
50%	0.28	0.17	0.28	0.18	0.28	0.17
55%	0.33	0.19	0.33	0.20	0.33	0.19
60%	0.39	0.21	0.40	0.22	0.39	0.20
65%	0.47	0.23	0.48	0.24	0.47	0.23
70%	0.58	0.26	0.58	0.28	0.57	0.25
75%	0.70	0.30	0.70	0.32	0.71	0.29
80%	0.88	0.36	0.87	0.40	0.88	0.35
85%	1.20	0.44	1.16	0.48	1.24	0.42
90%	1.97	0.57	1.89	0.60	2.02	0.56
95%	4.18	0.80	4.02	0.82	4.28	0.80
100%	109.4	35.8	91.5	16.1	109.4	35.8

6.3 Supporting Figures and Tables for SO₂ Baseline Assessment

In this section additional results based upon the analyses that led to the temporal adjusted baseline estimation protocol and the SO₂ recommendations above are provided. The figures and tables shown are intended to provide insights into the patterns of SO₂ levels in Fort McKay and associated influential factors. **Note: Except when noted, all these Tables and Figures are based on distributions for the entire 2014-2021 dataset and not the temporal factor adjusted SO₂ baseline estimate datasets. These non-temporal adjusted figures and tables are intended to provide information on the variability within the dataset.**

6.3.1 Characteristics of the Hourly SO₂ Concentration Distribution

Figure 21 shows cumulative percentile concentration distribution plots for hourly SO₂ values in Fort McKay for the 2014-2021 period for “all WD” directions and for the “WD screened” (WNW) wind direction. Both the “all WD” and the WNW WD, have very low SO₂ concentrations with the “all WD” starting to increase at the 5th percentile frequency and increasing at the rate of ~0.03-0.04 ppb per 5th percentile until approximately the 55th percentile frequency after which the rate of change starts to rapidly increase. For the WD screened approach, SO₂ levels starts to increase at the 10th percentile frequency and increases steadily at the rate of ~0.02-0.03 ppb per 5th percentile until about the 70th percentile after which the rate of change starts to rapidly increase. Both frequency-percentile plots indicate that both percentile methods are seeing some, but relatively small, SO₂ emission influences at relatively low percentile concentrations with the rate of these increases relatively small and relatively constant until the greater than 50th percentile frequencies.

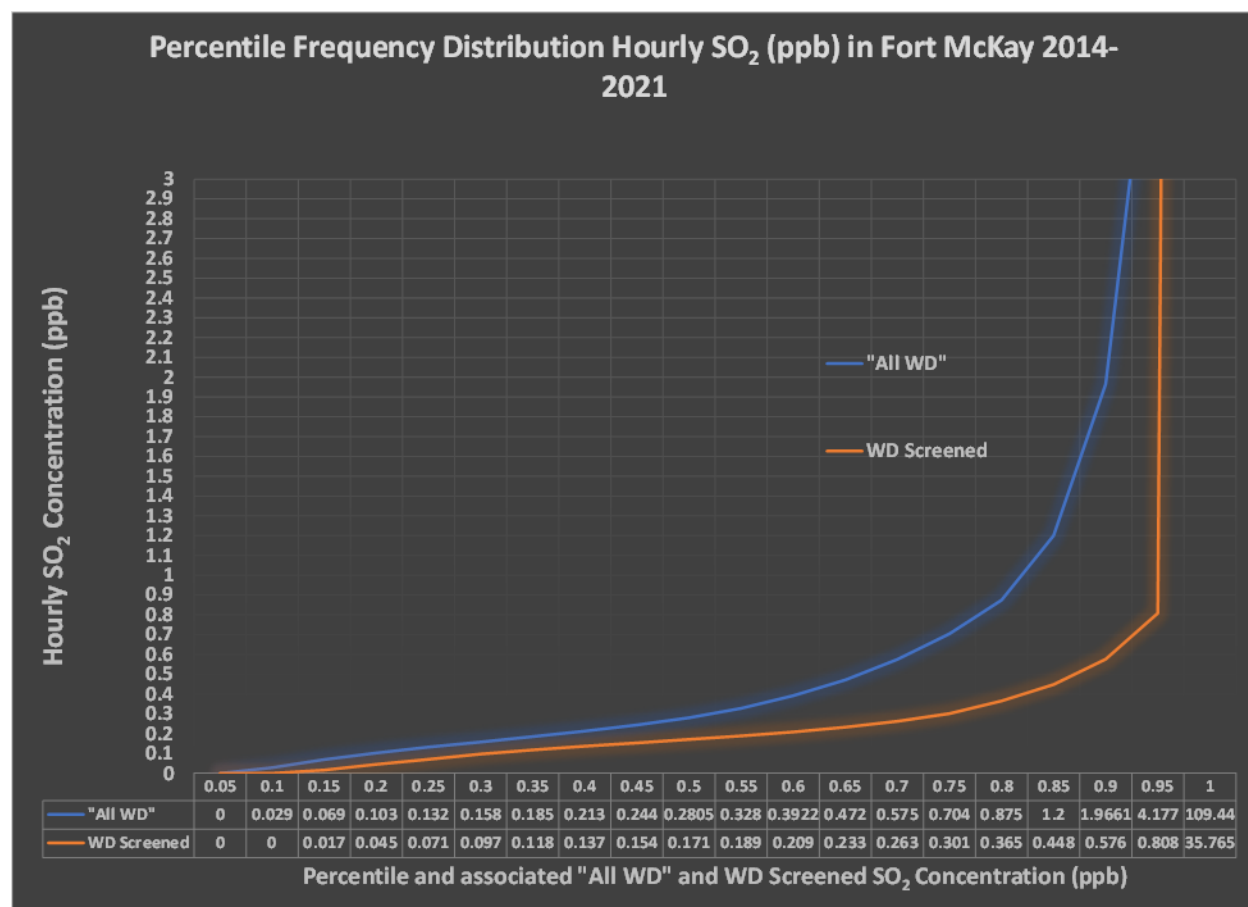


Figure 21: Hourly SO₂ Percentile Concentration Distribution Plots in Fort McKay for the 2014-2021 period for All Wind Directions and for the WNW Wind Direction.

Figure 27 is a histogram of all the hourly SO₂ concentrations in the 2014-2021 period for all wind directions (i.e., summarizes the “all WD” dataset used in the analysis (68,370 hourly values)). This “all WD” histogram, gives an SO₂ concentration distribution that indicates that a very large fraction of hourly SO₂ concentrations fall in the <0.3 ppb range (~ 50%) and therefore baseline SO₂ levels would be expected to be within the 0-0.3 ppb range.

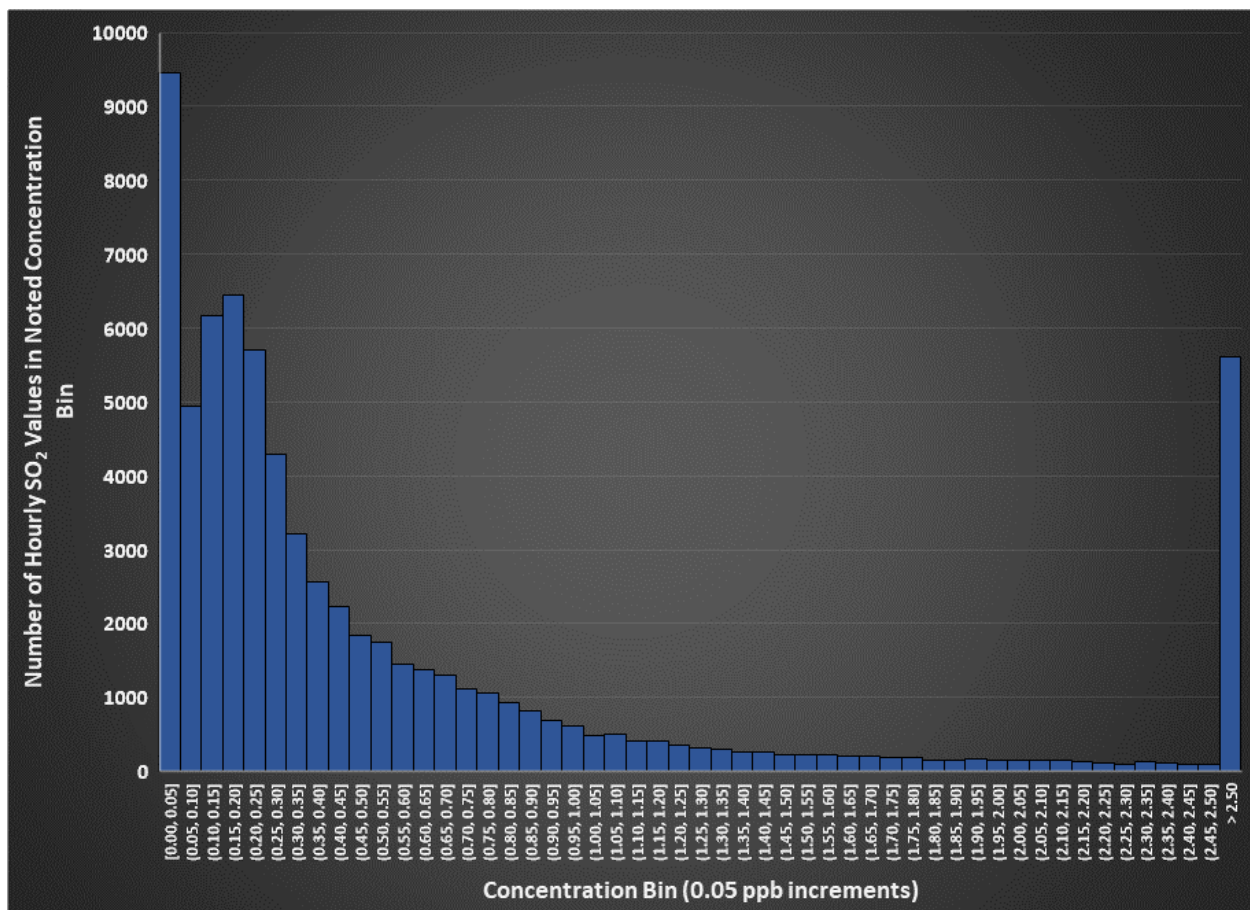


Figure 22: Histogram of Hourly SO₂ Concentrations in Fort McKay in the 2014-2021 Period (69,370 hourly values) (0.05 ppb bins with all hours with an SO₂ concentration >2.5 ppb put in one bin).

Figure 23 is a histogram of only the 0-1.0 ppb range of the “all WD” SO₂ concentrations. The cumulative percentile SO₂ concentrations plot provides a general indication of how the selection of different “all WD” baseline estimating percentiles changes baseline estimates. The “no temporal considerations” “all WD” 5th percentile and 10th percentile baseline estimates for SO₂ presented in this analysis are based on the datasets used to generate **Figure 20**. Similar to the lower range NO₂ histogram analysis (Figure 10), an analysis of the lower concentration dataset was undertaken and, unlike for NO₂ which had an approximate normal distribution at lower concentrations, the SO₂ data would indicate a more log-normal distribution at lower concentrations. This is not unexpected in that, unlike NO₂ which has a number of non-anthropogenic sources, SO₂ has minimal non-anthropogenic sources in the OSR and therefore a log-normal distribution would be expected. The log-normal distribution would indicate that the baseline for SO₂ is within the 0.0-0.15 ppb range – consistent with the above recommended baseline value of 0.09 ppb.

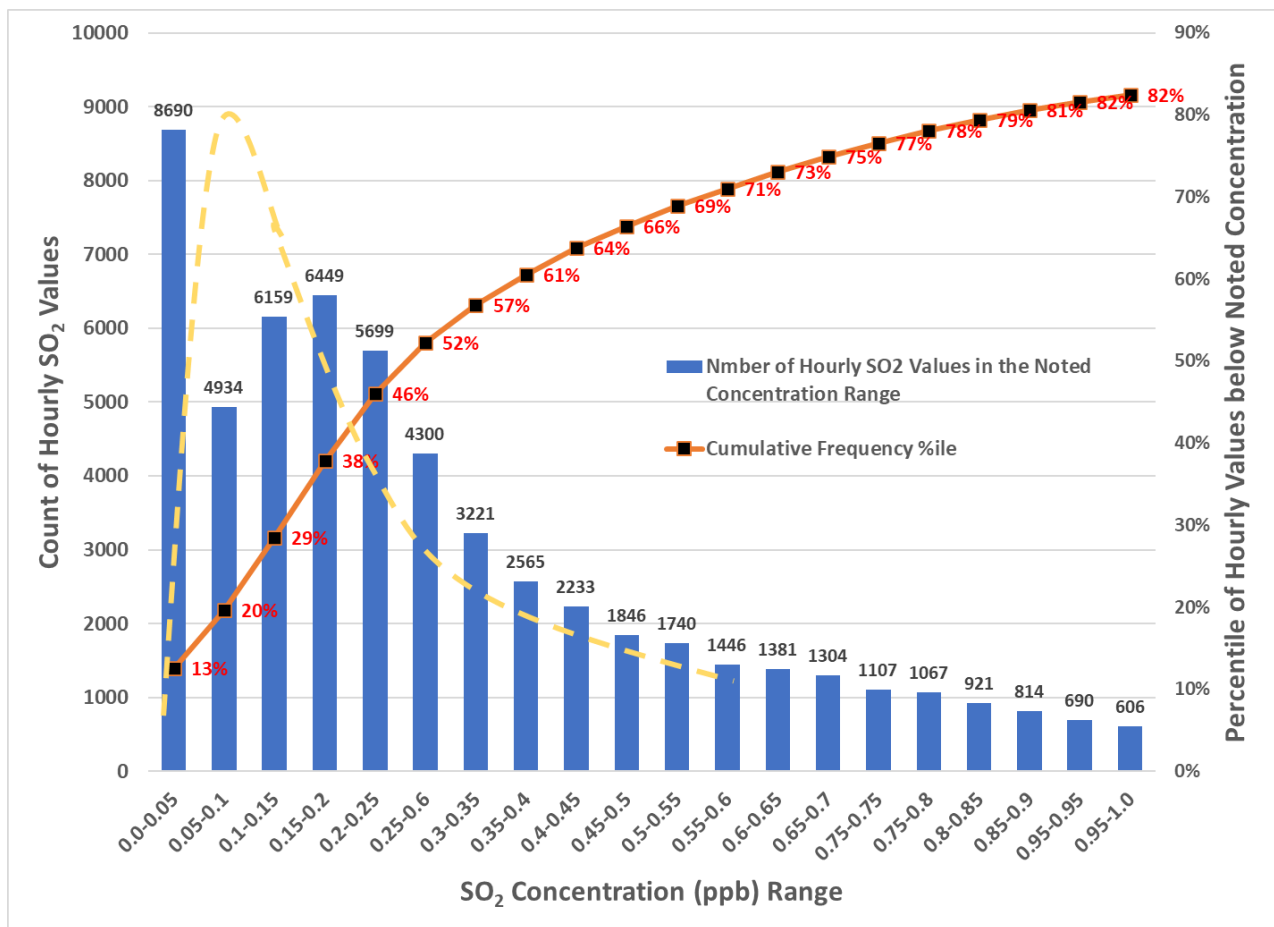


Figure 23: A Histogram of the Count of Hourly SO₂ Levels in Fort McKay in the 0-1.0 ppb Concentration Range over the Period 2014-2021 and the Cumulative Percentile Frequency that the Noted Concentration Range Represents (Total Dataset has 69,370 Hourly SO₂ Values) with an Approximate Log-Normal Distribution Curve for the 0.0-0.6 ppb Data Shown (Dashed Line).

Figure 24 is a histogram of all the hourly SO₂ concentrations in the 2014-2021 period when the wind was from the WNW which is the “WD screened” wind direction used in the analysis (5,116 hourly values). Similar to the “all WD” histogram, this WNW gives an SO₂ concentration distribution that indicates a large fraction of WNW WD hourly SO₂ concentrations fall in the <0.2 ppb range (~ 60%) and therefore baseline SO₂ levels would be expected to be within the 0-0.2 ppb range.

Figure 27 is a histogram of only the 0-1.0 ppb WD screened (WNW WD) SO₂ concentrations with the cumulative percentile SO₂ concentrations within this 0-1.0 ppb range plotted. The cumulative percentile SO₂ concentrations plot provides a general indication of how the selection of different “WD screened” baseline estimating percentiles would change baseline estimates. The “no temporal considerations” WD screened 25th percentile and 50th percentile baseline estimates for SO₂ presented in this analysis are based on the datasets used to generate **Figure 20**.

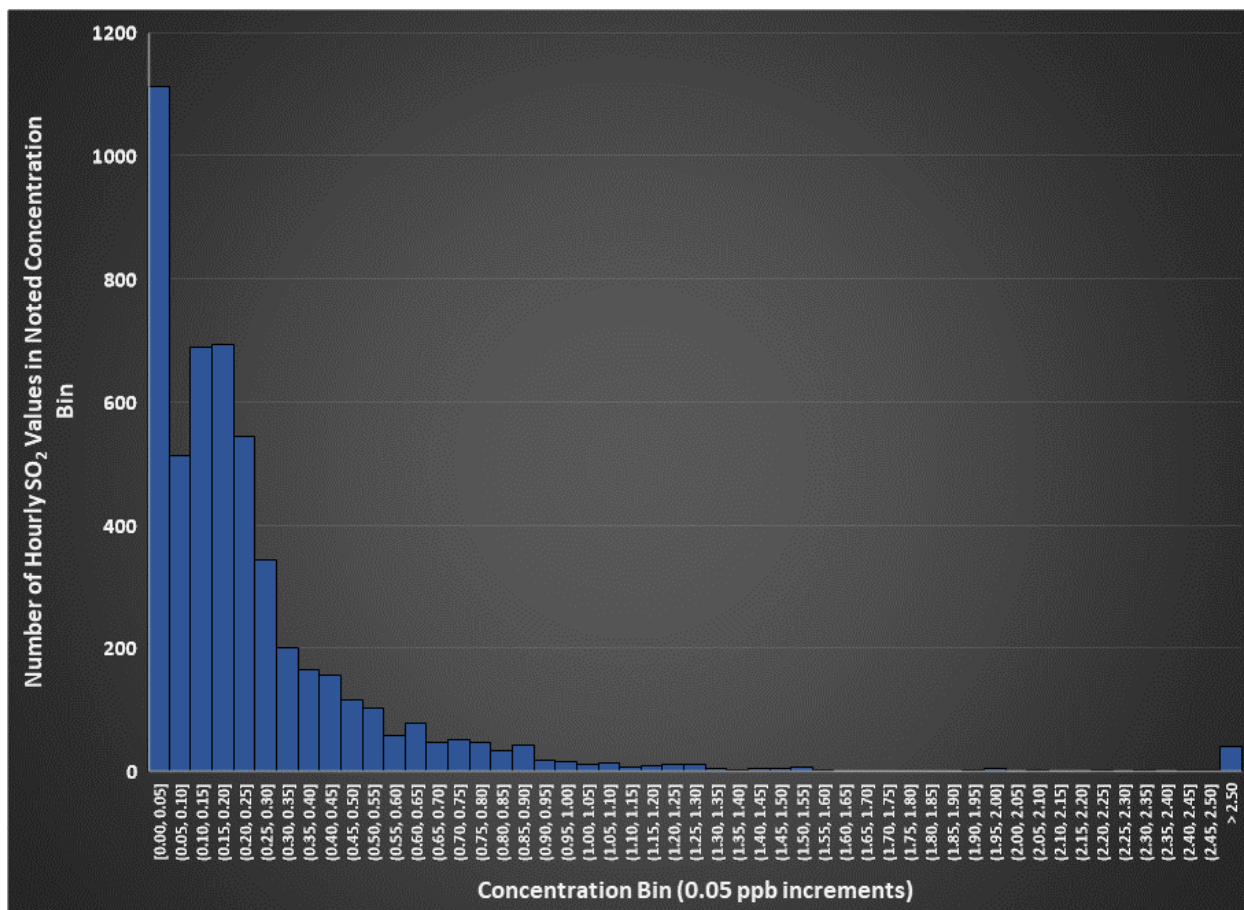


Figure 24: Histogram of Hourly SO₂ Concentrations in Fort McKay in the 2014-2021 Period when the Wind was from the WNW (5,144 hourly values) (0.05 ppb bins with all hours with SO₂ concentration >2.5 ppb put in one bin)

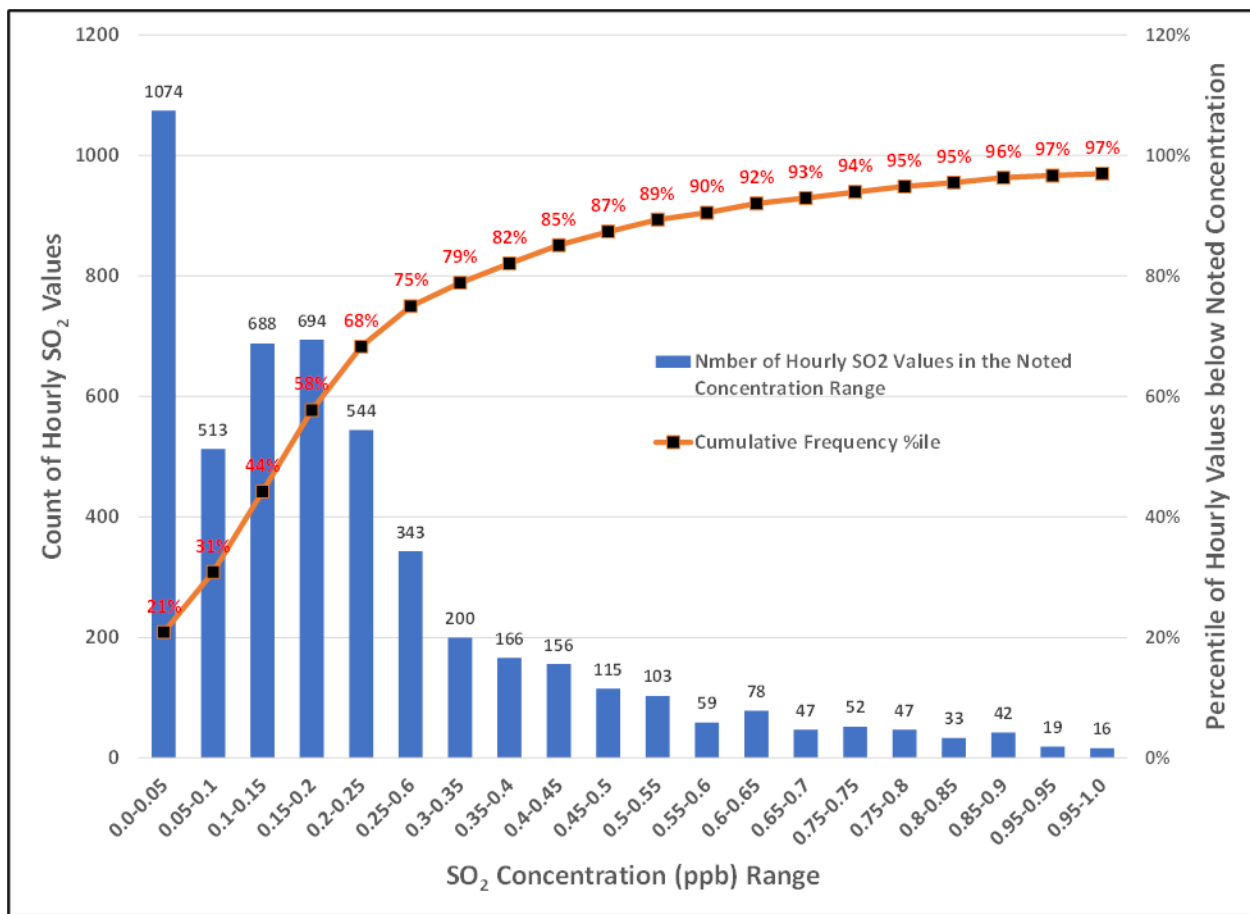


Figure 25: A Histogram of the Count of Hourly SO₂ Levels in Fort McKay in the 0-1.0 ppb Concentration Range over the Period 2014-2021 when the Wind Direction was from the WNW and the Cumulative Percentile Frequency that the Noted Concentration Range Represents (Total Dataset has 5,144 Hourly SO₂ Values)

Figure 25 is a plot of both the “all WD” and WD screened (WNW WD) SO₂ frequency percentiles over the percentile ranges that were used in the analysis. Figure 25 shows the shapes of the frequency percentile curves for the “all WD” and “WD screened” SO₂ datasets and also the how the “all WD” 5th percentile and 10th percentile baseline estimates compare to the WD screened 25th percentile and 50th percentile baseline estimates. The 5th percentile “all WD” corresponds to the WD screened 10th percentile value. The 10th percentile “all WD” corresponds to the WD screened ~17th percentile value. The 25th percentile WD screened value corresponds to the “all WD” ~15th percentile value. The 50th percentile WD screened values corresponds to an “all WD” ~32 percentile value. In general, the linear relationships at the lower percentile values would indicate somewhat constant SO₂ influences and, since any natural SO₂ influence would be very small, these must be anthropogenic emission influences. It needs to be again noted that these percentiles are based on non-temporal adjustment considerations. Figure 27 shows how temporal adjusted percentile estimates differ from those Figure 25.

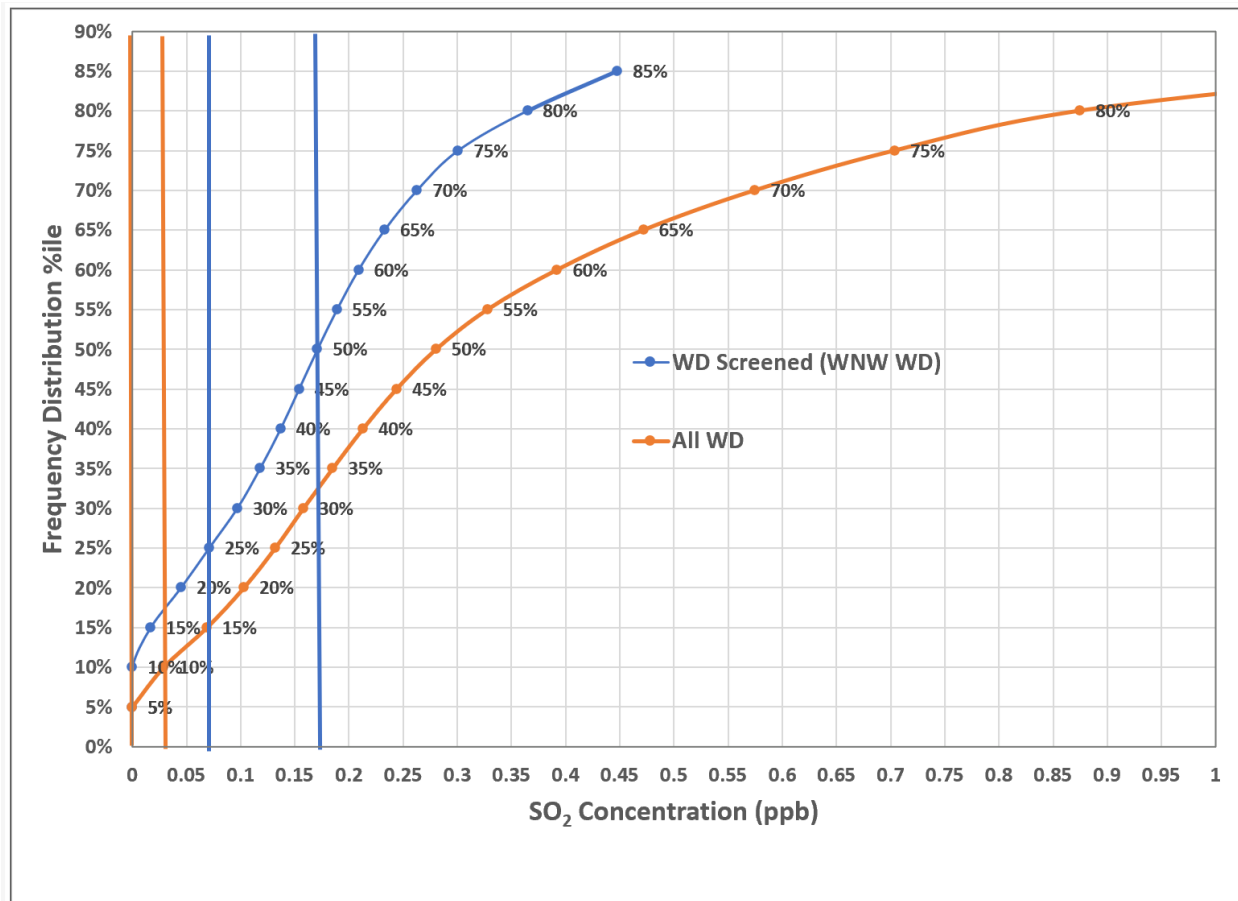


Figure 25: Cumulative Frequency Percentiles for the “All WD” and WD Screened (WNW WD) Hourly SO₂ Concentrations in Fort McKay (2014-2021 Period) and the “All WD” 5th percentile SO₂ Baseline Estimates and WD Screened (WNW WD) 25th percentile and 50th percentile SO₂ Baseline Estimates.

6.3.2 Temporal Variations in the Fort McKay SO₂ Percentiles

Figure 26 is a time series plot of hourly SO₂ levels in Fort McKay over the 2014-2021 period. There is clearly significant seasonal variability in peak SO₂ levels with the warm weather periods having the majority of peak values. This is opposite of the NO₂ seasonality and it hypothesized to be due to the majority of the SO₂ emissions coming from taller stacks which remain above the boundary-layer in winter, but mix to the surface more often in the summer or warmer months.

Figure 27, which is similar to Figure 25 but for the warm and cold weather periods, shows the seasonal difference in the lower end of the distribution which as noted previously is not as significant as it was for NO₂.

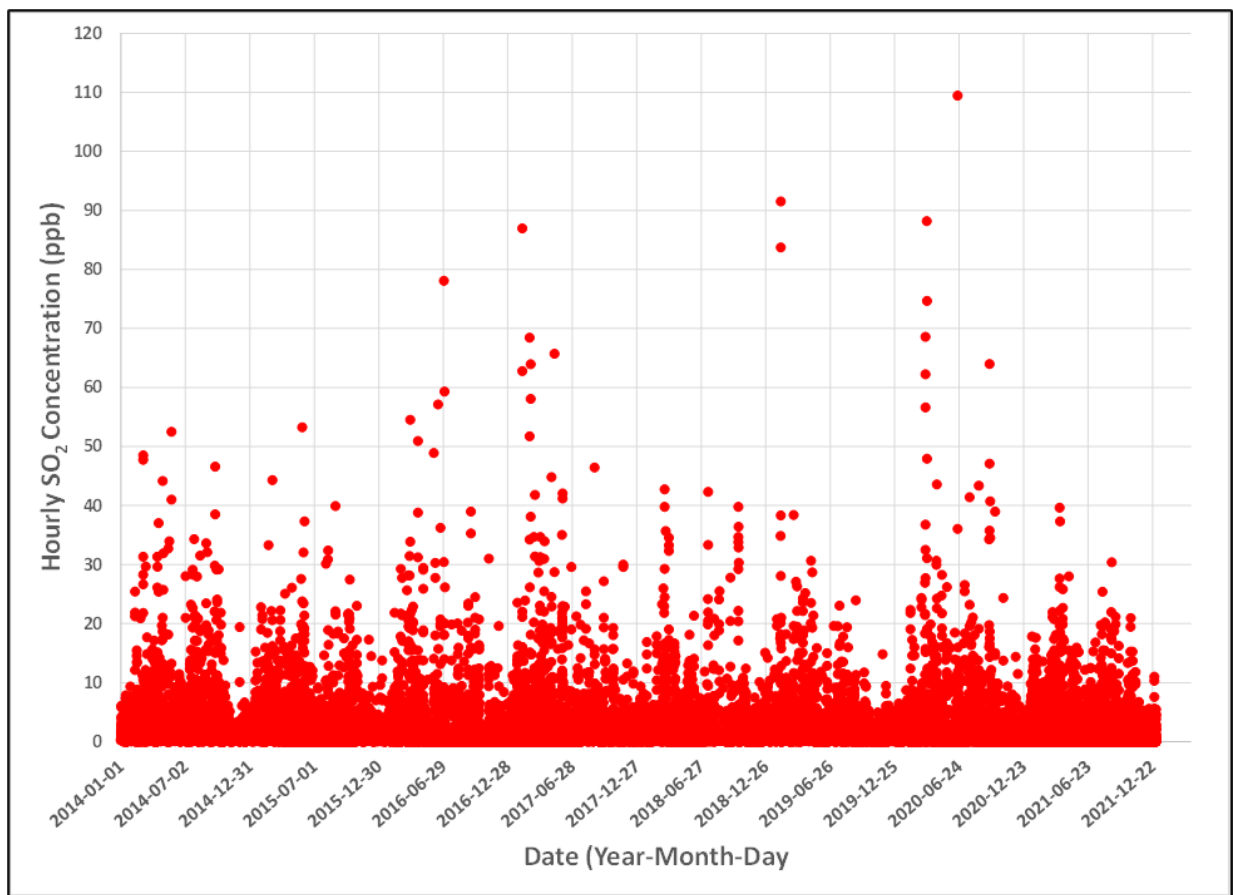


Figure 26: Hourly SO₂ Concentrations in Fort McKay in the 2014-2021 Period

Figure 28 compares the different SO₂ baseline estimates for each percentile approach as well as the baseline estimate if the hour of day, month and year are not considered. The non-temporal adjusted SO₂ baseline estimates, which are lower than the temporal adjusted estimates, but not to the magnitude of the NO₂ estimates, indicate that temporal variables also need to be considered when estimating SO₂ baselines. The data for this plot comes from Table 13.

Figure is a plot of the annual “All WD” 5th percentile and 10th percentile “All WD” SO₂ concentrations (ppb) in Fort McKay in each of the 2014-2021 analysis period years and the overall average 5th percentile and 10th percentile SO₂ concentrations for the entire 2014-2021 period. This plot shows that there is considerable inter-annual variability in the estimated SO₂ baselines associated with the “All WD” 5th percentile and 10th percentile baseline setting approach. This highlights the desirability of using multi-year datasets when baseline estimating. The data for this plot comes from

Table 12.

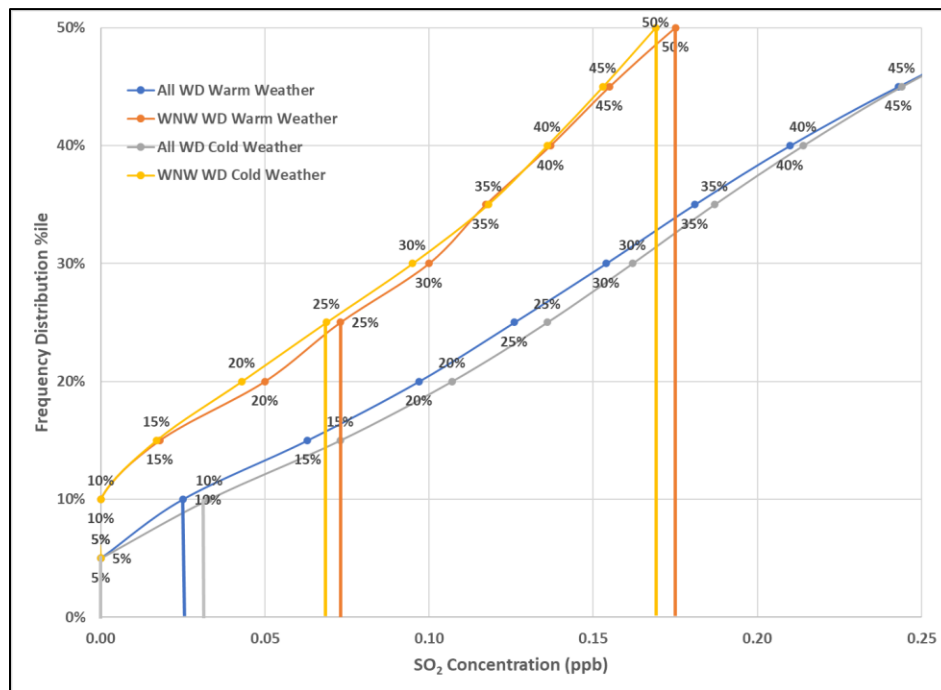


Figure 27: Cumulative Frequency Percentiles for the Warm Weather Period (May-September) and the Cold Weather Period (October-April) "All WD" and "WD Screened" (WNW WD) Hourly NO₂ Concentrations in Fort McKay (2014-2021 Period) and the "All WD" 5th percentile NO₂ Baseline Estimates and WD Screened (WNW WD) 25th percentile and 50th percentile NO₂ Baseline Estimates for Each Period.

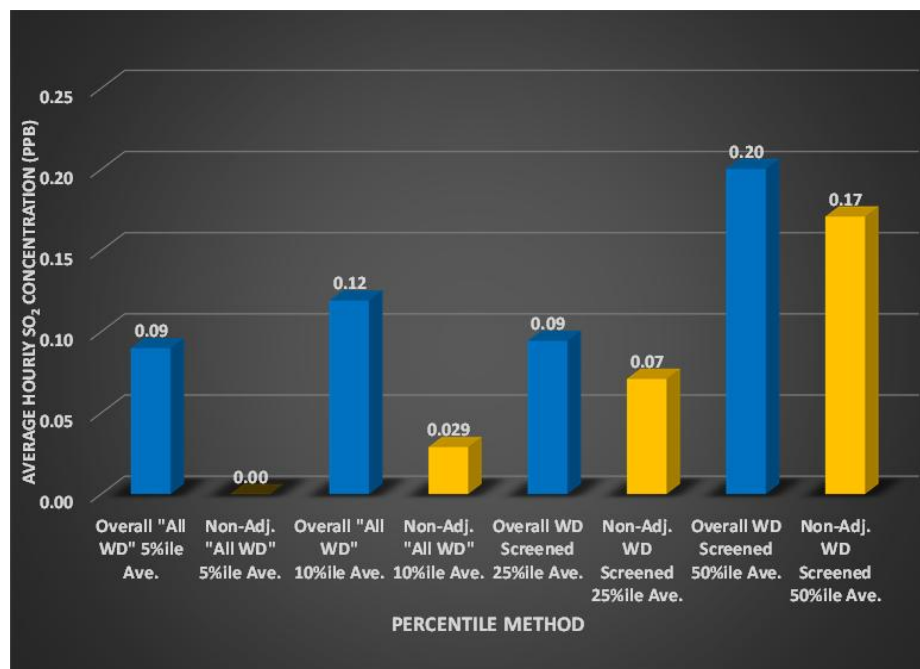


Figure 28: A Comparison of the Different percentile Method SO₂ Baseline Estimates Considering Temporal Factors (referred to as "Overall") and the Non-Temporal Factor SO₂ Baseline Estimates

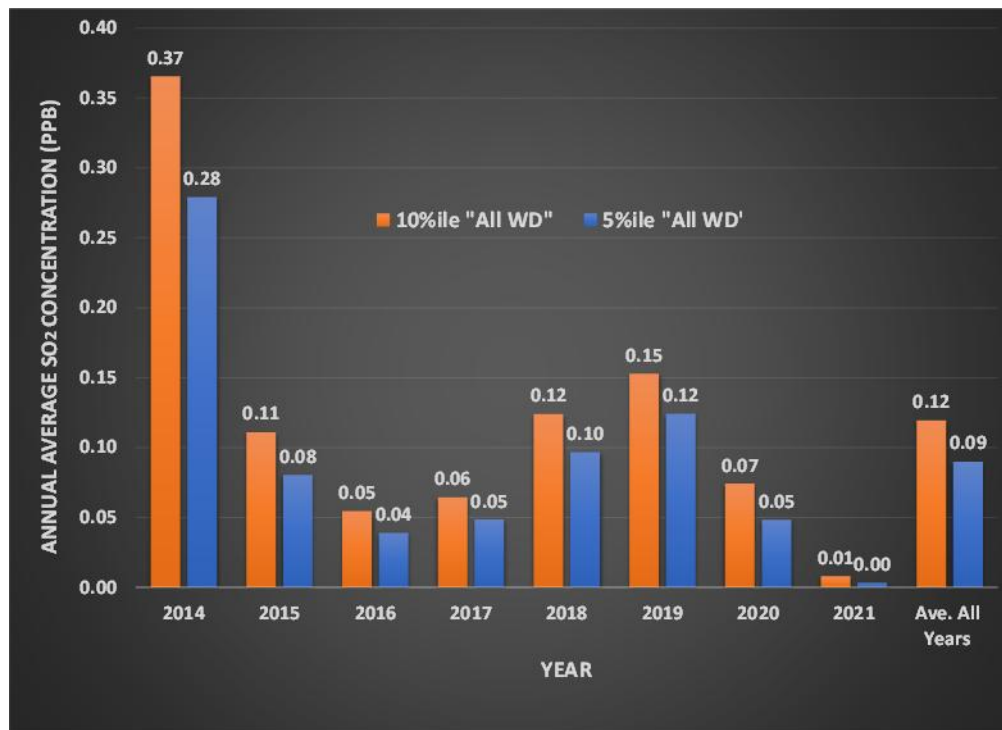


Figure 30: Temporal Adjusted Average Annual 5th percentile and 10th percentile All WD SO₂ Concentrations (ppb) in Fort McKay for the Period (2014-2021) and the Average Annual 5th percentile and 10th percentile All WD SO₂ Concentrations for the Entire 2014-2021 Period.

Figure 29 highlights the significant inter-monthly variability in terms of SO₂ baseline estimates and therefore the need to consider this monthly variability when estimating SO₂ baselines. The data for this plot comes from

Table 12.

Figure 30 plots hour of the day monthly average SO₂ concentrations for each month January, March, June, September and November for the entire 2014-2021 period for the 5th percentile approach to illustrate both the inter-daily and inter-monthly by hour of the day SO₂ concentrations. The plot shows that there is a complicated diurnal pattern to SO₂ levels with some differences among the months. In the summer (June and September) mid-day SO₂ levels are slightly lower but in the colder months of January and March mid-day levels are slightly higher. These diurnal patterns are much less pronounced as the diurnal patterns for NO₂. This difference in patterns may reflect the nature of the anthropogenic emissions of each pollutant. SO₂ emissions are almost entirely stack emissions and the greatest downmixing of concentrated emissions occurring in different times of the day in different seasons. In contrast, a large fraction of NO_x emissions is associated with ground-level sources and therefore, as a result of increased mid-day atmospheric mixing, the lowest ground-level concentrations would be expected mid-day in the summer due to more dilution, which is what happens (see Figure 18). The data for this plot comes from the Tables in **Appendix E**.

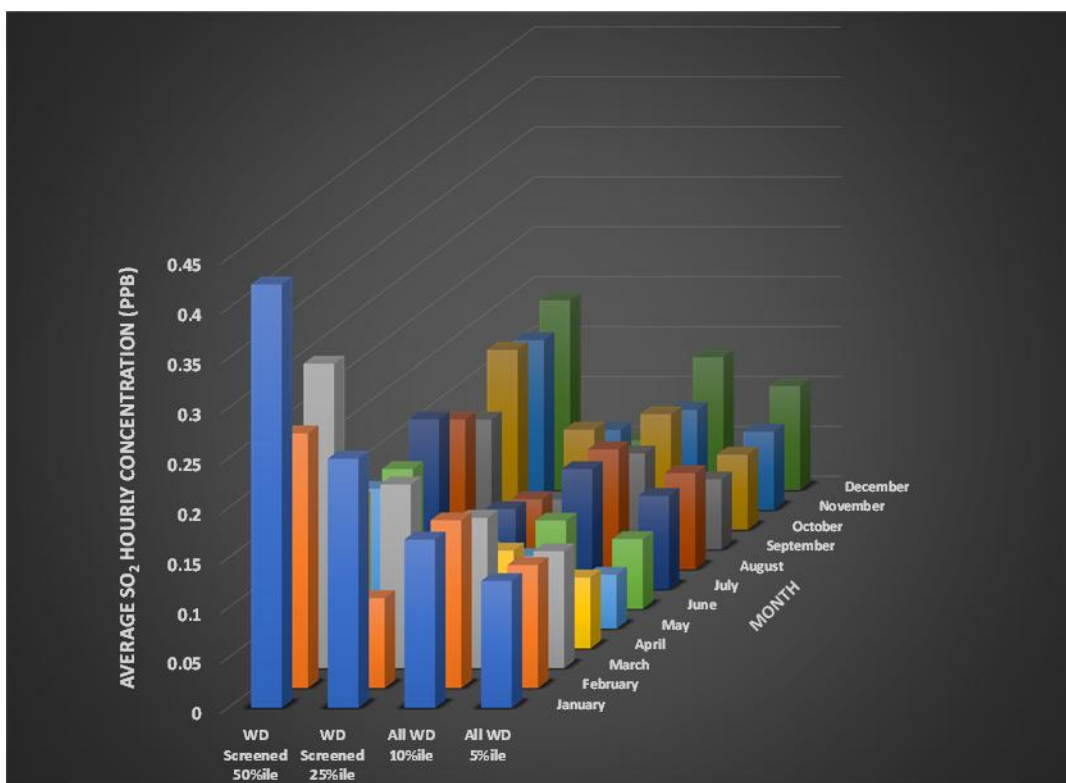


Figure 29: The Temporal Adjusted SO₂ Baseline Estimates for Each percentile Method by Month.

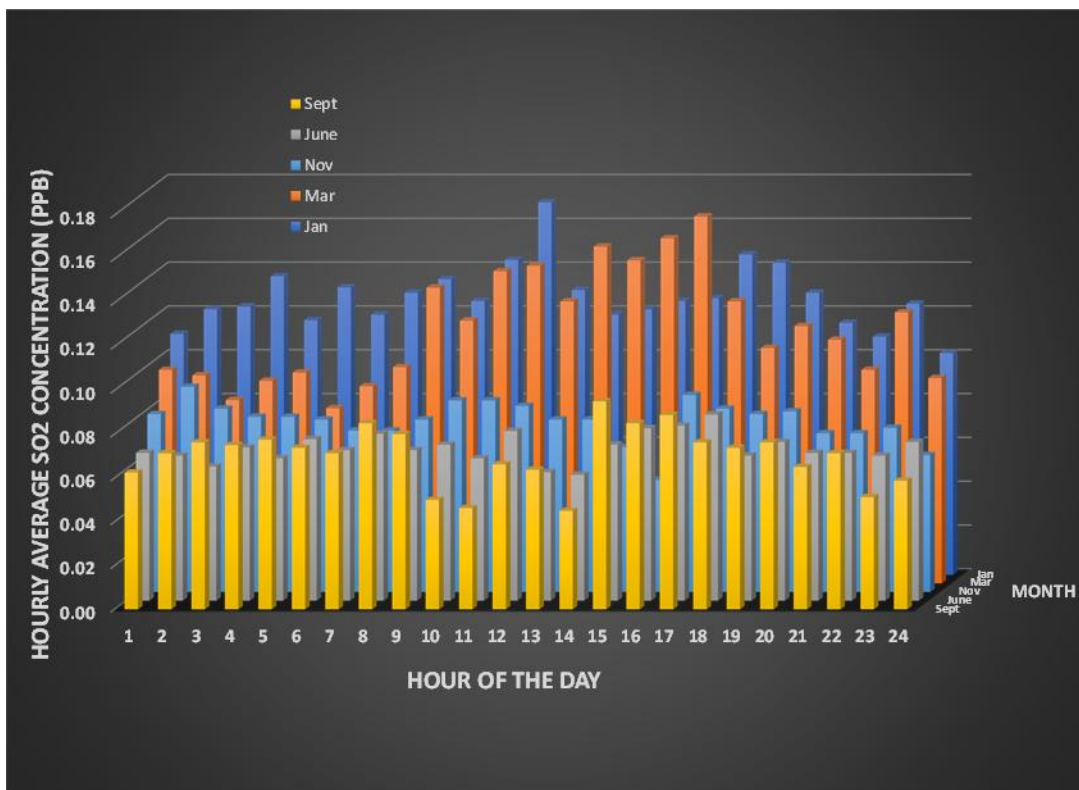


Figure 30: Temporal Adjusted 5th percentile "All WD" Average SO₂ Concentrations (ppb) by Hour of the Day in Fort McKay for the Period 2014-2021 for Select Months of the Year.

Figure 31 groups the monthly SO₂ baseline estimates into cold weather (October – April) and warm weather (May – September) periods which shows that while there is some monthly/seasonal variability in SO₂ concentrations in Fort McKay. However, the absolute magnitude of this variability is relatively small compared to the seasonal variability in NO₂ baseline estimates. The data for this plot comes from

Table 12.

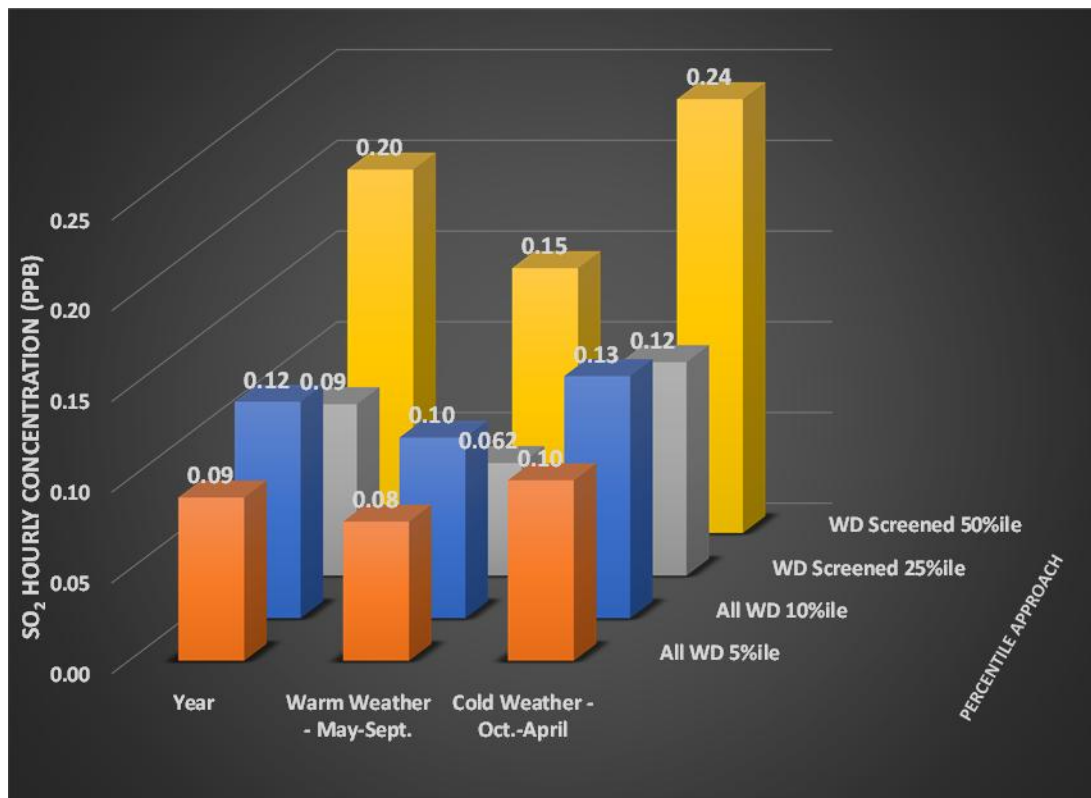


Figure 31: The Temporal Adjusted SO₂ Baseline Estimates for Each percentile Method by Season (Cold Weather and Warm Weather).

Tables 14 to 16 are examples of the monthly tables that were generated and used to generate the above Figures and to generate the temporal adjusted SO₂ baseline estimates. All the tables generated are provided in Appendix E. These tables also provide that data that can be used to generate distribution statistics for the variables considered i.e. hour of the day, month of the year and year.

6.4 Conclusion

The proposed interim SO₂ baseline for Fort McKay of 0.09 ppb with a warm weather baseline of 0.08 ppb and cold weather baseline of 0.10 ppb are in the general range of literature-based baseline SO₂ estimates and consistent with the ECCC estimate for Fort Chipewyan which shares the same climatic conditions as Fort McKay. Therefore, the proposed interim SO₂ baseline estimates as presented in **Table 13** appear to be a reasonable initial approximation.

Table 14: Example of the WD Screened SO₂ percentile Baseline Estimates (the 25th percentile and 50th percentile Estimates Highlighted in Red) (Note: the Tables for all Months are in Appendix E)

By Hour of the Day and WD Screened %ile SO ₂ Concentrations (ppb) in Fort McKay for the Month of January for the Period 2014-2021																										
Percentile	Hr of the day																								Average	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24		
5%	0.24	0.14	0.17	0.10	0.18	0.08	0.00	0.11	0.11	0.17	0.19	0.18	0.11	0.13	0.21	0.18	0.21	0.05	0.09	0.01	0.05	0.04	0.07	0.07	0.12	
10%	0.25	0.18	0.18	0.12	0.18	0.09	0.04	0.13	0.14	0.19	0.20	0.20	0.12	0.16	0.35	0.25	0.26	0.07	0.12	0.05	0.08	0.08	0.10	0.08	0.15	
15%	0.26	0.20	0.18	0.12	0.19	0.12	0.09	0.13	0.15	0.20	0.21	0.23	0.12	0.20	0.49	0.32	0.30	0.10	0.17	0.14	0.10	0.13	0.13	0.16	0.19	
20%	0.28	0.22	0.19	0.16	0.20	0.14	0.12	0.14	0.15	0.21	0.21	0.26	0.13	0.25	0.57	0.37	0.33	0.12	0.22	0.18	0.16	0.17	0.23	0.24	0.22	
25%	0.29	0.24	0.20	0.20	0.23	0.16	0.13	0.17	0.17	0.22	0.22	0.29	0.14	0.34	0.63	0.39	0.36	0.22	0.27	0.18	0.23	0.21	0.25	0.27	0.25	
30%	0.30	0.28	0.22	0.24	0.24	0.16	0.16	0.17	0.18	0.23	0.22	0.32	0.26	0.47	0.69	0.42	0.38	0.31	0.31	0.22	0.24	0.24	0.25	0.30	0.28	
35%	0.30	0.33	0.28	0.27	0.24	0.18	0.19	0.18	0.20	0.23	0.23	0.36	0.38	0.57	0.75	0.44	0.40	0.34	0.34	0.26	0.27	0.26	0.28	0.34	0.32	
40%	0.31	0.35	0.33	0.30	0.24	0.19	0.23	0.19	0.21	0.27	0.23	0.43	0.50	0.60	0.80	0.45	0.40	0.36	0.39	0.28	0.28	0.26	0.38	0.40	0.35	
45%	0.32	0.35	0.36	0.32	0.24	0.20	0.24	0.25	0.24	0.32	0.30	0.49	0.63	0.64	0.85	0.46	0.40	0.40	0.46	0.30	0.28	0.30	0.38	0.45	0.38	
50%	0.32	0.35	0.37	0.32	0.25	0.22	0.25	0.32	0.27	0.37	0.45	0.56	0.75	0.79	0.91	0.47	0.40	0.44	0.48	0.33	0.35	0.34	0.41	0.49	0.42	
55%	0.45	0.44	0.38	0.32	0.26	0.23	0.28	0.35	0.31	0.38	0.59	0.63	0.77	0.95	0.94	0.48	0.43	0.46	0.50	0.39	0.41	0.36	0.45	0.56	0.47	
60%	0.59	0.53	0.42	0.34	0.38	0.27	0.34	0.37	0.35	0.41	0.69	0.69	0.78	1.04	0.98	0.48	0.45	0.49	0.54	0.44	0.45	0.36	0.49	0.68	0.52	
65%	0.68	0.58	0.47	0.38	0.48	0.38	0.39	0.38	0.37	0.44	0.74	0.76	0.80	1.11	1.01	0.48	0.48	0.49	0.59	0.47	0.61	0.45	0.53	0.71	0.57	
70%	0.72	0.58	0.52	0.41	0.51	0.52	0.46	0.54	0.39	0.58	0.79	0.85	0.81	1.15	1.03	0.55	0.52	0.50	0.66	0.48	0.62	0.50	0.60	0.83	0.63	
75%	0.76	0.58	0.66	0.44	0.61	0.54	0.59	0.79	0.41	0.67	0.91	0.94	0.83	1.18	1.04	0.64	0.56	0.60	0.74	0.49	0.78	0.51	0.67	0.87	0.70	
80%	0.84	1.74	0.78	0.47	0.78	0.59	0.80	0.79	0.43	0.75	1.06	1.04	0.92	1.20	1.04	0.74	0.60	0.71	0.84	0.68	1.08	0.52	0.69	0.92	0.83	
85%	0.93	2.89	0.80	0.50	0.89	0.76	0.84	0.79	0.60	0.86	1.21	1.13	1.01	1.23	1.09	0.88	1.07	1.10	0.88	0.85	1.39	0.88	0.73	0.94	1.01	
90%	1.20	3.48	1.17	0.53	0.97	0.91	0.88	0.79	0.77	0.87	1.31	1.23	1.10	1.77	1.21	1.09	2.39	1.49	0.89	0.98	1.68	1.15	0.95	0.98	1.24	
95%	1.63	3.50	1.73	0.92	1.16	1.00	0.98	1.27	0.84	0.99	1.41	1.32	1.19	4.13	1.34	1.30	3.71	3.60	0.90	1.09	1.98	1.74	1.16	1.08	1.67	
100%	2.07	3.52	2.49	1.50	1.37	1.10	1.16	1.99	0.91	1.25	1.51	1.42	1.28	6.49	1.46	1.52	5.03	5.72	0.91	1.17	2.23	3.05	1.18	1.23	2.13	

Table 15: Example of the “All WD” SO₂ 5th percentile Baseline Estimates (Note: the Tables for all Months are in Appendix E)

By Hour of the Day and By Year "All WD" 5%ile PM _{2.5} Concentration in Fort McKay for the Month of January for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	1.56	1.65	1.98	1.64	1.71	1.74	2.03	2.79	2.33	1.83	1.68	0.67	1.8	1.59	1.46	1.61	1.62	1.69	1.78	1.3	1.62	1.29	1.58	1.73	1.70	0.38	(0.67-2.79)
	2015	1.61	1.59	1.72	1.21	1.07	1.18	1.23	0.87	0.96	0.74	0.78	0.85	0.79	1.28	0.13	0.06	1.31	1.58	1.5	1.37	1.26	1.52	1.34	1.1	1.13	0.43	(0.06-1.72)
	2016	0.4	0.59	0.81	0.61	0.76	0.87	0.73	0.69	0.64	0.88	1.31	1.45	1.4	0	0.57	1.35	1.19	1.64	1.33	1.6	1.34	1.35	0.83	0.84	0.97	0.42	(0.1-1.64)
	2017	1.59	1.17	1.61	1.51	1.4	0.82	0.83	0.88	1.26	1.27	0.49	0.34	0.75	0.63	0.49	1.47	1.54	1.87	1.3	0.93	0.61	1.17	1.25	1.73	1.12	0.43	(0.34-1.87)
	2018	1.15	1.23	1.06	1.15	1.35	1.36	1.53	1.51	1.49	1.74	1.79	1.75	1.32	1.98	1.63	1.91	1.88	1.66	1.42	1.61	1.24	1.19	1.15	1.05	1.46	0.28	(1.05-1.98)
	2019	2.09	1.09	0.98	1.33	1.55	1.71	1.64	1.36	1.71	1.37	1.6	1.54	1.04	0.22	0.17	0.68	1.41	1.22	1.62	1.28	1.95	1.22	2.07	2.13	1.37	0.51	(0.17-2.13)
	2020	1.53	2.62	1.39	1.41	1.7	1.22	2.08	2.15	1.66	1.57	1.63	1.62	1.87	1.43	1.46	1.41	1.43	1.99	2.27	2.45	2.31	2.59	1.8	2.81	1.85	0.46	(1.22-2.81)
	2021	0.87	0.59	0.57	0.72	0.69	0.77	0.95	1.13	1.24	1.18	1.23	0.98	1.15	1.35	1.44	1.08	1.31	1.15	1.23	1.1	1.43	1.11	1	0.97	1.05	0.25	(0.57-1.44)
																									1.33	0.50	(0-2.81)	
Average		1.35	1.32	1.27	1.20	1.28	1.21	1.38	1.42	1.41	1.32	1.31	1.15	1.27	1.06	0.92	1.20	1.46	1.60	1.56	1.46	1.46	1.47	1.43	1.38	1.55	1.33	
Std Dev		0.52	0.66	0.49	0.36	0.40	0.38	0.53	0.72	0.51	0.39	0.46	0.51	0.42	0.70	0.64	0.59	0.22	0.29	0.34	0.46	0.51	0.49	0.42	0.68	0.16		
Range		(0.4-2.62)	(0.59-2.62)	(0.57-1.98)	(0.61-1.71)	(0.69-1.74)	(0.77-2.08)	(0.73-2.08)	(0.69-2.79)	(0.64-2.33)	(0.74-1.83)	(0.49-1.74)	(0.37-1.75)	(0.75-1.87)	(0-1.98)	(0.13-1.63)	(0.06-1.91)	(0.19-1.88)	(0.15-1.99)	(0.23-2.77)	(0.93-2.45)	(0.61-2.31)	(1.11-2.59)	(0.83-2.07)	(0.84-2.81)		(0.92-1.6)	

Table 16: Example of the “All WD” SO₂ 10th percentile Baseline Estimates (Note: the Tables for all Months are in Appendix E)

By Hour of the Day and By Year "All WD" 10 th ile PM _{2.5} Concentrations (µg/m ³) in Fort McKay for the Month of January for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev	Range
Year	2014	3.2	1.77	2.73	2.57	2.57	2.16	2.6	3.42	3.24	3.25	3.12	1.75	1.93	1.65	1.67	1.68	1.65	1.8	2.2	1.64	2.19	1.59	2.49	3.19	2.34	0.64	(1.59-3.42)
	2015	1.64	2.2	1.86	1.31	1.5	1.9	1.85	1.3	1.58	1.15	0.87	0.89	1.29	1.39	1.27	1.21	1.81	1.98	1.95	1.76	1.62	1.56	1.56	1.35	1.53	0.34	(0.87-2.2)
	2016	1.53	1.16	1.32	1.13	1.46	1.16	1.31	1.43	1.49	1.4	1.74	1.49	1.54	1.41	1.32	1.58	1.39	1.72	1.64	1.77	1.44	1.56	1.16	1.39	1.44	0.18	(1.13-1.77)
	2017	1.71	1.6	2.13	1.71	2.17	1.19	1.55	1.43	1.35	1.53	1.37	1.26	1.45	1.24	1.32	1.55	1.69	1.94	1.63	1.28	1.48	1.2	1.53	1.98	1.55	0.28	(1.19-2.17)
	2018	1.38	1.52	1.53	1.61	1.6	1.56	1.8	1.69	1.69	1.99	1.88	1.98	1.89	2.41	2.26	2.25	2.22	1.92	1.67	1.79	1.64	1.73	1.24	1.15	1.77	0.32	(1.15-2.41)
	2019	2.71	2.24	2.32	2.26	2.13	2.22	2.17	1.55	2.45	1.89	1.97	1.82	1.36	0.68	0.54	1.68	1.74	1.81	2.66	1.53	3.14	1.55	3.11	2.71	2.01	0.65	(0.54-3.14)
	2020	1.94	3.83	1.7	1.82	1.89	1.32	2.39	2.63	2.38	1.87	2.27	2.48	2.63	2.36	1.74	1.86	1.77	2.81	2.76	2.58	3.27	3.18	3.83	4.33	2.49	0.76	(1.32-4.33)
	2021	1.11	0.92	0.8	0.88	0.8	1.14	1.24	1.13	1.39	1.4	1.35	1.32	1.68	1.52	1.58	1.41	1.38	1.5	1.62	1.7	1.78	1.56	1.38	1.34	1.33	0.28	(0.8-1.78)
																										1.81	0.62	(0.54-4.33)
	Average	1.90	1.91	1.80	1.66	1.77	1.58	1.86	1.82	1.95	1.81	1.82	1.62	1.72	1.58	1.46	1.65	1.71	1.94	2.02	1.76	2.07	1.74	2.04	2.18	1.81		
	StdDev	0.71	0.90	0.60	0.56	0.55	0.45	0.49	0.79	0.67	0.65	0.68	0.49	0.43	0.57	0.49	0.31	0.26	0.38	0.47	0.37	0.74	0.60	0.99	1.14	0.17		
	Range	(1.11-3.83)	(0.92-2.73)	(0.88-2.73)	(0.88-2.57)	(0.8-2.22)	(1.14-2.22)	(1.14-2.61)	(1.13-3.42)	(1.35-3.24)	(1.15-3.25)	(0.87-3.12)	(0.89-2.48)	(1.29-2.63)	(1.39-2.36)	(1.27-2.26)	(1.21-2.58)	(1.81-2.22)	(1.94-2.81)	(1.63-2.66)	(1.28-3.14)	(1.44-1.55)	(1.16-3.27)	(1.16-3.83)	(1.15-4.33)	(1.18-2.18)		

7 PM_{2.5} Baseline Estimates

7.1 Literature PM_{2.5} Baseline Estimates

To assess how the “temporal adjusted” percentile approach PM_{2.5} baseline estimates compared to other PM_{2.5} baseline estimates, a scan of the literature on background ambient PM_{2.5} levels was conducted.

The residence time of PM_{2.5} in the atmospheric boundary layer is hours to days and in the free troposphere in the order of days to weeks which means that long range PM transport can influence background PM_{2.5} concentrations i.e. non-local/region emission influences (UNECE, 2010). Non-local/regional PM_{2.5} emission influences can include long range natural dust and wildfire smoke influences and primary and secondary PM_{2.5} anthropogenic sources (US EPA, 2019).

Estimated background PM_{2.5} levels from modelling and/or measurement studies range from approximately 1 µg/m³ (US EPA, 2009) to approximately 4.8 ± 2.4 µg/m³ (UNECE, 2010). Measured rural background PM_{2.5} concentrations in Norway, Sweden and Finland ranged from 1 to 4 µg/m³ (EEA, 2019), in the Western United State were ~3 µg/m³ (US EPA, 2019), in British Columbia were estimated to be 2 µg/m³ with a seasonal range from 1-4 µg/m³ (McKendry, 2006) and for Canada were estimated to be approximately 1.8 µg/m³ (annual average) based on many years of rural and remote measurement data (Health Canada, 2021).

7.2 Recommendations

Table 17 shows the baseline estimates for PM_{2.5} using the above approaches and temporal considerations. The PM_{2.5} baseline estimates in Table 17 indicate that:

- The “all WD” 5th percentile is not consistent with the 25th percentile “WD screened” (the WNW WD) as they were for NO₂ and SO₂. Instead, 10th percentile all WD values tend to more consistent with the 25th percentile WD screened result for PM_{2.5}.
- There is some difference in the estimates between the warm weather and cold weather periods with the warm weather baseline estimates slightly higher, which might be the result of wildfires contributing to the continental background and other natural sources of PM_{2.5} that occur when soil is exposed (i.e., no snow cover) and vegetation is growing (e.g., biogenic VOCs, plant detritus).

The reason the “all WD” 5th percentile and the 25th percentile “WD screened” are not consistent for PM_{2.5} is uncertain. The shape of the cumulative PM_{2.5} distribution at low concentrations (see **Figure 36** below) is different than for NO₂ and SO₂ with a more gradual increase. This could be due to a greater contribution of natural PM_{2.5} sources and/or measurement technology challenges for PM_{2.5}. For example, the varying composition and volatility of PM_{2.5} complicates measurements at low concentrations. Due to these uncertainties the ‘all WD’ 5th percentile estimates in **Table 17** may be an extreme lower bound on the baseline. Considering information from the literature and **Table 17** results, a reasonable interim PM_{2.5} baseline for Fort McKay would be in the range of 1.0-2.0 µg/m³. Given Health Canada’s recent PM_{2.5} background estimate of 1.8 µg/m³, which is similar to the 10thile “all WD” PM_{2.5} baseline estimate, 1.8 µg/m³ is recommended as a reasonable value for a remote boreal forest environment.

Table 17: Summary of Non-Adjusted and Temporal Adjusted PM_{2.5} Baseline Estimates for Fort McKay using “All WD” 5th percentile and 10th percentile and “WD Screened” (the WNW WD) 25th percentile and 50th percentile Concentrations based on Hourly SO₂ Data from the Fort McKay Bertha Ganter Air Monitoring Station for the Period 2014-2021

Summary of the PM _{2.5} Baseline Estimates using the Noted Metric, Period and Approach						
%ile Metric	PM _{2.5} (µg/m ³) for Noted Period and Non-Adjusted (NA) and Temporal Adjusted (TA) Approaches					
	Full Year		Warm Weather (May-September)		Cold Weather (October-April)	
	NA	TA	NA	TA	NA	TA
Overall "All WD" 5%ile Ave.	0.98	1.34	1.05	1.42	0.97	1.29
Overall "All WD" 10%ile Ave.	1.53	1.81	1.58	1.95	1.49	1.71
Overall WD Screened 25%ile Ave.	1.84	1.97	1.75	2.20	1.91	1.80
Overall WD Screened 50%ile Ave.	3.59	3.42	3.64	3.87	3.56	3.10

In addition to comparison of the values in **Table 17**, which serves as some level of sensitivity analysis, **Tables 18** and 19 provide further sensitivity analyses showing the monthly and annual PM_{2.5} baseline values that were used to generate the annual and seasonal PM_{2.5} baseline temporal adjusted values and no temporal adjustment, respectively, in **Table 17**. The data in Table 18 can be used to generate basic statistics on the inter-annual variability of the “by month” baseline values and also for the inter-annual baseline values. Table 19 shows how sensitive the baseline value is to the percentile used to define it. Table 18 shows that regardless of year there is some seasonality in the baseline value using the methods proposed here. There is also considerable interannual variability in the value but no consistent trend.

Table 18: PM_{2.5} Baseline Estimates (µg/m³) for the Noted Years by Month and the Average for all Years (2014-2021 Period) Calculated using the "All WD" percentile Method (5th percentile and 10th percentile Values Shown) and the WD Screened percentile Method (WNW WD and 25th percentile and 50th percentile Values Shown) with Monthly Values based on the Average of by Hour of the Day percentiles for the Noted percentile Method and the Noted percentile

Month	%ile Metric	Year								
		2014	2015	2016	2017	2018	2019	2020	2021	Average
January	All WD 5%ile	1.70	1.13	0.97	1.12	1.46	1.37	1.85	1.05	1.33
	All WD 10%ile	2.34	1.53	1.44	1.55	1.77	2.01	2.49	1.33	1.81
	WD Screened 25%ile	2014-2021 Period as One Dataset								1.98
	WD Screened 50%ile	2014-2021 Period as One Dataset								2.96
February	All WD 5%ile	1.47	1.34	1.30	1.30	0.48	2.05	1.94	1.98	1.48
	All WD 10%ile	1.75	1.98	1.58	1.65	0.62	2.70	2.64	2.72	1.95
	WD Screened 25%ile	2014-2021 Period as One Dataset								1.84
	WD Screened 50%ile	2014-2021 Period as One Dataset								3.29
March	All WD 5%ile	1.35	0.93	0.73	1.77	0.89	1.50	2.01	1.79	1.37
	All WD 10%ile	1.99	1.34	1.08	2.67	1.05	1.84	3.11	2.33	1.93
	WD Screened 25%ile	2014-2021 Period as One Dataset								2.14
	WD Screened 50%ile	2014-2021 Period as One Dataset								3.74
April	All WD 5%ile	0.88	1.40	0.60		1.27	1.56	1.69	1.79	1.31
	All WD 10%ile	2.17	1.18	1.78	1.03	0.64	1.70	2.10	2.30	1.61
	WD Screened 25%ile	2014-2021 Period as One Dataset								1.5
	WD Screened 50%ile	2014-2021 Period as One Dataset								2.47
May	All WD 5%ile	0.50	1.59	0.58	0.38		2.21	0.84	1.71	1.12
	All WD 10%ile	1.13	2.09	0.76	0.74		2.85	1.66	2.63	1.69
	WD Screened 25%ile	2014-2021 Period as One Dataset								1.73
	WD Screened 50%ile	2014-2021 Period as One Dataset								3.04
June	All WD 5%ile	0.88	2.15	1.12	0.77	1.13	1.90	1.77	1.63	1.42
	All WD 10%ile	1.43	2.78	1.56	1.20	1.41	2.90	2.29	2.07	1.95
	WD Screened 25%ile	2014-2021 Period as One Dataset								2.42
	WD Screened 50%ile	2014-2021 Period as One Dataset								4.77
July	All WD 5%ile	1.44	1.20	1.42	1.20	1.77	1.76	1.96	1.83	1.57
	All WD 10%ile	1.97	1.55	1.93	1.62	2.43	2.49	3.01	2.57	2.20
	WD Screened 25%ile	2014-2021 Period as One Dataset								2.4
	WD Screened 50%ile	2014-2021 Period as One Dataset								4.74
August	All WD 5%ile	1.73	1.35	2.17	1.66	2.41	1.62	1.48	1.76	1.77
	All WD 10%ile	2.34	1.79	2.75	2.07	3.24	2.00	1.88	2.35	2.30
	WD Screened 25%ile	2014-2021 Period as One Dataset								2.7
	WD Screened 50%ile	2014-2021 Period as One Dataset								4.01
September	All WD 5%ile	1.25	2.09	0.92	0.75	1.02	1.51	1.33	1.02	1.24
	All WD 10%ile	1.65	2.33	1.14	1.17	1.31	2.02	1.69	1.46	1.60
	WD Screened 25%ile	2014-2021 Period as One Dataset								1.76
	WD Screened 50%ile	2014-2021 Period as One Dataset								2.77
October	All WD 5%ile	0.82	0.43	0.65	0.59	1.23	0.57	0.61	1.40	0.79
	All WD 10%ile	1.15	0.63	0.82	0.74	1.52	0.84	0.77	1.66	1.02
	WD Screened 25%ile	2014-2021 Period as One Dataset								0.99
	WD Screened 50%ile	2014-2021 Period as One Dataset								2
November	All WD 5%ile	0.93	1.34	0.68	1.05	1.57	1.44	1.46	1.11	1.20
	All WD 10%ile	1.40	1.57	0.93	1.21	2.07	1.87	1.79	1.62	1.56
	WD Screened 25%ile	2014-2021 Period as One Dataset								2.17
	WD Screened 50%ile	2014-2021 Period as One Dataset								3.68
December	All WD 5%ile	1.05	1.56	1.45	0.33	2.23	2.49	1.18	1.89	1.52
	All WD 10%ile	1.50	1.83	1.87	0.65	3.12	3.36	1.79	2.43	2.07
	WD Screened 25%ile	2014-2021 Period as One Dataset								1.96
	WD Screened 50%ile	2014-2021 Period as One Dataset								3.59
Overall "All WD" 5%ile Ave.										1.34
Overall "All WD" 10%ile Ave.										1.81
Overall WD Screened 25%ile Ave.										1.97
Overall WD Screened 50%ile Ave.										3.42

Table 19: Distribution (i.e., percentile values) in PM_{2.5} in Fort McKay using all data from 2014-2021 and data only associated with WNW wind directions. The 5th percentile and 10th percentile values are highlighted) for all WD data and the 25th percentile and 50th percentile values highlighted in the WD-screened data. Separate warm weather (May-September) and cold weather (October-April) results are also shown.

Percentile	Wind Direction (WD) and Parameter					
	Full Period		Warm Weather (May-September)		Cold Weather (October-April)	
	All WD	WNW WD	All WD	WNW WD	All WD	WNW WD
	PM _{2.5} (µg/m ³)	PM _{2.5} (µg/m ³)	PM _{2.5} (µg/m ³)	PM _{2.5} (µg/m ³)	PM _{2.5} (µg/m ³)	PM _{2.5} (µg/m ³)
5%	0.98	0.60	1.05	0.52	0.97	0.64
10%	1.53	0.93	1.58	0.91	1.49	0.95
15%	2.01	1.18	2.08	1.15	1.97	1.24
20%	2.47	1.49	2.54	1.43	2.42	1.55
25%	2.91	1.84	2.95	1.75	2.88	1.91
30%	3.35	2.20	3.37	2.12	3.33	2.25
35%	3.77	2.50	3.80	2.47	3.75	2.54
40%	4.20	2.86	4.24	2.82	4.18	2.89
45%	4.65	3.23	4.68	3.24	4.63	3.24
50%	5.14	3.59	5.16	3.64	5.13	3.56
55%	5.69	4.02	5.71	4.16	5.66	3.93
60%	6.29	4.48	6.31	4.57	6.27	4.38
65%	7.01	5.01	7.01	5.03	7.01	4.95
70%	7.84	5.72	7.81	5.82	7.86	5.64
75%	8.82	6.56	8.72	6.76	8.91	6.39
80%	10.07	7.62	9.91	7.91	10.22	7.38
85%	11.78	9.10	11.51	9.30	11.97	8.92
90%	14.41	11.40	14.09	11.57	14.69	11.18
95%	20.51	17.21	19.47	16.45	21.29	17.30
100%	3151.6	235.8	2641.1	235.8	3151.6	158.0

7.3 PM_{2.5} Baseline Related Figures and Tables

The following are Figures and examples of the data Tables that were generated as part of the PM_{2.5} baseline estimation. These provide insights into the patterns of PM_{2.5} levels and associated influential factors. **Note: Except when noted, all these Tables and Figures are based on distributions for the entire 2014-2021 dataset and not the temporal factor adjusted PM_{2.5} baseline estimate datasets. As noted, these non-temporal adjusted figures and tables are intended to provide information on the variability within the dataset.**

Figure 31 shows percentile concentration distribution plots for hourly PM_{2.5} values in Fort McKay for the 2014-2021 period for all wind directions and for the WNW wind direction. Both the “all WD” and WD screened plots show similar concentration increase trends with, as would be expected, the “all WD” having slightly concentration levels. A linear trend can be seen for both plots until approximately the 90th percentile when the concentrations increase significantly reflecting wildfire smoke influence.

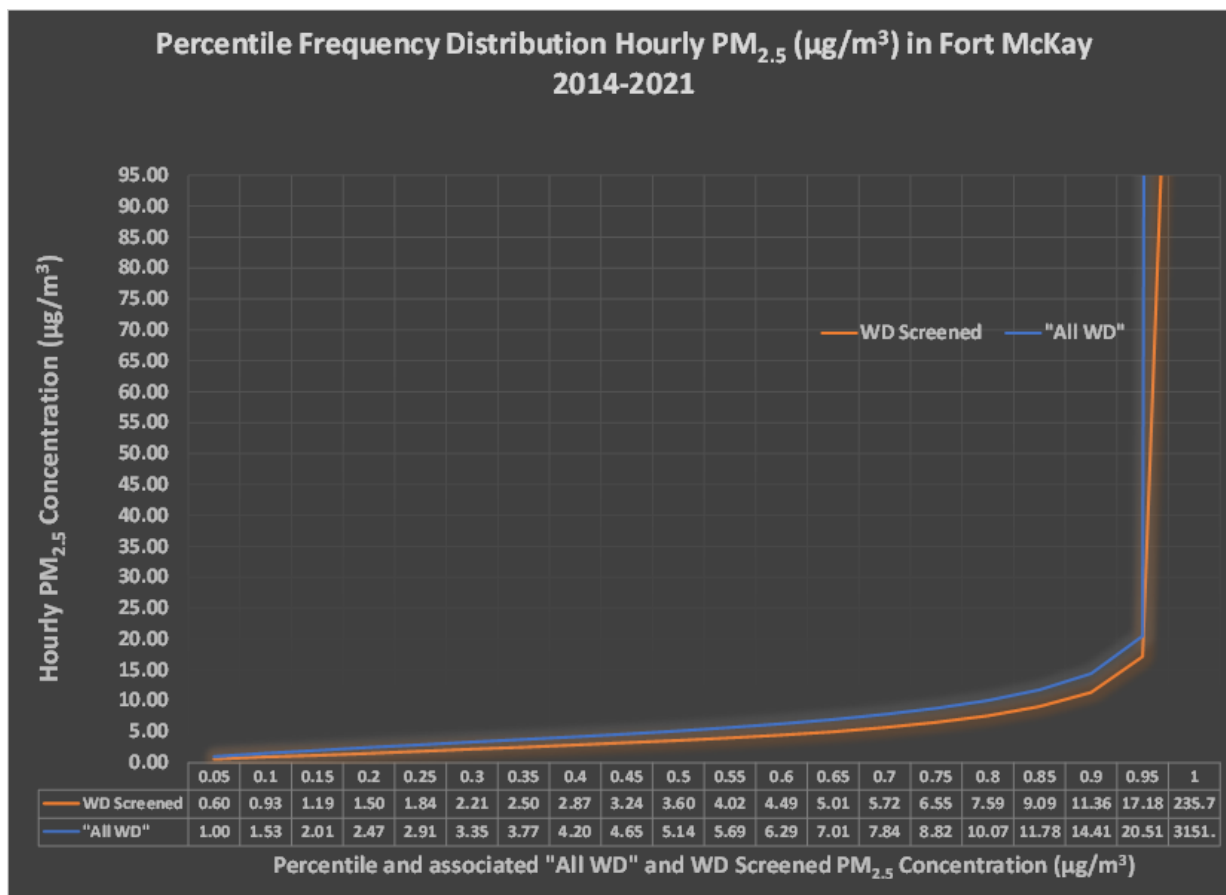


Figure 32: Hourly PM_{2.5} Percentile Concentration Distribution Plots in Fort McKay for the 2014-2021 period for All Wind Directions and for the WNW Wind Direction.

Figure 33 is a histogram of all the hourly PM_{2.5} concentrations in the 2014-2021 period for all wind directions. The dataset for this histogram consisted of 69,431 hourly values. This “all WD” histogram, gives a PM_{2.5} concentration distribution indicating that up to approximately the 25th percentile hourly PM_{2.5} concentrations fall are <3 µg/m³.

Figure 34 is a histogram of only the 0-5 µg/m³ “all WD” PM_{2.5} concentrations with the cumulative percentile PM_{2.5} concentrations within this 0-5 µg/m³ range plotted. The cumulative percentile PM_{2.5} concentrations plot provides a general indication of how baseline estimates change as a function of the selection of different “all WD” baseline estimating percentiles. As noted above, the characteristics of this plot are different than observed for NO₂ and SO₂. There is no clear mode; instead the frequency of observations increase sharply to a concentration of about 1.75 µg/m³ and then is relatively steady to 4.5-5 µg/m³. The “no temporal considerations” “all WD” 5th percentile and 10th percentile baseline estimates for PM_{2.5} presented in **Table 17** are based on the datasets used to generate Figure 32 and 36.

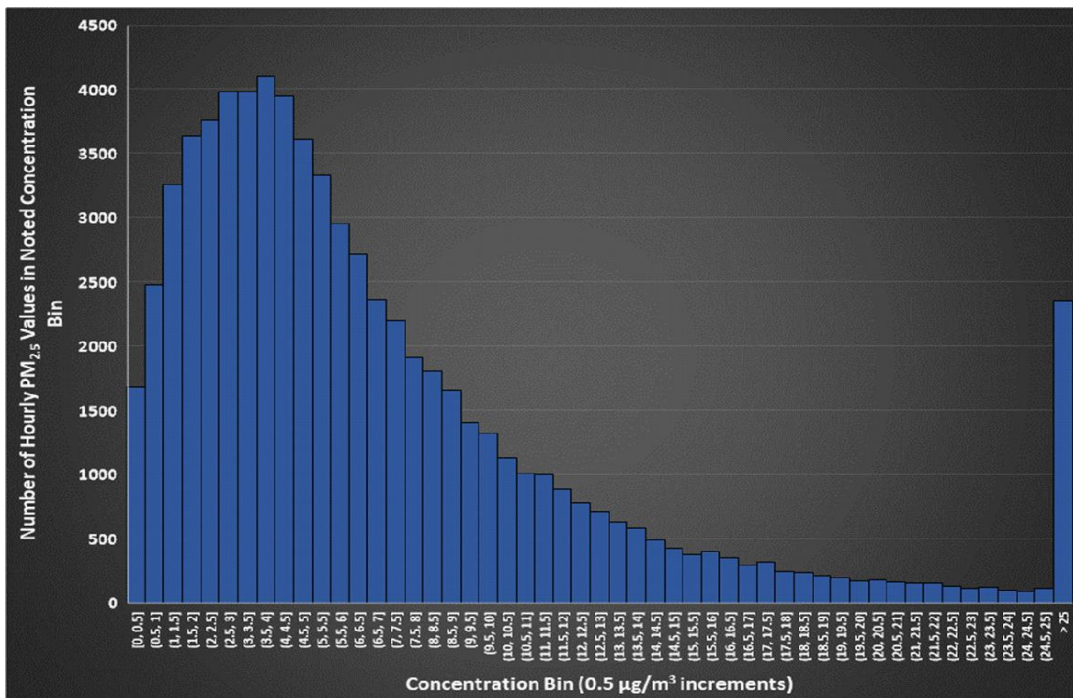


Figure 33: Histogram of Hourly $PM_{2.5}$ Concentrations in Fort McKay in the 2014-2021 Period (69,431 hourly values) ($0.5 \mu g/m^3$ bins with all hours with an $PM_{2.5}$ concentration $> 25 \mu g/m^3$ put in one bin).

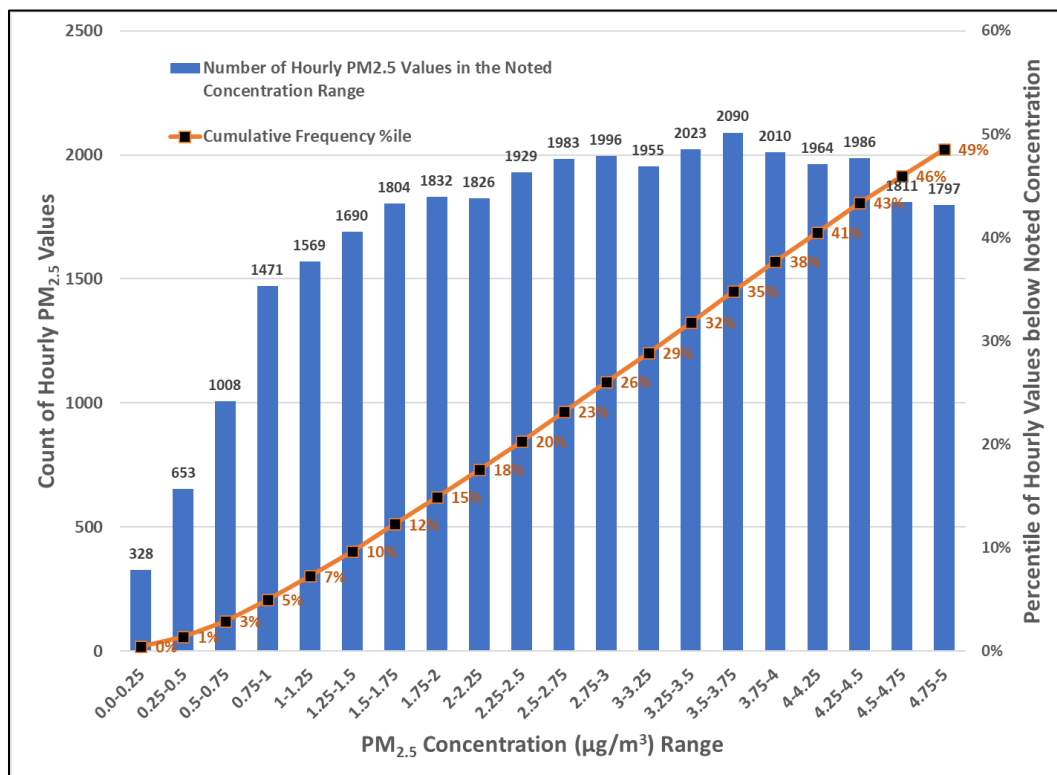


Figure 34: A Histogram of the Count of Hourly $PM_{2.5}$ Levels in Fort McKay in 0-5 $\mu g/m^3$ Concentration Range over the Period 2014-2021 and the Cumulative Percentile Frequency that the Noted Concentration Range Represents (Total Dataset has 69,431 Hourly $PM_{2.5}$ Values).

Figure 34 is a histogram of all the hourly PM_{2.5} concentrations in the 2014-2021 period when the wind was from the WNW which is the WD screened wind direction used in the analysis (5,116 hourly values). Similar to the “all WD” histogram, this WNW-only dataset gives an PM_{2.5} concentration distribution that also indicates a large fraction of WNW WD hourly PM_{2.5} concentrations are <3.0 µg/m³ (~ 42%).

Figure 35 is a histogram of only the 0-5.0 µg/m³ WD screened (WNW WD) PM_{2.5} concentrations with the cumulative percentile PM_{2.5} concentrations within this 0-5.0 µg/m³ range plotted. In contrast to **Figure 36**, there is some evidence of a mode in this distribution at a concentration of about 1.0 µg/m³. The cumulative percentile PM_{2.5} concentrations line provides a general indication of how the selection of different WD screened baseline estimating percentiles changes baseline estimates. The “no temporal considerations” WD screened 25th percentile and 50th percentile baseline estimates for PM_{2.5} presented in this analysis are based on the datasets used to generate **Figure 31**.

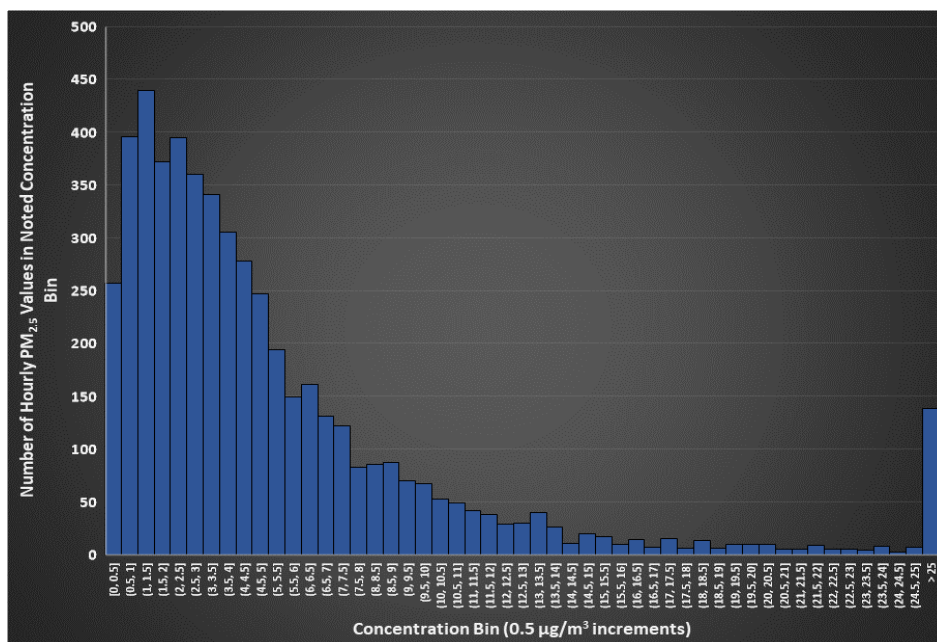


Figure 37: Histogram of Hourly PM_{2.5} Concentrations in Fort McKay in the 2014-2021 Period when the Wind was from the WNW (5,116 hourly values) (0.5 µg/m³ bins with all hours with PM_{2.5} concentration >25 µg/m³ put in one bin)

Figure 36 is a plot of both the “all WD” and WD screened (WNW WD) PM_{2.5} frequency percentiles over the percentile ranges that were used in the analysis. **Figure 36** shows the shapes of the frequency percentile curves for the “all WD” and WD screened PM_{2.5} datasets, which are considerably different than observed for NO₂ and SO₂. In general, there is also a more-gradual increase in concentration in relation to the percentile value. Of particular importance is that there are larger differences between the lines; the “all WD” 5th percentile and 10th percentile baseline estimates differing more from the WD screened 25th percentile and 50th percentile baseline estimates. The 5th percentile “all WD” corresponds

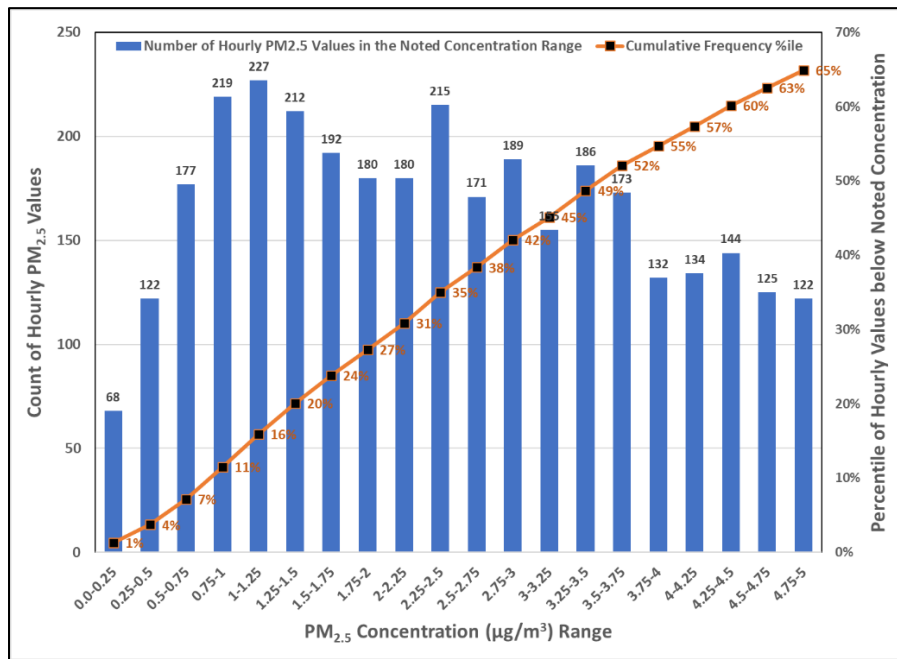


Figure 35: A Histogram of the Count of Hourly PM_{2.5} Levels in Fort McKay in the 0-5.0 µg/m³ Concentration Range over the Period 2014-2021 when the Wind Direction was from the WNW and the Cumulative Percentile Frequency that the Noted Concentration Range Represents (Total Dataset has 5,116 Hourly PM_{2.5} Values).

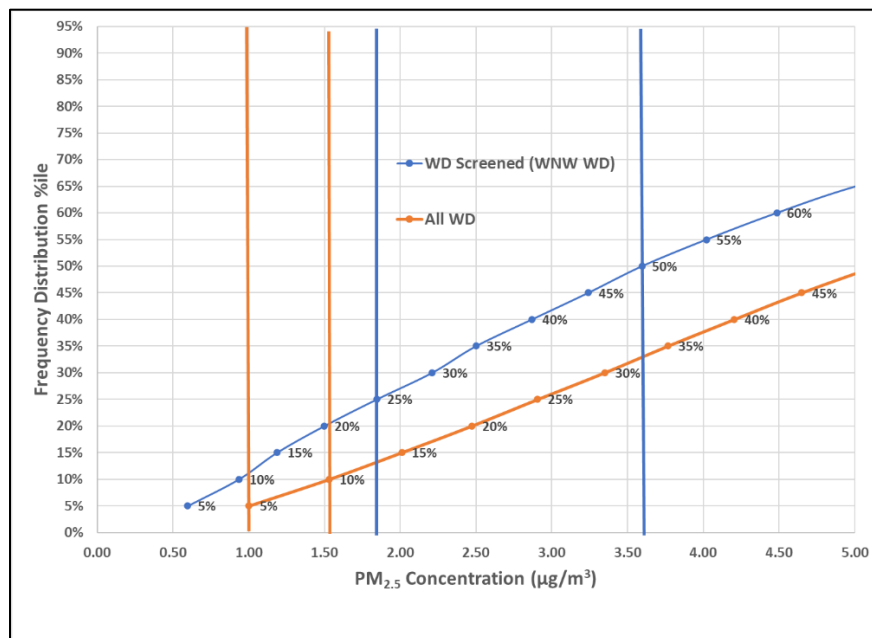


Figure 36: Cumulative Frequency Percentiles for the "All WD" and WD Screened (WNW WD) Hourly PM_{2.5} Concentrations in Fort McKay (2014-2021 Period) and the "All WD" 5th percentile and 10th percentile PM_{2.5} Baseline Estimates and WD Screened (WNW WD) 25th percentile and 50th percentile PM_{2.5} Baseline Estimates.

better to the WD screened ~12th percentile value while the 10th percentile “all WD” corresponds better to the WD-screened 21st percentile value. The 25th percentile WD screened value corresponds to the “all WD” 13th percentile value. The 50th percentile WD screened values corresponds to an “all WD” ~32th percentile value. It needs to be again noted that these percentiles are based on non-temporal adjustment considerations. Figure shows how temporal adjusted percentile estimates differ from those in Figure 36.

Figure 37 is a scatter plot of hourly PM_{2.5} levels in Fort McKay over the 2014-2021 period which appears to show some but small warm versus cold weather seasonal variability (see Table 18 and Table 19) with the summer period wildfire related high PM_{2.5} levels very prominent.

Figure, which is similar to Figure 36, but for the warm and cold weather periods, shows the seasonal difference in the lower end of the distribution. It indicates that while seasonality is an influencing factors when establishing PM_{2.5} baseline values, it is not particularly relevant (i.e. <±10% compared to the non-seasonally adjusted estimate).

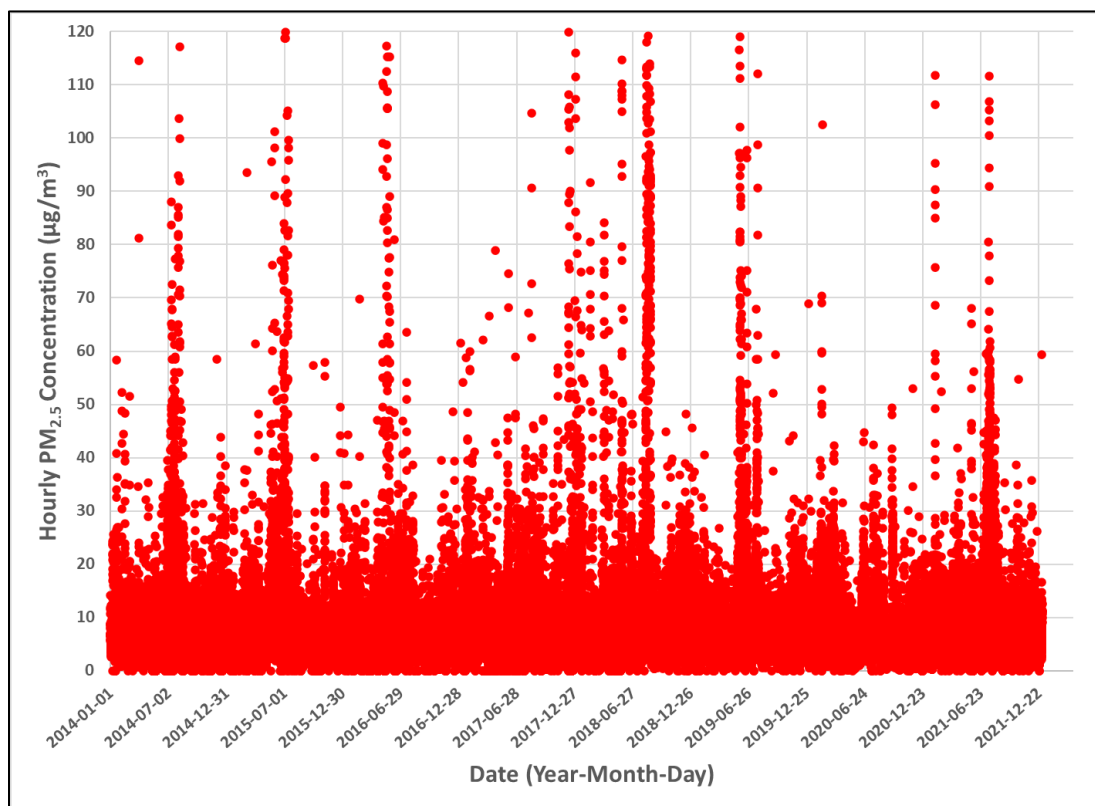


Figure 37: Hourly PM_{2.5} Concentrations in Fort McKay in the 2014-2021 Period.

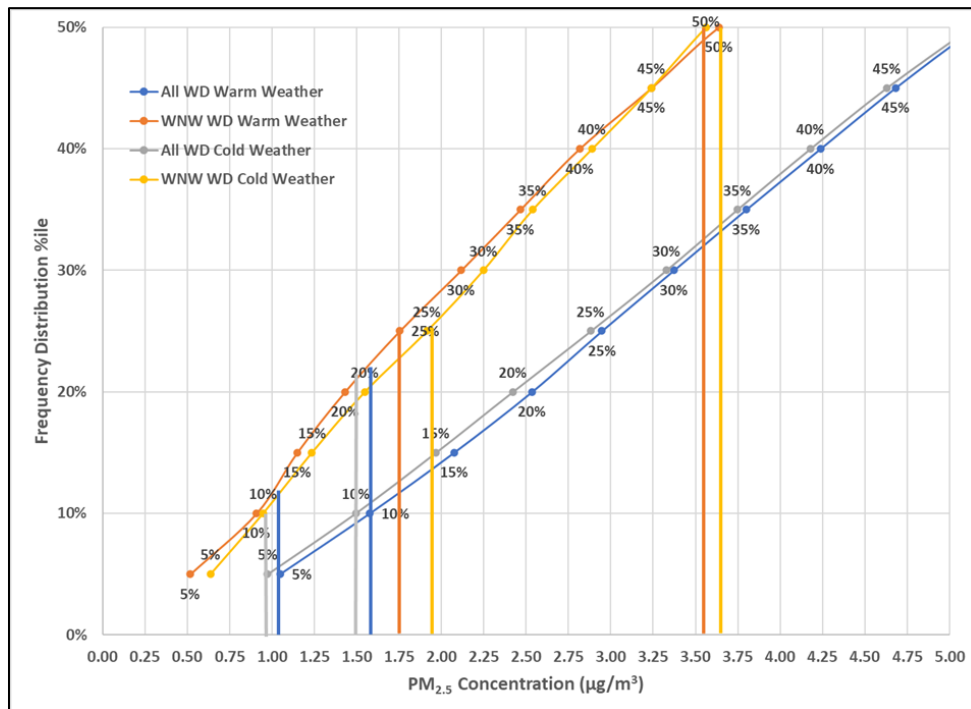


Figure 41: Cumulative Frequency Percentiles for the Warm Weather Period (May-September) and the Cold Weather Period (October-April) “All WD” and “WD Screened” (WNW WD) Hourly PM_{2.5} Concentrations in Fort McKay (2014-2021 Period) and the “All WD” 5th percentile and 10th percentile NO₂ Baseline Estimates and WD Screened (WNW WD) 25th percentile and 50th percentile PM_{2.5} Baseline.

Figure compares the different PM_{2.5} baseline estimates for each percentile approach as well as the baseline estimate if the hour of day, month and year are not considered. The non-variable adjusted PM_{2.5} baseline estimates are somewhat lower than the variable-based estimates except for the 50th percentile WD screened estimates where the two approaches give similar estimates.

Figure 38 is a plot of the annual “All WD” 5th percentile and 10th percentile “All WD” PM_{2.5} concentrations (ppb) in Fort McKay in each of the years 2014-2021 analysis period and the overall average 5th percentile and 10th percentile PM_{2.5} concentrations for the entire 2014-2021 period. This plot shows that there is considerable inter-annual variability in the estimated PM_{2.5} baselines associated with the “All WD” 5th percentile and 10th percentile baseline setting approach. This highlights the importance of using multi-year datasets when baseline estimating. The data for this plot comes from Table 18.

Overall, this analysis would indicate that temporal variables should be considered when estimating PM_{2.5} baselines and that inter-annual variability is a significant consideration in PM_{2.5} baseline setting.

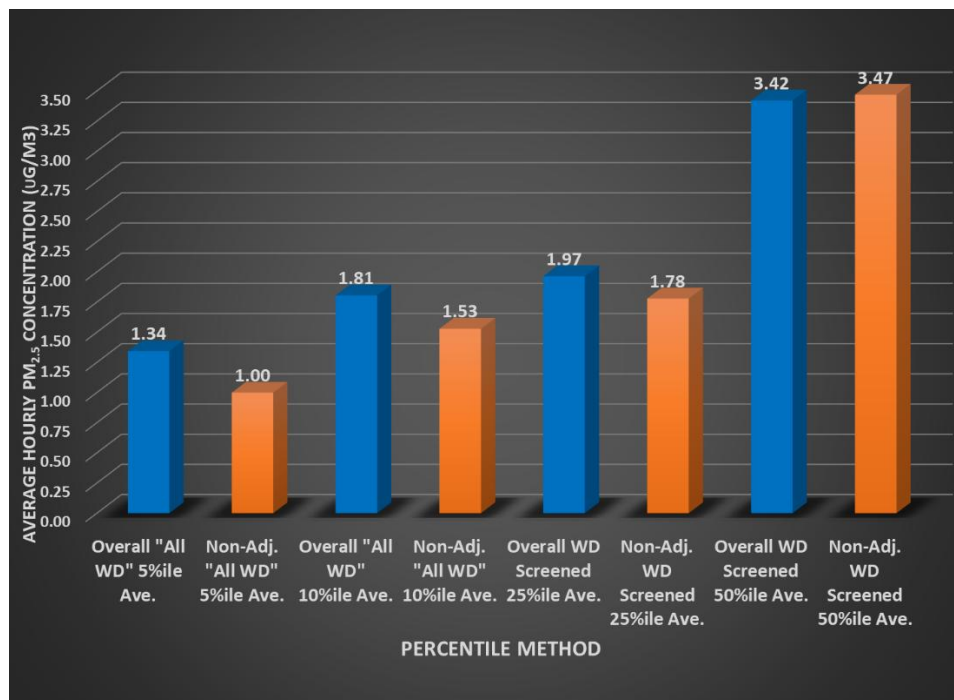


Figure 38: A Comparison of the Different percentile Method PM_{2.5} Baseline Estimates and the Non-Adjusted (Non-Temporal Consideration) PM_{2.5} Baseline Estimates.

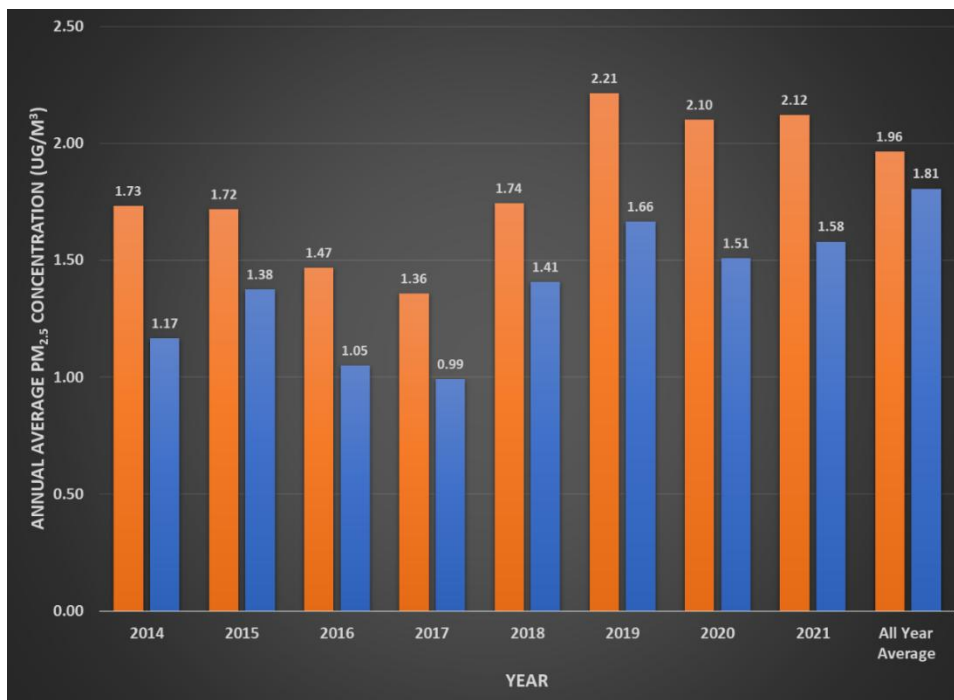


Figure 39: Average Annual 5th percentile and 10th percentile All WD PM_{2.5} Concentrations (µg/m³) in Fort McKay for the Period (2014-2021) and the Average Annual 5th percentile and 10th percentile All WD PM_{2.5} Concentrations for the Entire 2014-2021 Period.

Figure 40 shows the inter-monthly variability in terms of $PM_{2.5}$ baseline estimates which indicates that monthly variability is a temporal factor that needs to be considered when estimating $PM_{2.5}$ baselines. The data for this plot comes from Table 18.

Figure 41 plots hour of the day monthly average $PM_{2.5}$ concentrations for each of October, April, February and August month for the entire 2014-2021 period for the 5th percentile approach to illustrate both the inter-daily and inter-monthly by hour of the day $PM_{2.5}$ concentrations. The plot shows that there is a diurnal pattern to $PM_{2.5}$ levels but with mid-day levels slightly lower than the other periods of the day. The monthly by hour of the day patterns with February and August having the highest levels and October and April having the lowest levels with the other months falling within these highest and lowest months (data not shown). One possible explanation is that in the warm weather periods dust contributes to $PM_{2.5}$ levels in Fort McKay and in the winter stable ground-level mixing patterns may result in increased influences from $PM_{2.5}$ mine fleet emissions. The data for this plot comes from the Tables in **Appendix F**.

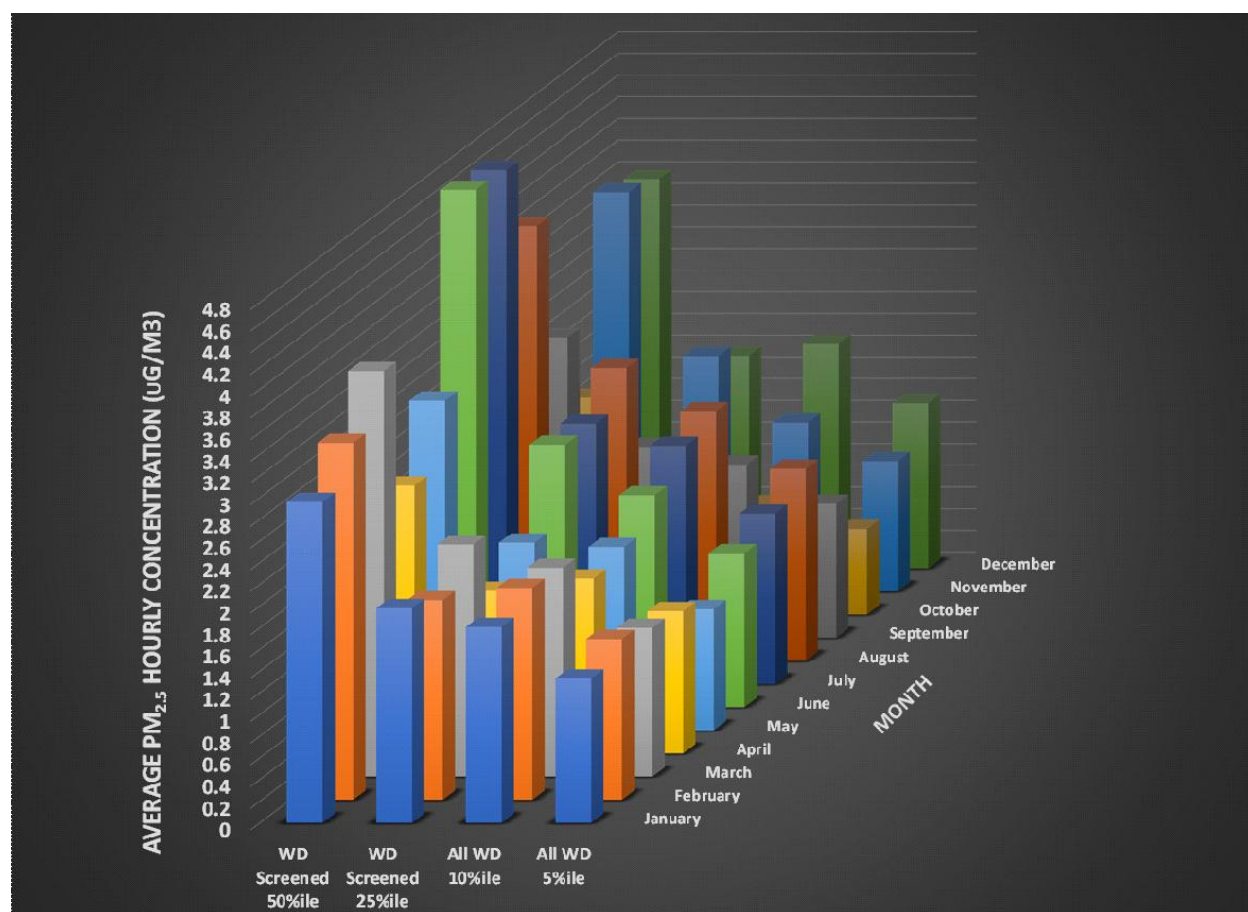


Figure 40: The $PM_{2.5}$ Baseline Estimates for Each Percentile Method by Month.

Figure 42 groups the monthly $PM_{2.5}$ baseline estimates into cold weather (October – April) and warm weather (May – September) periods and shows that while there is some monthly/seasonal variability in $PM_{2.5}$ concentrations in Fort McKay, the absolute magnitude of this variability is relatively small compared to the seasonal variability in NO_2 baseline estimates. The data for this plot comes from Table 18.

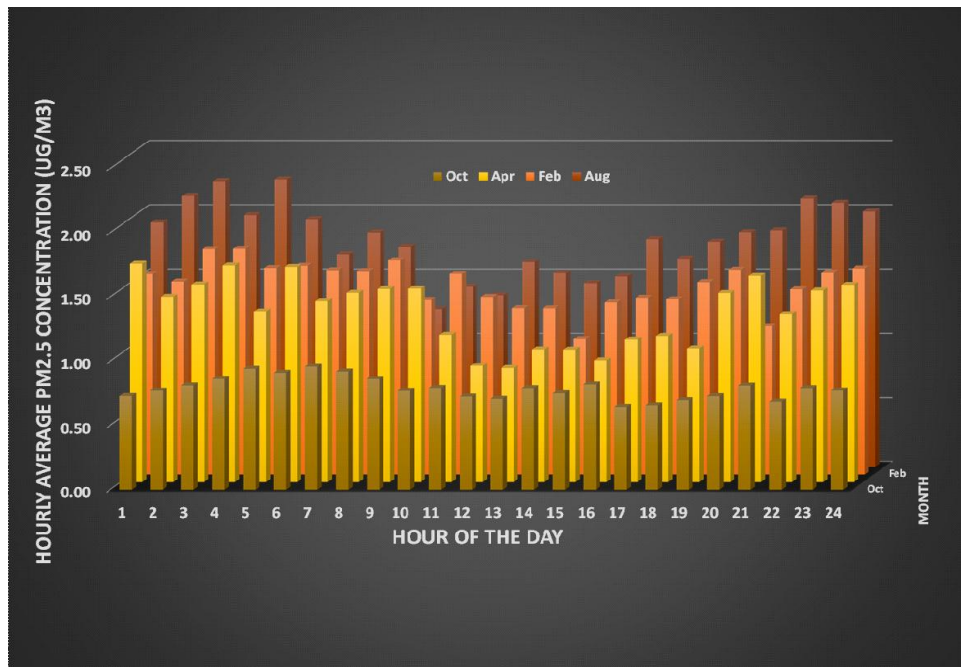


Figure 41: 5th percentile "All WD" Average PM_{2.5} Concentrations (μg/m³) by Hour of the Day in Fort McKay for the Period 2014-2021 for Select Months of the Year.

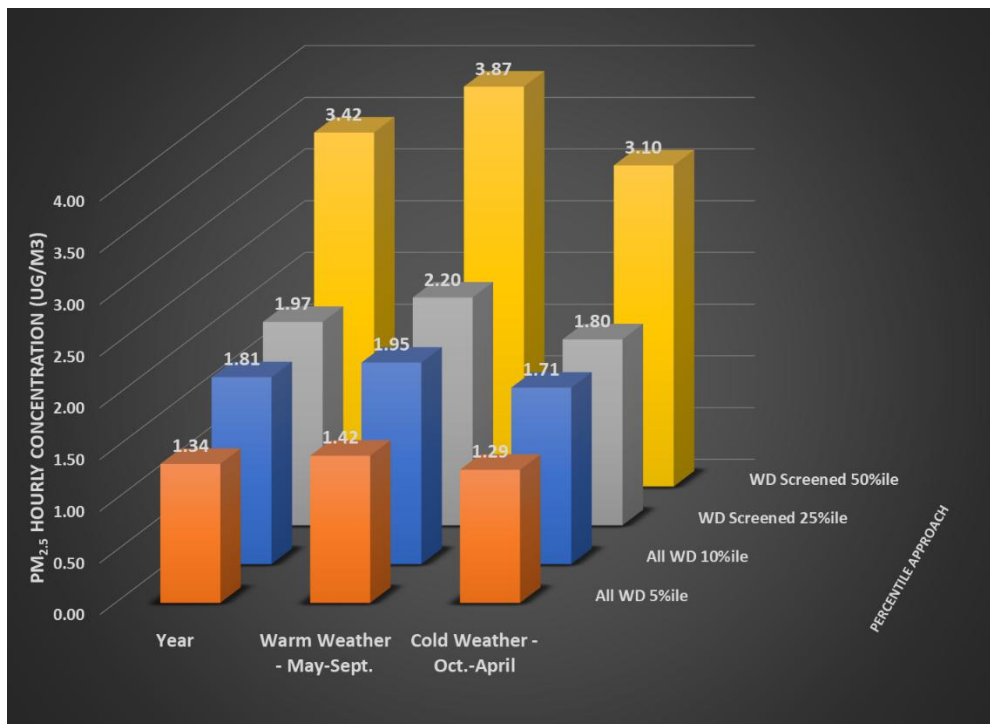


Figure 42: The PM_{2.5} Baseline Estimates for Each percentile Method by Season (Cold Weather and Warm Weather)

Tables 20 to 22 examples of the monthly “temporal adjusted” tables that were calculated and which were used to generate the above Figures and to generate the PM_{2.5} baseline estimates. All the tables generated are provided in Appendix F. These tables also provide data that can be used to generate distribution statistics for the variables considered (i.e., hour of the day, month of the year and year).

Table 20: Example of the WD Screened PM_{2.5} percentile Baseline Estimates (the 25th percentile and 50th percentile Estimates Highlighted in Red) (Note: the Tables for all Months are in Appendix F)

By Hour of the Day and WD Screened %ile PM _{2.5} Concentrations (ug/m ³) in Fort McKay for the Month of January for the Period 2014-2021																									
Percentile	Hr of the day																								Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
5%	0.51	0.21	0.23	0.24	1.72	0.94	0.81	0.62	0.78	1.39	1.71	2.54	1.75	1.77	0.29	0.75	2.78	1.46	0.74	1.72	2.04	1.39	1.11	0.56	1.17
10%	0.57	0.24	0.27	0.25	1.84	1.30	1.15	0.85	1.43	1.70	1.75	2.60	1.87	1.86	0.31	1.11	2.79	2.49	1.01	1.99	2.59	1.59	1.57	0.81	1.41
15%	0.69	0.30	0.35	0.28	2.00	1.52	1.38	0.96	1.50	1.74	1.82	2.67	1.99	1.92	0.34	1.46	2.81	2.54	1.32	2.25	2.75	1.81	2.15	0.94	1.56
20%	0.88	0.40	0.60	0.83	2.16	1.66	1.63	1.27	1.58	1.89	2.07	2.73	2.10	1.95	0.38	1.69	2.83	2.59	1.59	2.43	2.87	2.35	2.60	1.00	1.75
25%	1.06	0.49	1.20	1.63	2.30	2.16	2.12	1.69	1.59	1.96	2.31	2.80	2.22	1.99	0.44	1.86	2.88	2.68	1.79	2.58	3.10	2.88	2.64	1.07	1.98
30%	1.27	0.50	1.75	1.65	2.37	2.40	2.28	1.92	1.61	2.03	2.51	2.86	2.23	2.11	0.50	2.03	2.92	2.77	2.21	2.64	3.37	3.20	2.77	1.23	2.13
35%	1.48	0.51	1.83	1.71	2.40	2.48	2.31	2.08	1.75	2.19	2.62	2.92	2.25	2.24	0.65	2.16	2.97	2.90	2.81	2.76	3.50	3.44	2.91	1.34	2.26
40%	1.67	0.79	1.84	1.88	2.50	2.61	2.39	2.09	1.89	2.32	2.73	2.99	2.27	2.80	0.99	2.23	3.02	3.03	2.98	3.03	3.65	3.72	3.00	2.24	2.46
45%	1.83	1.34	1.90	2.29	2.63	2.82	2.42	2.28	2.21	2.41	2.93	3.05	2.28	3.77	1.33	2.29	3.54	3.03	2.98	3.23	4.23	3.94	3.34	2.94	2.71
50%	2.00	1.90	2.02	2.82	2.76	2.94	2.57	2.57	2.53	2.44	3.23	3.12	2.30	4.75	1.67	2.36	4.06	3.03	3.13	3.40	4.56	4.02	3.59	3.28	2.96
55%	2.32	2.45	2.46	4.29	3.01	3.33	2.87	2.60	3.07	2.44	3.54	3.16	2.33	4.87	1.83	2.49	4.58	3.11	3.29	3.89	4.60	4.09	3.74	3.49	3.24
60%	2.65	3.01	2.70	5.50	4.49	3.53	3.34	2.81	3.60	3.13	4.11	3.21	2.37	4.98	1.98	2.63	5.10	3.20	3.51	4.61	4.61	4.30	3.81	3.96	3.63
65%	2.93	3.47	2.78	6.21	5.59	4.18	3.52	3.37	3.93	4.17	4.90	3.26	2.40	5.09	2.14	2.77	7.04	3.74	3.68	5.78	4.62	4.73	3.98	4.90	4.13
70%	3.15	3.85	2.90	6.66	5.68	5.16	3.98	3.67	4.26	4.21	5.68	3.31	2.43	5.21	2.20	3.38	8.99	4.29	3.72	6.65	4.75	4.94	4.98	6.16	4.59
75%	3.37	4.23	3.39	6.99	6.08	5.52	4.80	3.86	5.00	4.81	6.84	3.35	2.46	5.32	2.22	4.24	10.93	5.25	3.95	7.37	5.04	5.87	6.58	6.39	5.16
80%	4.31	6.84	4.26	8.65	6.84	7.16	6.09	3.90	5.74	5.46	8.14	3.40	2.66	5.81	2.24	5.10	12.87	6.21	4.41	8.11	7.15	8.46	8.56	7.46	6.24
85%	5.24	9.46	5.74	9.87	7.26	7.79	7.43	4.05	5.75	5.72	9.45	3.45	2.86	6.31	3.28	5.98	14.17	11.49	6.72	8.88	8.54	8.56	8.96	8.67	7.32
90%	5.89	10.78	7.73	10.21	7.51	8.15	8.45	4.43	5.76	6.04	10.03	3.50	3.06	18.77	6.38	6.90	15.46	16.76	10.08	9.73	10.57	10.25	10.51	9.91	9.04
95%	6.26	10.79	9.24	11.45	9.55	8.92	9.32	11.69	6.84	7.30	10.50	3.54	3.26	43.20	9.48	7.82	16.75	23.37	15.67	10.58	16.47	12.83	12.75	13.31	12.12
100%	6.62	10.80	9.98	13.14	12.00	10.76	10.21	22.39	7.91	9.79	10.96	3.59	3.46	67.63	12.59	8.73	18.05	29.97	21.75	11.44	23.91	15.63	15.17	24.53	15.87

Table 21: Example of the “All WD” PM_{2.5} percentile Baseline Estimates (Note: the Tables for all Months are in Appendix F)

By Hour of the Day and By Year "All WD" 5 th ile PM _{2.5} Concentration in Fort McKay for the Month of January for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	1.56	1.65	1.98	1.64	1.71	1.74	2.03	2.79	2.33	1.83	1.68	0.67	1.8	1.59	1.46	1.61	1.62	1.69	1.78	1.3	1.62	1.29	1.58	1.73	1.70	0.38	(0.67-2.79)
	2015	1.61	1.59	1.72	1.21	1.07	1.18	1.23	0.87	0.96	0.74	0.78	0.85	0.79	1.28	0.13	0.06	1.31	1.58	1.5	1.37	1.26	1.52	1.34	1.1	1.13	0.43	(0.06-1.72)
	2016	0.4	0.59	0.81	0.61	0.76	0.87	0.73	0.69	0.64	0.88	1.31	1.45	1.4	0	0.57	1.35	1.19	1.64	1.33	1.6	1.34	1.35	0.83	0.84	0.97	0.42	(0-1.64)
	2017	1.59	1.17	1.61	1.51	1.4	0.82	0.83	0.88	1.26	1.27	0.49	0.34	0.75	0.63	0.49	1.47	1.54	1.87	1.3	0.93	0.61	1.17	1.25	1.73	1.12	0.43	(0.34-1.87)
	2018	1.15	1.23	1.06	1.15	1.35	1.36	1.53	1.51	1.49	1.74	1.79	1.75	1.32	1.98	1.63	1.91	1.88	1.66	1.42	1.61	1.24	1.19	1.15	1.05	1.46	0.28	(1.05-1.98)
	2019	2.09	1.09	0.98	1.33	1.55	1.71	1.64	1.36	1.71	1.37	1.6	1.54	1.04	0.22	0.17	0.68	1.41	1.22	1.62	1.28	1.95	1.22	2.07	2.13	1.37	0.51	(0.17-2.13)
	2020	1.53	2.62	1.39	1.41	1.7	1.22	2.08	2.15	1.66	1.57	1.63	1.62	1.87	1.43	1.46	1.41	1.43	1.99	2.27	2.45	2.31	2.59	1.8	2.81	1.85	0.46	(1.22-2.81)
	2021	0.87	0.59	0.57	0.72	0.69	0.77	0.95	1.13	1.24	1.18	1.23	0.98	1.15	1.35	1.44	1.08	1.31	1.15	1.23	1.1	1.43	1.11	1	0.97	1.05	0.25	(0.57-1.44)
																									1.33	0.50	(0-2.81)	
Average		1.35	1.32	1.27	1.20	1.28	1.21	1.38	1.42	1.41	1.32	1.31	1.15	1.27	1.06	0.92	1.20	1.46	1.60	1.56	1.46	1.47	1.43	1.38	1.55	1.33		
Std Dev		0.52	0.66	0.49	0.36	0.40	0.38	0.53	0.72	0.51	0.39	0.46	0.51	0.42	0.70	0.64	0.59	0.22	0.29	0.34	0.46	0.51	0.49	0.42	0.68	0.16		
Range		[0.4-2.09]	[0.59-2.62]	[0.57-1.98]	[0.61-1.64]	[0.69-1.71]	[0.77-1.74]	[0.73-2.08]	[0.69-2.79]	[0.64-2.33]	[0.74-1.83]	[0.49-1.79]	[0.34-1.75]	[0.75-1.87]	[0-1.98]	[0.13-1.63]	[0.06-1.91]	[1.19-1.88]	[1.15-1.99]	[1.23-2.27]	[0.93-2.45]	[0.61-2.31]	[1.11-2.59]	[0.83-2.07]	[0.84-2.81]	(0.92-1.6)		

Table 22: Example of the “All WD” PM_{2.5} 10th percentile Baseline Estimates (Note: the Tables for all Months are in Appendix F))

By Hour of the Day and By Year "All WD" 10%ile PM2.5 Concentration in Fort McKay for the Month of January for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev	Range
Year	2014	3.2	1.77	2.73	2.57	2.57	2.16	2.6	3.42	3.24	3.25	3.12	1.75	1.93	1.65	1.67	1.68	1.65	1.8	2.2	1.64	2.19	1.59	2.49	3.19	2.34	0.64	(1.59-3.42)
	2015	1.64	2.2	1.86	1.31	1.5	1.9	1.85	1.3	1.58	1.15	0.87	0.89	1.29	1.39	1.27	1.21	1.81	1.98	1.95	1.76	1.62	1.56	1.56	1.35	1.53	0.34	(0.87-2.2)
	2016	1.53	1.16	1.32	1.13	1.46	1.16	1.31	1.43	1.49	1.4	1.74	1.49	1.54	1.41	1.32	1.58	1.39	1.72	1.64	1.77	1.44	1.56	1.16	1.39	1.44	0.18	(1.13-1.77)
	2017	1.71	1.6	2.13	1.71	2.17	1.19	1.55	1.43	1.35	1.53	1.37	1.26	1.45	1.24	1.32	1.55	1.69	1.94	1.63	1.28	1.48	1.2	1.53	1.98	1.55	0.28	(1.19-2.17)
	2018	1.38	1.52	1.53	1.61	1.6	1.56	1.8	1.69	1.69	1.99	1.88	1.98	1.89	2.41	2.26	2.25	2.22	1.92	1.67	1.79	1.64	1.73	1.24	1.15	1.77	0.32	(1.15-2.41)
	2019	2.71	2.24	2.32	2.26	2.13	2.22	2.17	1.55	2.45	1.89	1.97	1.82	1.36	0.68	0.54	1.68	1.74	1.81	2.66	1.53	3.14	1.55	3.11	2.71	2.01	0.65	(0.54-3.14)
	2020	1.94	3.83	1.7	1.82	1.89	1.32	2.39	2.63	2.38	1.87	2.27	2.48	2.63	2.36	1.74	1.86	1.77	2.81	2.76	2.58	3.27	3.18	3.83	4.33	2.49	0.76	(1.32-4.33)
	2021	1.11	0.92	0.8	0.88	0.8	1.14	1.24	1.13	1.39	1.4	1.35	1.32	1.68	1.52	1.58	1.41	1.38	1.5	1.62	1.7	1.78	1.56	1.38	1.34	1.33	0.28	(0.8-1.78)
																									1.81	0.62	(0.54-4.33)	
	Average	1.90	1.91	1.80	1.66	1.77	1.58	1.86	1.82	1.95	1.81	1.82	1.62	1.72	1.58	1.46	1.65	1.71	1.94	2.02	1.76	2.07	1.74	2.04	2.18	1.81		
	Std Dev	0.71	0.90	0.60	0.56	0.55	0.45	0.49	0.79	0.67	0.65	0.68	0.49	0.43	0.57	0.49	0.31	0.26	0.38	0.47	0.37	0.74	0.60	0.99	1.14	0.17		
	Range	(1.11-3.2)	(0.92-3.83)	(0.8-2.73)	(0.88-2.57)	(0.8-2.57)	(1.14-2.22)	(1.24-2.6)	(1.13-3.42)	(1.35-3.24)	(1.15-3.25)	(0.87-3.12)	(0.89-2.48)	(1.29-2.63)	(0.68-2.41)	(0.54-2.26)	(1.21-2.25)	(1.38-2.22)	(1.5-2.81)	(1.62-2.76)	(1.28-2.58)	(1.44-3.27)	(1.2-3.18)	(1.16-3.83)	(1.15-4.33)	(1.46-2.18)		

7.4 Conclusion

The analyses of the data with and without WD screen and temporal adjustments do not converge on a single baseline estimate as was determined for NO₂ and SO₂. The greater variability in the PM_{2.5} baseline estimates reported above is hypothesized to be due to the importance of natural sources of PM_{2.5} and possibly wildfires skewing the distribution. Another reason may be that PM_{2.5} measurement methods lead to more-variable results for low concentrations compared to NO₂ and SO₂. Considering this variability, it is more appropriate to suggest that the PM_{2.5} baseline is likely in the range of 1.0-2.0 µg/m³.

Evidence in the literature gives a larger range, ~1.5 to 4 µg/m³, with some seasonal variability. However, recognizing that background PM_{2.5} concentrations are region/location specific and dependent upon land cover in the context of local/regional natural dust influences and the significance of non-regional and long-range transport PM_{2.5} influences, the upper values of the literature range are not likely appropriate for the OSR. While the data presented above suggest that 1.5 µg/m³ may be the most-appropriate single value to select, Health Canada has set a precedent with a value of 1.8 µg/m³. The Fort McKay data are sufficiently consistent with this value and thus it is recommended here as the interim baseline.

8 References

- AEP. (2019, January). *Alberta Ambient Air Quality Objectives and Guidelines Summary*. Retrieved from Government of Alberta: <https://open.alberta.ca/publications/9781460134856>
- Air Management Committee of the Canadian Council of Ministers of the Environment. (2016). *Range of Concentration Values for 1-hour and Annual Canadian Ambient Air Quality Standards for Nitrogen Dioxide*. Winnipeg: CCME.
- Atkins, D. H., & Lee, D. S. (1995). Spatial and Temporal Variations of Rural NO₂ Concentrations across the U.K. *Atmospheric Environment*, 223-239.
- CCME. (2019). *Guidance Document on Air Zone Management*. Winnipeg: Canadian Council of Ministers of the Environment.
- CNRL. (2002). *CNRL Horizon Oil sands Mine Project: Volume 4 Appendix B*. Calgary: Canadian Natural Resources Limited .
- Colls, J. (2002). *Air Pollution*. (Second, Ed.) London: Spon Press.
- Cox, R. A. (1977). Some measurements of ground level NO, NO₂, and O₃ concentrations at an unpolluted maritime site . *Tellus*, 356-362.
- Crutzen, P. J. (1979). The Role of NO and NO₂ in the Chemistry of the Troposphere and Stratosphere. *Ann. Rev. Earth Planet. Sci.*, 7, 443-472.
- EEA. (2019). *Annual mean PM_{2.5} concentrations observed at background stations, 2017*. Copenhagen : European Environment Agency.
- Finlayson-Pitts, B. J., & Pitts, Jr., J. N. (2000). *Chemistry of the Upper and Lower Atmosphere*. San Diego: Academic Press.
- Golder Associates. (2005). *Estimating Contributions to Ambient Concentrations in Fort McKay*. Fort McKay: CEMA.
- Health Canada. (1999). *National Ambient Air Quality Objectives for Particulate Matter: Addendum* . Ottawa: Health Canada.
- Health Canada. (2021). *Health Impacts of Air Pollution in Canada: Estimates of premature deaths and nonfatal outcomes*. Ottawa: Health Canada.
- Henry, R. C. (2008). Locating and quantifying the impact of local sources of air pollution. *Atmospheric Environment*, 358-363.
- Hidy, G. M., & Blanchard, C. L. (2016). The changing face of lower tropospheric sulfur oxides in the United States. *ELEMENTA: Science of the Anthropocene*, 1-20.
- Hyndman, R. J., & Fan, Y. (1996). Sample Quantiles in Statistical Packages. *The American Statistician*, 361-365.

- IAAC. (2022, February 16). *Suncor Base Mine Extension Project*. Retrieved from Impact Assessment Agency of Canada : <https://iaac-aeic.gc.ca/050/documents/p80521/139259E.pdf>
- Kettle, A. J., Kuhn, U., von Hobe, M., Kesselmeier, J., & Andreae, M. O. (2002). Global budget of atmospheric carbonyl sulfide: Temporal and spatial variations of the dominant sources and sinks. *Journal of Geophysical Research*, 25-1 - 25-16.
- Khalil, M. A., & Rasmussen, R. (1984). Global Sources, Lifetimes and Mass Balances of Carbonyl Sulfide (OCS) and Carbon Disulfide (CS₂) in the Atmosphere. *Atmospheric Environment* , 18(9), 1805-1813.
- Maroulis, P. J., Torres, A. L., Goldberg, A. B., & Bandy, A. R. (1980). Atmospheric SO₂ measurements on Project Gametag. *Journal of Geophysical Research: Oceans*, 7345-7349.
- McKendry, I. G. (2006). *Background Concentrations of PM_{2.5} and Ozone in British Columbia, Canada*. Victoria: British Columbia Ministry of Environment.
- Rinsland, C. P., Goldman, A., Mahieu, E., Zander, R., Notholt, J., Jones, N. B., . . . Chiou, L. S. (2002). Ground-based infrared spectroscopic measurement of carbonyl sulfide: Free tropospheric trends from 24-year time series of solar absorption measurements. *Journal of Geophysical Research* , 107(NO. D22, 4657), doi:10.1029/2002JD002522.
- Shell. (2012). *Air Emissions and Predictions: APPENDIX 3.2* . Ottawa: CEAA .
- Stein, A. F., Draxler, R. R., Rolph, G. D., Stunder, B. J., Cohen, M. D., & Ngan, F. (2015). NOAA's HYSPLIT Atmospheric Transport and Dispersion Modelling System. *American Meteorological Society* , 2059-2077.
- Teck. (2011, November 24). Application for Approval of the Frontier Oil Sands Mine Project (Frontier Project). Calgary: Canadian Environmental Assessment Agency.
- Teck Resource Limited. (2011, November 24). *Canadian Environmental Assessment Agency Frontier Oil Sands Mine Project - Environmental Impact Statement*. Retrieved May 31, 2015, from http://www.ceaa.gc.ca/050/documents_staticpost/65505/54021/volume4.pdf
- UNECE. (2010). *Hemispheric Transport of Air Pollution PART A: Ozone and Particulate Matter - Air Pollution Studies No. 17*. Geneva: UNECE.
- USEPA. (2009). *U.S. EPA. 2009 Final Report: Integrated Science Assessment for Particulate Matter. EPA/600/R-08/139F, 2009*. Washington, D.C.: U.S. Environmental Protection Agency. Retrieved March 13, 2016, from <https://www.epa.gov/isa>
- USEPA. (2017). *Integrated Science Assessment for Sulfur Oxides –Health Criteria*. Research Triangle Park, NC: United States Environmental Protection Agency.
- USEPA. (2019). *Integrated Science Assessment for Particulate Matter*. Research Triangle Park, NC: United States Environmental Protection Agency.
- Vingarzan, R. (2007). *Government of Canada Publications*. Retrieved from Government of Canada: https://publications.gc.ca/collections/collection_2007/ec/En56-215-2007E.pdf

Wallace, J. M., & Hobbs, P. V. (2006). *Atmospheric Science An Introductory Survey*. San Diego: Elsevier Inc.

WHO. (2021). *WHO global air quality guidelines: Particulate matter (PM_{2.5} and PM₁₀), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide*. World Health Organization. Retrieved from <https://apps.who.int/iris/handle/10665/345329>

Wikipedia. (2023, March 3). Retrieved from Percentile: <https://en.wikipedia.org/wiki/Percentile>

9 Appendices

Appendix A Historical Air Quality Measurement Approaches in the AOSR

A.1 AEOSRP (1981)

In 1975, Alberta and Canada signed an Alberta Oil Sands Environmental Research Program Agreement (AOSERP) that was intended to provide information that would be “... *useful in predicting the effects of any proposed development...*” (Smith, 1981). The AOSERP included meteorology and air quality components and a report summarizing background air quality measurements made in the March 1977 to March 1980 was published in 1981 (Stroscher, 1981). The region covered by the AOSERP was the Athabasca Oil Sands Region (AOSR) and the air quality measurements were for SO₂ (data from 13 continuous air monitoring stations) and for NO_x, NO₂, O₃ and CO (data from 2 continuous monitoring stations). Particulates were collected by high volume samplers at 4 locations (~100 hr sampling period) and measured for metals. The metals analyzed for were Cu, Pb, Zn, Ni, Co, K, Mo, Cr, Fe, Al, V, Cl and Mn. The report noted a number of detection limit and QA/QC issues with the air datasets used. It concluded that: “*Baseline data collection is a desirable objective for the assessment of changes in environmental quality*” but also noted that a number of monitoring QA/QC issues needed to be addressed. The detection limits associated with the continuous monitoring datasets from the air quality modelling during this period are high and, as such, cannot be used in setting pre-development air quality baselines for the region.

A.2 CNRL (2002) – A Combined Air Quality Measurement and Modelled Air Quality Prediction Approach

The 2002 Environmental Impact Assessment (EIA) for the CNRL Horizon project (CNRL, 2002) estimated background community air quality concentrations for Fort McKay, Fort McMurray and Fort Chipewyan with the Fort Chipewyan determination applied to Anzac, Janvier/Chard and Conklin. The air quality pollutants assessed were SO₂, NO_x and PM_{2.5}. The methodology used involved:

- Using 2000 air quality data from the WBEA Fort McKay, Fort McMurray (Athabasca Valley) and Fort Chipewyan air monitoring stations;
- CALPUFF modelling of existing (as of year 2000) point and area oil sands related emissions sources;
- Ranking predictions from the existing modelling run and the measured datasets and taking the differences between monitored and modelled for each rank (measured minus modelled) with negative values set to zero. The resultant air quality values were considered to represent the non-oil sand emission background levels in each community;
- The differences were ranked in descending order and used to determine percentile values which were then added to the corresponding model emission-based predictions (e.g., the 90th percentile SO₂ difference was added to the 90th percentile SO₂ model prediction).

This approach assumes that the model predictions are reliable and that the highest community contributions to the pollutant occur at the same time as the highest predictions from industrial sources occur. There are also CALPUFF modelling limitations in terms of predicting secondary PM_{2.5} levels. The estimated community background levels from the use of this approach are a combination of natural background levels and community only air quality influences. The approach assumed that community

contributions to H₂S, TRS and PAHs were negligible and were set to zero which also translates to using a natural background for these pollutants of zero.

A.3 CEMA TMAC (2005)

In 2004, the Trace Metal and Air Contaminants (TMAC) Working Group of the Cumulative Environmental Management Association (CEMA) contracted Golder Associates to undertake a study to understand discrepancies between modelled source emission air quality levels and ambient air quality measurements (Golder Associates, 2005).

This study examined possible approaches for determining representative background ambient concentrations of a broad suite of air contaminants with the objective of developing “... *a transparent, defensible methodology for generating representative background concentrations for communities in the Oil Sands Region, with the focus being on the community of Fort McKay.*”

In the report, “*natural background*” was considered as air quality without oil sands emissions but including normal regional human activity but not the specific community’s influences. A “*community background*” was considered as “*natural background*” air quality plus community-specific air quality influences. The study used wind directional, upwind-downwind and combined modelled-measured air quality methods to estimate “*natural background*,” “*community background*” and “*community only*” baselines for Fort McKay for a number of air contaminants, i.e. SO₂, NO_x, NO₂, PM_{2.5}, H₂S and a number of VOCs. The estimated range for short-term and long-term background levels for the different approaches was given for different dataset percentile values and the derivation. The selection of a baseline from such a dataset would require the selection of a specific percentile upon which to determine the baseline which is a requirement for any percentile baseline setting approach.

A.4 Teck (2011) - A Combined Air Quality Measurement and Modelled Air Quality Prediction Approach

The Teck Frontier Mine Project EIA (Teck Resource Limited, 2011) compared predicted project and cumulative air emission scenarios to what was termed a “*predevelopment condition*” which it was indicated represented:

“...the period prior to the construction and operation of the Great Canadian Oil Sands (GCOS) project (now the Suncor mining, extraction and upgrading operation). GCOS commenced operation in 1968. The Fort McMurray populations in 1961 and 1966 were about 1,200 and 2,000, respectively.”

Predevelopment air quality was determined by removing model predicted industry emission from ambient air quality measurements in Fort McKay for NO₂, SO₂ and PM_{2.5}.

A.5 (Shell Canada Limited, 2012)- A Non-Emission Influenced Wind Direction Air Quality Data Approach for Natural Baseline and a Community Emission Air Quality Impacted Modelling Approach for Community Only Impacts

The Federal-Provincial Joint Review Panel for the Shell Jackpine Expansion Mine Project (JRP, 2012) indicated to Shell that: “... *the cumulative effects assessment should include a pre-industrial case to allow the Panel to take into account the effects that may have already been experienced prior to the Project ...*”. Shell had Golder Associates prepare a pre-industrial air quality baseline). The approach used

by Golder was to use the above noted CEMA TMAC “natural background” (Section **A.3**) in conjunction with estimates of Fort McKay community air emissions circa 1965 and modelling the impacts of these emissions on air quality in Fort McKay. The modelled community emissions-air quality model predictions were added to the “*natural background*” air quality estimates, which were wind direction based, to give a Fort McKay circa 1965 air quality baseline. The baseline was for SO₂, NO₂ and PM_{2.5} with the “*natural background*” based on the wind sector analysis of SO₂, NO₂ and PM_{2.5} monitoring data collected in Fort McKay.

In explaining the approach used to develop a pre-industrial case (PIC), Golder Associates (2012) noted:

- Pre-industrial conditions are often referred to as Pre-Development or the Pre-Development Case and in its analysis Golder Associates is referring to this case as a Pre-Industrial Case (PIC);
- The PIC is intended to represent conditions before substantial industrial development occurred in the region, however, because of data limitations for some components the PIC may not always be representative of true pre-industrial conditions;
- For air, the PIC focused on SO₂, PM_{2.5} and NO₂ because these air quality pollutants are of particular relevance in terms of oil sands development emissions;
- Before oil sands developments, the emission sources of SO₂, PM_{2.5} and NO₂ would have been a mix of natural and anthropogenic sources;
- Natural sources of these pollutants that were identified included forest fires and windblown dust and anthropogenic sources identified were vehicle fuel combustion and home heating fuel combustion (e.g., wood or oil); and
- In general, before industrial development in the region, the ambient concentrations of most air quality compounds associated with anthropogenic sources would be quite low.

A.6 Summary

In the above noted “baseline” setting initiatives, a number of different “baselines” were developed which were:

- a “natural background” baseline which does not include any regional oil sands emission sources or any near community influences,
- a “natural + community” baseline which is the “natural background” plus a community’s influence on its air quality, and
- a “community-only” air quality influenced baseline.

Based on the above noted initiatives, the following is a summary of the different baseline setting approaches that have been used to derive one or more of the above noted “baseline” types:

- actual early period regional air quality monitoring for the specific purpose of establishing pre-development (or early oil sands development stage) air quality in the area North of Fort McMurray,
- using existing air quality data from one or more stations and subtracting model predicted oil sands related emissions (note: depending on the location(s) of the air monitoring station(s) used in such an analysis, this would give either a community-only influenced baseline or a “natural background” with only general regional and global influences included),
- using existing air quality data measurements from wind directions that have no or minimal industrial air emission influences,

- estimating pre-development circa 1965 community air emissions to estimate pre-development “baseline” air quality, and
- analyzing upwind and downwind measured air quality data with the only intermediate air emission source being a community which gives a community-only air quality “baseline.”

A.7 References

- CNRL. (2002). *CNRL Horizon Oil sands Mine Project: Volume 4 Appendix B*. Retrieved from Calgary: Golder Associates. (2005). *Estimating Contributions to Ambient Concentrations in Fort McKay*. Fort McKay: CEMA.
- Golder Associates. (2012). *Project No. 10-1346-0001. APPENDIX 2 SIR 11 – Cumulative Effects*. Golder Associates. Calgary.
- JRP. (2012). *Supplemental Information Request Shell Canada Limited Jackpine Mine Expansion Project*. Joint Review Panel for the Jackpine Mine Expansion Project. Calgary.
- Shell Canada Limited. (2012). *Canadian Environmental Assessment Agency*. CEAA. Ottawa. Retrieved from http://www.ceaa-acee.gc.ca/050/documents_staticpost/59540/56367/A2-Cumulative_Effects.pdf
- Smith, S. B. (1981). *Alberta Oil Sands Environmental Research Program: Summary Report 1975-1980*. Edmonton: AOSERP. Retrieved from <https://era.library.ualberta.ca/files/fb4948667#.WpxQfnDrsgM>
- Stroscher, M. M. (1981). *Background Air Quality in the AOSERP Area March 1977 to March 1980*. Retrieved from Alberta Environment:
- Teck Resource Limited. (2011). *Application for Approval of the Frontier Oil Sands Mine Project (Frontier Project) - Environmental Impact Statement*. Retrieved from http://www.ceaa.gc.ca/050/documents_staticpost/65505/54021/volume4.pdf

Appendix B Meteorological, Natural Emission and Atmospheric Chemistry Variability Considerations Relevant to Baseline Estimating

The following is a very brief overview of some of the natural factors that are relevant to, and need to be considered when, estimating an air quality baseline using a percentile-measurement based air quality dataset analysis approach.

- Nighttime atmospheric chemistry is significantly different than daytime atmospheric chemistry because of the significant role that photochemistry plays in atmospheric oxidation reactions during the day (Ball, 2022);
- Local and/or regional anthropogenic emission influences may result in temporal and/or spatial variability in pollutant concentrations that are below what would be a normal background baseline. An example of such a scenario is the ozone scavenging associated with NO_x emissions that can result in very low ambient O₃ levels (Zhang, Lei, Tie, & Hess, 2004) which will influence the all-WD percentile estimated O₃ background estimate i.e. result in an underestimate of the O₃ baseline background. These types of influences may have a day of the week pattern depending on the nature of the emission sources i.e. traffic related vs continuous industrial activity;
- Temperature and sunlight play a role in natural source emissions of many air contaminants and their impact on air quality e.g. during warm weather periods vegetation related emissions can result in elevated ozone and/or particulate levels (Churkina et al., 2017);
- Time of day and time of year play a strong role in atmospheric stability based on solar radiation levels (Wallace & Hobbs, 2006) and also on average wind speed (Colls, 2002) both of which determine the mixing and dispersion of air contaminants from both natural and anthropogenic contaminant sources and therefore their ground-level concentrations;
- Interannual meteorological variability with respect to temperature, wind speed, wind direction and precipitation all influence ground-level concentrations of both natural and anthropogenic contaminant sources. Davidson and Spink (2018) showed that there was considerable inter-annual variability in the frequency of SSE-SSW wind directions in Fort McKay in the 1999-2014 period which are the wind directions that result in significant oil sands development related air emission influences in Fort McKay; and
- Wind speed (WS) has the potential to introduce uncertainties when using percentile approaches to estimate baselines e.g. at low wind speeds higher ground-level pollutant concentrations associated with local natural and/or anthropogenic emissions sources would be expected and these influences would be underestimated using percentile methods (Veira, Jackson, Ainslie, & Fudge, 2013).

B.1 References

- Ball, S. (2022, 10 29). Atmospheric chemistry at night. Retrieved from Environmental Chemistry Group: <https://www.envchemgroup.com/eb3-atmospheric-chemistry-at-night.html>
- Churkina, G., Kuik, F., Bonn, B., Lauer, A., Grote, R. d., Tomiak, K., & Butler, T. M. (2017). Effect of VOC emissions from vegetation on air quality in Berlin during a heatwave. *Environmental science & technology*, 51(11), 6120-6130.
- Colls, J. (2002). *Air Pollution* (2nd ed.). London: Spon Press.

- Davidson, C., & Spink, D. (2018). Alternate approaches for assessing impacts of oil sands development on air quality: A case study using the First Nation Community of Fort McKay. *Journal of the Air & Waste Management Association*, 68(4), 308-328.
- Veira, A., Jackson, P. L., Ainslie, B., & Fudge, D. (2013). Assessment of background particulate matter concentrations in small cities and rural locations—Prince George, Canada. *Journal of the Air & Waste Management Association*, 63(7), 773-787.
- Wallace, J. M., & Hobbs, P. V. (2006). *Atmospheric science: an introductory survey* (Vol. 92): Elsevier.
- Zhang, R., Lei, W., Tie, X., & Hess, P. (2004). Industrial emissions cause extreme urban ozone diurnal variability. *Proceedings of the National Academy of Sciences*, 101(17), 6346-6350.

Appendix C Temporal Factor Plots for the 10th percentile “All WD” and 50th percentile “WD Screened” Baseline Setting Approached for Fort McKay for the 2002-2021 Period for Hourly NO₂, SO₂, TRS, THC, NMHC, PM_{2.5} and O₃ Concentrations

C.1 By Hour of the Day Analysis

C.1.1 Hour of the Day “Fractional Contribution” Assessment

The results of the “by hour of the day” “fraction of contributions” analyses is presented in **Figure C.1**. For both the “all WD” 10th percentile approach and the 50th percentile WD screened approach there are clear diurnal patterns in terms of the fraction of the total hourly contributions to both of these two percentile baseline setting approaches. It needs to be noted that the higher the percent contribution of a given hour to the total hourly values the lower the ambient concentration in that hour i.e. the ambient concentration of the pollutant is inversely proportional to its contribution to the baseline 10th percentile and 50th percentile datasets. For example, in **Figure C.1 (inset d)** the very low fraction of hourly O₃ concentrations contributing to the baseline 10th percentile and 50th percentile datasets during the mid-day period reflects that this is the time of day when ambient O₃ concentrations are the highest.

The “by hour of day” contributions to the “all WD” 10th percentile and the 50th percentile WD datasets and the comparisons between the differences in contributions between the “all WD” 10th percentile and the 50th percentile WD indicates that:

- Both the “all WD” 10th percentile and the 50th percentile WD datasets show the same general diurnal trends;
- In general the 50th percentile WD screened dataset shows more diurnal variation than the “all WD” 10th percentile dataset;
- O₃ shows the greatest diurnal variation and these variations are similar for both the “all WD” 10th percentile and the 50th percentile WD datasets; and
- The greatest difference in diurnal patterns is between the “all WD” 10th percentile and the 50th percentile WD datasets for NO₂ and THC.

This analysis indicates that “by hour of day” is a dataset variable that needs to be considered when baseline estimating using percentile methods. The following “by hour of the day” concentration analysis (**Section C.1.2 “By Hour of the Day” Hourly Concentrations**) is, however, considered to be a better approach for assessing the significance of diurnal variation.

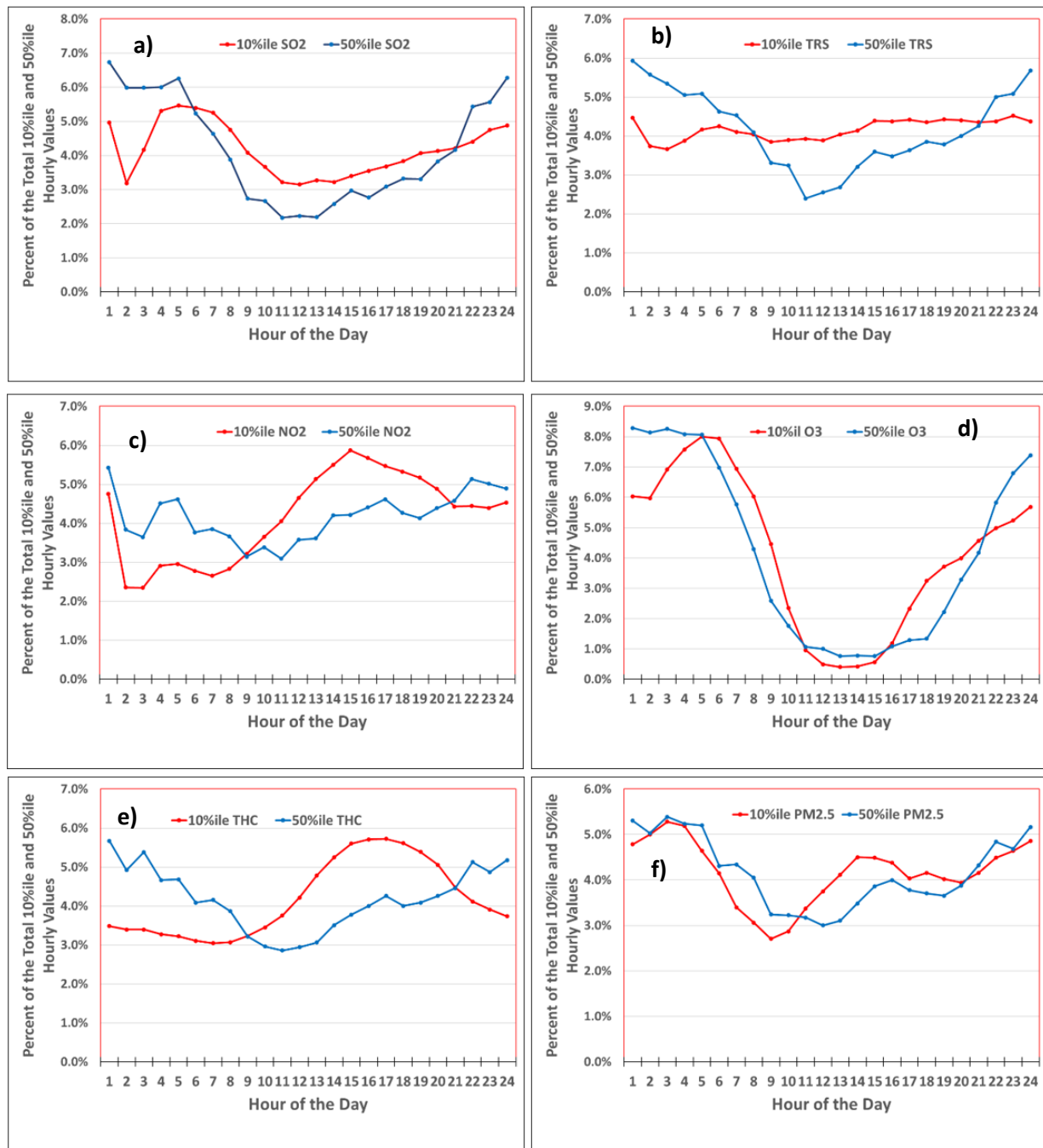


Figure C.1: Percent of the Total 10th percentile "All WD" and 50th percentile WD Screened Hourly Values in Fort McKay for the Noted Pollutant: a) SO₂; b) TRS; c) NO₂; d) O₃; e) THC; and f) PM_{2.5}, Contributed by the Noted Hour of the Day (2002-2021 Period)

C.1.2 "By Hour of the Day" Hourly Concentrations

The "by hour of the day" "all WD" 10th percentile and WD screened 50th percentile concentrations are presented in **Table C.1** and were plotted (**Figure C.2**). The "hour of the day" "all WD" 10th percentile and WD screened 50th percentile concentrations were averaged to give "by hour of the day - variable considered" baseline estimates which were compared to the "no temporal considerations" baselines in **Table C.2** in Section C.1.3 "By Hour of the Day" Variable Considerations.

Table C.1: “By hour of the Day” Average NO₂, SO₂, TRS, THC, NMHC, PM_{2.5} and O₃ Concentrations in Fort McKay for the 2002-2021 Period

The "By Hour of the Day" All Wind Direction 10 Percentile Concentrations and the Wind Direction Screened (WNW) 50 Percentile Concentrations for the Noted Parameter: Fort McKay Hourly Data for Period 2002-2021														
Hour of the Day	NO ₂ (ppb)		SO ₂ (ppb)		TRS (ppb)		THC (ppm)		NMHC (ppm)		PM _{2.5} (µg/m ³)		O ₃ (ppb)	
	All WD	WNW WD	All WD	WNW WD	All WD	WNW WD	All WD	WNW WD	All WD	WNW WD	All WD	WNW WD	All WD	WNW WD
	10%ile	50%ile	10%ile	50%ile	10%ile	50%ile	10%ile	50%ile	10%ile	50%ile	10%ile	50%ile	10%ile	50%ile
1	0.22	1.4	0	0.157	0.232	0.398	1.8	1.944	0	0	0.891	3.777	1.989	13.384
2	0.173	1.722	0.004	0.177	0.247	0.4	1.8	1.957	0	0	0.862	3.675	2.1	12.926
3	0.456	2.392	0	0.175	0.254	0.4	1.8	1.942	0	0	0.832	3.5	1.726	12.006
4	0.398	1.925	0	0.157	0.25	0.4	1.8	1.956	0	0	0.804	3.386	1.491	11.609
5	0.394	1.703	0	0.156	0.243	0.411	1.8	1.958	0	0	0.83	3.401	1.407	12.096
6	0.419	1.8	0	0.17	0.24	0.402	1.8	1.96	0	0	0.902	3.407	1.417	11.424
7	0.462	1.334	0	0.175	0.249	0.395	1.8	1.942	0	0	1	3.003	1.628	13.989
8	0.428	1.023	0	0.173	0.251	0.378	1.8	1.92	0	0	1.058	2.645	2.118	16.666
9	0.387	0.815	0	0.192	0.261	0.372	1.8	1.912	0	0	1.102	2.494	3.1	20.248
10	0.32	0.531	0	0.167	0.258	0.358	1.8	1.907	0	0	1.107	2.214	5.413	23.519
11	0.276	0.354	0.005	0.173	0.257	0.373	1.798	1.9	0	0	1.058	1.951	7.7	27.068
12	0.215	0.3	0.004	0.183	0.256	0.376	1.787	1.896	0	0	0.961	1.9	9.821	28.3
13	0.195	0.263	0	0.19	0.246	0.367	1.772	1.898	0	0	0.9	1.867	11.358	28.7
14	0.169	0.289	0.003	0.183	0.237	0.362	1.762	1.889	0	0	0.816	1.978	11.831	29.991
15	0.151	0.263	0	0.161	0.228	0.351	1.755	1.891	0	0	0.84	1.759	11.7	30.098
16	0.181	0.3	0	0.199	0.232	0.371	1.751	1.89	0	0	0.84	1.893	9.938	29.8
17	0.182	0.38	0	0.185	0.233	0.367	1.753	1.89	0	0	0.895	2.158	7.296	28.4
18	0.193	0.41	0	0.177	0.237	0.363	1.756	1.896	0	0	0.9	2.411	5.399	27.447
19	0.2	0.605	0	0.2	0.238	0.376	1.76	1.9	0	0	0.957	2.677	4.303	24.834
20	0.2	0.732	0	0.191	0.236	0.396	1.766	1.913	0	0	1	3.191	3.691	22.348
21	0.246	0.899	0	0.2	0.241	0.4	1.785	1.924	0	0	1	3.08	3.068	19.578
22	0.246	1	0	0.169	0.24	0.4	1.795	1.933	0	0	0.976	3.4	2.5	17.429
23	0.253	1.2	0	0.173	0.232	0.4	1.8	1.942	0	0	0.915	3.971	2.464	15.058
24	0.238	1.408	0	0.158	0.237	0.399	1.8	1.945	0	0	0.9	3.699	2.258	14.981
Average	0.275	0.96	0.001	0.177	0.243	0.384	1.785	1.921	0	0	0.931	2.81	4.822	20.496
SD	0.101	0.616	0.002	0.014	0.009	0.017	0.019	0.025	0	0	0.089	0.711	3.579	6.836
Range	(0.151-0.462)	(0.262-2.392)	(0-0.005)	(0.156-0.2)	(0.228-0.261)	(0.351-0.411)	(1.751-1.8)	(1.889-1.96)	(0-0)	(0-0)	(0.804-1.107)	(1.759-3.971)	(1.407-11.831)	(11.424-30.098)

For both the “all WD” 10th percentile approach and the 50th percentile “WD screened approach” there are some very clear and significant diurnal patterns in terms of hourly NO₂ and O₃ concentrations for both the “all WD” 10th percentile and 50th percentile “WD screened” approaches and for PM_{2.5} for the 50th percentile “WD screened” approach. There is also a clear, but smaller magnitude, diurnal pattern for THC for both the “all WD” 10th percentile and 50th percentile “WD screened” approaches. SO₂ and TRS do not show a clear or strong diurnal pattern. The diurnal patterns based on concentrations present a slightly different picture than the “by hour of day” “fraction of concentration” contribution patterns. This indicates that other temporal factors e.g. month and or year, may be resulting in certain months or years contributing a disproportionate amount of data to the “all WD” 10th percentile and 50th percentile “WD screened” datasets. The resultant baseline estimates are therefore not reflective of the average “by hour” concentrations over the entire 2002-2021 dataset period which highlights the need to consider temporal variables collectively.

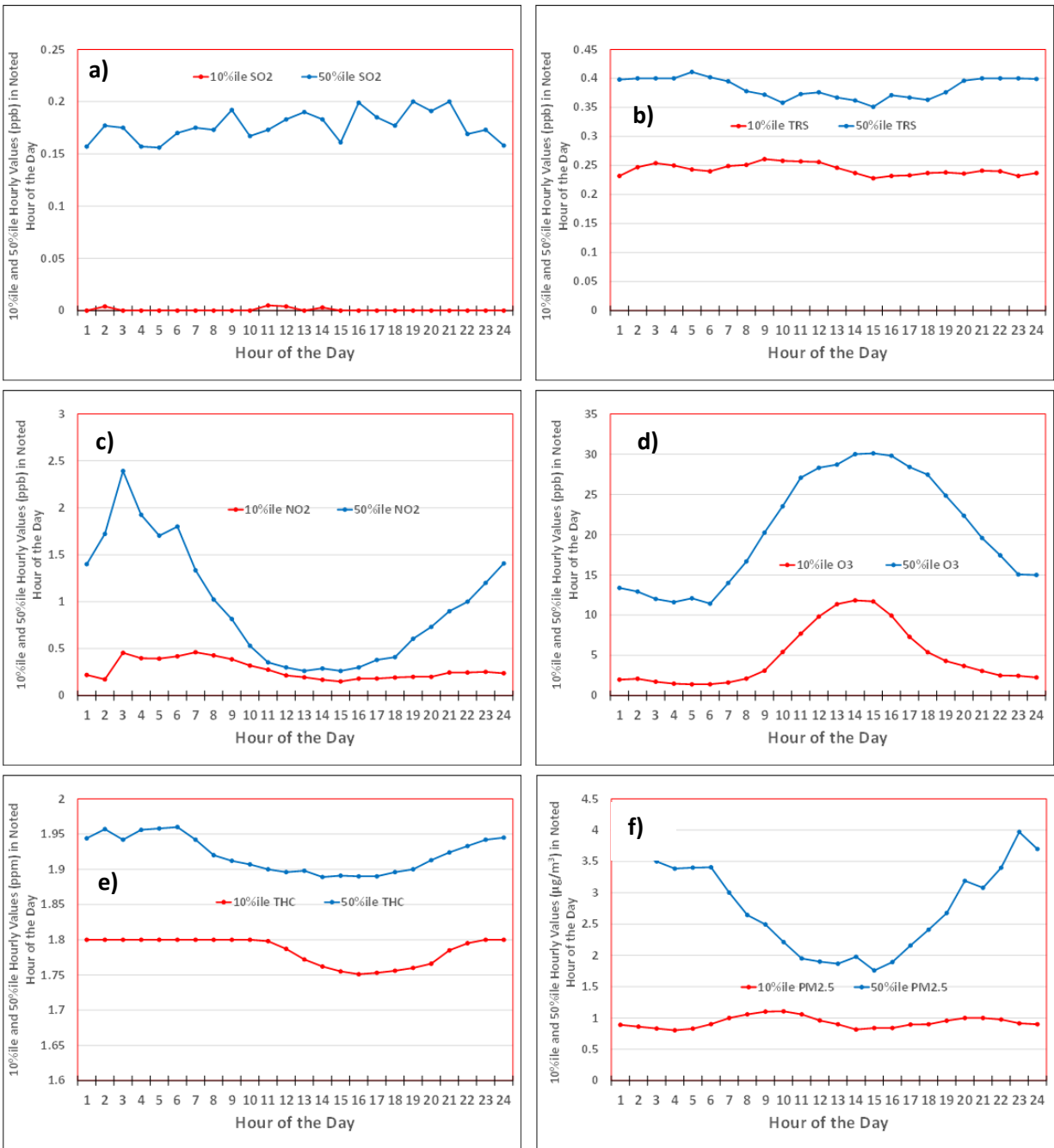


Figure C.2: 10th percentile "All WD" and 50th percentile WD Screened Hourly Concentrations in Fort McKay for the 2002-2021 Period for the Noted Pollutant (a) SO₂; b) TRS; c) NO₂; d) O₃; e) THC; and f) PM_{2.5}) in the Noted Hour of the Day (Note: the different y-axis scale for each pollutant))

C.1.3 "By Hour of the Day" Variable Considerations

The "fraction of by hour of the day" contribution to the percentile "all WD" 10th percentile and "WD screened" 50th percentile datasets and the "by hour of day" concentration plots show clear diurnal patterns. However, in general, these diurnal trends do not have a strong influence on baseline estimates when compared to the "no variable considered" baseline estimates. **Table C.2** shows the no "by hour day" estimated 10th percentile "all WD" and 50th percentile "WD screened" baselines compared to the

averaged “by hour of day” estimated “all WD” 10th percentile and “WD screened” 50th percentile baselines. This comparison indicates that, as a standalone consideration, “by hour of the day” only has a strong influence on the “WD screened” 50th percentile hourly baseline estimate for NO₂ and the “all WD” 10th percentile hourly baseline estimate for O₃. The range of “by hour of day” values as shown in **Table C.2** for NO₂, TRS, PM_{2.5} and O₃, combined with the significant diurnal variability in both “by hour of the day” “fraction of contribution” and concentration levels (**Figures C.1 and C.2**) would indicate that in baseline estimating “by hour of the day” is a temporal variable that needs to be considered.

Understanding and quantifying hourly baseline variability also has potential usefulness in, for example, comparing and evaluating the significance of a maximum hourly model air quality pollutant concentration relative to an estimated maximum hourly baseline concentration.

Table C.2: Estimated Baseline Concentrations of SO₂, TRS, NO₂, THC, NMHC, PM_{2.5} and O₃ based on a “By Hour of Day” “all WD” 10th percentile and “WD screened” 50th percentile Baseline Estimating Approaches and a Comparison of these “By Hour of Day” Baseline Estimates to the “No Variable Consideration” Baseline

"Time of Day " versus "No Time of Day " "All Wind Direction" 10 Percentile Values and "Wind Direction Screened" (WNW) 50 Percentile Values Fort McKay Hourly Data for Period 2002-2021														
Parameter	NO ₂		SO ₂		TRS		THC		NMHC		PM _{2.5}		O ₃	
Wind Direction	All	WNW	All	WNW	All	WNW	All	WNW	All	WNW	All	WNW	All	WNW
%ile	10%	50%	10%	50%	10%	50%	10%	50%	10%	50%	10%	50%	10%	50%
%ile of all Values	0.27	0.897	0	0.175	0.243	0.388	1.792	1.921	0	0	0.916	2.942	3.4	18.7
Average of "by Hr of Day" %iles*	0.275	1.137	0.001	0.174	0.243	0.389	1.785	1.928	0.000	0.000	0.931	3.028	4.822	18.523
Standard Deviation (SD) of by Hour Values	0.101	0.616	0.002	0.014	0.009	0.017	0.019	0.025	0.000	0.000	0.089	0.711	3.579	6.836
Range of by Hour Values	(0.151-0.462)	(0.262-2.392)	(0-0.005)	(0.156-0.2)	(0.228-0.261)	(0.351-0.411)	(1.751-1.8)	(1.889-1.96)	(0-0)	(0-0)	(0.804-1.107)	(1.759-3.971)	(1.407-11.831)	(11.424-30.098)
% Difference between the "by hr" and "no by hr" approaches	1.9%	26.7%	0.0%	-0.3%	0.1%	0.2%	-0.4%	0.4%	0.0%	0.0%	1.6%	2.9%	41.8%	-0.9%
* The average of "by hour of the day" %ile values for the Wind Direction screened dataset are time weighted based on the fraction of the total WNW WD hours that occurred in each hour														

C.2 By Day of the Week Analysis

Unlike hour of the day, month of year and year, day of the week has no meteorological relevance and therefore is not directly related to the atmospheric processing of pollutants. Day of the week can, however, have implications in terms of the amount, timing and nature of air emissions which in turn influence the diurnal patterns of pollutant levels and weekly pollutant level patterns. Since the “all WD” 10th percentile approach and “WD screened” 50th percentile approaches are structured to exclude local and/or regional emission influences, there should be minimal day of the week influences on the baseline estimates using these two percentile approaches. Also, since oil sands developments are 24/7 operations there should be minimal day of the week emission differences.

C.2.1 Hour of the Day “Fractional Concentration” Assessment

Figure C.3 shows the “by day of the week” fraction of contributions that each day contributed to the 2002-2021 “all WD” 10th percentile dataset and the “WD screened” 50th percentile datasets. All pollutants are included in this Figure which makes it difficult to differentiate between pollutants so the intent of the Figure is solely to indicate that, in general, each day of the week contributes equally to the

“all WD” 10th percentile dataset and the “WD screened” 50th percentile datasets. This would indicate that the “by day of the week” variable is not relevant in baseline estimating using these two percentile approaches.

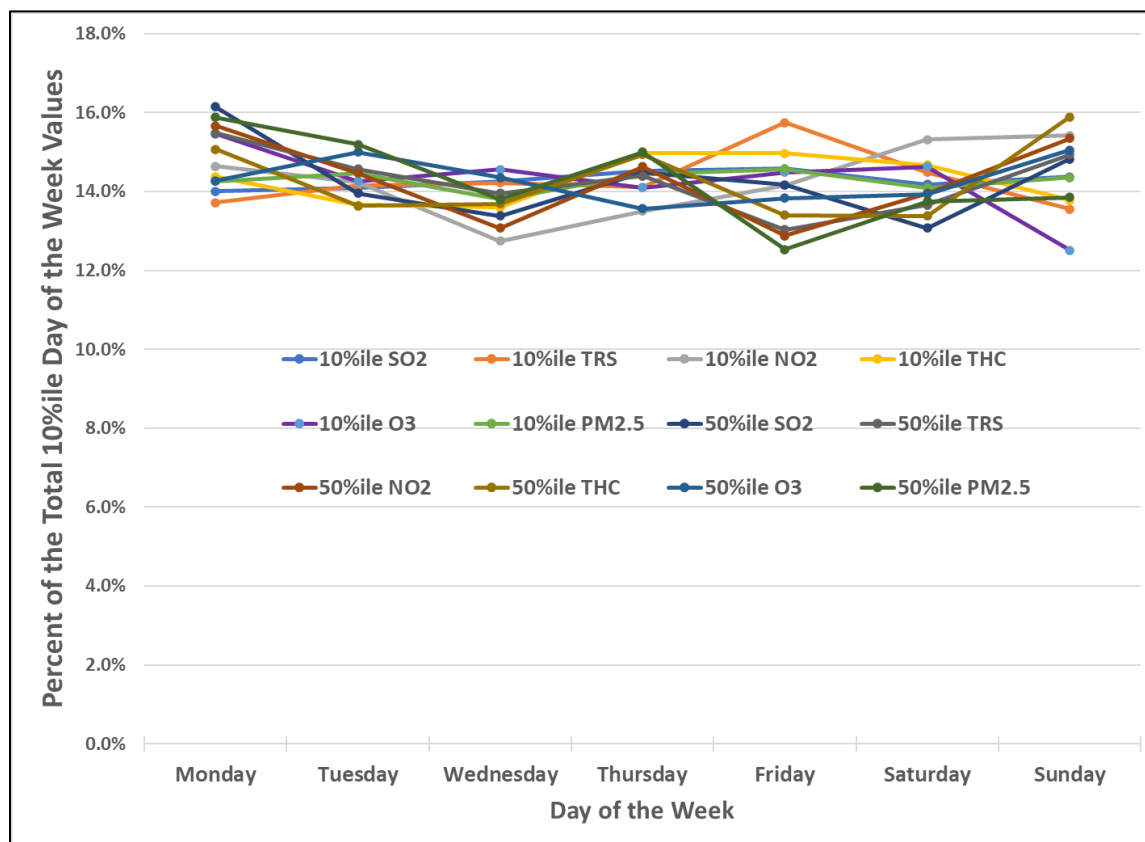


Figure C.3: Percent of the Total 10th percentile “All WD” and 50th percentile “WD Screened” Hourly Values in Fort McKay for the Noted Pollutant Contributed by the Noted Day of the Week (2002-2021 Period)

C.2.2 “By Day of the Week” Hourly Concentrations

“By day of the week” “all WD” 10th percentile and “WD screened” 50th percentile hourly average concentration were generated for SO₂, H₂S, TRS, NO, NO₂, NO_x, THC, O₃, PM_{2.5}, NMHC and CH₄ in Fort McKay for the 2002-2021 period. The resultant “by day of the week” “all WD” 10th percentile and “WD screened” 50th percentile concentrations were plotted to assess any possible significant “by day of the week” concentration differences. The “by day of the week” “all WD” 10th percentile and “WD screened” 50th percentile concentrations were averaged to give a “by day of the week” temporal considered baseline estimates which were compared to the “no temporal considerations” baseline estimate.

Table C.3 shows the “All WD” 10th percentile and “WD screened” 50th percentile “by day of the week” hourly concentrations for SO₂, TRS, NO₂, THC, NMHC, O₃ and PM_{2.5}.

Table C.3: “By Day of the Week” Average NO₂, SO₂, TRS, THC, NMHC, PM_{2.5} and O₃ Concentrations in Fort McKay for the 2002-2021 Period

The "By Day of the Week" All Wind Direction 10 Percentile Concentrations and the Wind Direction Screened (WNW) 50 Percentile concentrations Values for the Noted Parameter: Fort McKay Hourly Data for Period 2002-														
Day of the Week	NO ₂ (ppb)		SO ₂ (ppb)		TRS (ppb)		THC (ppm)		NMHC (ppm)		PM _{2.5} (µg/m ³)		O ₃ (ppb)	
	All WD	WNW WD	All WD	WNW WD	All WD	WNW WD	All WD	WNW WD	All WD	WNW WD	All WD	WNW WD	All WD	WNW WD
	10%ile	50%ile	10%ile	50%ile	10%ile	50%ile	10%ile	50%ile	10%ile	50%ile	10%ile	50%ile	10%ile	50%ile
Monday	0.249	0.791	0	0.154	0.248	0.382	1.791	1.921	0.000	0.000	0.953	2.728	3.050	19.616
Tuesday	0.252	0.875	0	0.183	0.243	0.385	1.796	1.928	0.000	0.000	0.911	2.667	3.359	17.856
Wednesday	0.3	1	0	0.183	0.247	0.387	1.797	1.919	0.000	0.000	1.000	3.118	3.295	18.060
Thursday	0.281	0.9	0	0.177	0.243	0.389	1.785	1.915	0.000	0.000	0.900	2.805	3.410	20.585
Friday	0.265	0.979	0	0.158	0.225	0.399	1.785	1.921	0.000	0.000	0.912	3.296	3.346	17.840
Saturday	0.235	0.931	0	0.198	0.243	0.391	1.788	1.927	0.000	0.000	0.900	2.978	3.300	18.800
Sunday	0.235	0.8	0	0.177	0.252	0.389	1.795	1.911	0.000	0.000	0.876	3.171	3.994	18.535
Average	0.26	0.896	0	0.176	0.243	0.389	1.791	1.920	0.000	0.000	0.922	2.966	3.393	18.756

Figure C.4 shows plots for each pollutant from the Table C.3 data and provides a graphical depiction of the "by day of the week" variation for each pollutant and each percentile approach and the difference in the baseline estimates between each percentile approach.

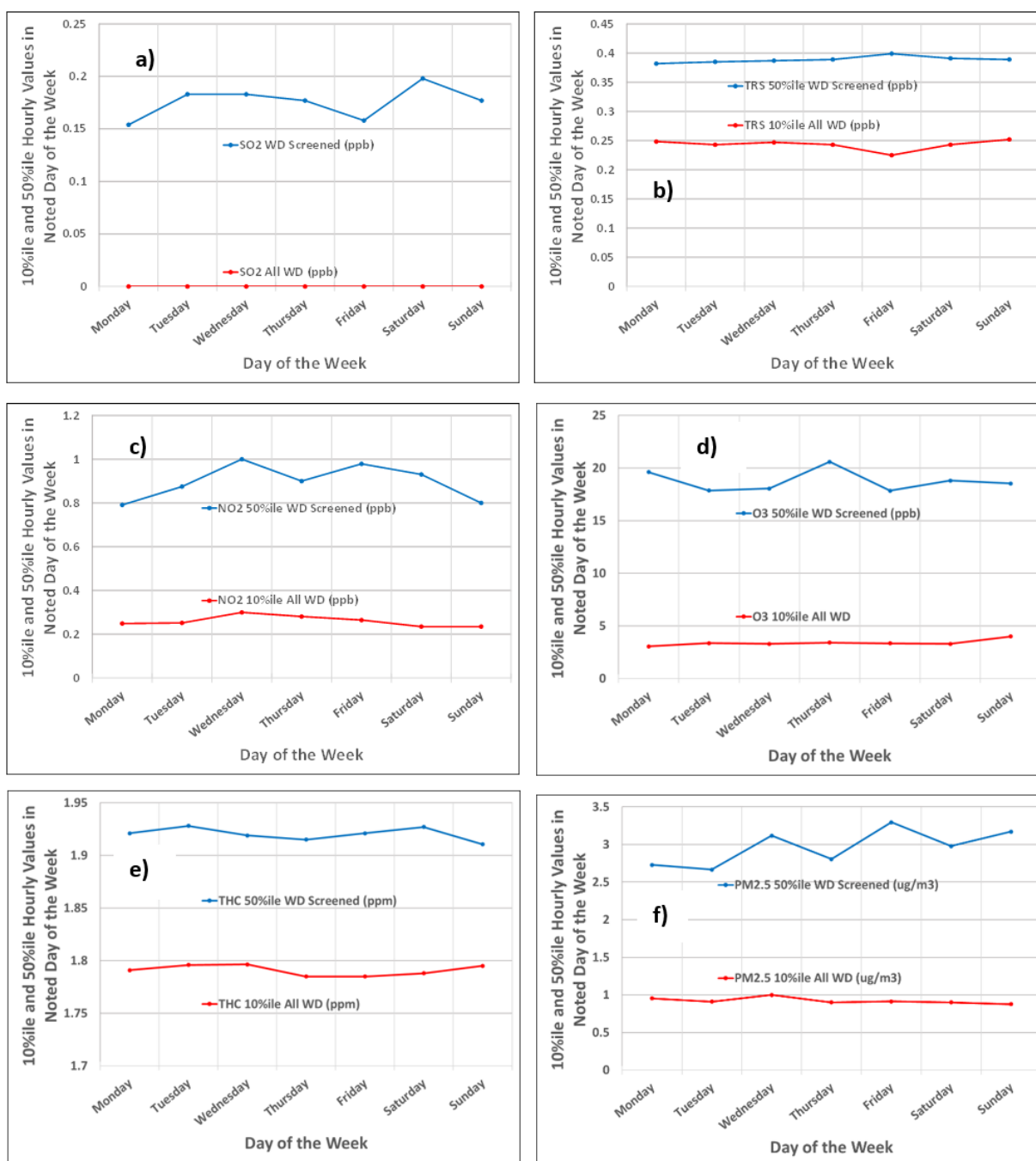


Figure C.4: 10th percentile "All WD" and 50th percentile "WD Screened" Hourly Values in Fort McKay for the 2002-2021 Period for the Noted Pollutant: a) SO₂; b) TRS; c) NO₂; d) O₃; e) THC; and f) PM_{2.5}, in the Noted Day of the Week (Note: the different y-axis scale for each pollutant)

C.2.3 "By Day of the Week" Variable Considerations

The "by day of the week" "all WD" 10th percentile and "WD screened" 50th percentile concentrations were averaged (see **Table C.3**) to give "by day of the week" temporal considered baseline estimates which were compared to the "no temporal considerations" baselines estimates and this comparison is shown in **Table C.4**.

As **Table C.4** shows, the effect of averaging “by day of the week” “all WD” 10th percentile and “WD screened” 50th percentile has essentially no influence on the “all WD” 10th percentile and “WD screened” 50th percentile hourly baseline estimates.

The conclusion from the above analyses is that “day of the week” does not need to be a consideration for setting a no to very limited local and/or regional emission impact baseline.

Table C.4: Estimated Baseline Concentrations of SO₂, TRS, NO₂, THC, NMHC, PM_{2.5} and O₃ based on a “By Day of Week” “all WD” 10th percentile and “WD screened” 50th percentile Baseline Estimating Approaches and a Comparison of these “By Day of Week” Baseline Estimates to the “No Day of the Week Variable Consideration” Baseline

"Day of the Week " versus "No Day of Week " "All Wind Direction" 10 Percentile Values and "Wind Direction Screened" (WNW) 50 Percentile Values Fort McKay Hourly Data for Period 2002-2021														
Parameter	NO ₂ (ppb)		SO ₂ (ppb)		TRS (ppb)		THC (ppm)		NMHC (ppm)		PM _{2.5} (µg/m ³)		O ₃ (ppb)	
Wind Direction	All	WNW	All	WNW	All	WNW	All	WNW	All	WNW	All	WNW	All	WNW
%ile	10%	50%	10%	50%	10%	50%	10%	50%	10%	50%	10%	50%	10%	50%
%ile of all Values (No by Day of Wk consideration)	0.27	0.897	0	0.175	0.243	0.388	1.792	1.921	0	0	0.916	2.942	3.4	18.7
Average of "by Day of Wk" %iles	0.26	0.896	0	0.176	0.243	0.389	1.791	1.920	0.000	0.000	0.922	2.966	3.39	18.76
Standard Deviation (SD) of by Hour Values	0.022	0.075	0	0.014	0.008	0.005	0.005	0.006	0	0	0.038	0.222	0.268	0.946
Range of "by Day of Wk" Values	(0.235-0.3)	(0.791-1)	(0-0)	(0.154-0.198)	(0.225-0.252)	(0.382-0.399)	(1.785-1.7965)	(1.9105-1.928)	(0-0)	(0-0)	(0.876-1)	(2.667-3.2955)	(3.0496-3.9941)	(17.84-20.585)
% Difference between the "by Day of Wk" and "no by Day of Wk" Analyses	-4.00%	-0.40%	0.00%	0.30%	0.00%	0.20%	0.10%	0.00%	0.00%	0.00%	-0.60%	0.60%	0.20%	0.40%

C.3 “Month of the Year” Variable Assessment

Month of the year is a variable that would be expected to have significant relevance in terms of natural emission sources, atmospheric mixing and photochemical and chemical reactions and reaction rates.

C.3.1 Month of the Year “Fractional Contribution” Assessment

The results of the “by month of the year” “fraction of contributions” analyses is presented in **Figure C.5**. For both the “all WD” 10th percentile approach and the 50th percentile “WD screened” approach there are clear time-of-year patterns in terms of the fraction of the total hourly contributions contributed to both of these two percentile baseline setting approaches. Again, it needs to be noted that the higher the percent contribution of a given month to the total hourly values the lower the ambient concentration in that hour i.e. the ambient concentration of the pollutant is inversely proportional to its contribution to the baseline 10th percentile and 50th percentile datasets. For example, in **Figure C.5 (inset a)** the very low fraction of hourly SO₂ concentrations contributing to the baseline 10th percentile and 50th percentile datasets during the cold weather months reflects that this is the time of year when ambient SO₂ concentrations are the highest.

The “by month of the year” contributions to the “all WD” 10th percentile and the 50th percentile “WD screened” datasets and the comparisons between the differences in contributions between the “all WD” 10th percentile and the 50th percentile “WD screened” datasets indicates that:

- Both the “all WD” 10th percentile and the 50th percentile “WD datasets” show the same general monthly trends with higher to much higher warm month contributions to 10th percentile and

50th percentile datasets as a result of the generally lower ambient pollutant concentrations during this period;

- The “by month” variation in contributions to 10th percentile and 50th percentile datasets is similar in trend and magnitude for all pollutants except TRS and O₃;
- O₃ shows the greatest “by month” variation between the “all WD” 10th percentile and the 50th percentile “WD screened” datasets which likely reflects the “all WD” 10th percentile approach capturing the ozone scavenging effect of regional NO_x emissions resulting in “unnatural” i.e. local/regional emission influences, which indicates that at least for setting an O₃ baseline the “all WD” 10th percentile approach is probably not appropriate; and
- The “all WD” 10th percentile TRS by month contributions show much less variability than the 50th percentile “WD screened” dataset indicating a somewhat constant yearly “all WD” 10th percentile TRS level and the 50th percentile “WD screened” indicating that there is greater variability using this approach and if this variability is the result of local and/or regional emission influences then this is a limitation of this approach and possibly a lower percentile needs to be considered.

This “by month of the year” “fraction of contributions” to the “all WD” 10th percentile approach and the 50th percentile “WD screened” datasets clearly indicates that “by month of the year” is a dataset variable that needs to be considered when baseline estimating using percentile methods.



Figure C.5: Percent of the Total 10th percentile "All WD" and 50th percentile WD Screened Hourly Values in Fort McKay for the Noted Pollutant: a) SO₂; b) TRS; c) NO₂; d) O₃; e) THC; and f) PM_{2.5} Contributed by the Noted Month of the Year (2002-2021 Period)

C.3.2 "By Month of the Year" Hourly Concentrations

How significant the monthly "fraction of contribution" differences is in terms of the actual concentration differences in monthly "all WD" 10th percentile concentrations and WD screened 50th percentile concentrations was assessed. "By month of the year" "all WD" 10th percentile and "WD screened" 50th percentile hourly datasets were generated for SO₂, H₂S, TRS, NO, NO₂, NO_x, THC, O₃, PM_{2.5}, NMHC and CH₄ in Fort McKay for the 2002-2021 period. The resultant "by month of the year" "all WD" 10th

percentile and “WD screened” 50th percentile concentrations are presented in **Table C.5** and were plotted (**Figure C.6**) to assess any possible significant “by month of the year” concentration differences.

Table C.5: “All WD” 10th percentile and WD Screened 50th percentile “by Month of the Year” Hourly Concentrations for SO₂, TRS, NO₂, THC, NMHC, O₃ and PM_{2.5}.

The "By Month of the Year" All Wind Direction 10 Percentile Concentrations and the Wind Direction Screened (WNW) 50 Percentile concentrations Values for the Noted Parameter: Fort McKay Hourly Data for Period 2002-														
Month	NO ₂ (ppb)		SO ₂ (ppb)		TRS (ppb)		THC (ppm)		NMHC (ppm)		PM _{2.5} (µg/m ³)		O ₃ (ppb)	
	All WD	WNW WD	All WD	WNW WD	All WD	WNW WD	All WD	WNW WD	All WD	WNW WD	All WD	WNW WD	All WD	WNW WD
	10%ile	50%ile	10%ile	50%ile	10%ile	50%ile	10%ile	50%ile	10%ile	50%ile	10%ile	50%ile	10%ile	50%ile
January	0.930	3.145	0.093	0.336	0.300	0.437	1.823	1.943	0.000	0.000	1.100	2.590	1.328	22.730
February	0.988	4.491	0.099	0.302	0.317	0.446	1.833	1.961	0.000	0.000	1.060	3.068	1.997	24.400
March	0.600	1.667	0.031	0.28	0.263	0.401	1.797	1.934	0.000	0.000	0.968	2.693	8.800	30.899
April	0.371	0.530	0	0.153	0.215	0.399	1.777	1.913	0.000	0.000	0.962	2.173	14.546	37.395
May	0.200	1.063	0	0.145	0.200	0.400	1.750	1.900	0.000	0.000	0.900	3.074	11.947	23.298
June	0.107	0.961	0	0.154	0.233	0.428	1.754	1.902	0.000	0.000	1.156	4.367	8.266	17.367
July	0.099	0.457	0	0.141	0.245	0.416	1.719	1.900	0.000	0.001	1.300	4.597	5.958	14.718
August	0.101	0.581	0	0.127	0.212	0.390	1.746	1.912	0.000	0.000	1.000	3.724	4.202	13.305
September	0.100	0.517	0	0.109	0.219	0.336	1.747	1.908	0.000	0.000	0.686	2.400	3.100	13.830
October	0.191	0.576	0	0.192	0.209	0.309	1.800	1.928	0.000	0.000	0.600	1.837	2.627	19.842
November	0.500	1.200	0	0.195	0.234	0.353	1.830	1.942	0.000	0.000	0.793	2.745	1.900	22.436
December	0.837	3.019	0.05	0.257	0.304	0.408	1.872	1.990	0.000	0.000	1.152	2.785	1.000	20.716
Average	0.419	1.517	0.023	0.199	0.246	0.394	1.787	1.928	0.000	0.000	0.973	3.004	5.473	21.745

Figure C.6 shows plots for each pollutant from **Table C.5** data to provide a graphical depiction of the “by month of the year” concentration variations for each pollutant and each percentile approach and the difference in the baseline estimates between each percentile approach.

The plots in **Figure C.6** show that the “by month variability” for the “all WD” 10th percentile and “WD screened” 50th percentile concentrations for all the pollutants follow very similar patterns and there is significant inter-month variability.

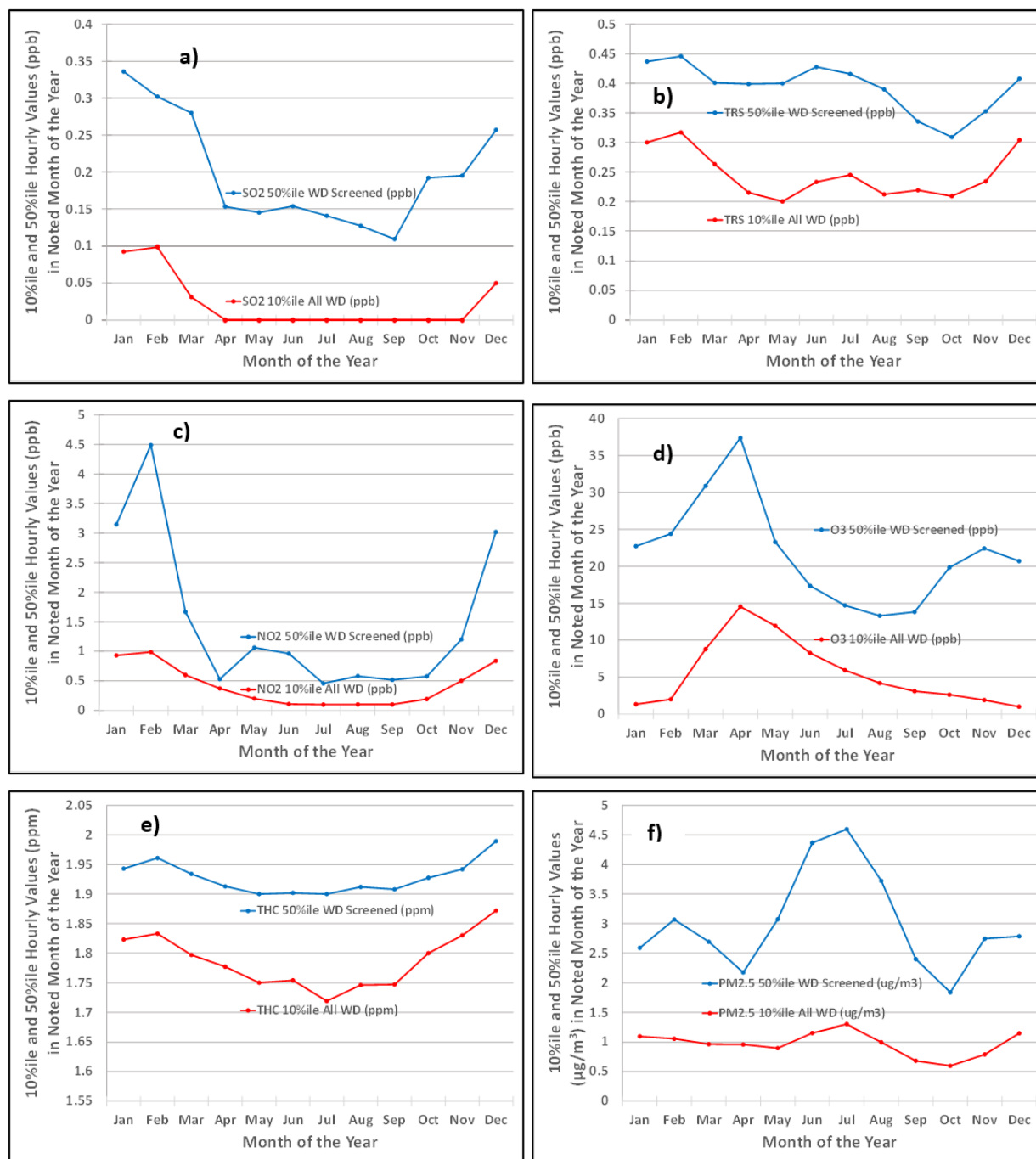


Figure C.6 10th percentile "All WD" and 50th percentile WD Screened Hourly Values in Fort McKay for the 2002-2021 Period for the Noted Pollutant: a) SO₂; b) TRS; c) NO₂; d) O₃; e) THC; and f) PM_{2.5}, in the Noted Month of the Year (Note: the different y-axis scale for each pollutant))

C.3.3 Percentile Approaches "By Month of the Year" Hourly Concentrations

The "by month of the year" "all WD" 10th percentile and WD screened 50th percentile concentrations were averaged to give a "by month of the year variable considered" baseline estimates (**Table C.5**) which were compared to the "no temporal considerations" baselines estimates and this comparison is shown in **Table C.6** which also gives the range and standard deviation of the monthly variability for these pollutants.

Table C.6: Estimated Baseline Concentrations of SO₂, TRS, NO₂, THC, NMHC, PM_{2.5} and O₃ based on a “By Month of Year” “all WD” 10th percentile and “WD screened” 50th percentile Baseline Estimating Approaches and a Comparison of these Baseline Estimates to the “No Month of Year Consideration” Baseline estimates with the Range of Monthly Baseline Estimates and the Standard Deviation of this Range

"Month of the Year" versus "No Month of the Year Consideration " "All Wind Direction" 10 Percentile Values and "Wind Direction Screened" (WNW) 50 Percentile Values Fort McKay Hourly Data for Period 2002-2021														
Parameter	NO ₂ (ppb)		SO ₂ (ppb)		TRS (ppb)		THC (ppm)		NMHC (ppm)		PM _{2.5} (µg/m ³)		O ₃ (ppb)	
Wind Direction	All	WNW	All	WNW	All	WNW	All	WNW	All	WNW	All	WNW	All	WNW
%ile	10%	50%	10%	50%	10%	50%	10%	50%	10%	50%	10%	50%	10%	50%
%ile of all Values (No Variable Consideration)	0.27	0.897	0	0.175	0.243	0.388	1.792	1.921	0	0	0.916	2.942	3.4	18.7
Average of "by Month of Year" %iles	0.419	1.249	0.023	0.181	0.246	0.387	1.787	1.923	0.000	0.000	0.973	3.106	5.473	19.828
Standard Deviation (SD) of "by Month" Values	0.330	1.267	0.036	0.073	0.039	0.040	0.044	0.027	0.000	0.000	0.195	0.802	4.289	6.750
Range of "by Mnth of Yr" Values	(0.099-0.988)	(0.457-4.491)	(0-0.099)	(0.109-0.336)	(0.2-0.317)	(0.309-0.446)	(1.719-1.872)	(1.9-1.990)	(0-0)	(0-0.0005)	(0.6-1.3)	(1.837-4.596)	(1-14.546)	(13.305-37.395)
Difference between the "by Mnth of Yr" and "no by Mnth of Yr" Analyses	0.15	0.35	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.16	2.07	1.13

As for the “by hour of the day” analysis, this “by month of the year” analysis indicates that that despite considerable “by month” variability in the “all WD” 10th percentile and “WD screened” 50th percentile concentrations for all pollutants, considering this variability has negligible to small impacts on the baseline estimates for SO₂, THC, PM_{2.5} and TRS. However, for NO₂ and O₃, considering “by month of the year” results in 6-55% changes in the estimated baseline concentrations. These results would indicate that in baseline estimating “by month of the year” is a temporal variable that needs to be considered. Also this type of temporal analysis provides “by month” baselines for each pollutant which can be used to develop seasonal baselines that may be relevant in the context of environmental effects assessments. Monthly and/or seasonal baselines are also relevant in assessing the contribution of non-regional emission sources to air quality pollutants that have a monthly objective e.g. the 30-day AAAQO for SO₂ and the six month CAAQS for O₃.

C.4 “Inter-Annual” Analysis

The inter-annual meteorological differences e.g. precipitation, temperature, solar radiation, wind speeds and wind rose patterns, would be expected to impact percentile approach baseline estimates that are based on multi-year datasets. Inter-annual dataset differences may also be the result of measurement methodology and/or measurement reporting procedure changes.

For example, in Fort McKay in the 1999-2021 period, PM_{2.5} has been measured using a TEOM instrument, which was replaced with a Sharp instrument, which in turn was replaced with a T640 instrument. Under certain conditions each of these PM_{2.5} instruments can give significantly different PM_{2.5} concentration estimates. In reviewing the 2002-2021 SO₂ hourly dataset it was noted that starting in 2004 and ending in July 2007 hourly SO₂ values were only reported to one decimal place instead of the 3 decimal place reporting for the remainder of the dataset. This meant that in the 2004 to mid-2007 period SO₂ hourly values less than 0.05 ppb were reported as 0 ppb. This means some of the zero values in this period would not have been zero values using the three decimal point approach. Another SO₂ hourly data comparison issue is that, in the 2008/9 period, the SO₂ analyzer was changed from a ThermoScientific 43C SO₂ analyzer to a 43i SO₂ analyzer and in ~2013 signal capture from the 43i analyzer was changed from analogue to digital. No analyses of how these analyzer changes may have influence SO₂ measurements was made.

In the 2012-2018 period there were a number of instrument changes in Fort McKay some of which likely resulted in before and after data comparability issues. These meteorological, instrument and reporting issues may have resulted in certain years being disproportionately over or under-represented in the “all WD” 10th percentile and/or “WD screened” 50th percentile datasets.

C.4.1 “By Year” “Fractional Contribution” Assessment

The results of the “by year” “fraction of contributions” analyses is presented in **Figure C.7**. The “by year” contributions to the “all WD” 10th percentile and the 50th percentile “WD screened” datasets and the comparisons between the differences in contributions between the “all WD” 10th percentile and the 50th percentile “WD screened” datasets indicates that:

- In general, the “by year” contributions follow similar patterns for both the “all WD” 10th percentile and “WD screened” 50th percentile approaches except for TRS (**inset b**) but with some significant differences between the two approaches in specific years e.g. SO₂ in 2009; O₃ in 2015; NO₂ in 2003, and THC in 2002 & 2003. Except for O₃ in 2015, these differences have those years contributing a much higher fraction of values to the “all WD” 10th percentile dataset which indicates that for some reason(s) the “WD screened” 50th percentile approach was capturing much higher hourly SO₂, NO₂ and THC concentrations in those years than the “all WD” 10th percentile approach”; and
- In general, the “WD screened” 50th percentile approach has a more even “by year” fraction of contributions to its overall dataset than the “all WD” 10th percentile approach which gets almost no contribution to its dataset from certain years e.g. TRS in the 2015-2021 period, THC in the 2011-2021 period and PM_{2.5} in the 2013-2021 period. (Note: If this lower dataset contribution for these pollutants in these periods is the result anthropogenic air quality influences then it is appropriate that they are excluded/minimized. However, if these years just reflect higher natural variability periods then their exclusion from baseline estimating is an approach limitation).

This “by year” “fraction of contributions” to the “all WD” 10th percentile approach and the 50th percentile “WD screened” datasets would clearly indicate, as was the case for “by hour of the day” and “by month of the year”, that “by year” is a dataset variable that needs to be considered when baseline estimating using percentile methods.



Figure C.7: Percent of the Total 10th percentile "All WD" and 50th percentile "WD Screened" Hourly Values in Fort McKay for the Noted Pollutant: a) SO₂; b) TRS; c) NO₂; d) O₃; e) THC; and f) PM_{2.5}, Contributed by the Noted Year (2002-2021 Period)

C.4.2 “By Year” Hourly Concentrations

How significant the annual “fraction of contribution” differences are in terms of the actual concentration differences in annual “all WD” 10th percentile concentrations and WD screened 50th percentile concentrations was assessed. “By year” “all WD” 10th percentile and WD screened 50th percentile hourly datasets were generated for SO₂, H₂S, TRS, NO, NO₂, NO_x, THC, O₃, PM_{2.5}, NMHC and CH₄ in Fort McKay for the 2002-2021 period. The resultant “by year” “all WD” 10th percentile and WD screened 50th percentile concentrations are presented in **Table C.7** and were plotted (**Figure C.8**) to assess any possible significant “by year” concentration differences.

Table C.7: “All WD” 10th percentile and WD screened 50th percentile “by Year” hourly concentrations for SO₂, TRS, NO₂, THC, NMHC, O₃ and PM_{2.5}.

The “By Year” All Wind Direction 10 Percentile Concentrations and the Wind Direction Screened (WNW) 50 Percentile Concentrations for the Noted Parameter in the Noted Year (Fort McKay Hourly Data for Period 2002-2021)														
Year	NO ₂ (ppb)		SO ₂ (ppb)		TRS (ppb)		THC (ppm)		NMHC (ppm)		PM _{2.5} (µg/m ³)		O ₃ (ppb)	
	All WD	WNW WD	All WD	WNW WD	All WD	WNW WD	All WD	WNW WD	All WD	WNW WD	All WD	WNW WD	All WD	WNW WD
	10%ile	50%ile	10%ile	50%ile	10%ile	50%ile	10%ile	50%ile	10%ile	50%ile	10%ile	50%ile	10%ile	50%ile
2002	0.954	4.506	0.031	0.146	0.27	0.39	1.613	1.714	NA	NA	0.719	2.535	3.724	17.57
2003	0	0.29	0	0.085	0.23	0.447	1.585	1.709	NA	NA	0.734	2.288	1.938	18.41
2004	0.3	1.4	0	0.1	0.1	0.3	1.7	1.8	NA	NA	0.3	1.6	5.9	20.65
2005	0	0.1	0	0.1	0.2	0.3	1.7	1.8	NA	NA	0.4	1.4	3.4	19
2006	0	0.1	0	0.1	0.4	0.5	1.8	1.9	NA	NA	0.4	1.6	3.9	20.05
2007	0	0.6	0	0.118	0.467	0.566	1.8	1.9	NA	NA	0.5	1.866	3.156	27.487
2008	0.577	1.523	0	0.128	0.246	0.534	1.779	1.899	NA	NA	0.83	2.3	1.845	19.569
2009	0.325	0.869	0	0.121	0.273	0.414	1.78	1.869	NA	NA	0.629	2.14	2.655	16.061
2010	0.272	0.649	0	0.188	0.31	0.416	1.88	1.989	NA	NA	0.682	1.985	2.217	15.738
2011	0.338	1.059	0.205	0.695	0.265	0.404	1.921	2.122	NA	NA	0.996	2.386	3.032	20.826
2012	0.295	0.802	0.134	0.424	0.292	0.402	1.837	1.895	0	0	1.15	3.274	2.236	15.132
2013	0.472	0.879	0	0.339	0.109	0.207	1.837	1.871	0	0	2.401	4.711	2.425	18.719
2014	0.581	1.224	0.357	0.529	0.175	0.298	1.8	1.859	0	0	1.635	3.877	3.951	18.443
2015	0.333	0.625	0	0.101	0.316	0.37	1.803	1.838	0	0	1.615	3.351	6.975	22.517
2016	0.395	0.933	0.018	0.12	0.308	0.383	1.907	1.969	0	0	1.254	3.025	4.823	18.94
2017	0.356	0.786	0	0.161	0.306	0.368	1.922	1.976	0	0	1.167	3.643	4.169	22.311
2018	0.397	1.669	0.104	0.221	0.312	0.377	1.944	2.008	0	0.008	1.356	3.914	3.025	16.905
2019	0.536	1.595	0.135	0.211	0.313	0.376	1.934	1.994	0	0	2.052	4.277	2.91	15.116
2020	0.331	0.468	0.063	0.148	0.318	0.378	1.907	1.955	0	0	1.798	3.057	3.771	19.368
2021	0.44	1.236	0	0.033	0.335	0.423	1.915	2.028	0	0.002	2.127	4.06	3.245	17.712
Average	0.345	1.066	0.052	0.203	0.277	0.393	1.818	1.905	0	0.001	1.137	2.864	3.465	19.026
SD	0.227	0.908	0.091	0.164	0.084	0.08	0.102	0.101	0	0.002	0.612	0.966	1.26	2.838
Range	(0-0.954)	4.506	(0-0.357)	(0.0325-0.695)	(0.1-0.467)	(0.2065-0.566)	(1.5854-1.944)	(1.709-2.122)	(0-0)	(0-0.008)	(0.3-2.401)	(1.4-4.711)	(1.8452-6.975)	(15.116-27.487)

Figure C.8 shows plots for each pollutant from the **Table C.7** data to give a graphical depiction of the “by the year” concentration variation for each pollutant and each percentile approach and the difference in the baseline estimates between each percentile approach.

The plots in **Figure C.8** show that the “by year” concentration variations for the “all WD” 10th percentile and “WD screened” 50th percentile approaches follow very similar patterns except for O₃. This would indicate that both percentile approaches are capturing the same natural and/or anthropogenic influences but that the “all WD” 10th percentile approach is capturing less of these influences. If these influences are predominately natural source related then this would be a limitation of the 10th percentile approach. However, if most of the influences being detected by the “WD screened” 50th percentile approach are anthropogenic then this a limitation of this percentile approach. If one or the other influences i.e. natural or anthropogenic, can be determined then either percentile approach could be modified to

address the issue i.e. increase the “all WD” percentile value used or lower the “WD screened” percentile value.

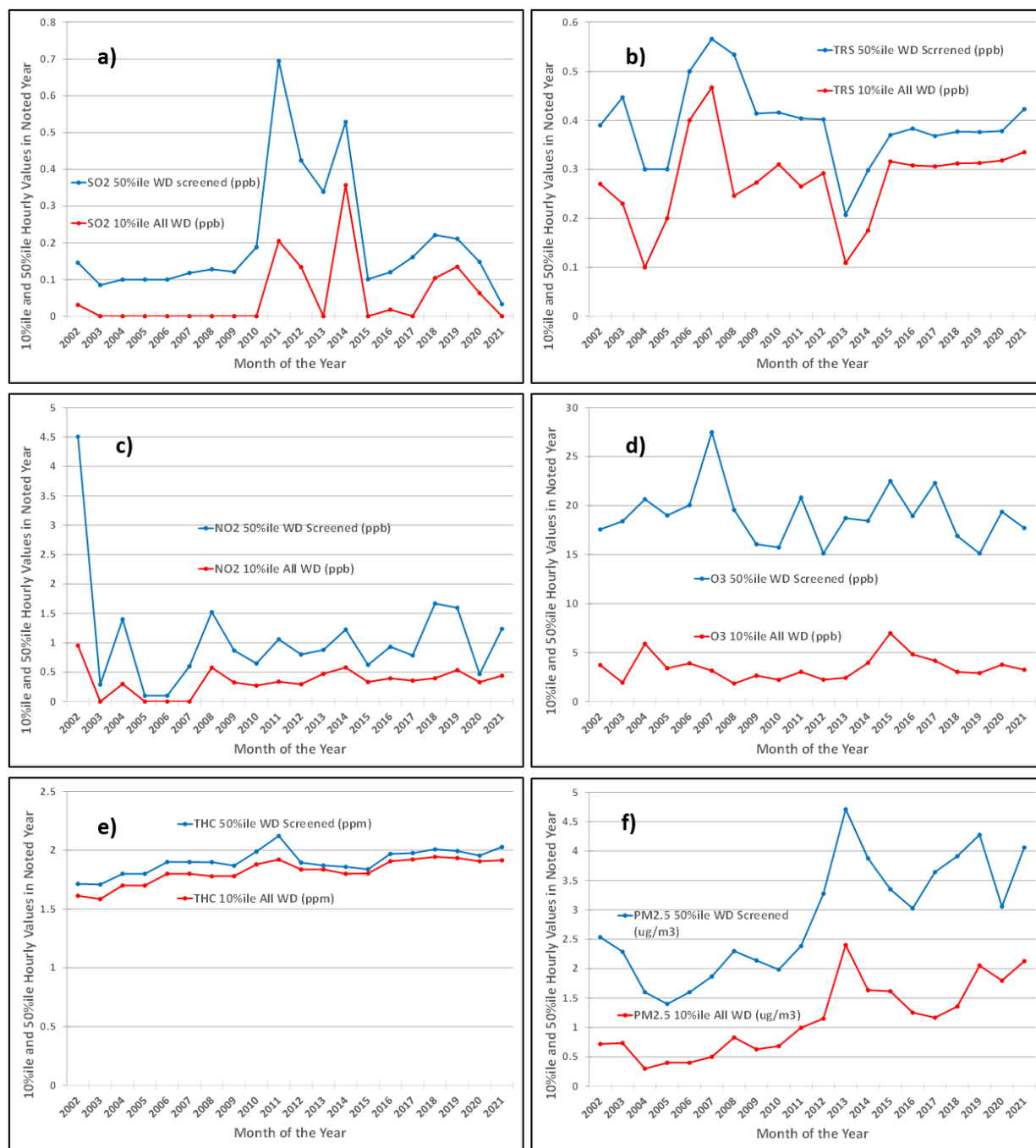


Figure C.8: 10th percentile "All WD" and 50th percentile WD Screened Hourly Values in Fort McKay for the 2002-2021 Period for the Noted Pollutant: a) SO₂; b) TRS; c) NO₂; d) O₃; e) THC; and f) PM_{2.5}, in the Noted Year (Note: the different y-axis scale for each pollutant))

C.4.3 "By Year" Variable Considerations

The “by year” “all WD” 10th percentile and WD screened 50th percentile concentrations were averaged to give a “by year” variable considered baseline estimates (**Table C.7**) which were compared to the “no

temporal considerations” baseline estimates and this comparison is shown in **Table C.8** which also gives the range and standard deviation of the monthly variability for these pollutants.

Table C.8: Estimated Baseline Concentrations of SO₂, TRS, NO₂, THC, NMHC, PM_{2.5} and O₃ based on a “By Year” “all WD” 10th percentile and WD screened 50th percentile Baseline Estimating Approaches and a Comparison of these Baseline Estimates to the “No by Year Consideration” Baseline estimates with the Range of Monthly Baseline Estimates and the Standard Deviation of this Range

"By Year" versus "No by Year" Consideration "All Wind Direction" 10 Percentile Values and "Wind Direction Screened" (WNW) 50 Percentile Values Fort McKay Hourly Data for Period 2002-2021														
Parameter	NO ₂ (ppb)		SO ₂ (ppb)		TRS (ppb)		THC (ppm)		NMHC (ppm)		PM _{2.5} (µg/m ³)		O ₃ (ppb)	
Wind Direction	All	WNW	All	WNW	All	WNW	All	WNW	All	WNW	All	WNW	All	WNW
%ile	10%	50%	10%	50%	10%	50%	10%	50%	10%	50%	10%	50%	10%	50%
%ile of all Values (No Variable Consideration)	0.27	0.897	0	0.175	0.243	0.388	1.792	1.921	0	0	0.916	2.942	3.4	18.7
Average of "by Year" %iles	0.345	1.064	0.052	0.208	0.277	0.388	1.818	1.908	0.000	0.001	1.137	2.922	3.465	18.871
Standard Deviation (SD) of "by Year" Values	0.330	1.267	0.036	0.073	0.039	0.040	0.044	0.027	0.000	0.000	0.195	0.802	4.289	6.750
Range of "by Yr" Values	(0.099-0.988)	(0.457-4.491)	(0-0.099)	(0.109-0.336)	(0.2-0.317)	(0.309-0.446)	(1.719-1.872)	(1.9-1.990)	(0-0)	(0-0.0005)	(0.6-1.3)	(1.837-4.596)	(1-14.546)	(13.305-37.395)
Difference between the "by Yr" and "no by Yr" Analyses	0.08	0.17	0.05	0.03	0.03	0.00	0.03	-0.01	0.00	0.00	0.22	-0.02	0.06	0.17

This analysis indicates that for certain pollutants e.g. NO₂ and PM_{2.5}, incorporating these temporal variables into the baseline estimate using 2002-2021 hourly air quality data for Fort McKay significantly alters the “no temporal” consideration baseline estimates for these pollutants. For other pollutants, considering “by year” variability does not impact baseline estimates which would indicate that by using a long dataset period (20 years in this case), temporal effects tend to get smoothed even though the “by year” range and standard deviations are significant.

Overall this "by year" analysis would indicate that in baseline estimating “by year” is a temporal variable that needs to be considered. Also this type of “by year” temporal analysis provides information that can be used to estimate a range and distribution for annual baseline concentrations provided that the percentile approach used is principally capturing baseline air quality.

C.5 “Wind Speed” Variable Assessment

As noted in **Section 4.4**, wind speed (WS) has the potential to introduce uncertainties when using percentile approaches to estimate baselines and these uncertainties could result in either an under- or over-estimation of a baseline. **Table C.9** shows the impact that removing low WS data (<=1 km/h; <=2 km/h; and <=3 km/h) has in terms of the “all WD” 10th percentile and WD screened 50th percentile baseline estimating approaches. As would be expected, the 10th percentile “all WD” shows the least effect of removing these lower WSs since this approach has ~170,000 hourly values and removing low wind speed data, whether this lower WS data represents higher or lower concentrations than the dataset average, it does not significantly shift the frequency-percentile distribution curve. However, this is not the case for the “WD screened” approach which only has ~12,000 hourly values and 50% of these values determine the baseline estimate with removing lower WSs, which represent a significant fraction of all WSs (see **Figure C.11**) results in a significant shift in the frequency-percentile distribution curve and a significant change in the NO₂ baseline estimates and some change in the PM_{2.5} and O₃ baseline estimates. Since O₃ concentrations are inversely linked to NO₂ concentrations (see APPENDIX B: Meteorological, Natural Emission and Atmospheric Chemistry B1 Variability Considerations Relevant to

Baseline Estimating), and since O₃ is a secondary pollutant, it is not addressed further in this WS analysis. As shown in **Table C.9**, removing ≤ 1 km/h does not remove a large percentage of data from either the “all WD” or “WD screened” datasets but the removal of ≤ 3 km/h WSs results in an ~20% reduction in the size of the baseline estimating datasets which highlights that low wind speeds occur frequently in Fort McKay and therefore addressing the issue of possible unanticipated low WS anthropogenic emission influences is important when using a “WD screened” percentile baseline estimating method.

It needs to be noted that for Fort McKay only the WNW WD was selected as a “WD screened” WD and the impact of removing and the number of clean WDs, prevailing WDs and the WS/WD distributions are all factors that will contribute to the significance of removing lower WSs from baseline estimates at a location.

Table C.9: The "All Wind" Direction 10th Percentile and the Wind Direction Screened (WNW) 50th Percentile Baseline Estimated Concentrations for the Noted Pollutant and the Noted Wind Speed Removed (Fort McKay Hourly Data for Period 2002-2021) (Note: the change in the baseline concentration estimate associated with each wind screening is noted in last 3 rows)

The "Wind Speed Screened" All Wind Direction 10 Percentile Concentrations and the Wind Direction Screened (WNW) 50 Percentile Concentrations for the Noted Parameter and the Noted Wind Speed Removed (Fort McKay Hourly Data for Period 2002-2021) (Note: the change in the baseline concentration estimate associated with each wind screening noted in last 3 rows)																
Wind Speeds Removed	Percentage of Total Hourly Readings Removed by Excluding Noted WS		NO ₂ (ppb)		SO ₂ (ppb)		TRS (ppb)		THC (ppm)		NMHC (ppm)		PM _{2.5} (µg/m ³)		O ₃ (ppb)	
			All	WNW	All	WNW	All	WNW	All	WNW	All	WNW	All	WNW	All	WNW
			10%	50%	10%	50%	10%	50%	10%	50%	10%	50%	10%	50%	10%	50%
None	0%	0%	0.27	0.897	0	0.175	0.22	0.385	1.792	1.921	0	0	0.93	2.82	3.4	18.7
<=1 km/h	2.4%	2.8%	0.27	0.84	0	0.172	0.22	0.383	1.791	1.92	0	0	0.92	2.79	3.61	19
<=2 km/h	8.1%	11.2%	0.25	0.69	0	0.166	0.22	0.378	1.787	1.91	0	0	0.9	2.66	4.16	20.1
<=3km/h	18.0%	23.5%	0.22	0.51	0	0.16	0.22	0.371	1.78	1.9	0	0	0.88	2.44	5.13	21.9
Estimated Baseline Conc. Difference w/noted WS removed	<=1 km/h		0	-0.057	0	-0.003	0	-0.002	-0.001	-0.001	0	0	-0.01	-0.03	0.21	0.3
	<=2 km/h		-0.02	-0.207	0	-0.009	0	-0.007	-0.005	-0.011	0	0	-0.03	-0.16	0.76	1.4
	<=3km/h		-0.05	-0.387	0	-0.015	0	-0.014	-0.012	-0.021	0	0	-0.05	-0.38	1.73	3.2

The WS issue that this analysis attempts to address is whether removing low WSs when estimating baselines is warranted on the basis that low WSs may capture local and/or regional anthropogenic emission influences and therefore overestimate baselines. The challenge in such an analysis is that low wind speeds in combination with cooler temperatures and/or cloud cover (Colls, 2002) result in limited vertical ground-level mixing and elevated pollutant concentrations from either natural and/or anthropogenic emission sources. Also natural and/or anthropogenic emissions are diluted in direct proportion to wind speed. Therefore, regardless of whether concentrations are the result of natural and/or anthropogenic emissions, removing lower WS concentrations, which represent the least wind diluted emission periods, will result in lower baseline estimates.

Figure C.9 is a histogram of WSs for all WDs and **Figure C.10** is a histogram of WSs for the “WD screened” WD i.e. the WNW WD. These wind speed histograms show very similar WS distribution patterns for the “all WD” and “WD screened” approaches which would indicate that WS distribution differences between the two approaches are not a factor when assessing and comparing the two approaches in terms of the impacts of removing low WS data.

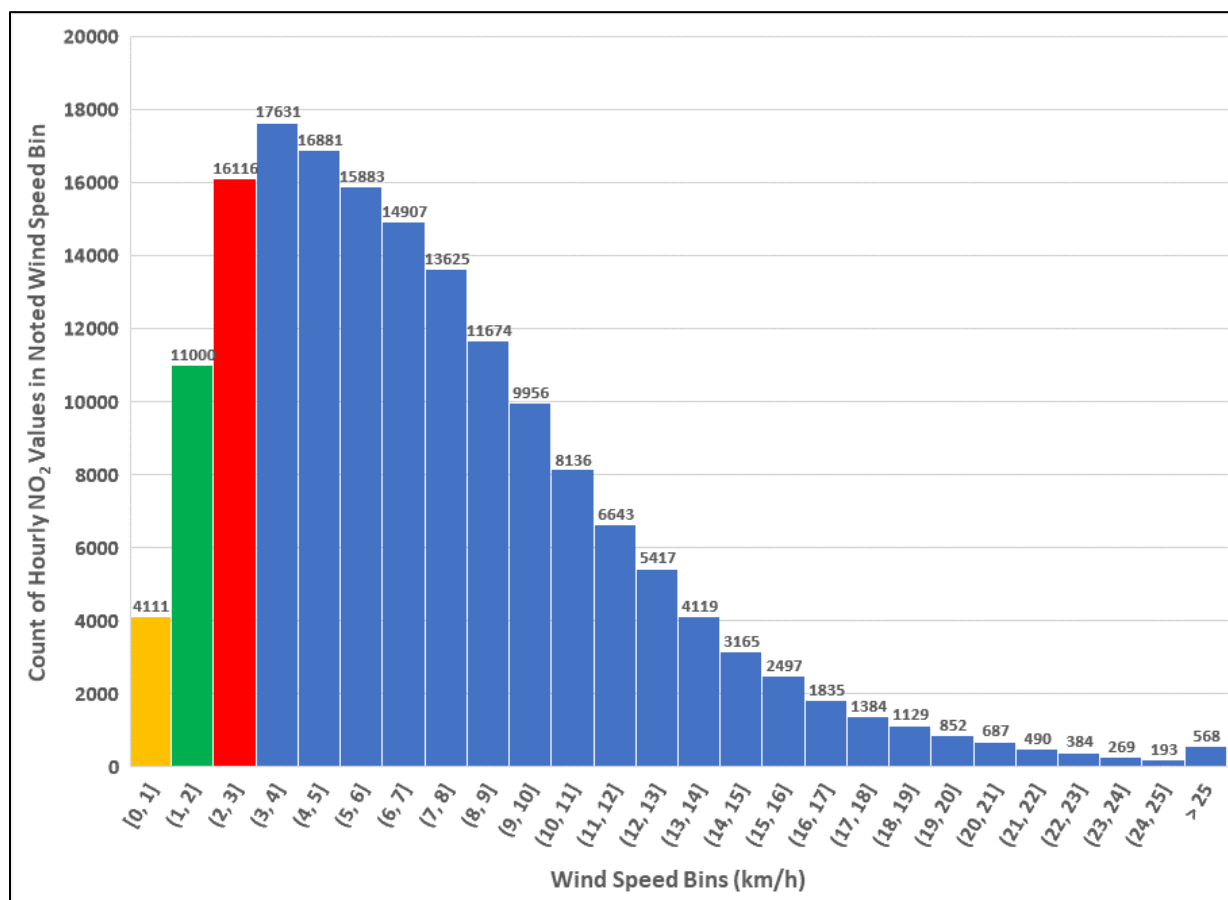


Figure C.9: Histogram of All Wind Direction Hourly Wind Speed Data (170,145 hourly values) in Fort McKay over the 2002-2021 Period with the 0-1 km/h (orange), 1-2 km/h (green) and 2-3 km/h (red) Wind Speeds Highlighted

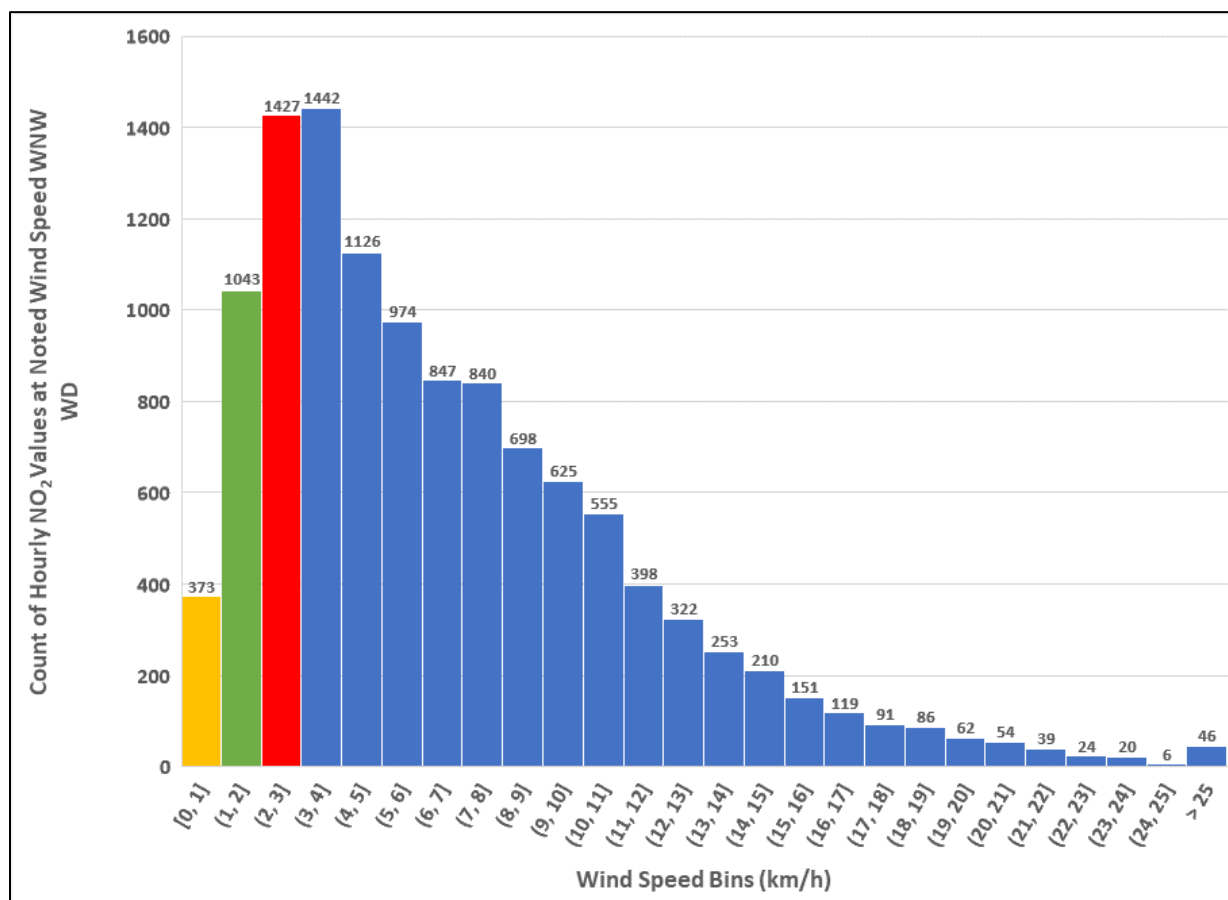


Figure C.10: Histogram of the Wind Direction Screened (WNW Wind Direction) Hourly Wind Speed Data in Fort McKay (11,617 hourly values) over the 2002-2021 Period with the 0-1 km/h (orange), 1-2 km/h (green) and 2-3 km/h (red) Wind Speeds Highlighted

Figure C.11 was generated to estimate how eliminating lower wind speed data from the WD screened dataset impacted the fraction of NO₂ concentration data that each 1 km/h WS bin contributed to the 50%WD screened (WNW WD) dataset.

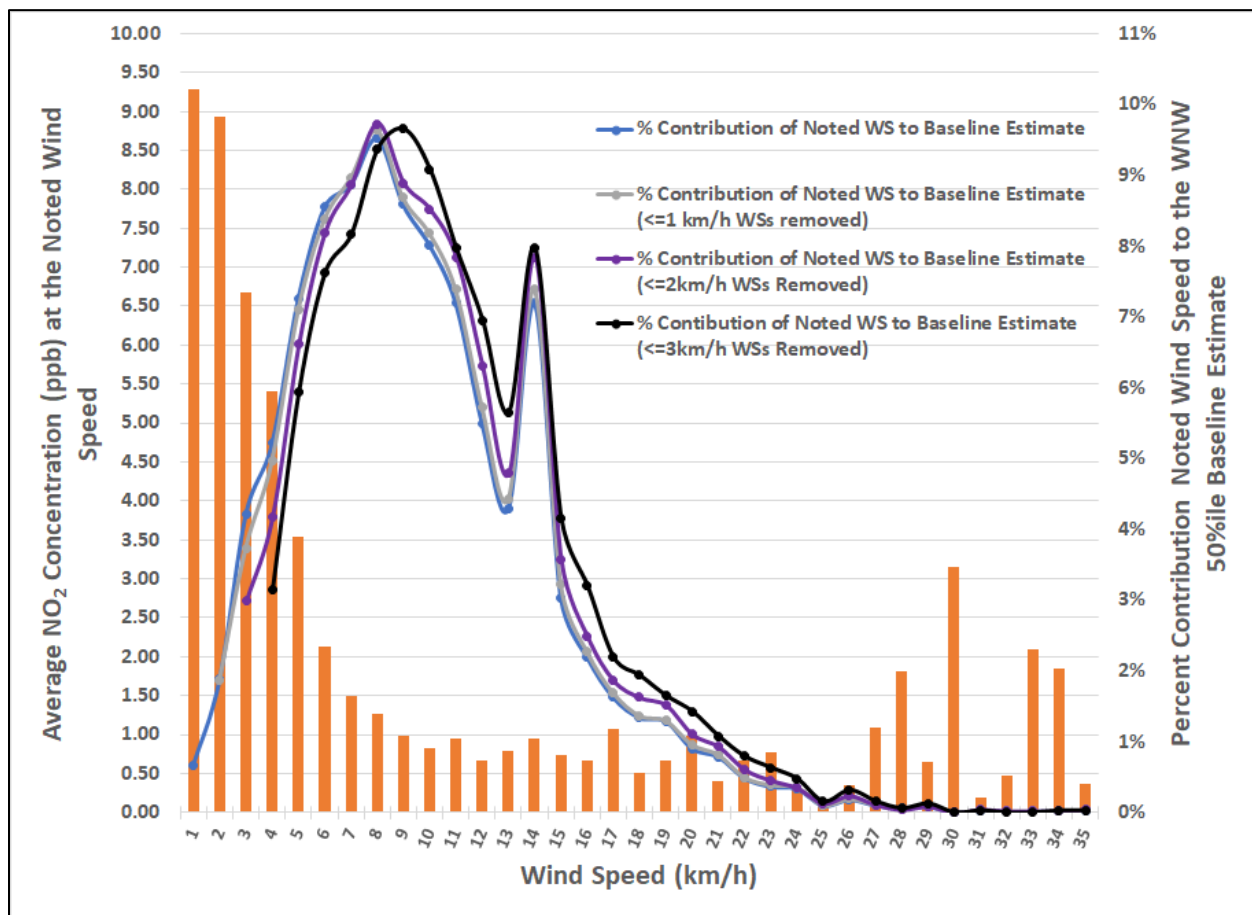


Figure C.11: The Average Hourly NO₂ Concentrations in Fort McKay over the Period 2002-2021 Associated with each Wind Speed when the Wind Direction was from the WNW and the Percent Contribution that each Wind Speed made to the 50th percentile Baseline Dataset (Note: 5,963 hourly NO₂ values in the no WS removal 50th percentile dataset; 5,621 hourly NO₂ values in the <=1 km/h WS removal 50th percentile dataset; 4,616 hourly NO₂ values in the <=2 km/h WS removal 50th percentile dataset; and 3,149 hourly NO₂ values in <=3 km/h WS removal 50th percentile dataset)

The data in **Figure C.11** indicates, as would be expected, that the highest average hourly NO₂ concentrations occur at the lower WSs reflecting a wind speed-emission dilution relationship with lower WSs resulting in the highest ground-level concentrations of local or near-regional natural and/or anthropogenic emission influences. It needs to be noted that any significant anthropogenic emission influences and the resultant higher pollutant concentrations would not be captured in the 50th percentile dataset but, if such anthropogenic emission influences occur frequently, then there will be a shift in the frequency-concentration distribution resulting in higher concentrations at any given frequency percentile value. Of interest in terms of the WS influences, is how baseline estimates change as lower WSs are removed from the dataset. To visually depict this WS-baseline estimate relationship, **Figure C.12** shows the frequency concentration distributions for the entire dataset and with the <=1 km/h, <=2 km/h, <=3 km/h, <=4 km/h, <=5 km/h, and <=6 km/h, WS data removed.

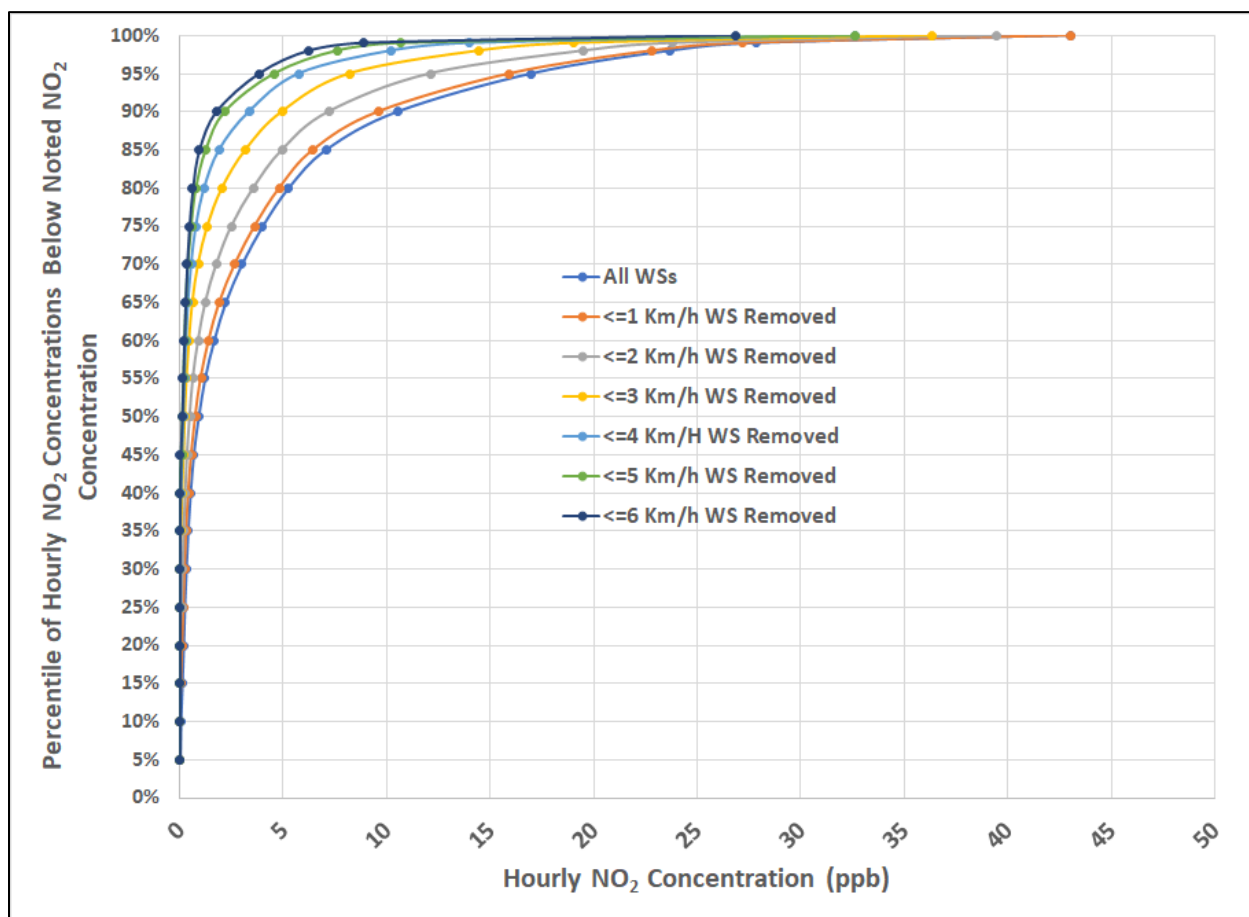


Figure C.12: WNW Wind Direction Hourly NO₂ Frequency-Concentration Plots for Fort McKay (2002-2021 Period) for All Wind Speeds (WSs) and for Datasets with NO₂ Concentrations Removed when the WSs were: <=1 km/h; <=2 km/h; <=3 km/h; <=4 km/h; <=5 km/h; and <=6 km/h.

Figure C.12 shows that, in the ~15 to 25th percentile range, WS removal starts to impact the percentile NO₂ concentrations and, in the ~40 to 60percentile range, WS removal starts to significantly impact the percentile NO₂ concentrations. To demonstrate this, **Figure C.13** shows the same frequency concentration distributions but with the higher frequency-concentration percentiles removed. To further demonstrate how WS removals affect the baseline estimates **Figure C.14** focuses on the lower end of the frequency-concentration plot using 2 ppb as the frequency-concentration endpoint.

Figure C.14 shows the 50th percentile baseline NO₂ estimates resulting from the removal of <=1 km/h, <=2 km/h, <=3 km/h, <=4 km/h, <=5 km/h, and <=6 km/h. The decrease in the baseline estimates as more WSs are removed, and the rate of the baseline estimate decrease, at least in part, can, be explained by the number of hourly values removed at each incremental WS removal step (**Figure C.11**) and by the average hourly NO₂ concentration associated with each WS bin (**Figure C.11**).

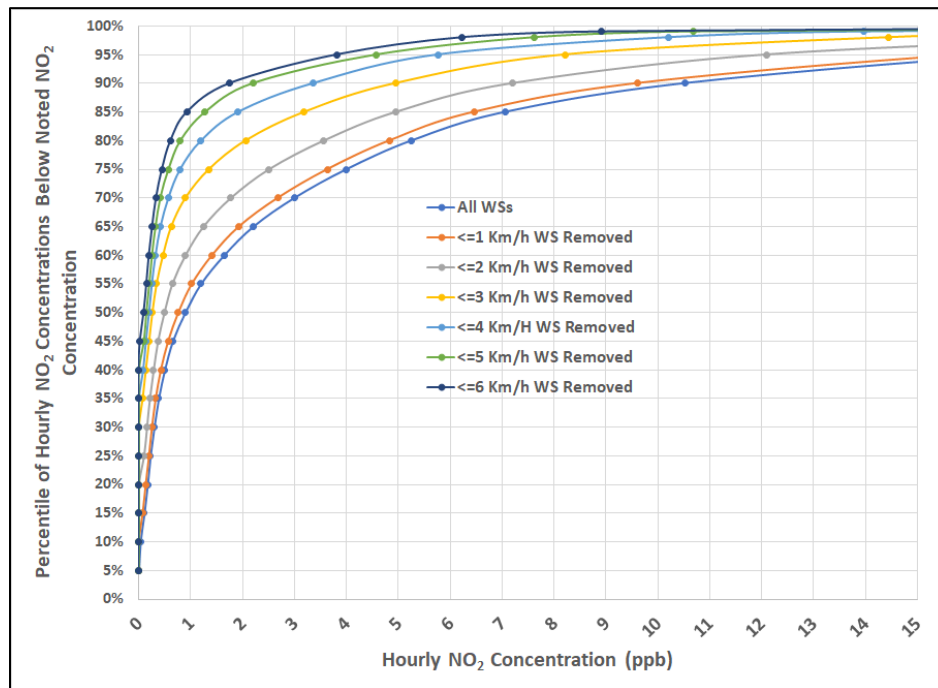


Figure C.13: WNW Wind Direction Hourly NO₂ Frequency-Concentration Plots for Fort McKay (2002-2021 Period) for All Wind Speeds (WSs) and for Datasets with NO₂ Concentrations Removed when the WSs were: <=1 km/h; <=2 km/h; <=3 km/h; <=4 km/h; <=5 km/h; and <=6 km/h and for Percentiles Having NO₂ Concentrations Less than 15 ppb.

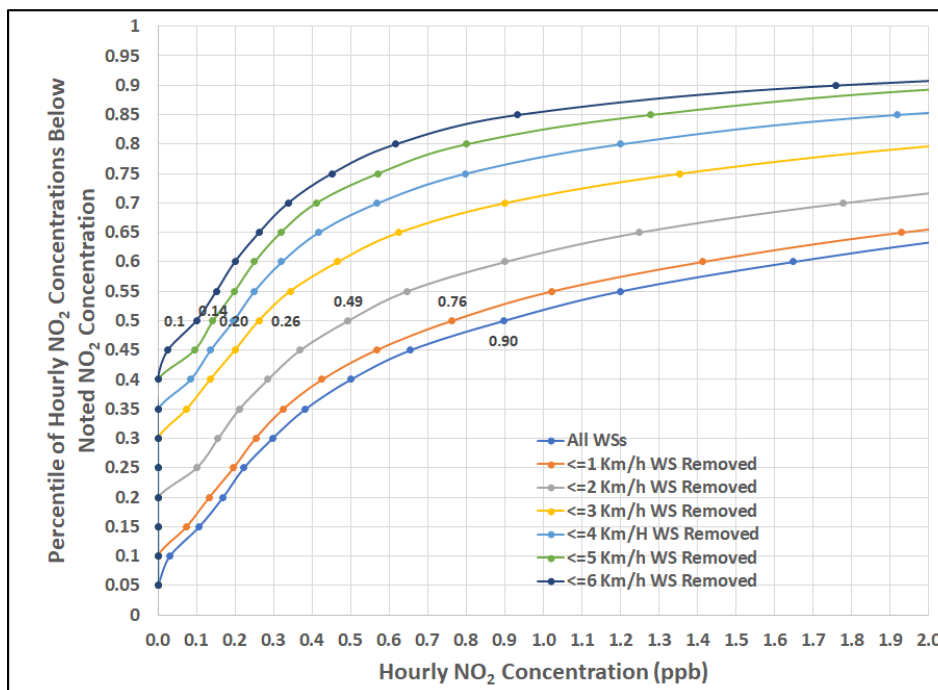


Figure C.14: The Lowest Part of the WNW Wind Direction Hourly NO₂ Frequency-Concentration Plots for Fort McKay (2002-2021 Period) for All Wind Speeds (WSs) and for Datasets with NO₂ Concentrations Removed when the WSs were: <=1 km/h; <=2 km/h; <=3 km/h; <=4 km/h; <=5 km/h; and <=6 km/h with the 50th percentile Baseline Estimates Associated with the noted WSs Removed.

The following outlines how the increasing removal of WSs relates to the decrease in NO₂ baseline estimates:

- Removing the ≤1 km/h data results in the removal of 373 hourly NO₂ values from the dataset that have an average NO₂ concentration of ~9.25 ppb which results in a baseline estimate decrease from 0.9 ppb to 0.76 ppb (a 0.14 ppb ~16% decrease in the baseline estimate). So the highest average NO₂ concentration WS bin i.e. 0-1 km/h and the 373 hourly NO₂ values associated with this high average NO₂ concentration results in a downward shift in the frequency-concentration curve that now gives a 50th percentile baseline estimate of 0.76 ppb.
- Removing the ≤2 km/h data results in the removal of an additional 1043 hourly NO₂ values from the dataset that have an average NO₂ concentration of ~8.8 ppb which results in a further baseline estimate decrease from 0.76 ppb to 0.49 ppb (a 0.27 ppb decrease and a total baseline estimate decrease of ~54%). The decrease in the baseline estimate change between the ≤1 km/h removal and the ≤2 km/h removal is approximately double that associated with the ≤1 km/h removal. This is the result of the larger number of hourly values in the 1-2 km/h WS bin (1043 vs. 373) and an average NO₂ concentration in this WS bin of ~8.8 ppb, which is not that much lower than the average NO₂ concentration in the 0-1 km/h WS bin i.e. ~9.25 ppb.
- Removal of ≤3 km/h WSs results in the removal of a further 1,427 hours of NO₂ values and a further baseline estimate decrease from 0.49 ppb to 0.29 ppb (a 0.2 ppb decrease and a total ≤3 km/h WSs baseline estimate decrease of ~68%). While more hourly values are removed in the 2-3 km/h WS bin compared to the 0-1 and 1-2 WS bins, the decrease in the baseline estimate is smaller because the average NO₂ concentration in the 2-3 km/h WS bin is ~6.6 ppb compared to ~9.25 ppb and ~8.8 ppb NO₂ concentrations for the 0-1 km/h and 1-2 km/h WS bins respectively. Also baseline estimates can only decrease to zero and therefore as lower dataset values start to dominate the dataset it takes a larger removal of higher data values to significantly change the baseline estimate.
- The rate of decrease in 50th percentile baseline estimates slows significantly for the removal of the ≤4 km/h, ≤5 km/h and ≤6 km/h removals, i.e. 0.29 ppb to 0.2 ppb, 0.2 ppb to 0.14 ppb and 0.14 ppb to 0.1 ppb respectively. These decreases reflect the decreasing NO₂ concentrations in the WS bins as WS increases and also that with the removal of each higher WS NO₂ dataset, the remaining dataset has a much higher fraction of lower NO₂ values and the removal the higher NO₂ concentrations from these datasets has less effect on baselines estimates.

This analysis of the implications of removing lower WSs from the WD screened dataset, in terms of 50th percentile baseline NO₂ estimates, clearly indicates that NO₂ concentrations are highest at lower WSs and removing WSs through, and up to, ≤4 km/h significantly reduces baseline estimates with the rate of baseline decrease in this WS range a function of the number of WS counts in each 1 km/h WS bin and the average NO₂ concentration within the WS bin.

The WD screened 50th percentile baseline estimates for NO₂ in Fort McKay, that were calculated for WNW WD for the 2002-2021 period for 50th percentile hourly datasets with the ≤1 km/h, ≤2 km/h, ≤3 km/h, ≤4 km/h, ≤5 km/h, and ≤6 km/h, WS data removed, were used to assess the possible relevance of the wind speed-dilution as a factor in explaining the decreasing baseline estimates associated with removing lower WS data. The resultant WS screened 50th percentile baseline estimates for NO₂ were compared to the estimates that would be expected if the change in baseline estimates was only due to wind speed dilution. The rationale being that, if the difference in changes in baseline

estimates was less than what would be predicted by wind speed dilution, then the difference in estimates could be related to anthropogenic emission influences which WS screening would possibly eliminate.

The approach used was to use the WNW WD 50th percentile NO₂ baseline estimate from the ≤1 km/h WS removed dataset as the starting WS analysis concentration used to calculate a wind speed dilution estimate baseline based on the WS increasing from 1 km/h to 2 km/h and then the ≤2 km/h WS removed dataset WS analysis concentration used to calculate a wind speed dilution estimate baseline based on the WS increasing from 2 km/h to 3 km/h and so on.

The results of this analysis are shown in **Table C.10** and indicate that at WSs greater than >2km/h the changes in 50th percentile estimated NO₂ baselines between 2 km/h and 6 km/h WSs can largely be attributed to WS dilution and not changes in emission influences.

Table C.10: A Comparison between the 50th percentile NO₂ Baseline Estimates using the WD screened Approach (WNW WD) with Certain Wind Speeds Removed and Baselines Estimated using a Wind Speed Dilution Approach

WNW Wind Direction Dataset (2002-2021) and Wind Speeds Removed	50 th ile NO ₂ Concentration (ppb) Estimate	NO ₂ Concentration Estimate (ppb) based on WS dilution of Previous WS 50 th ile Baseline Estimate	Difference between Estimates
All WSs (i.e. no WSs removed)	0.9	N/A	
≤1 km/h removed*	0.84	N/A	N/A
≤2 km/h removed	0.69	0.42	0.27
≤3 km/h removed	0.51	0.46	0.05
≤4 km/h removed	0.39	0.38	0.01
≤5 km/h removed	0.32	0.31	0.01
≤6 km/h removed	0.3	0.27	0.03
* 1 km/h is used as starting concentration and the WS dilution baseline estimated for the 2 km/h WS is calculated by dividing this 1 km/h estimate by 2. Similarly for the 3 km/h dilution based estimate the 2 km/h 50 th ile estimate is divided by [2 km/h]/[3 km/h] and so on			

This is a very approximation type analysis which doesn't consider temporal variations and variability that can influence natural emissions e.g. temperature, snow cover, moisture etc. As the data in Section 4 demonstrates, temporal considerations significantly influence baseline estimates for NO₂. However, based on this WS analysis, it appears that at WSs ≤2 km/h there may be anthropogenic emissions influencing the NO₂ baseline estimates i.e. the >1 km/h to < 2km/h 50th percentile baseline estimate is ~40% higher than the WS dilution estimate for that WS range.

Another approach was used to try and assess the significance of WS dilution on ambient concentrations versus other potential impacts e.g. anthropogenic influences. This approach involved using the NO₂ average concentration in the 0-1 km/h WS bin (~10.1 ppb) as the reference concentration and using a straight WS dilution approach to estimate the average NO₂ concentration in the other WS bins. These

calculated WS dilution average NO₂ concentrations were compared to the measured average NO₂ concentrations in each of the WS bins. This comparison is shown in **Figure C.15**.

In addition to using the measured 0-1 km/h WS bin average measured NO₂ concentration as a reference, a plot using the 2-3 km/h WS bin average NO₂ concentration as a reference was used to determine how the selection of the initial reference concentration affected the comparison between measured and WS dilution only effects NO₂ concentrations. As for the above analysis of low WS removal and 50th percentile NO₂ measured versus WS diluted calculated concentrations, it was assumed that a significant difference between measured and WS dilution concentrations represented a potential anthropogenic influence. The plots in **Figure C.15** indicate that the change in measured average NO₂ concentrations at low WSs do not change nearly as quickly as WS dilution would indicate which indicates other influences e.g. anthropogenic NO₂ inputs.

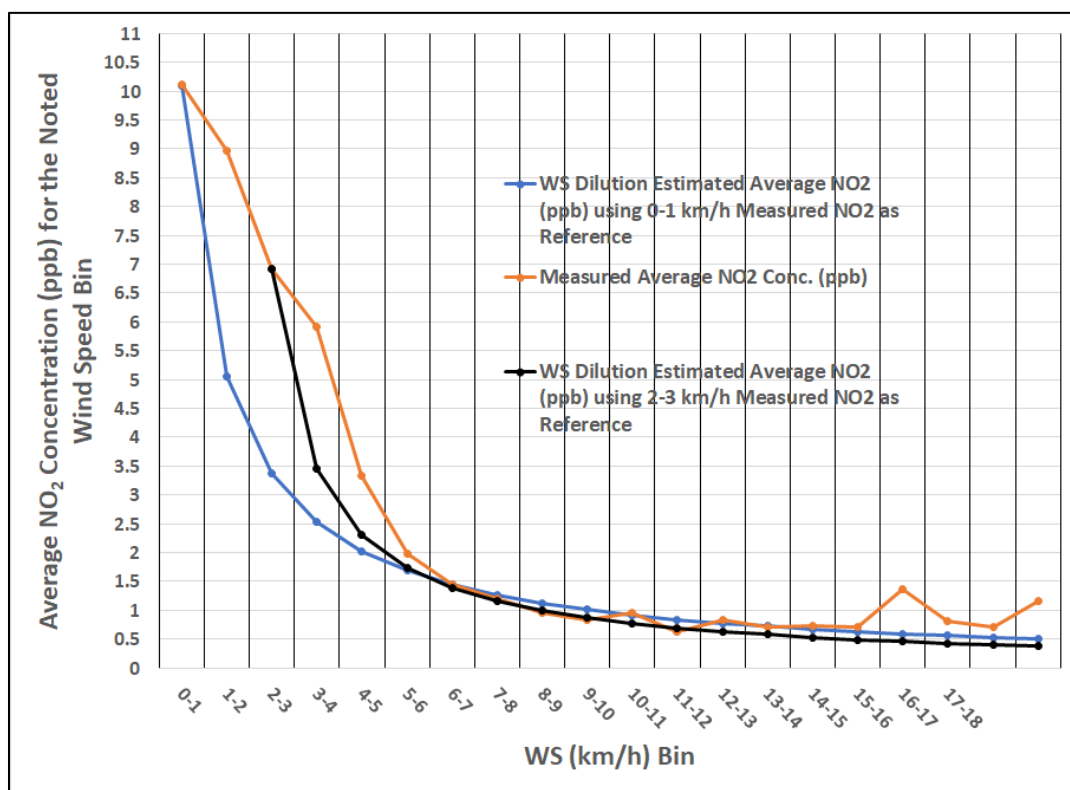


Figure C.15: Measure Average Hourly NO₂ Concentration (ppb) in the Noted Wind Speed Bin and the Wind Speed Dilution Calculated Average Hourly NO₂ Concentration (ppb) in the Noted Wind Speed Bin and for Noted Reference Concentration (based on Fort McKay Hourly NO₂ Data for the Period 2002-2021)

The challenge in assessing whether to remove low WSs from the WD screened baseline setting approach is that there is no definitive way to separate low wind speed “wash-in” or “wind direction uncertainties”, and associated anthropogenic emission influences, from natural emission influences.

In the case of the WD screened Fort McKay 2002-2021 dataset, based on the low WS analysis as outlined above, and the low percentage (~4.2% - see **Figure C.11**) WSs ≤3 km/h contribute to the 50th percentile WD screened datasets it appears that anthropogenic emission influences are not a significant factor affecting the 50th percentile WD screened baseline estimates. There does appear to be a potential that low WSs capture some anthropogenic influences which can skew frequency-concentrations upward. This

issue can be addressed by selecting a lower WD screened baseline percentile to further decrease the fraction of low WS NO₂ readings contributing to the baseline estimate.

The conclusion from this analysis on the effects of WS screening on baseline estimates is that there is no obvious “yes” or “no” answer in terms of whether WS screening is necessary when using percentile methods. Since the highest ground-level concentrations associated with natural emission sources will occur at low WSs, removing low WS data from the baseline determination, will remove the largest natural emission influence periods. Therefore, while in attempting to remove low WS anthropogenic influences, the highest natural emission influences will be removed resulting in a potential baseline underestimate. The degree of this underestimating will depend on the how significant the low WS anthropogenic influences are compared to the natural source influences. This is a baseline estimating issue that appears to favour the use of the “all WD” percentile over the “WD screened” percentile approach in terms of dealing with WS/WD emission influence issues. In the case of the “WD screened” approach, the best approach to dealing with the WS/WD anthropogenic influence issue is to minimize these potential influences by using a lower baseline estimating percentile e.g. a 25th percentile rather 50th percentile criteria. It would again be noted that, to some extent, the consideration of hour of the day, month of the year and inter-annual temporal factors in baseline estimating helps ensure that all time periods, and the meteorological conditions generally associated these periods e.g. lower WSs at night and during the winter, are considered and with the percentile used screening out significant anthropogenic influenced values.

C.6 References

Colls, J. (2002). *Air Pollution* (2nd ed.). London: Spon Press.

Appendix D NO₂

D.1 The Monthly/Annual Tables used to Estimate the “All-WD” 5th percentile and 10th percentile NO₂ Baselines and the Tables used to Estimate the WD Screened 25th percentile and 50th percentile NO₂ Baselines

Table D.1: The 5th percentile "All-WD" NO₂ Monthly/Annual Tables (January to March 2014-2021)

By Hour of the Day and By Year "All WD" 5%ile NO ₂ Concentration (ppb) in Fort McKay for the Month of January for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	1	1	0.71	1.17	0.66	0.92	0.43	0.32	0.41	0.47	0.15	0.29	0.42	0.46	0.45	0.66	0.7	0.73	0.88	0.32	0.37	0.41	0.54	0.44	0.58	0.26	(0.15-1.17)
	2015	0.28	0.4	0.26	0.49	0.31	0.61	0.58	0.59	0.48	0.77	0.7	0.6	0.73	0.35	0.26	0.5	0.73	0.51	0.34	0.29	0.56	0.69	0.5	0.36	0.50	0.16	(0.26-0.77)
	2016	0.76	0.88	0.92	0.7	0.53	0.84	0.5	1	0.84	2.21	0.66	0.37	0.34	0.35	0.38	0.39	0.4	0.62	1.24	0.79	0.68	0.69	0.83	1.04	0.75	0.40	(0.34-2.21)
	2017	0.56	0.52	0.95	1.1	0.81	0.78	0.55	0.53	0.55	0.53	0.44	0.51	0.51	0.55	0.6	0.51	0.76	0.98	0.82	0.63	0.44	0.51	0.48	0.5	0.63	0.18	(0.44-1.1)
	2018	0.86	0.84	1.14	2.06	1.47	1.63	1.16	1.26	0.56	0.57	0.86	1	0.6	0.39	1.32	1.01	1.23	2.06	1	1.13	1.15	1.22	1.01	0.76	1.10	0.42	(0.39-2.06)
	2019	2.39	1.41	0.82	2.11	1.79	0.53	1	0.69	1.21	1.3	1.05	0.88	0.48	0.57	0.73	0.63	0.6	0.62	1.35	2.39	2.38	1.46	1.86	1.55	1.24	0.63	(0.48-2.39)
	2020	0.32	0.5	0.54	0.44	0.45	0.62	0.56	0.46	0.54	0.6	0.53	0.48	0.47	0.41	0.43	0.48	1.57	1.2	3.11	1.27	1.79	1.45	0.66	0.36	0.80	0.64	(0.32-3.11)
	2021	0.56	0.49	0.38	0.43	1.09	1.98	1.97	2.62	3.78	3.28	3.04	1.33	1.88	1.72	1.37	1.53	1.27	1.23	1.17	1.07	1.13	0.61	0.73	0.56	1.47	0.93	(0.38-3.78)
																										0.88	0.33	(0.50-1.47)
Average		0.84	0.76	0.72	1.06	0.89	0.99	0.84	0.93	1.05	1.22	0.93	0.68	0.68	0.60	0.69	0.71	0.91	0.99	1.24	0.99	1.06	0.88	0.83	0.70	0.88		
Std Dev		0.67	0.34	0.30	0.69	0.52	0.53	0.52	0.75	1.13	1.02	0.89	0.36	0.50	0.46	0.43	0.38	0.40	0.51	0.82	0.67	0.71	0.43	0.45	0.41	0.17		
Range		(0.28-2.39)	(0.4-1.41)	(0.26-1.14)	(0.43-2.11)	(0.31-1.79)	(0.53-1.98)	(0.43-1.97)	(0.32-2.62)	(0.41-3.78)	(0.47-3.28)	(0.15-3.04)	(0.29-1.33)	(0.34-1.88)	(0.35-1.72)	(0.26-1.37)	(0.39-1.53)	(0.4-1.57)	(0.51-2.06)	(0.34-3.11)	(0.29-2.39)	(0.37-2.38)	(0.41-1.46)	(0.48-1.86)	(0.36-1.55)	(0.6-1.24)		
By Hour of the Day and By Year "All WD" 5%ile NO ₂ Concentration (ppb) in Fort McKay for the Month of February for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	0.69	0.77	0.37	0.44	0.58	0.84	0.96	0.8	0.79	0.8	0.5	0.36	0.31	0.56	0.69	0.81	1.12	1.23	1.4	0.6	0.47	0.57	0.76	0.7	0.71	0.27	(0.31-1.4)
	2015	1.27	1.32	1.01	0.71	0.49	0.4	0.67	1.13	1.88	1.35	1.63	1.65	1.81	1.65	1.99	1.05	1.12	2.03	1.48	1.52	1.76	1.76	1.59	1.19	1.35	0.46	(0.4-2.03)
	2016	2.83	1.82	2.28	2.47	2.48	2.91	2.49	2.46	2.11	1.62	1.37	1.11	1.71	1.45	1.07	0.81	0.58	0.66	3.15	4.89	3.17	3.42	4.24	3.46	2.27	1.12	(0.58-4.89)
	2017	0.27	0.37	0.94	0.42	0.31	0.28	0.31	0.55	0.62	0.57	0.69	0.41	0.29	0.23	0.34	0.29	0.2	0.17	0.22	0.18	0.24	0.36	0.37	0.38	0.38	0.18	(0.17-0.94)
	2018	0.13	0.18	0.44	0.44	0.42	0.35	0.34	0.33	0.28	0.25	0.23	0.26	0.22	0.23	0.23	0.22	0.12	0.28	0.64	0.24	0.28	0.26	0.29	0.23	0.29	0.11	(0.12-0.64)
	2019	1.54	1.52	1.31	1.87	0.51	1.06	2.44	2.07	1.51	1.92	0.64	0.8	0.76	0.86	0.66	0.98	0.61	0.85	0.99	1.13	0.85	0.88	0.99	2.02	1.20	0.54	(0.51-2.44)
	2020	0.66	0.81	0.78	0.72	0.78	0.69	0.66	0.58	0.62	0.52	0.51	0.39	0.38	0.44	0.38	0.42	0.65	0.46	0.48	0.71	1.05	0.97	0.76	0.78	0.63	0.18	(0.38-1.05)
	2021	0.71	0.62	0.61	0.54	0.43	0.52	0.63	0.48	0.74	0.57	0.6	0.38	0.35	0.3	0.28	0.31	0.63	0.63	0.59	0.49	0.38	0.53	0.44	0.42	0.51	0.13	(0.28-0.74)
																										0.92	0.62	(0.29-2.27)
Average		1.01	0.93	0.97	0.95	0.75	0.88	1.06	1.05	1.07	0.95	0.77	0.67	0.73	0.72	0.71	0.61	0.63	0.79	1.12	1.22	1.03	1.09	1.18	1.15	0.92		
Std Dev		0.87	0.57	0.61	0.78	0.71	0.86	0.89	0.79	0.67	0.60	0.48	0.49	0.66	0.56	0.59	0.34	0.36	0.60	0.93	1.55	1.00	1.05	1.30	1.10	0.19		
Range		(0.13-2.83)	(0.18-1.82)	(0.37-2.28)	(0.42-2.47)	(0.31-2.48)	(0.28-2.91)	(0.31-2.49)	(0.33-2.46)	(0.28-2.11)	(0.25-1.92)	(0.23-1.63)	(0.26-1.65)	(0.22-1.81)	(0.23-1.65)	(0.23-1.99)	(0.22-1.05)	(0.12-1.12)	(0.17-2.03)	(0.22-3.15)	(0.18-4.89)	(0.24-3.17)	(0.26-3.42)	(0.29-4.24)	(0.23-3.46)	(0.61-1.22)		
By Hour of the Day and By Year "All WD" 5%ile NO ₂ Concentration (ppb) in Fort McKay for the Month of March for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	0.23	0.31	0.38	0.36	0.5	0.73	0.61	0.58	0.61	0.56	0.46	0.26	0.22	0.25	0.21	0.23	0.29	0.4	0.3	0.47	0.63	0.4	0.48	0.49	0.42	0.15	(0.21-0.73)
	2015	0.28	0.54	0.72	0.89	0.65	0.87	1.46	2	2.24	1.06	0.4	0.52	0.44	0.37	0.35	0.43	0.39	0.32	0.27	0.38	0.54	0.49	0.37	0.59	0.69	0.52	(0.27-2.24)
	2016	1.29	0.96	0.98	0.78	0.94	0.87	0.8	1.84	1.48	1.16	1.12	1.46	1.05	0.76	0.52	0.56	0.54	0.66	0.35	0.38	0.33	0.38	0.45	0.58	0.84	0.40	(0.33-1.84)
	2017	1.14	0.8	0.51	0.68	0.99	1.84	1.45	1.1	1.01	1.16	1.45	0.86	0.57	0.45	0.31	0.48	1.25	1.5	0.73	1.06	0.48	0.77	0.99	0.96	0.94	0.39	(0.31-1.84)
	2018	0.39	0.38	0.91	1.5	2.18	1.81	0.97	0.92	0.76	0.6	0.31	0.34	0.35	0.26	0.33	0.3	0.28	0.18	0.34	0.25	0.65	0.64	0.69	0.5	0.66	0.52	(0.18-2.18)
	2019	0.6	0.55	0.55	0.56	0.45	0.63	1.19	1.24	0.91	0.67	0.51	0.53	0.47	0.44	0.4	0.36	0.42	0.39	0.4	0.34	0.64	0.32	0.49	0.61	0.57	0.24	(0.32-1.24)
	2020	0.82	0.5	0.52	0.52	0.9	0.74	0.83	0.81	1.08	1.2	0.65	0.66	0.58	0.51	0.49	0.51	0.62	0.56	0.58	1.31	0.93	0.62	0.58	0.98	0.73	0.23	(0.49-1.31)
	2021	0.25	0.52	0.63	0.98	1.29	1.64	0.43	0.69	0.67	0.54	0.48	0.36	0.39	0.5	0.63	0.73	0.51	0.42	0.75	0.92	0.69	0.45	0.27	0.63	0.32	(0.25-1.64)	
																										0.68	0.15	(0.42-0.94)
Average		0.63	0.57	0.65	0.78	0.99	1.14	0.97	1.15	1.10	0.87	0.67	0.62	0.51	0.44	0.41	0.45	0.54	0.55	0.47	0.64	0.61	0.51	0.54	0.62	0.68		
Std Dev		0.42	0.21	0.21	0.35	0.56	0.52	0.38	0.52	0.54	0.30	0.40	0.39	0.25	0.16	0.13	0.16	0.31	0.41	0.19	0.40	0.17	0.15	0.22	0.24	0.23		
Range		(0.23-1.29)	(0.31-0.96)	(0.38-0.98)	(0.36-1.5)	(0.45-2.18)	(0.63-1.84)	(0.43-1.46)	(0.58-2)	(0.61-2.24)	(0.54-1.2)	(0.31-1.45)	(0.26-1.46)	(0.22-1.05)	(0.25-0.76)	(0.21-0.63)	(0.23-0.73)	(0.28-1.25)	(0.18-1.5)	(0.27-0.75)	(0.25-1.31)	(0.33-0.93)	(0.32-0.77)	(0.27-0.99)	(0.26-0.98)	(0.40-1.15)		

Table D.2: The 5th percentile "All-WD" NO₂ Monthly/Annual Tables (April to June 2014-2021)

By Hour of the Day and By Year "All WD" 5%ile NO ₂ Concentration (ppb) in Fort McKay for the Month of April for the Period 2014-2021																													
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range	
Year	2014	0.25	0.59	0.5	0.65	0.46	0.55	0.91	0.79	0.48	1	0.54	0.45	0.33	0.36	0.22	0.17	0.38	0.36	0.28	0.28	0.47	0.34	0.5	0.54	0.48	0.21	(0.17-1)	
	2015	0.15	0.11	0.11	0.04	0.05	0.12	0.15	0.2	0.18	0.16	0.13	0.06	0.06	0.08	0.05	0.14	0.11	0.15	0.15	0.11	0.12	0.11	0.13	0.13	0.12	0.04	(0.04-0.2)	
	2016	0.92	0.67	0.63	0.69	0.61	0.67	0.73	0.51	0.54	0.46	0.55	0.42	0.32	0.36	0.28	0.32	0.29	0.29	0.36	0.34	0.43	0.33	0.41	0.79	0.50	0.18	(0.28-0.92)	
	2017	0.42	0.52	0.5	0.54	0.57	1.62	1.37	0.78	0.54	0.97	0.6	0.23	0.34	0.16	0.28	0.21	0.3	0.27	0.37	0.68	0.48	0.76	0.77	0.48	0.57	0.35	(0.16-1.62)	
	2018	0.38	0.41	0.19	0.26	0.38	0.28	0.26	0.23	0.25	0.23	0.21	0.29	0.21	0.1	0.09	0.13	0.13	0.18	0.25	0.44	0.38	0.37	0.32	0.31	0.26	0.10	(0.09-0.44)	
	2019	0.29	0.28	0.32	0.27	0.33	0.36	0.27	0.31	0.31	0.22	0.21	0.19	0.21	0.21	0.2	0.2	0.2	0.21	0.24	0.22	0.33	0.32	0.26	0.26	0.26	0.05	(0.19-0.36)	
	2020	0.3	0.53	0.47	0.7	0.41	0.37	0.33	0.37	0.32	0.38	0.3	0.28	0.32	0.34	0.3	0.28	0.33	0.31	0.28	0.4	0.46	0.41	0.32	0.33	0.37	0.10	(0.28-0.7)	
	2021	0.43	0.39	0.38	0.28	0.47	0.58	0.47	0.29	0.28	0.3	0.3	0.31	0.29	0.24	0.27	0.22	0.21	0.21	0.28	0.28	0.3	0.27	0.32	0.35	0.32	0.09	(0.21-0.58)	
																										0.36	0.14	(0.12-0.57)	
Average		0.39	0.44	0.39	0.43	0.41	0.57	0.56	0.44	0.36	0.47	0.36	0.28	0.26	0.23	0.21	0.21	0.24	0.25	0.28	0.34	0.37	0.36	0.38	0.40	0.36			
Std Dev		0.23	0.18	0.17	0.25	0.17	0.46	0.42	0.24	0.14	0.33	0.18	0.12	0.10	0.11	0.09	0.07	0.10	0.07	0.07	0.17	0.12	0.18	0.19	0.20	0.10			
Range		(0.15-0.92)	(0.11-0.67)	(0.11-0.63)	(0.04-0.7)	(0.05-0.61)	(0.12-1.62)	(0.15-1.37)	(0.2-0.79)	(0.18-0.54)	(0.16-1)	(0.13-0.6)	(0.06-0.45)	(0.06-0.34)	(0.08-0.36)	(0.05-0.3)	(0.13-0.32)	(0.11-0.38)	(0.15-0.36)	(0.15-0.37)	(0.11-0.68)	(0.12-0.48)	(0.11-0.76)	(0.13-0.77)	(0.13-0.79)	(0.21-0.57)			
By Hour of the Day and By Year "All WD" 5%ile NO ₂ Concentration (ppb) in Fort McKay for the Month of May for the Period 2014-2021																													
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range	
Year	2014	0.13	0.21	0.25	0.13	0.02	0.16	0.16	0.79	0.44	0.1	0.1	0.01	0.09	0.06	0.05	0.11	0.12	0.2	0.11	0.06	0.03	0.13	0.1	0.09	0.15	0.16	(0.01-0.79)	
	2015	0.2	0.53	0.63	0.73	0.44	0.51	0.83	0.47	0.5	0.37	0.32	0.44	0.61	0.53	0.37	0.41	0.34	0.26	0.32	0.26	0.21	0.4	0.27	0.28	0.43	0.16	(0.2-0.83)	
	2016	0.16	0.16	0.18	0.17	0.22	0.19	0.17	0.16	0.17	0.08	0.11	0.1	0.13	0.13	0.12	0.1	0.12	0.13	0.15	0.18	0.2	0.19	0.19	0.17	0.15	0.04	(0.08-0.22)	
	2017	0.13	0.19	0.19	0.2	0.28	0.24	0.15	0.06	0.12	0.09	0.05	0.05	0	0.02	0.01	0.01	0.08	0.07	0.12	0.24	0.26	0.2	0.13	0.12	0.13	0.08	(0-0.28)	
	2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)
	2019	0.64	0.49	0.52	0.3	0.57	0.29	0.39	0.45	0.22	0.29	0.72	0.41	0.25	0.25	0.25	0.32	0.31	0.32	0.28	0.41	0.38	0.53	0.42	0.61	0.40	0.14	(0.22-0.72)	
	2020	0.25	0.23	0.3	0.38	0.54	0.48	0.48	0.47	0.45	0.43	0.48	0.62	0.29	0.26	0.22	0.29	0.26	0.22	0.2	0.25	0.38	0.29	0.45	0.36	0.19	0.35	0.12	(0.19-0.62)
	2021	0.33	0.3	0.39	0.36	0.46	0.75	0.32	0.91	0.66	0.47	0.38	0.34	0.35	0.34	0.27	0.23	0.27	0.27	0.3	0.59	0.37	0.32	0.41	0.35	0.41	0.17	(0.23-0.91)	
																										0.25	0.15	(0.00-0.43)	
Average		0.23	0.26	0.31	0.28	0.32	0.33	0.31	0.41	0.32	0.24	0.29	0.21	0.21	0.19	0.17	0.18	0.18	0.18	0.19	0.27	0.22	0.28	0.24	0.23	0.25			
Std Dev		0.19	0.17	0.20	0.22	0.22	0.24	0.26	0.33	0.22	0.19	0.27	0.18	0.20	0.18	0.14	0.15	0.12	0.11	0.11	0.19	0.14	0.18	0.16	0.19	0.06			
Range		(0-0.64)	(0-0.53)	(0-0.63)	(0-0.73)	(0-0.57)	(0-0.75)	(0-0.83)	(0-0.91)	(0-0.66)	(0-0.48)	(0-0.72)	(0-0.44)	(0-0.61)	(0-0.53)	(0-0.37)	(0-0.41)	(0-0.34)	(0-0.32)	(0-0.32)	(0-0.59)	(0-0.38)	(0-0.53)	(0-0.42)	(0-0.61)	(0-0.41)			
By Hour of the Day and By Year "All WD" 5%ile NO ₂ Concentration (ppb) in Fort McKay for the Month of June for the Period 2014-2021																													
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range	
Year	2014	0.1	0.22	0.23	0.26	0.29	0.4	0.15	0.25	0.42	0.47	0.42	0.35	0.35	0.24	0.24	0.16	0.12	0.06	0.07	0.1	0.21	0.2	0.17	0.07	0.23	0.12	(0.06-0.47)	
	2015	0.2	0.14	0.58	0.28	0.27	0.45	0.16	0.12	0.19	0.13	0.15	0.04	0.07	0.08	0.02	0.04	0.01	0.04	0.06	0.06	0.2	0.22	0.5	0.17	0.17	0.15	(0.01-0.58)	
	2016	0.24	0.2	0.16	0.12	0.12	0.16	0.12	0.11	0.11	0.05	0.04	0.1	0.12	0.04	0.06	0.06	0.07	0.09	0.15	0.2	0.3	0.28	0.34	0.27	0.15	0.09	(0.04-0.34)	
	2017	0.1	0.08	0.04	0.09	0.09	0.11	0.1	0.07	0.09	0.05	0.02	0.02	0.02	0.01	0	0	0	0.02	0.06	0.17	0.27	0.16	0.05	0.18	0.08	0.07	(0-0.27)	
	2018	0.16	0.17	0.18	0.23	0.21	0.19	0.16	0.14	0.16	0.16	0.18	0.16	0.22	0.14	0.08	0.2	0.12	0.1	0.13	0.12	0.11	0.19	0.13	0.16	0.16	0.04	(0.08-0.23)	
	2019	0.18	0.19	0.19	0.12	0.17	0.13	0.16	0.18	0.18	0.18	0.17	0.19	0.18	0.18	0.2	0.18	0.2	0.15	0.19	0.14	0.17	0.17	0.15	0.21	0.17	0.02	(0.12-0.21)	
	2020	0.2	0.21	0.31	0.26	0.26	0.22	0.22	0.17	0.18	0.16	0.14	0.16	0.12	0.13	0.12	0.1	0.12	0.19	0.16	0.24	0.24	0.32	0.17	0.22	0.19	0.06	(0.1-0.32)	
	2021	0.22	0.16	0.28	0.25	0.25	0.26	0.28	0.45	0.24	0.28	0.2	0.13	0.21	0.26	0.22	0.16	0.13	0.21	0.22	0.21	0.22	0.26	0.22	0.25	0.23	0.06	(0.13-0.45)	
																										0.17	0.05	(0.08-0.23)	
Average		0.18	0.17	0.25	0.20	0.21	0.24	0.17	0.19	0.20	0.19	0.17	0.14	0.16	0.14	0.12	0.11	0.10	0.11	0.13	0.16	0.22	0.23	0.22	0.19	0.17			
Std Dev		0.05	0.05	0.16	0.08	0.07	0.12	0.06	0.12	0.10	0.14	0.12	0.10	0.10	0.09	0.09	0.07	0.07	0.07	0.06	0.06	0.06	0.06	0.14	0.06	0.04			
Range		(0.1-0.24)	(0.08-0.22)	(0.04-0.58)	(0.08-0.28)	(0.09-0.29)	(0.11-0.45)	(0.1-0.28)	(0.07-0.45)	(0.09-0.42)	(0.05-0.47)	(0.02-0.42)	(0.02-0.35)	(0.02-0.35)	(0.01-0.26)	(0-0.24)	(0-0.2)	(0-0.2)	(0.02-0.21)	(0.06-0.22)	(0.06-0.24)	(0.11-0.3)	(0.16-0.32)	(0.05-0.5)	(0.07-0.27)	(0.10-0.24)			

Table D.3: The 5th percentile "All-WD" NO₂ Monthly/Annual Tables (July to September 2014-2021)

By Hour of the Day and By Year "All WD" 5%ile NO ₂ Concentration (ppb) in Fort McKay for the Month of July for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	0	0	0	0	0.06	0.1	0.3	0.38	0.26	0.19	0.12	0.13	0.12	0.11	0.06	0.06	0.04	0.17	0.17	0.16	0.22	0.21	0.09	0.06	0.13	0.10	(0-0.38)
	2015	0.06	0.01	0.04	0.14	0.09	0.11	0.11	0.12	0.09	0.04	0.03	0.01	0	0	0.09	0.12	0.06	0.08	0.06	0.08	0.16	0.22	0.18	0.18	0.09	0.06	(0-0.22)
	2016	0.28	0.27	0.25	0.29	0.37	0.44	0.4	0.32	0.26	0.14	0.21	0.17	0.14	0.19	0.21	0.19	0.32	0.18	0.23	0.3	0.2	0.22	0.21	0.22	0.25	0.08	(0.14-0.44)
	2017	0.16	0.17	0.2	0.22	0.22	0.18	0.14	0.14	0.1	0.08	0.06	0.07	0.09	0.08	0.08	0.09	0.08	0.1	0.11	0.11	0.19	0.2	0.21	0.18	0.14	0.05	(0.06-0.22)
	2018	0.12	0.25	0.3	0.26	0.21	0.18	0.16	0.17	0.15	0.12	0.1	0.11	0.12	0.13	0.13	0.12	0.13	0.14	0.19	0.21	0.16	0.22	0.14	0.2	0.17	0.05	(0.1-0.3)
	2019	0.36	0.29	0.26	0.21	0.15	0.18	0.18	0.19	0.12	0.08	0.07	0.07	0.1	0.18	0.1	0.17	0.13	0.11	0.06	0.13	0.22	0.23	0.17	0.25	0.17	0.08	(0.06-0.36)
	2020	0.13	0.15	0.18	0.18	0.16	0.18	0.16	0.14	0.14	0.13	0.12	0.11	0.11	0.11	0.09	0.11	0.08	0.1	0.07	0.11	0.08	0.09	0.12	0.11	0.12	0.03	(0.07-0.18)
	2021	0.35	0.42	0.4	0.33	0.43	0.56	0.33	0.32	0.34	0.25	0.35	0.33	0.23	0.22	0.22	0.2	0.2	0.19	0.16	0.26	0.28	0.5	0.45	0.43	0.32	0.11	(0.16-0.56)
																										0.17	0.07	(0.12-0.32)
Average		0.18	0.20	0.20	0.20	0.21	0.24	0.22	0.22	0.18	0.13	0.13	0.13	0.11	0.13	0.12	0.13	0.13	0.13	0.13	0.17	0.19	0.24	0.20	0.20	0.17		
Std Dev		0.13	0.14	0.13	0.10	0.13	0.17	0.11	0.10	0.09	0.07	0.10	0.10	0.06	0.07	0.06	0.05	0.09	0.04	0.07	0.08	0.06	0.12	0.11	0.11	0.04		
Range		(0-0.36)	(0-0.42)	(0-0.4)	(0-0.33)	(0.06-0.43)	(0.1-0.56)	(0.11-0.4)	(0.12-0.38)	(0.09-0.34)	(0.04-0.25)	(0.03-0.35)	(0.01-0.33)	(0-0.23)	(0-0.22)	(0.06-0.22)	(0.06-0.2)	(0.04-0.32)	(0.08-0.19)	(0.06-0.23)	(0.08-0.3)	(0.08-0.28)	(0.09-0.5)	(0.09-0.45)	(0.06-0.43)	(0.11-0.24)		

By Hour of the Day and By Year "All WD" 5%ile NO ₂ Concentration (ppb) in Fort McKay for the Month of August for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	0.34	0.28	0.22	0.17	0.36	0.57	0.44	0.47	0.22	0.27	0.29	0.15	0.07	0.05	0.14	0.14	0.18	0.12	0.23	0.27	0.46	0.37	0.33	0.42	0.27	0.14	(0.05-0.57)
	2015	0	0.01	0	0	0.01	0.01	0.1	0.07	0.03	0.01	0.01	0.02	0.02	0.01	0	0	0	0	0	0.02	0.03	0	0.02	0	0.02	0.02	(0-0.1)
	2016	0.05	0.08	0.09	0.07	0.16	0.19	0.19	0.12	0.08	0.07	0.06	0.12	0.08	0.1	0.16	0.12	0.12	0.13	0.13	0.17	0.14	0.06	0.03	0.04	0.11	0.05	(0.03-0.19)
	2017	0.23	0.16	0.19	0.24	0.29	0.3	0.21	0.21	0.15	0.14	0.14	0.13	0.11	0.09	0.12	0.1	0.12	0.14	0.14	0.18	0.18	0.15	0.23	0.24	0.17	0.06	(0.09-0.3)
	2018	0.08	0.13	0.19	0.22	0.36	0.49	0.38	0.26	0.17	0.19	0.36	0.25	0.27	0.31	0.16	0.34	0.28	0.4	0.42	0.29	0.33	0.15	0.11	0.27	0.11	0.08	(0.08-0.49)
	2019	0.18	0.15	0.24	0.27	0.24	0.22	0.21	0.15	0.15	0.16	0.13	0.19	0.18	0.17	0.2	0.21	0.16	0.2	0.24	0.2	0.24	0.29	0.15	0.17	0.20	0.04	(0.13-0.29)
	2020	0.13	0.12	0.13	0.13	0.17	0.14	0.13	0.1	0.15	0.13	0.12	0.14	0.1	0.1	0.08	0.13	0.1	0.15	0.12	0.15	0.15	0.14	0.14	0.15	0.13	0.02	(0.08-0.17)
	2021	0.18	0.18	0.16	0.22	0.18	0.32	0.24	0.23	0.2	0.2	0.16	0.15	0.22	0.23	0.21	0.09	0.08	0.1	0.13	0.17	0.23	0.36	0.17	0.14	0.19	0.06	(0.08-0.36)
																										0.17	0.08	(0.02-0.27)
Average		0.15	0.14	0.15	0.17	0.22	0.28	0.24	0.20	0.14	0.15	0.16	0.14	0.13	0.13	0.15	0.12	0.14	0.14	0.17	0.20	0.22	0.21	0.15	0.16	0.17		
Std Dev		0.11	0.08	0.08	0.09	0.12	0.18	0.12	0.13	0.06	0.08	0.11	0.07	0.08	0.09	0.09	0.06	0.10	0.08	0.12	0.11	0.13	0.14	0.10	0.13	0.04		
Range		(0-0.34)	(0.01-0.28)	(0-0.24)	(0-0.27)	(0.01-0.36)	(0.01-0.57)	(0.1-0.44)	(0.07-0.47)	(0.03-0.22)	(0.01-0.27)	(0.01-0.36)	(0.01-0.25)	(0.02-0.27)	(0.01-0.27)	(0-0.31)	(0-0.21)	(0-0.34)	(0-0.28)	(0-0.4)	(0.02-0.42)	(0.03-0.46)	(0-0.37)	(0.02-0.33)	(0-0.42)	(0.12-0.28)		

By Hour of the Day and By Year "All WD" 5%ile NO ₂ Concentration (ppb) in Fort McKay for the Month of September for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	0.29	0.25	0.2	0.23	0.36	0.51	0.47	0.51	0.47	0.65	0.48	0.19	0.17	0.24	0.26	0.25	0.35	0.34	0.29	0.3	0.21	0.33	0.26	0.51	0.34	0.13	(0.17-0.65)
	2015	0.02	0	0	0	0	0	0.03	0	0.06	0.02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	(0-0.06)
	2016	0.07	0.04	0.04	0.07	0.09	0.11	0.12	0.08	0.02	0.01	0.08	0.07	0.06	0.04	0.03	0.04	0.07	0.08	0.1	0.13	0.2	0.2	0.15	0.13	0.08	0.05	(0.01-0.2)
	2017	0.29	0.31	0.22	0.2	0.22	0.28	0.32	0.19	0.18	0.23	0.18	0.16	0.17	0.15	0.17	0.11	0.09	0.12	0.21	0.22	0.2	0.28	0.29	0.27	0.21	0.06	(0.09-0.32)
	2018	0.07	0.04	0.14	0.14	0.19	0.26	0.23	0.16	0.11	0.08	0.1	0.07	0.07	0.07	0.07	0.06	0.08	0.14	0.07	0.07	0.06	0.08	0.06	0.07	0.10	0.06	(0.04-0.26)
	2019	0.25	0.24	0.18	0.14	0.23	0.27	0.33	0.29	0.22	0.11	0.19	0.19	0.18	0.14	0.11	0.15	0.26	0.19	0.24	0.24	0.33	0.19	0.2	0.2	0.21	0.06	(0.11-0.33)
	2020	0.17	0.21	0.26	0.15	0.13	0.2	0.19	0.15	0.1	0.16	0.16	0.15	0.13	0.11	0.09	0.1	0.09	0.1	0.11	0.12	0.11	0.14	0.12	0.14	0.14	0.04	(0.09-0.26)
	2021	0.07	0.07	0.12	0.15	0.2	0.22	0.2	0.2	0.17	0.17	0.19	0.14	0.12	0.1	0.12	0.11	0.14	0.11	0.09	0.09	0.12	0.1	0.13	0.08	0.13	0.04	(0.07-0.22)
																										0.15	0.09	(0.01-0.34)
Average		0.15	0.15	0.15	0.14	0.18	0.23	0.24	0.20	0.17	0.18	0.17	0.12	0.11	0.11	0.11	0.10	0.14	0.14	0.14	0.15	0.15	0.17	0.15	0.18	0.15		
Std Dev		0.11	0.12	0.09	0.07	0.11	0.15	0.14	0.15	0.14	0.20	0.14	0.07	0.06	0.07	0.08	0.08	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.04		
Range		(0.02-0.29)	(0-0.31)	(0-0.26)	(0-0.23)	(0.06-0.36)	(0-0.51)	(0.03-0.47)	(0-0.51)	(0.02-0.47)	(0.01-0.65)	(0-0.48)	(0-0.19)	(0-0.18)	(0-0.24)	(0-0.26)	(0-0.25)	(0.03-0.35)	(0-0.34)	(0.02-0.29)	(0.03-0.33)	(0.03-0.33)	(0-0.29)	(0-0.51)	(0.10-0.24)			

Table D.4: The 5th percentile "All-WD" NO₂ Monthly/Annual Tables (October to December 2014-2021)

By Hour of the Day and By Year "All WD" 5%ile NO ₂ Concentration (ppb) in Fort McKay for the Month of October for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	0.09	0.09	0.07	0	0.17	0.43	0.5	0.45	0.45	0.28	0.11	0.17	0.07	0.01	0.04	0.09	0.07	0.07	0.06	0.19	0.23	0.17	0.23	0.17	0.18	0.15	(0-0.5)
	2015	0.22	0.24	0.29	0.26	0.13	0.26	0.51	0.34	0.2	0.25	0.15	0.06	0.12	0.09	0.05	0.09	0.13	0.11	0.32	0.29	0.36	0.32	0.45	0.23	0.23	0.12	(0.05-0.51)
	2016	0.32	0.32	0.29	0.26	0.34	0.39	0.61	0.32	0.4	0.15	0.22	0.14	0.12	0.1	0.08	0.11	0.13	0.2	0.18	0.17	0.2	0.22	0.27	0.3	0.24	0.12	(0.08-0.61)
	2017	0.15	0.15	0.11	0.16	0.16	0.18	0.19	0.17	0.11	0.21	0.15	0.16	0.16	0.26	0.15	0.21	0.26	0.19	0.23	0.26	0.15	0.17	0.14	0.12	0.18	0.04	(0.11-0.26)
	2018	0.27	0.15	0.2	0.28	0.37	0.41	0.4	0.19	0.15	0.14	0.15	0.06	0.16	0.09	0.08	0.05	0.12	0.28	0.19	0.25	0.38	0.24	0.31	0.27	0.22	0.11	(0.05-0.41)
	2019	0.15	0.13	0.26	0.32	0.19	0.25	0.27	0.27	0.22	0.26	0.21	0.19	0.14	0.1	0.12	0.16	0.17	0.31	0.18	0.28	0.2	0.17	0.18	0.18	0.20	0.06	(0.1-0.32)
	2020	0.09	0.14	0.12	0.14	0.1	0.13	0.11	0.12	0.12	0.12	0.11	0.11	0.1	0.11	0.11	0.11	0.11	0.12	0.11	0.09	0.1	0.11	0.1	0.12	0.11	0.01	(0.09-0.14)
	2021	0.27	0.29	0.28	0.24	0.24	0.57	0.38	0.64	0.34	0.07	0.16	0.08	0	0.01	0	0	0	0	0	0.06	0.16	0.19	0.27	0.21	0.19	0.18	(0-0.64)
																										0.19	0.04	(0.11-0.24)
Average		0.20	0.19	0.20	0.21	0.21	0.33	0.37	0.31	0.25	0.19	0.16	0.12	0.11	0.10	0.08	0.10	0.12	0.16	0.16	0.20	0.22	0.20	0.24	0.20	0.19		
Std Dev		0.09	0.08	0.09	0.10	0.10	0.15	0.17	0.17	0.13	0.08	0.04	0.05	0.05	0.08	0.05	0.06	0.07	0.11	0.10	0.09	0.10	0.06	0.11	0.07	0.07		
Range		(0.09-0.32)	(0.09-0.32)	(0.07-0.29)	(0-0.32)	(0.1-0.37)	(0.13-0.57)	(0.11-0.61)	(0.12-0.64)	(0.11-0.45)	(0.07-0.28)	(0.11-0.22)	(0.06-0.19)	(0-0.16)	(0.01-0.26)	(0-0.15)	(0-0.21)	(0-0.26)	(0-0.31)	(0-0.32)	(0.06-0.29)	(0.1-0.38)	(0.11-0.32)	(0.1-0.45)	(0.12-0.3)	(0.08-0.37)		

By Hour of the Day and By Year "All WD" 5%ile NO ₂ Concentration (ppb) in Fort McKay for the Month of November for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	0.14	0.34	0.26	0.24	0.18	0.23	0.31	0.54	0.58	0.68	0.54	0.67	0.72	0.79	0.66	1.34	2.18	1.85	1.58	0.75	0.22	0.19	0.4	0.38	0.66	0.55	(0.14-2.18)
	2015	0.39	0.4	0.94	0.43	0.4	0.33	0.3	0.46	0.61	0.67	0.68	0.51	0.64	0.48	0.45	0.45	0.85	1.23	0.66	0.54	0.55	0.52	0.4	0.39	0.55	0.21	(0.3-1.23)
	2016	0.12	0.09	0.15	0.19	0.22	0.25	0.25	0.23	0.3	0.48	0.21	0.12	0.08	0.22	0.1	0.19	0.07	0.19	0.21	0.19	0.2	0.21	0.26	0.23	0.20	0.09	(0.07-0.48)
	2017	0.17	0.29	0.54	0.45	0.29	0.28	0.24	0.16	0.13	0.11	0.1	0.18	0.17	0.15	0.12	0.13	0.37	0.35	0.16	0.19	0.19	0.35	0.33	0.18	0.23	0.12	(0.1-0.54)
	2018	0.42	0.57	0.68	1.04	0.55	1.05	0.66	0.25	0.7	0.54	1.21	1.21	0.94	1.17	0.98	0.96	1.39	1.02	0.54	0.56	0.61	0.87	0.43	0.99	0.81	0.30	(0.25-1.39)
	2019	0.3	0.65	0.68	0.56	0.53	0.46	0.42	0.39	0.39	0.46	0.3	0.39	0.36	0.43	0.35	0.36	0.38	0.27	0.43	0.41	0.42	0.47	0.6	0.36	0.43	0.11	(0.27-0.68)
	2020	0.97	1.01	0.7	0.49	0.5	0.7	0.63	0.55	0.48	0.69	0.39	0.33	0.5	0.39	0.39	0.36	0.82	0.72	0.57	0.59	0.49	0.65	1.23	0.64	0.62	0.22	(0.33-1.23)
	2021	0.27	0.27	0.36	0.43	0.38	0.8	0.99	0.46	0.36	0.18	0.26	0.18	0.27	0.21	0.25	0.17	0.33	0.18	0.14	0.07	0.27	0.43	0.39	0.27	0.33	0.20	(0.07-0.99)
																										0.48	0.20	(0.20-0.81)
Average		0.35	0.45	0.54	0.48	0.38	0.51	0.48	0.38	0.44	0.48	0.46	0.45	0.46	0.48	0.41	0.50	0.80	0.73	0.54	0.41	0.37	0.46	0.51	0.43	0.48		
Std Dev		0.27	0.29	0.26	0.26	0.14	0.30	0.26	0.15	0.19	0.22	0.35	0.36	0.29	0.34	0.29	0.43	0.69	0.60	0.47	0.24	0.17	0.23	0.31	0.27	0.10		
Range		(0.12-0.97)	(0.09-1.01)	(0.15-0.94)	(0.19-1.04)	(0.18-0.55)	(0.23-1.05)	(0.24-0.99)	(0.16-0.55)	(0.13-0.7)	(0.11-0.69)	(0.1-1.21)	(0.12-1.21)	(0.08-0.94)	(0.15-1.17)	(0.1-0.98)	(0.13-1.34)	(0.07-2.18)	(0.18-1.85)	(0.14-1.58)	(0.07-0.75)	(0.19-0.61)	(0.19-0.87)	(0.26-1.23)	(0.18-0.99)	(0.35-0.80)		

By Hour of the Day and By Year "All WD" 5%ile NO ₂ Concentration (ppb) in Fort McKay for the Month of December for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	0.46	0.63	1.05	1.16	1.03	1.14	2.26	2.25	0.74	0.94	0.79	1.48	1.32	0.59	0.64	0.72	0.86	0.82	0.82	1.53	0.49	0.61	0.69	0.75	0.99	0.48	(0.46-2.26)
	2015	1.28	1.4	1.21	0.91	0.5	0.41	0.34	0.5	0.37	0.75	0.77	0.6	0.53	0.62	0.64	1.38	2.16	2	1.84	1.15	1.22	1.45	1.68	1.15	1.04	0.54	(0.34-2.16)
	2016	0.31	0.16	0.07	0.15	0.15	0.11	0.14	0.19	0.2	0.3	0.19	0.43	0.25	0.24	0.2	0.22	0.31	0.55	0.78	0.63	0.52	0.55	0.39	0.41	0.31	0.18	(0.07-0.78)
	2017	0.77	0.68	0.82	0.77	0.87	0.95	1.21	0.57	0.76	0.55	0.41	0.16	0.12	0.09	0.09	0.46	0.08	0.13	0.17	0.3	0.35	0.42	0.3	0.3	0.47	0.32	(0.08-1.21)
	2018	0.77	0.39	0.56	0.75	1.8	1.25	2.62	1.07	0.8	0.7	1.12	0.41	0.44	0.42	0.4	0.47	0.53	0.49	0.4	0.31	0.39	0.43	0.34	0.55	0.73	0.54	(0.31-2.62)
	2019	2.89	1.59	1.41	1.08	1.15	1.18	1.19	3.93	6.4	6.02	6.32	3.17	1.78	2.18	3.16	1.3	2.52	2.74	1.18	1.84	3.31	3.11	4.33	2.64	2.77	1.64	(1.08-6.4)
	2020	0.47	0.37	0.39	0.43	0.51	0.28	0.53	0.53	0.53	0.45	1.01	0.72	0.66	0.67	0.83	0.61	0.57	0.79	0.43	0.48	1.1	0.74	0.88	0.76	0.61	0.21	(0.28-1.1)
	2021	0.28	0.76	1.44	1.87	0.61	0.64	0.39	0.39	0.42	0.24	0.21	0.21	0.23	0.12	0.12	0.63	0.6	0.85	0.62	0.44	0.32	0.31	0.32	0.23	0.51	0.41	(0.12-1.87)
																										0.93	0.73	(0.31-2.77)
Average		0.90	0.75	0.87	0.89	0.83	0.75	1.09	1.18	1.28	1.24	1.35	0.90	0.67	0.62	0.76	0.72	0.95	1.05	0.78	0.84	0.96	0.95	1.12	0.85	0.93		
Std Dev		0.87	0.50	0.50	0.52	0.51	0.44	0.93	1.29	2.08	1.94	2.04	1.01	0.59	0.67	1.01	0.41	0.89	0.87	0.53	0.60	1.01	0.94	1.38	0.78	0.20		
Range		(0.28-2.89)	(0.16-1.59)	(0.07-1.44)	(0.15-1.87)	(0.15-1.8)	(0.11-2.62)	(0.14-3.93)	(0.2-6.4)	(0.24-6.02)	(0.19-6.32)	(0.16-3.17)	(0.12-1.78)	(0.09-2.18)	(0.09-3.16)	(0.22-1.38)	(0.08-2.52)	(0.13-2.74)	(0.17-1.84)	(0.3-3.31)	(0.32-3.11)	(0.31-4.33)	(0.23-2.64)	(0.62-1.35)				

Table D.5: The 10th percentile "All-WD" NO₂ Monthly/Annual Tables (January to March 2014-2021)

By Hour of the Day and By Year "All WD" 10 th ile NO ₂ Concentration (ppb) in Fort McKay for the Month of January for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	1.88	1.61	1.23	1.77	1.07	1.53	2.2	0.94	0.87	1.48	0.55	0.71	0.62	0.57	0.61	1.17	1	1.05	0.99	0.63	0.68	0.63	0.8	0.92	1.06	0.46	(0.55-2.2)
	2015	0.69	0.81	0.79	0.81	0.87	1.25	2.97	2.13	1.74	0.95	0.81	1.22	2.31	1.78	0.91	0.62	0.83	0.73	0.83	0.92	1	1.17	0.85	0.71	1.15	0.60	(0.62-2.97)
	2016	1.84	2.69	2.59	1.26	1.93	2.56	1.73	1.74	1.35	2.8	1.41	1.41	1.28	0.96	1.3	1.11	1.36	1.9	2.26	6.24	3.12	1.02	1.17	1.54	1.94	1.10	(0.96-6.24)
	2017	0.97	0.8	1.1	1.37	1.11	0.84	0.77	0.85	1.36	1.34	0.69	0.62	0.63	0.76	0.7	0.71	1.31	1.19	1.37	1.16	0.73	0.81	0.89	0.88	0.96	0.26	(0.62-1.37)
	2018	1.51	1.3	2.64	3.28	4.61	2.62	2.54	2.14	3	2.95	2.47	1.96	1.59	0.91	1.85	1.59	2.48	3.05	2.35	1.69	1.58	2.33	1.56	1.31	2.22	0.82	(0.91-4.61)
	2019	3.51	3.67	3.26	3.74	4.06	2.58	4.25	2.35	3.1	2.93	3.09	2.03	1.07	0.88	1.56	1.69	1.25	1.77	2.99	4.07	4.64	2.94	3	3.29	2.82	1.05	(0.88-4.64)
	2020	6.04	1.41	1.41	1.13	0.91	1.23	1.04	0.83	0.74	0.82	0.76	0.71	0.67	0.61	0.68	1.79	4.17	5.27	5.66	5.19	6.05	5.87	5.35	5.58	2.66	2.26	(0.61-6.05)
	2021	0.84	0.63	0.62	1.28	2.11	3.06	3.02	3.6	4.61	4.18	4.21	2.03	3.73	2.44	2.74	2.52	2.06	2.02	1.81	1.49	1.4	1.5	1.17	0.96	2.25	1.18	(0.62-4.61)
																										1.88	0.69	(0.96-2.82)
Average		2.16	1.62	1.71	1.83	2.08	1.96	2.32	1.82	2.10	2.18	1.75	1.34	1.49	1.11	1.29	1.40	1.81	2.12	2.28	2.67	2.40	2.03	1.85	1.90	1.88		
Std Dev		1.80	1.06	0.98	1.08	1.47	0.83	1.14	0.95	1.35	1.20	1.36	0.62	1.07	0.65	0.74	0.63	1.10	1.46	1.55	2.17	2.01	1.74	1.59	1.70	0.38		
Range		(0.69-6.04)	(0.63-3.67)	(0.62-3.26)	(0.81-3.74)	(0.87-4.61)	(0.84-3.06)	(0.77-4.25)	(0.83-3.6)	(0.74-4.61)	(0.82-4.18)	(0.55-4.21)	(0.62-2.03)	(0.62-3.73)	(0.57-2.44)	(0.61-2.74)	(0.62-2.52)	(0.83-4.17)	(0.73-5.27)	(0.83-5.66)	(0.63-6.24)	(0.68-6.05)	(0.63-5.87)	(0.8-5.35)	(0.71-5.58)	(1.11-2.67)		

By Hour of the Day and By Year "All WD" 10 th ile NO ₂ Concentration (ppb) in Fort McKay for the Month of February for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	1.09	1.2	1.17	1.05	1.61	2.9	2.68	1.93	2.13	1.35	1.01	0.81	0.53	0.92	0.83	0.89	1.92	2.77	2.73	1.52	0.9	0.81	1.66	1.28	1.49	0.71	(0.53-2.9)
	2015	2.88	2.68	2.67	1.28	2.18	0.74	2.16	2.44	4.01	4.44	3.18	2.12	2.47	2.14	2.89	2.7	2.38	3.6	2.4	2.6	2.8	2.32	2.33	3.13	2.61	0.77	(0.74-4.44)
	2016	3.44	3.23	3.89	5.41	3.24	3.45	3.07	3.66	3.81	3.38	2.64	2.14	2.9	3.03	3.15	2.94	3.92	4.64	5.03	6.36	3.81	4.75	4.48	5.49	3.83	1.02	(2.14-6.36)
	2017	0.72	0.95	2.06	0.99	0.57	0.75	0.69	0.77	0.76	0.8	1.53	0.78	0.5	0.46	0.42	0.4	0.55	0.75	0.68	0.69	0.79	0.64	0.56	0.65	0.77	0.36	(0.4-2.06)
	2018	0.33	0.43	0.62	0.54	0.46	0.51	0.46	0.48	0.73	0.53	0.32	0.3	0.32	0.3	0.35	0.25	0.21	0.64	1.21	0.45	0.33	0.38	0.58	0.34	0.46	0.21	(0.21-1.21)
	2019	3.58	2.42	1.97	3.69	2.12	3.06	5.23	3.37	5.73	2.29	1.13	1.37	0.89	1.56	1.11	1.43	1.66	1.56	3.16	2.92	5.2	2.38	2.35	3.57	2.66	1.35	(0.89-5.73)
	2020	0.83	0.96	0.8	0.9	0.91	0.82	0.91	0.69	0.81	0.76	0.72	0.72	0.68	0.77	0.67	0.58	0.88	0.73	1.25	0.9	1.12	1.16	0.89	1.02	0.85	0.16	(0.58-1.25)
	2021	1.59	1.02	3.73	4	2.31	4.38	2.55	1.06	1.28	1.98	1.33	1.09	0.79	0.9	0.69	0.46	1	1.07	1.53	0.82	0.58	0.81	1.79	3.39	1.67	1.14	(0.46-4.38)
																										1.79	1.08	(0.46-2.66)
Average		1.81	1.61	2.11	2.23	1.68	2.08	2.22	1.80	2.41	1.94	1.48	1.17	1.14	1.26	1.26	1.21	1.57	1.97	2.25	2.03	1.94	1.66	1.83	2.36	1.79		
Std Dev		1.30	1.01	1.25	1.85	0.97	1.53	1.57	1.25	1.89	1.39	0.97	0.67	0.98	0.93	1.11	1.06	1.20	1.52	1.41	1.97	1.79	1.46	1.29	1.81	0.39		
Range		(0.33-3.58)	(0.43-3.23)	(0.62-3.89)	(0.54-5.41)	(0.46-3.24)	(0.51-4.38)	(0.46-5.23)	(0.48-3.66)	(0.73-5.73)	(0.53-4.44)	(0.32-3.18)	(0.3-2.14)	(0.32-2.9)	(0.3-3.03)	(0.35-3.15)	(0.25-2.94)	(0.21-3.92)	(0.64-4.64)	(0.68-5.03)	(0.45-6.36)	(0.33-5.2)	(0.38-4.75)	(0.56-4.48)	(0.34-5.49)	(1.14-2.41)		

By Hour of the Day and By Year "All WD" 10 th ile NO ₂ Concentration (ppb) in Fort McKay for the Month of March for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	0.49	0.5	0.49	0.51	0.59	0.99	1.01	1.27	1.15	0.91	0.8	0.48	0.25	0.31	0.35	0.27	0.62	0.77	0.58	0.58	1.14	0.97	0.86	0.63	0.69	0.29	(0.25-1.27)
	2015	0.99	0.74	1.52	1.17	1.96	1.72	3.25	3.96	3.91	2.07	0.54	0.79	0.77	0.64	0.61	1.16	1.42	0.64	0.63	1.28	0.91	0.77	0.91	1.72	1.42	0.99	(0.54-3.96)
	2016	1.59	2.06	1.36	0.84	1.12	1.76	0.98	2.35	1.65	1.84	1.54	2.25	1.59	1.2	0.68	0.61	0.98	1.03	0.85	1.54	0.79	1.1	1.26	0.98	1.33	0.49	(0.61-2.35)
	2017	1.38	1.06	1.01	1.09	1.98	3.05	2.54	2.11	2.27	2.86	2.88	1.45	2.4	1.3	1.54	1.58	2.94	3.24	1.89	1.68	1.15	1.61	1.57	1.32	1.91	0.70	(1.01-3.24)
	2018	1.31	1.24	2.45	3.35	4.07	4.81	3.08	2.92	2.05	1.37	0.62	0.6	0.62	0.33	0.38	0.41	1.25	0.9	0.6	0.72	0.96	1.13	1.14	1.03	1.56	1.24	(0.33-4.81)
	2019	0.68	0.92	0.67	0.73	0.6	1.04	1.55	1.92	1.16	0.88	0.6	0.67	0.51	0.68	0.54	0.48	0.55	0.51	0.55	0.66	1.34	0.74	0.67	0.82	0.81	0.36	(0.48-1.92)
	2020	1.17	0.79	0.81	0.71	1.49	1.66	2	1.99	1.86	1.49	1.11	0.91	0.81	0.78	0.62	0.74	0.66	0.64	0.69	1.58	1.86	1.3	1.15	1.67	1.19	0.48	(0.62-2)
	2021	1.83	2.21	1.63	2.58	1.98	3.36	1.84	1.47	1.16	0.85	0.67	0.59	0.64	0.59	0.84	0.8	0.69	0.5	1.25	1.28	1.21	0.7	0.56	1.7	1.29	0.74	(0.5-3.36)
																										1.27	0.37	(0.69-1.91)
Average		1.18	1.19	1.24	1.37	1.72	2.30	2.03	2.25	1.90	1.53	1.10	0.97	0.95	0.73	0.70	0.76	1.14	1.03	0.88	1.17	1.17	1.04	1.02	1.23	1.27		
Std Dev		0.45	0.62	0.64	1.03	1.11	1.33	0.87	0.86	0.92	0.70	0.80	0.60	0.70	0.36	0.38	0.43	0.79	0.91	0.47	0.45	0.33	0.31	0.33	0.43	0.46		
Range		(0.49-1.83)	(0.5-2.21)	(0.49-2.45)	(0.51-3.35)	(0.59-4.07)	(0.99-4.81)	(0.98-3.25)	(1.27-3.96)	(1.15-3.91)	(0.85-2.86)	(0.54-2.88)	(0.48-2.25)	(0.25-2.4)	(0.31-1.3)	(0.35-1.54)	(0.27-1.58)	(0.55-2.94)	(0.5-3.24)	(0.55-1.89)	(0.58-1.68)	(0.79-1.61)	(0.7-1.61)	(0.56-1.57)	(0.63-1.72)	(0.70-2.30)		

Table D.6: The 10th percentile "All-WD" NO₂ Monthly/Annual Tables (April to June 2014-2021)

By Hour of the Day and By Year "All WD" 10%ile NO ₂ Concentration (ppb) in Fort McKay for the Month of April for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	0.52	0.9	0.98	0.83	0.96	0.71	1.39	1.26	1.12	1.36	0.8	0.73	0.81	0.66	0.38	0.41	0.8	0.5	0.47	0.53	0.61	0.63	1.01	0.89	0.80	0.29	(0.38-1.39)
	2015	0.45	0.26	0.3	0.24	0.24	0.27	0.27	0.44	0.31	0.21	0.29	0.18	0.18	0.15	0.2	0.23	0.26	0.18	0.28	0.26	0.24	0.14	0.28	0.31	0.26	0.08	(0.14-0.45)
	2016	3.46	2.78	1.58	1	0.81	1.12	0.95	1.14	1.65	0.95	1.19	1.06	1.07	0.59	0.45	0.43	0.37	0.42	0.5	0.77	0.77	0.75	1.01	1.79	1.11	0.73	(0.37-3.46)
	2017	0.52	0.6	0.73	0.73	0.89	2.39	1.88	1.92	1.61	1.77	1.77	1.1	0.7	0.4	0.41	0.62	0.69	1.13	0.93	1.19	1.48	1.15	1.35	0.78	1.11	0.55	(0.4-2.39)
	2018	1.02	1.79	0.6	0.53	0.61	0.54	0.58	0.59	0.46	0.39	0.39	0.32	0.28	0.2	0.17	0.21	0.17	0.25	0.4	0.51	0.7	0.89	0.85	0.56	0.54	0.35	(0.17-1.79)
	2019	0.33	0.36	0.37	0.33	0.41	0.45	0.41	0.41	0.45	0.32	0.26	0.23	0.42	0.36	0.4	0.38	0.4	0.32	0.37	0.41	0.83	0.45	0.29	0.27	0.38	0.11	(0.23-0.83)
	2020	0.9	0.72	1.48	1.34	0.48	0.44	0.44	0.66	0.45	0.46	0.39	0.42	0.39	0.44	0.38	0.32	0.35	0.34	0.33	0.48	0.63	0.53	0.47	0.61	0.56	0.30	(0.32-1.48)
2021	0.51	0.56	1.07	0.6	0.75	0.83	1.24	1.13	0.43	0.35	0.34	0.36	0.39	0.32	0.3	0.32	0.3	0.43	0.36	0.37	0.65	0.41	0.58	0.72	0.56	0.27	(0.3-1.24)	
																										0.67	0.30	(0.26-1.11)
Average		0.96	1.00	0.89	0.70	0.64	0.84	0.90	0.94	0.81	0.73	0.68	0.55	0.53	0.39	0.34	0.37	0.42	0.45	0.46	0.57	0.74	0.62	0.73	0.74	0.67		
Std Dev		1.04	0.86	0.48	0.36	0.25	0.68	0.57	0.52	0.56	0.57	0.54	0.37	0.30	0.18	0.10	0.13	0.22	0.29	0.20	0.29	0.35	0.31	0.39	0.48	0.20		
Range		(0.33-3.46)	(0.26-2.78)	(0.3-1.58)	(0.24-1.34)	(0.24-0.96)	(0.27-2.39)	(0.27-1.88)	(0.41-1.92)	(0.31-1.65)	(0.21-1.77)	(0.26-1.77)	(0.18-1.1)	(0.18-1.07)	(0.15-0.66)	(0.17-0.45)	(0.21-0.62)	(0.17-0.8)	(0.18-1.13)	(0.28-0.93)	(0.26-1.19)	(0.24-1.48)	(0.14-1.15)	(0.28-1.35)	(0.27-1.79)	(0.34-1.00)		

By Hour of the Day and By Year "All WD" 10%ile NO ₂ Concentration (ppb) in Fort McKay for the Month of May for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	0.17	0.42	0.4	0.24	0.18	0.22	0.52	1.5	0.46	0.54	0.36	0.23	0.34	0.26	0.25	0.3	0.27	0.39	0.38	0.15	0.15	0.43	0.92	0.25	0.39	0.29	(0.15-1.5)
	2015	0.47	0.81	1.13	1.16	0.96	0.83	1.26	1.71	0.71	0.61	0.43	0.5	0.73	0.61	0.51	0.65	0.59	0.44	0.37	0.46	0.63	0.72	0.52	0.48	0.72	0.32	(0.37-1.71)
	2016	0.29	0.22	0.25	0.3	0.31	0.23	0.19	0.25	0.23	0.19	0.17	0.15	0.19	0.23	0.19	0.17	0.14	0.16	0.16	0.22	0.24	0.25	0.26	0.46	0.23	0.07	(0.14-0.46)
	2017	0.24	0.36	0.44	0.48	0.65	0.39	0.25	0.22	0.23	0.14	0.12	0.15	0.1	0.11	0.09	0.12	0.17	0.37	0.35	0.5	0.42	0.34	0.49	0.38	0.30	0.16	(0.09-0.65)
	2018	0.03	0.02	0.02	0.04	0.04	0.04	0.03	0.02	0.04	0.02	0	0	0	0	0	0	0	0	0.01	0.01	0.01	0.01	0.02	0.01	0.02	0.01	(0-0.04)
	2019	1.2	0.98	0.88	0.74	0.88	1.06	0.79	0.82	0.62	0.72	1.23	0.62	0.44	0.4	0.4	0.44	0.49	0.48	0.54	0.61	0.47	0.79	0.62	0.84	0.71	0.24	(0.4-1.23)
	2020	0.5	0.44	0.46	0.54	0.73	0.72	0.67	0.77	0.59	0.99	0.96	0.4	0.37	0.37	0.36	0.29	0.28	0.25	0.43	0.54	0.45	0.56	0.54	0.46	0.53	0.20	(0.25-0.99)
2021	0.48	0.46	0.47	0.47	0.77	0.97	0.91	1.13	1.7	0.67	1.09	0.81	0.82	0.42	0.31	0.32	0.31	0.32	0.32	0.89	0.62	0.41	0.67	0.42	0.66	0.34	(0.31-1.7)	
																										0.44	0.24	(0.02-0.72)
Average		0.42	0.46	0.51	0.50	0.57	0.56	0.58	0.80	0.57	0.49	0.55	0.36	0.37	0.30	0.26	0.29	0.28	0.30	0.32	0.42	0.37	0.44	0.50	0.41	0.44		
Std Dev		0.36	0.31	0.35	0.34	0.34	0.39	0.41	0.62	0.51	0.33	0.48	0.27	0.29	0.19	0.17	0.20	0.19	0.16	0.16	0.28	0.22	0.25	0.27	0.23	0.13		
Range		(0.03-1.2)	(0.02-0.98)	(0.02-1.13)	(0.04-1.16)	(0.04-0.96)	(0.04-1.06)	(0.03-1.26)	(0.02-1.71)	(0.04-1.7)	(0.02-0.99)	(0-1.23)	(0-0.81)	(0-0.82)	(0-0.61)	(0-0.51)	(0-0.65)	(0-0.59)	(0-0.48)	(0-0.54)	(0.01-0.89)	(0.01-0.63)	(0.01-0.79)	(0.02-0.92)	(0.01-0.84)	(0.02-0.80)		

By Hour of the Day and By Year "All WD" 10%ile NO ₂ Concentration (ppb) in Fort McKay for the Month of June for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	0.23	0.27	0.38	0.35	0.5	0.61	0.49	0.45	0.73	0.85	0.63	0.42	0.45	0.25	0.3	0.35	0.18	0.13	0.14	0.1	0.31	0.24	0.27	0.29	0.37	0.19	(0.1-0.85)
	2015	0.57	0.57	0.97	0.48	0.53	0.56	0.32	0.16	0.46	0.27	0.26	0.21	0.13	0.08	0.07	0.14	0.07	0.08	0.13	0.11	0.32	0.38	0.87	0.41	0.34	0.25	(0.07-0.97)
	2016	0.38	0.24	0.24	0.28	0.26	0.26	0.2	0.18	0.2	0.17	0.13	0.15	0.2	0.19	0.2	0.12	0.15	0.11	0.15	0.27	0.36	0.34	0.45	0.43	0.24	0.10	(0.11-0.45)
	2017	0.33	0.18	0.13	0.18	0.21	0.17	0.21	0.3	0.3	0.14	0.06	0.08	0.03	0.04	0	0.05	0.07	0.15	0.15	0.3	0.34	0.32	0.4	0.35	0.19	0.12	(0-0.4)
	2018	0.23	0.2	0.24	0.27	0.4	0.37	0.33	0.21	0.22	0.23	0.29	0.23	0.27	0.22	0.25	0.24	0.16	0.16	0.24	0.29	0.2	0.3	0.26	0.25	0.25	0.06	(0.16-0.4)
	2019	0.24	0.22	0.26	0.24	0.31	0.22	0.19	0.21	0.22	0.22	0.22	0.23	0.25	0.25	0.24	0.23	0.23	0.21	0.41	0.26	0.32	0.22	0.32	0.32	0.25	0.05	(0.19-0.41)
	2020	0.25	0.29	0.4	0.31	0.35	0.32	0.29	0.32	0.22	0.26	0.24	0.26	0.22	0.21	0.21	0.21	0.2	0.26	0.22	0.32	0.36	0.38	0.28	0.24	0.28	0.06	(0.2-0.4)
2021	0.34	0.31	0.33	0.36	0.35	0.29	0.39	0.51	0.37	0.36	0.27	0.15	0.22	0.29	0.25	0.21	0.2	0.27	0.27	0.4	0.39	0.35	0.33	0.36	0.32	0.08	(0.15-0.51)	
																										0.28	0.06	(0.19-0.37)
Average		0.32	0.29	0.37	0.31	0.36	0.35	0.30	0.29	0.34	0.31	0.26	0.22	0.22	0.19	0.19	0.19	0.16	0.17	0.21	0.26	0.33	0.32	0.40	0.33	0.28		
Std Dev		0.12	0.12	0.26	0.09	0.11	0.16	0.10	0.13	0.18	0.23	0.17	0.10	0.12	0.09	0.10	0.09	0.06	0.07	0.09	0.10	0.06	0.06	0.20	0.07	0.07		
Range		(0.23-0.57)	(0.18-0.57)	(0.13-0.97)	(0.18-0.48)	(0.21-0.53)	(0.17-0.61)	(0.19-0.49)	(0.16-0.51)	(0.2-0.73)	(0.14-0.85)	(0.06-0.63)	(0.08-0.42)	(0.03-0.45)	(0.04-0.29)	(0-0.3)	(0.05-0.35)	(0.07-0.23)	(0.08-0.27)	(0.13-0.41)	(0.1-0.4)	(0.2-0.39)	(0.22-0.38)	(0.26-0.87)	(0.24-0.43)	(0.16-0.40)		

Table D.7: The 10th percentile "All-WD" NO₂ Monthly/Annual Tables (July to September 2014-2021)

By Hour of the Day and By Year "All WD" 10%ile NO ₂ Concentration (ppb) in Fort McKay for the Month of July for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	0.14	0.16	0.09	0.04	0.11	0.3	0.44	0.45	0.4	0.37	0.33	0.2	0.28	0.18	0.13	0.12	0.33	0.27	0.33	0.25	0.35	0.45	0.39	0.31	0.27	0.12	(0.04-0.45)
	2015	0.11	0.02	0.16	0.19	0.2	0.27	0.19	0.16	0.18	0.16	0.04	0.05	0.02	0.05	0.17	0.16	0.13	0.12	0.14	0.17	0.23	0.38	0.71	0.24	0.18	0.14	(0.02-0.71)
	2016	0.48	0.37	0.3	0.31	0.44	0.51	0.58	0.59	0.31	0.27	0.29	0.19	0.31	0.24	0.26	0.28	0.4	0.31	0.4	0.35	0.31	0.29	0.24	0.32	0.35	0.11	(0.19-0.59)
	2017	0.19	0.18	0.28	0.3	0.26	0.21	0.22	0.23	0.2	0.18	0.1	0.09	0.11	0.11	0.1	0.1	0.1	0.16	0.23	0.29	0.31	0.33	0.3	0.24	0.20	0.08	(0.09-0.33)
	2018	0.22	0.35	0.35	0.35	0.33	0.37	0.35	0.24	0.2	0.22	0.18	0.15	0.27	0.31	0.26	0.2	0.24	0.24	0.29	0.32	0.38	0.45	0.5	0.35	0.30	0.09	(0.15-0.5)
	2019	0.63	0.61	0.57	0.38	0.33	0.37	0.26	0.33	0.32	0.25	0.22	0.13	0.27	0.31	0.26	0.28	0.26	0.25	0.26	0.29	0.84	0.62	0.49	0.52	0.38	0.17	(0.13-0.84)
	2020	0.22	0.24	0.22	0.21	0.2	0.19	0.19	0.17	0.17	0.16	0.14	0.12	0.12	0.14	0.15	0.17	0.15	0.15	0.12	0.15	0.14	0.19	0.22	0.19	0.17	0.04	(0.12-0.24)
2021	0.46	0.5	0.43	0.39	0.5	0.67	0.52	0.45	0.45	0.35	0.44	0.39	0.38	0.36	0.23	0.25	0.29	0.27	0.22	0.38	0.37	0.63	0.64	0.47	0.42	0.12	(0.22-0.67)	
																										0.28	0.09	(0.17-0.42)
Average		0.31	0.30	0.30	0.27	0.30	0.36	0.34	0.33	0.28	0.25	0.22	0.17	0.22	0.21	0.20	0.20	0.24	0.22	0.25	0.28	0.37	0.42	0.44	0.33	0.28		
Std Dev		0.19	0.19	0.15	0.12	0.13	0.16	0.15	0.16	0.11	0.08	0.13	0.10	0.12	0.11	0.07	0.07	0.10	0.07	0.09	0.08	0.21	0.15	0.18	0.11	0.07		
Range		(0.11-0.63)	(0.02-0.61)	(0.09-0.57)	(0.04-0.39)	(0.11-0.5)	(0.19-0.67)	(0.19-0.58)	(0.16-0.59)	(0.17-0.45)	(0.16-0.37)	(0.04-0.44)	(0.05-0.39)	(0.02-0.38)	(0.05-0.36)	(0.1-0.26)	(0.1-0.28)	(0.1-0.4)	(0.12-0.31)	(0.12-0.4)	(0.15-0.38)	(0.14-0.84)	(0.19-0.63)	(0.22-0.71)	(0.19-0.52)	(0.16-0.44)		
By Hour of the Day and By Year "All WD" 10%ile NO2 Concentration (ppb) in Fort McKay for the Month of August for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	0.62	0.55	0.39	0.4	0.46	0.8	0.53	0.55	0.44	0.49	0.76	0.41	0.25	0.2	0.22	0.27	0.6	0.41	0.46	0.6	0.79	0.54	0.68	0.68	0.50	0.17	(0.2-0.8)
	2015	0.05	0.1	0.11	0.1	0.02	0.09	0.13	0.17	0.08	0.05	0.11	0.09	0.06	0.02	0	0	0	0	0.01	0.07	0.09	0.07	0.1	0.05	0.07	0.05	(0-0.17)
	2016	0.17	0.15	0.17	0.18	0.24	0.48	0.49	0.29	0.44	0.53	0.4	0.3	0.1	0.18	0.25	0.17	0.18	0.17	0.26	0.29	0.26	0.18	0.09	0.13	0.25	0.13	(0.09-0.53)
	2017	0.33	0.28	0.27	0.35	0.37	0.39	0.35	0.36	0.19	0.19	0.18	0.17	0.14	0.15	0.16	0.13	0.15	0.18	0.2	0.26	0.27	0.27	0.38	0.3	0.25	0.09	(0.13-0.39)
	2018	0.18	0.25	0.29	0.32	0.52	0.56	0.53	0.4	0.39	0.31	0.38	0.28	0.35	0.35	0.35	0.47	0.43	0.45	0.77	0.78	0.7	0.59	0.41	0.18	0.43	0.16	(0.18-0.78)
	2019	0.31	0.2	0.3	0.31	0.37	0.29	0.26	0.25	0.37	0.32	0.35	0.33	0.27	0.24	0.26	0.4	0.47	0.32	0.35	0.41	0.64	0.5	0.22	0.27	0.33	0.10	(0.2-0.64)
	2020	0.16	0.17	0.19	0.16	0.18	0.23	0.2	0.17	0.17	0.17	0.13	0.15	0.13	0.12	0.14	0.15	0.15	0.17	0.23	0.17	0.23	0.17	0.19	0.18	0.17	0.03	(0.12-0.23)
2021	0.24	0.3	0.26	0.28	0.29	0.38	0.36	0.27	0.32	0.32	0.28	0.35	0.32	0.34	0.38	0.27	0.16	0.17	0.2	0.25	0.43	0.57	0.26	0.26	0.30	0.09	(0.16-0.57)	
																										0.29	0.13	(0.07-0.50)
Average		0.26	0.25	0.25	0.26	0.31	0.40	0.36	0.31	0.30	0.30	0.32	0.26	0.20	0.20	0.22	0.23	0.27	0.23	0.31	0.35	0.43	0.36	0.29	0.26	0.29		
Std Dev		0.17	0.14	0.09	0.10	0.16	0.22	0.15	0.13	0.14	0.16	0.21	0.11	0.11	0.11	0.12	0.15	0.21	0.15	0.23	0.23	0.26	0.21	0.20	0.19	0.06		
Range		(0.05-0.62)	(0.1-0.55)	(0.11-0.39)	(0.1-0.4)	(0.02-0.52)	(0.09-0.8)	(0.13-0.53)	(0.17-0.55)	(0.08-0.44)	(0.05-0.53)	(0.11-0.76)	(0.09-0.41)	(0.06-0.35)	(0.02-0.35)	(0-0.38)	(0-0.47)	(0-0.6)	(0-0.45)	(0.01-0.77)	(0.07-0.78)	(0.09-0.79)	(0.07-0.59)	(0.09-0.68)	(0.05-0.68)	(0.2-0.43)		
By Hour of the Day and By Year "All WD" 10%ile NO ₂ Concentration (ppb) in Fort McKay for the Month of September for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	0.38	0.41	0.47	0.48	0.6	0.71	0.96	0.83	0.73	0.97	0.66	0.31	0.3	0.35	0.3	0.33	0.42	0.53	0.44	0.45	0.68	0.61	0.71	0.66	0.55	0.20	(0.3-0.97)
	2015	0.04	0	0	0	0.01	0.04	0.06	0.05	0.19	0.05	0.01	0	0	0	0	0	0	0.01	0	0.01	0.06	0	0.01	0.01	0.02	0.04	(0-0.19)
	2016	0.18	0.15	0.08	0.09	0.11	0.17	0.13	0.12	0.1	0.09	0.1	0.08	0.1	0.11	0.1	0.09	0.08	0.14	0.13	0.23	0.29	0.35	0.24	0.18	0.14	0.07	(0.08-0.35)
	2017	0.31	0.32	0.33	0.27	0.35	0.45	0.4	0.31	0.28	0.3	0.28	0.29	0.2	0.27	0.26	0.18	0.14	0.22	0.35	0.38	0.5	0.37	0.33	0.36	0.31	0.08	(0.14-0.5)
	2018	0.15	0.22	0.26	0.29	0.27	0.31	0.29	0.2	0.17	0.13	0.13	0.09	0.1	0.08	0.08	0.12	0.14	0.2	0.23	0.19	0.33	0.15	0.12	0.11	0.18	0.08	(0.08-0.33)
	2019	0.58	0.42	0.56	0.2	0.33	0.46	0.42	0.41	0.25	0.19	0.2	0.26	0.32	0.27	0.17	0.27	0.37	0.28	0.6	0.37	0.53	0.38	0.49	0.8	0.38	0.16	(0.17-0.8)
	2020	0.28	0.26	0.31	0.28	0.19	0.32	0.26	0.21	0.11	0.21	0.19	0.17	0.16	0.12	0.11	0.12	0.11	0.21	0.2	0.3	0.24	0.35	0.34	0.26	0.22	0.08	(0.11-0.35)
2021	0.18	0.18	0.31	0.19	0.29	0.25	0.32	0.31	0.22	0.2	0.21	0.16	0.16	0.11	0.14	0.12	0.16	0.13	0.14	0.14	0.16	0.19	0.22	0.19	0.20	0.06	(0.11-0.32)	
																										0.25	0.15	(0-0.97)
Average		0.26	0.25	0.29	0.23	0.27	0.34	0.36	0.31	0.26	0.27	0.22	0.17	0.17	0.16	0.15	0.15	0.18	0.22	0.26	0.26	0.35	0.30	0.31	0.32	0.25		
Std Dev		0.17	0.14	0.18	0.14	0.18	0.20	0.20	0.24	0.20	0.29	0.19	0.11	0.11	0.12	0.10	0.10	0.14	0.15	0.19	0.14	0.21	0.18	0.22	0.27	0.06		
Range		(0.04-0.58)	(0-0.42)	(0-0.56)	(0-0.48)	(0.01-0.6)	(0.04-0.71)	(0.06-0.96)	(0.05-0.83)	(0.1-0.73)	(0.05-0.97)	(0.01-0.66)	(0-0.31)	(0-0.32)	(0-0.35)	(0-0.3)	(0-0.33)	(0-0.42)	(0.01-0.53)	(0-0.6)	(0.01-0.45)	(0.06-0.68)	(0-0.61)	(0.01-0.71)	(0.01-0.8)	(0.14-0.36)		

Table D.8: The 10th percentile "All-WD" NO₂ Monthly/Annual Tables (October to December 2014-2021)

By Hour of the Day and By Year "All WD" 10%ile NO ₂ Concentration (ppb) in Fort McKay for the Month of October for the Period 2014-2021																													
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range	
Year	2014	0.18	0.18	0.13	0.12	0.11	0.22	0.63	0.79	0.82	0.87	0.54	0.26	0.32	0.28	0.09	0.18	0.3	0.35	0.38	0.28	0.31	0.3	0.33	0.26	0.25	0.35	0.22	(0.09-0.87)
	2015	0.46	0.49	0.36	0.4	0.34	0.65	0.89	0.64	0.43	0.31	0.24	0.1	0.12	0.11	0.08	0.14	0.17	0.2	0.69	0.41	0.53	0.52	0.68	0.36	0.39	0.22	(0.08-0.89)	
	2016	0.52	0.47	0.66	0.42	0.6	0.69	0.8	0.52	0.52	0.45	0.46	0.41	0.17	0.15	0.27	0.58	0.5	0.36	0.32	0.37	0.4	0.36	0.56	0.47	0.46	0.15	(0.15-0.8)	
	2017	0.23	0.34	0.22	0.22	0.31	0.2	0.22	0.29	0.28	0.34	0.31	0.18	0.23	0.35	0.24	0.33	0.36	0.34	0.38	0.36	0.32	0.29	0.22	0.23	0.28	0.06	(0.18-0.38)	
	2018	0.32	0.29	0.42	0.57	0.46	0.49	0.53	0.39	0.28	0.38	0.32	0.24	0.46	0.58	0.24	0.31	0.7	0.74	0.5	0.45	0.45	0.56	0.54	0.48	0.45	0.13	(0.24-0.74)	
	2019	0.3	0.2	0.34	0.37	0.26	0.39	0.31	0.34	0.36	0.31	0.31	0.29	0.27	0.2	0.21	0.29	0.27	0.55	0.47	0.53	0.31	0.29	0.24	0.3	0.32	0.09	(0.2-0.55)	
	2020	0.17	0.2	0.24	0.16	0.12	0.15	0.13	0.13	0.14	0.15	0.14	0.12	0.11	0.13	0.14	0.21	0.13	0.14	0.13	0.12	0.12	0.12	0.13	0.15	0.15	0.03	(0.11-0.24)	
	2021	0.54	0.46	0.5	0.46	0.58	0.79	0.67	0.69	0.48	0.17	0.26	0.12	0.15	0.04	0.02	0.01	0.03	0.18	0.23	0.22	0.29	0.44	0.88	0.42	0.36	0.25	(0.01-0.88)	
																										0.34	0.09	(0.15-0.46)	
Average		0.34	0.33	0.36	0.34	0.36	0.50	0.54	0.48	0.42	0.33	0.29	0.22	0.22	0.21	0.17	0.27	0.31	0.36	0.38	0.35	0.34	0.36	0.44	0.33	0.34			
Std Dev		0.15	0.13	0.17	0.16	0.17	0.23	0.29	0.23	0.22	0.13	0.09	0.11	0.12	0.18	0.09	0.17	0.22	0.20	0.18	0.13	0.12	0.14	0.27	0.12	0.09			
Range		(0.17-0.54)	(0.18-0.49)	(0.12-0.66)	(0.11-0.57)	(0.12-0.6)	(0.15-0.79)	(0.13-0.89)	(0.13-0.82)	(0.14-0.87)	(0.15-0.54)	(0.14-0.46)	(0.11-0.41)	(0.11-0.46)	(0.11-0.58)	(0.04-0.27)	(0.02-0.58)	(0.01-0.7)	(0.03-0.74)	(0.14-0.69)	(0.13-0.53)	(0.12-0.53)	(0.12-0.56)	(0.12-0.88)	(0.13-0.48)	(0.15-0.54)			
By Hour of the Day and By Year "All WD" 10%ile NO ₂ Concentration (ppb) in Fort McKay for the Month of November for the Period 2014-2021																													
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range	
Year	2014	0.78	0.63	0.42	0.49	0.47	0.48	0.59	0.78	1.19	1.1	0.86	0.77	0.94	0.84	1.31	1.89	2.88	3.73	2.69	0.89	0.45	0.49	0.8	0.72	1.09	0.86	(0.42-3.73)	
	2015	0.93	0.87	1.38	0.53	0.63	0.79	0.73	1.04	1.18	0.96	0.72	0.67	0.7	0.67	0.66	0.54	1.01	1.82	0.9	1.06	0.77	0.72	0.47	0.69	0.85	0.30	(0.47-1.82)	
	2016	0.18	0.18	0.2	0.27	0.41	0.49	0.81	0.92	0.81	1.06	0.33	0.25	0.16	0.26	0.13	0.3	0.25	0.61	0.33	0.65	0.66	0.48	0.39	0.39	0.44	0.26	(0.13-1.06)	
	2017	0.41	0.45	0.58	0.72	0.6	0.53	0.79	0.69	0.28	0.21	0.28	0.43	0.51	0.46	0.45	0.54	0.59	0.6	0.36	0.62	0.52	0.44	0.49	0.42	0.50	0.14	(0.21-0.79)	
	2018	0.56	1.09	1.14	1.17	1.28	1.3	1.6	0.86	1.65	0.93	1.64	1.72	1.54	1.41	1.88	1.9	2.15	1.72	1.35	1.13	1.17	1.51	1.6	2.49	1.45	0.43	(0.56-2.49)	
	2019	0.82	0.84	0.78	0.71	0.62	0.74	0.68	0.99	1.17	0.58	0.47	0.47	0.54	0.46	0.53	0.62	0.78	0.82	0.98	0.8	0.81	0.94	0.98	0.84	0.75	0.19	(0.46-1.17)	
	2020	1.33	2.04	0.98	1.18	1.56	1.21	0.96	0.94	0.68	1	0.6	0.57	0.99	0.8	0.88	0.59	1.31	2.07	1.89	1.22	1.47	1.27	1.82	1.46	1.20	0.44	(0.57-2.07)	
	2021	0.56	0.59	0.55	0.78	0.78	1.83	1.12	1.79	0.91	0.42	0.68	0.29	0.74	0.69	0.51	0.3	0.58	0.26	0.22	0.77	0.46	0.62	0.64	0.68	0.70	0.40	(0.22-1.83)	
																										0.87	0.33	(0.44-1.45)	
Average		0.70	0.84	0.75	0.73	0.79	0.92	0.91	1.00	0.98	0.78	0.70	0.65	0.77	0.70	0.79	0.84	1.19	1.45	1.09	0.89	0.79	0.81	0.90	0.96	0.87			
Std Dev		0.35	0.56	0.39	0.32	0.41	0.48	0.32	0.34	0.41	0.33	0.43	0.47	0.41	0.35	0.56	0.67	0.90	1.14	0.86	0.22	0.36	0.40	0.54	0.70	0.18			
Range		(0.18-1.33)	(0.18-2.04)	(0.2-1.38)	(0.27-1.18)	(0.41-1.56)	(0.48-1.83)	(0.59-1.6)	(0.69-1.79)	(0.28-1.65)	(0.21-1.1)	(0.28-1.64)	(0.25-1.72)	(0.16-1.54)	(0.26-1.41)	(0.13-1.88)	(0.3-1.9)	(0.25-2.88)	(0.26-3.73)	(0.22-2.69)	(0.62-1.22)	(0.45-1.47)	(0.44-1.51)	(0.39-1.82)	(0.39-2.49)	(0.65-1.45)			
By Hour of the Day and By Year "All WD" 10%ile NO ₂ Concentration (ppb) in Fort McKay for the Month of December																													
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range	
Year	2014	2.33	1.75	1.34	1.91	2.66	3.76	5.1	4.15	5.14	3.8	4.83	2.5	3.15	4.56	5.54	5.74	3.93	1.67	1.98	3.34	2.68	2.63	1.64	1.94	3.25	1.37	(1.34-5.74)	
	2015	2.15	1.89	1.7	1.37	1.4	0.54	1.24	1.48	1.88	1.24	1.8	1.25	1.44	0.94	0.87	1.99	3.48	2.99	3.52	2.88	2.06	2.18	2.83	1.78	1.87	0.79	(0.54-3.52)	
	2016	1.15	0.45	0.35	0.61	0.76	0.58	0.61	0.59	0.93	0.84	0.77	1.07	0.82	0.73	0.61	0.82	1.34	1.46	1.47	1.61	1.05	1.88	0.88	0.89	0.93	0.39	(0.35-1.88)	
	2017	2.8	2.54	1.4	1.56	1.85	3.92	5.12	5.62	1.47	1.42	1.24	0.39	0.56	0.5	0.47	0.76	0.39	0.26	0.32	0.44	0.42	0.85	2	1.55	1.58	1.48	(0.26-5.62)	
	2018	1.71	1.95	3.22	2.28	7	6.3	4.57	2.53	2.87	2.42	1.58	0.65	0.66	0.75	0.99	0.82	0.99	0.79	0.71	0.53	0.46	0.71	0.55	1.93	1.96	1.78		(0.46-7)
	2019	4.57	3.21	2.03	2.4	2.25	2.36	5.36	7.55	7.34	8.79	8.56	4.61	4.8	6.32	5.1	5.16	3.65	3.76	3.24	4.18	4.81	8.57	6.94	6.12	5.07	2.08	(2.03-8.79)	
	2020	1.95	1.89	0.61	1.06	1.27	1.26	0.8	0.74	1.15	2.26	1.18	1.04	0.87	1.12	1.18	1.1	1.53	1.26	1.64	1.39	1.29	1.29	1.19	1.39	1.27	0.38	(0.61-2.26)	
	2021	0.74	2.72	3.73	4.3	2.58	1.49	1.52	2.39	2.74	2.3	1.06	0.42	0.7	0.42	0.31	1.03	1.16	0.97	1.43	1.07	0.58	0.49	1.01	0.71	1.49	1.09	(0.31-4.3)	
																										2.18	1.27	(0.93-5.07)	
Average		2.18	2.05	1.80	1.94	2.47	2.53	3.04	3.13	2.94	2.88	2.63	1.49	1.63	1.92	1.88	2.18	2.06	1.65	1.79	1.93	1.67	2.33	2.13	2.04	2.18			
Std Dev		1.17	0.82	1.18	1.13	1.95	2.01	2.16	2.47	2.23	2.55	2.72	1.43	1.54	2.24	2.14	2.06	1.39	1.17	1.12	1.38	1.50	2.63	2.07	1.71	0.47			
Range		(0.74-4.57)	(0.45-3.21)	(0.35-3.73)	(0.61-4.3)	(0.76-7)	(0.54-6.3)	(0.61-5.36)	(0.59-7.55)	(0.93-7.34)	(0.84-8.79)	(0.77-8.56)	(0.39-4.61)	(0.56-4.8)	(0.42-6.32)	(0.31-5.54)	(0.76-5.74)	(0.39-3.93)	(0.26-3.76)	(0.32-3.52)	(0.44-4.18)	(0.42-4.81)	(0.49-8.57)	(0.55-6.94)	(0.71-6.12)	(1.49-3.13)			

Table D.9: The Wind Direction Screened NO₂ Percentile by Hour of the Day and by Month Tables (January and February for entire 2014-2021 Period) with 25th percentile and 50th percentile Values Highlighted in “Red”

By Hour of the Day and WD Screened %ile NO ₂ Concentrations (ppb) in Fort McKay for the Month of January for the Period 2014-2021																									
Percentile	Hr of the day																								Ave.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
10%	0.18	0.40	0.27	0.35	0.37	0.45	0.33	0.39	0.46	0.29								0.42	0.30	0.20	0.20	0.46	0.30	0.32	0.33
15%	0.25	0.45	0.37	0.53	0.41	0.81	0.47	0.41	0.48	0.39	0.18			0.20	0.20	0.38	0.38	0.50	0.37	0.24	0.31	0.58	0.31	0.37	0.39
20%	0.31	0.49	0.53	0.53	0.63	1.01	0.62	0.44	0.57	0.49	0.25	0.11	0.34	0.26	0.24	0.41	0.58	0.56	0.45	0.36	0.55	0.69	0.44	0.40	0.47
25%	0.32	0.55	0.76	0.71	0.82	1.70	0.94	0.47	0.71	0.71	0.31	0.16	0.36	0.29	0.28	0.44	0.78	0.61	0.52	0.44	0.65	1.09	0.65	0.56	0.62
30%	0.33	0.60	0.82	1.04	0.95	4.39	1.67	0.53	0.77	0.71	0.36	0.21	0.39	0.30	0.36	0.44	0.78	0.85	0.58	0.52	0.77	2.17	0.73	0.67	0.87
35%	0.34	0.61	0.88	1.61	1.67	8.00	1.80	0.66	0.82	0.77	0.43	0.26	0.45	0.34	0.44	0.44	0.78	1.05	0.61	0.60	4.06	4.50	0.77	0.75	1.36
40%	0.35	0.61	0.92	2.80	2.54	9.90	3.95	1.12	0.82	0.88	0.57	0.32	0.57	0.43	0.52	0.51	0.81	1.17	0.70	1.37	6.58	5.26	0.83	1.22	1.86
45%	0.37	0.80	1.11	5.03	3.49	12.60	10.49	1.51	3.20	1.15	0.74	0.49	0.70	0.51	0.61	0.63	0.87	2.50	0.91	2.05	9.34	8.77	2.46	1.61	3.00
50%	0.39	0.98	1.83	8.50	10.78	15.63	13.90	1.73	6.76	1.81	1.12	0.66	0.82	0.54	0.70	0.75	0.93	4.42	1.34	2.47	13.23	12.60	6.98	2.28	4.63
55%	0.60	5.94	3.30	11.47	18.35	17.36	14.50	2.39	7.04	4.20	1.49	0.83	1.33	0.56	0.72	0.81	1.14	11.35	2.07	2.85	16.05	15.28	10.99	6.76	6.56
60%	0.81	10.90	8.51	14.07	20.52	18.17	15.56	3.04	8.47	7.67	2.91	1.00	1.83	5.73	0.74	0.86	1.34	16.19	3.61	9.17	17.12	17.12	12.66	12.53	8.77
65%	3.40	12.05	12.71	16.27	21.66	22.37	16.74	4.17	12.19	10.38	4.46	4.67	2.34	11.54	0.77	1.14	5.72	16.86	5.56	18.77	17.40	19.77	16.77	14.98	11.36
70%	6.00	13.20	14.84	17.76	22.38	24.65	17.81	8.15	15.22	11.87	6.50	8.34	3.24	14.25	0.82	1.65	14.27	21.47	7.45	21.23	19.61	23.30	18.55	17.11	13.73
75%	10.94	16.12	17.43	18.86	23.29	25.37	20.59	12.74	17.90	13.08	8.79	12.01	4.34	15.40	0.86	2.16	22.82	28.04	8.05	24.49	24.86	24.80	20.57	18.49	16.33
80%	15.88	19.05	19.46	20.91	25.10	25.78	22.28	16.43	20.18	14.46	10.69	15.69	5.44	16.26	3.02	14.15	24.72	31.05	14.20	27.40	26.12	26.99	24.61	20.06	19.16
85%	17.81	25.87	22.36	25.72	27.32	26.84	25.59	17.31	23.07	20.62	12.11			16.76	5.19	26.14	26.63	33.32	23.80	28.63	28.15	28.52	27.68	22.01	23.25
90%	19.75	32.69	27.20	29.42	27.68	29.17	29.29	20.69	27.17	25.20								34.07	33.30	29.26	31.55	29.47	28.65	27.16	28.34
By Hour of the Day and WD Screened %ile NO ₂ Concentrations (ppb) in Fort McKay for the Month of February for the Period 2014-2021																									
Percentile	Hr of the day																								Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
10%	0.14	0.18	0.43	0.17	0.30	0.27	0.33	0.31	0.29	0.29	0.30				0.22		0.11	0.12	0.32	0.23	0.19	0.35	0.32	0.39	0.26
15%	0.31	0.43	0.53	0.38	0.43	0.31	0.35	0.36	0.31	0.36	0.32	0.26	0.20	0.23	0.23	0.21	0.16	0.14	0.50	0.29	0.30	0.43	0.53	0.50	0.34
20%	1.48	0.75	0.69	0.53	0.61	0.34	0.40	0.50	0.49	0.44	0.35	0.27	0.21	0.23	0.24	0.22	0.17	0.17	1.08	0.63	0.30	0.60	1.02	0.67	0.52
25%	3.17	0.85	0.86	1.12	2.51	0.39	0.58	0.68	0.56	0.48	0.38	0.28	0.22	0.25	0.25	0.23	0.18	0.22	1.49	0.73	0.39	1.03	1.79	0.90	0.81
30%	3.70	0.86	0.90	1.32	3.09	0.55	1.50	0.73	0.65	0.52	0.39	0.28	0.23	0.29	0.26	0.24	0.20	0.25	1.66	0.82	0.87	2.08	2.67	3.30	1.14
35%	4.66	0.91	1.15	1.37	4.22	0.87	3.26	1.13	0.98	0.53	0.45	0.29	0.26	0.32	0.28	0.25	0.22	0.27	1.94	1.64	1.35	3.54	3.61	5.26	1.61
40%	6.49	3.34	1.82	1.52	5.53	1.43	4.66	2.22	1.22	0.54	0.60	0.32	0.31	0.32	0.30	0.25	0.23	0.70	2.43	6.23	1.42	9.08	4.74	6.35	2.59
45%	9.19	6.32	2.82	2.53	7.87	1.91	6.60	3.46	2.59	1.32	0.69	0.34	0.37	0.32	0.31	0.26	0.24	1.29	3.51	9.21	2.05	20.16	6.56	11.81	4.24
50%	12.33	9.49	3.97	3.17	10.64	2.86	7.92	4.08	5.53	2.10	0.76	0.36	0.39	0.35	0.31	0.26	0.27	1.59	5.73	10.34	4.05	21.42	9.51	14.08	5.48
55%	12.89	11.04	6.32	4.42	12.10	5.55	7.97	4.20	7.86	2.49	0.78	0.37	0.41	0.38	0.51	0.26	0.37	2.08	7.46	11.59	7.47	24.43	12.80	14.82	6.61
60%	14.00	12.38	8.18	7.25	12.38	8.56	8.87	4.26	9.16	2.88	0.82	0.39	0.42	0.43	0.70	0.76	0.50	4.77	8.21	12.04	12.37	26.56	14.98	15.87	7.78
65%	16.21	13.49	9.06	7.51	12.55	10.14	10.18	4.77	11.06	3.36	0.91	0.41	0.42	0.48	1.15	1.62	0.71	7.99	8.63	12.85	15.98	27.70	15.25	17.45	8.75
70%	17.50	14.12	11.70	8.37	13.45	11.88	12.77	11.30	12.77	3.83	2.78	0.75	0.51	0.57	1.60	2.49	0.87	12.61	14.93	14.34	22.68	28.37	18.01	20.16	10.76
75%	18.33	15.14	15.21	9.52	14.01	14.76	17.29	14.96	15.08	6.28	5.56	1.24	0.64	0.67	2.32	5.31	1.01	17.48	23.33	17.60	28.57	28.72	18.45	24.60	13.17
80%	19.32	16.82	17.00	10.60	18.37	15.93	20.70	19.06	20.45	8.72	10.73	4.35	1.45	0.74	3.04	8.91	1.62	22.64	28.00	25.70	29.79	29.38	22.85	25.42	15.90
85%	21.43	19.81	20.92	12.38	23.08	20.92	21.77	24.44	21.68	10.16	17.72	10.75	3.11	0.76	6.78	12.51	3.25	27.93	29.07	26.70	30.25	31.63	26.25	27.13	18.77
90%	25.80	21.97	29.08	22.10	26.52	23.68	27.48	30.20	22.85	11.59	28.35				10.53		6.95	33.30	30.50	29.97	36.44	36.14	27.61	29.14	25.51

Table D.10: The Wind Direction Screened NO₂ Percentile by Hour of the Day and by Month Tables (March and April for entire 2014-2021 Period) with 25th percentile and 50th percentile Values Highlighted in “Red”

By Hour of the Day and WD Screened %ile NO ₂ Concentrations (ppb) in Fort McKay for the Month of March for the Period 2014-2021																									
Percentile	Hr of the day																								Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
10%	0.24	0.56	0.54	0.68	0.47	1.06	0.36	0.54	0.26							0.19		0.23		0.33	0.28	0.25	0.33	0.27	0.41
15%	1.24	0.67	0.58	0.92	0.59	1.42	0.39	0.76	0.31	0.24	0.23		0.21		0.18	0.19	0.28	0.26	0.33	0.38	0.29	0.35	0.46	0.50	0.49
20%	2.11	0.82	0.94	1.28	1.15	1.96	0.40	1.64	0.40	0.29	0.23		0.22	0.21	0.19	0.19	0.38	0.30	0.36	0.43	0.54	0.53	0.54	0.62	0.68
25%	2.64	0.98	1.34	2.06	1.94	2.86	0.68	2.67	0.57	0.36	0.25	0.24	0.23	0.22	0.20	0.22	0.48	0.33	0.43	0.48	0.71	0.62	0.97	1.00	0.94
30%	3.92	1.23	1.67	3.53	2.12	3.38	0.88	3.62	0.72	0.45	0.28	0.25	0.26	0.22	0.22	0.25	0.50	0.37	0.53	0.58	0.74	0.66	1.22	2.57	1.26
35%	5.93	2.13	2.68	4.18	2.66	3.81	1.09	4.21	0.84	0.57	0.32	0.25	0.28	0.23	0.24	0.28	0.52	0.41	0.61	0.66	0.81	0.74	6.32	4.53	1.85
40%	7.22	2.82	3.46	6.04	4.32	5.50	1.44	5.81	1.13	0.73	0.35	0.26	0.53	0.25	0.28	0.31	0.55	0.42	0.61	0.67	1.09	0.92	6.98	5.45	2.38
45%	8.34	3.46	3.98	6.94	5.35	6.36	1.51	7.48	1.48	0.86	0.39	0.26	1.00	0.27	0.33	0.34	0.59	0.43	0.63	1.01	1.82	1.00	8.24	7.84	2.91
50%	10.57	4.92	4.32	7.77	7.54	6.80	1.99	8.99	1.58	0.88	0.48	0.27	1.47	0.29	0.42	0.37	0.64	0.43	0.76	1.37	2.69	1.35	10.53	8.33	3.53
55%	11.43	6.86	5.20	8.73	10.03	8.77	2.54	9.17	1.66	0.89	0.56	1.59	2.23	0.39	0.51	0.43	0.64	0.45	0.90	1.64	4.94	3.30	11.91	10.77	4.40
60%	11.67	8.36	7.34	9.56	11.40	9.74	2.80	11.17	1.81	1.07	0.57	2.91	2.98	0.50	0.55	0.48	0.64	0.50	0.93	1.72	11.65	8.15	12.23	11.63	5.43
65%	14.76	9.04	9.78	10.41	12.22	10.39	4.54	14.14	2.13	1.27	0.58	4.23	3.98	0.60	0.57	0.53	0.65	0.58	0.96	2.13	14.21	10.99	12.78	11.88	6.39
70%	17.61	10.93	11.22	10.65	13.01	11.36	8.77	14.80	2.89	1.50	0.60	5.55	5.22	0.73	0.60	0.57	0.66	0.67	7.15	6.97	14.96	13.37	16.28	12.26	7.85
75%	19.53	11.70	12.28	10.86	13.58	12.40	13.68	15.75	3.54	1.74	0.64	6.87	6.46	0.87	0.64	0.65	0.67	0.77	16.42	12.52	15.93	14.94	23.38	13.95	9.57
80%	21.37	14.16	14.61	11.64	14.62	16.92	17.49	16.79	4.07	2.54	0.69		10.64	1.02	0.72	0.73	5.78	0.88	24.05	15.07	17.73	15.34	27.31	18.25	11.85
85%	22.82	16.01	16.34	16.56	17.75	19.74	21.38	17.80	6.05	4.05	0.77		14.83		0.87	2.01	10.89	2.88	29.60	15.16	20.36	20.64	30.39	24.01	15.04
90%	24.42	19.12	20.50	25.27	21.84	22.22	24.33	23.87	8.86							3.29		8.64		16.82	26.55	32.74	32.40	28.31	21.20
By Hour of the Day and WD Screened %ile NO ₂ Concentrations (ppb) in Fort McKay for the Month of April for the Period 2014-2021																									
Percentile	Hr of the day																								Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
10%	0.39	0.26	0.25	0.22	0.25	0.32	0.25						0.04	0.08	0.02	0.13	0.15	0.14	0.07		0.17	0.12	0.15	0.26	0.18
15%	0.47	0.34	0.32	0.26	0.31	0.35	0.32	0.24	0.14	0.12	0.15	0.07	0.07	0.15	0.04	0.16	0.16	0.15	0.14	0.17	0.19	0.23	0.31	0.31	0.22
20%	0.48	0.38	0.52	0.26	0.33	0.36	0.33	0.26	0.18	0.14	0.16	0.12	0.09	0.16	0.14	0.19	0.16	0.15	0.20	0.18	0.21	0.24	0.39	0.84	0.27
25%	0.52	0.39	1.14	0.27	0.35	0.36	0.33	0.27	0.22	0.17	0.16	0.17	0.13	0.18	0.17	0.21	0.18	0.16	0.22	0.20	0.25	0.27	0.94	2.08	0.39
30%	0.66	0.40	1.52	0.33	0.37	0.38	0.35	0.28	0.25	0.20	0.17	0.17	0.17	0.20	0.18	0.22	0.20	0.17	0.24	0.24	0.28	0.31	1.29	3.13	0.49
35%	1.60	0.67	2.15	0.59	0.39	0.41	0.39	0.29	0.27	0.22	0.18	0.18	0.21	0.20	0.20	0.23	0.21	0.20	0.24	0.27	0.32	0.35	1.60	3.67	0.63
40%	3.30	2.21	2.65	1.49	0.41	0.47	0.49	0.30	0.29	0.22	0.20	0.19	0.26	0.23	0.22	0.25	0.23	0.22	0.25	0.30	0.36	0.38	2.02	4.43	0.89
45%	4.20	4.09	3.10	3.30	0.43	0.57	0.70	0.31	0.30	0.23	0.20	0.21	0.27	0.28	0.23	0.27	0.23	0.25	0.29	0.33	0.37	0.40	3.54	4.89	1.21
50%	4.71	5.02	4.35	4.81	0.46	0.71	1.29	0.32	0.30	0.26	0.21	0.23	0.28	0.35	0.25	0.31	0.24	0.29	0.34	0.40	0.38	0.78	4.20	6.24	1.53
55%	5.19	5.77	5.18	5.60	0.79	3.17	1.96	0.93	0.31	0.28	0.21	0.23	0.32	0.35	0.28	0.32	0.25	0.33	0.39	0.47	1.23	1.31	4.70	6.33	1.91
60%	5.69	5.98	5.70	6.11	1.64	3.79	2.52	1.55	0.31	0.31	0.22	0.23	0.35	0.39	0.30	0.32	0.30	0.34	0.44	0.77	2.07	1.92	5.77	6.48	2.23
65%	6.13	6.35	6.62	6.50	1.87	4.16	2.99	3.04	0.66	0.33	0.24	0.25	0.37	0.43	0.31	0.34	0.36	0.36	0.45	1.10	2.59	3.87	6.52	7.27	2.63
70%	6.75	7.73	6.96	7.01	3.88	4.92	3.53	5.42	1.35	0.34	0.26	0.29	0.39	0.47	0.32	0.36	0.43	0.38	0.46	2.23	3.11	6.07	7.33	9.22	3.30
75%	7.58	8.40	7.48	7.55	5.57	5.77	4.58	7.80	2.05	0.34	0.28	0.33	0.50	0.50	0.33	0.43	0.48	0.43	0.48	3.77	3.82	6.33	8.76	12.38	4.00
80%	7.80	10.61	8.57	9.17	6.44	6.49	5.60	9.29	5.01	0.79	0.30	0.52	0.61	0.53	0.40	0.53	0.52	0.46	0.50	5.30	4.54	7.76	11.36	14.55	4.90
85%	8.44	12.56	9.19	10.18	7.55	8.24	6.70	10.77	7.97	1.80	0.33	0.70	0.70	0.55	0.63	0.66	0.66	0.52	0.61	6.84	4.81	9.79	17.69	15.70	5.98
90%	9.59	13.29	13.55	12.43	9.39	9.57	8.99						0.79	0.64	1.57	1.00	0.85	1.14	0.73		5.09	10.30	21.56	19.65	7.78

Table D.11: The Wind Direction Screened NO₂ Percentile by Hour of the Day and by Month Tables (May and June for entire 2014-2021 Period) with 25th percentile and 50th percentile Values Highlighted in “Red”

By Hour of the Day and WD Screened %ile NO ₂ Concentrations (ppb) in Fort McKay for the Month of May for the Period 2014-2021																									
Percentile	Hr of the day																								Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
10%	0.18	0.39	0.55	0.21	0.22	0.21	0.14	0.06		0.14			0.00		0.00	0.00		0.00				0.29	0.27	0.20	0.18
15%	0.29	0.42	1.33	0.46	0.48	0.22	0.19	0.11	0.17	0.14		0.00	0.03	0.05	0.01	0.01	0.09	0.04	0.10		0.42	0.34	0.44	0.34	0.26
20%	0.42	0.49	1.67	0.57	0.64	0.23	0.21	0.17	0.19	0.14	0.02	0.01	0.06	0.07	0.02	0.02	0.18	0.07	0.23	0.13	0.52	0.36	0.58	0.46	0.31
25%	0.56	0.93	2.38	0.85	0.72	0.32	0.24	0.20	0.20	0.19	0.03	0.02	0.08	0.09	0.04	0.03	0.27	0.07	0.35	0.17	0.61	0.42	0.69	0.46	0.41
30%	1.15	2.49	2.90	1.69	1.03	0.42	0.28	0.23	0.22	0.24	0.03	0.05	0.10	0.11	0.06	0.04	0.34	0.07	0.45	0.21	0.67	1.13	0.76	0.64	0.64
35%	1.71	3.85	3.10	2.06	1.44	0.88	0.34	0.25	0.25	0.26	0.05	0.08	0.13	0.14	0.08	0.06	0.35	0.15	0.46	0.25	0.68	1.44	0.80	0.81	0.82
40%	2.39	4.17	4.15	3.05	1.76	1.07	0.35	0.28	0.27	0.28	0.07	0.11	0.17	0.17	0.10	0.09	0.37	0.22	0.48	0.28	0.69	1.72	0.83	1.30	1.02
45%	2.93	4.58	4.93	3.85	2.53	1.35	0.39	0.32	0.29	0.29	0.09	0.14	0.20	0.20	0.12	0.12	0.38	0.29	0.49	0.31	0.72	2.05	2.03	2.00	1.27
50%	3.47	5.21	5.14	4.27	2.82	1.69	0.48	0.36	0.30	0.30	0.12	0.18	0.23	0.21	0.19	0.19	0.40	0.37	0.52	0.34	0.77	2.23	2.51	2.58	1.45
55%	4.23	6.22	5.18	4.87	3.25	1.94	1.34	0.45	0.30	0.40	0.16	0.21	0.23	0.22	0.26	0.26	0.41	0.46	0.54	0.35	0.82	2.40	2.66	3.05	1.68
60%	4.95	6.82	5.20	5.56	3.69	2.57	1.83	0.54	0.40	0.50	0.21	0.25	0.23	0.24	0.31	0.39	0.47	0.55	0.59	0.37	1.45	3.34	2.83	3.66	1.96
65%	6.17	7.37	5.66	6.81	4.04	2.59	2.07	0.82	0.57	0.64	0.25	0.27	0.23	0.26	0.34	0.51	0.56	0.61	0.66	0.38	2.53	4.12	4.20	5.08	2.36
70%	7.32	7.90	6.66	7.48	5.32	3.32	2.47	1.11	0.74	0.79	0.27	0.28	0.23	0.28	0.35	0.60	0.64	0.67	0.72	0.42	3.60	4.68	4.95	5.44	2.76
75%	7.96	8.67	6.94	8.72	5.95	4.71	4.34	1.31	1.35	0.95	0.28	0.29	0.26	0.42	0.40	0.73	0.68	0.70	1.23	0.48	4.29	5.78	5.98	6.89	3.31
80%	8.11	10.54	9.24	10.11	9.46	4.89	6.30	1.52	2.14	1.11	0.29	0.87	0.28	0.59	0.48	0.91	0.71	0.72	1.93	0.54	4.84	5.90	8.14	8.08	4.07
85%	10.97	11.57	12.46	10.68	10.53	5.56	7.03	3.89	2.93	2.84		1.45	0.55	0.77	1.85	1.26	0.74	2.59	2.62		5.39	8.84	10.18	8.81	5.61
90%	12.73	11.78	13.72	13.66	12.37	5.96	9.38	6.26		4.58			0.82		3.96	1.70		4.45				12.81	11.72	12.22	8.63
By Hour of the Day and WD Screened %ile NO ₂ Concentrations (ppb) in Fort McKay for the Month of June for the Period 2014-2021																									
Percentile	Hr of the day																								Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
10%	0.20	0.21	0.20	0.16	0.21	0.16	0.10	0.04		0.01		0.04	0.03			0.00	0.02	0.03	0.10	0.09	0.13	0.21	0.55	0.29	0.14
15%	0.24	0.25	0.23	0.28	0.25	0.19	0.16	0.09	0.19	0.02	0.01	0.11	0.12	0.02	0.00	0.01	0.06	0.06	0.11	0.14	0.19	0.33	0.85	0.36	0.18
20%	0.33	0.33	0.33	0.44	0.35	0.27	0.17	0.17	0.21	0.04	0.03	0.17	0.18	0.06	0.00	0.04	0.09	0.08	0.13	0.16	0.19	0.54	1.01	0.66	0.25
25%	0.42	0.56	0.50	0.47	0.42	0.32	0.18	0.19	0.23	0.07	0.04	0.20	0.18	0.10	0.02	0.15	0.12	0.09	0.18	0.18	0.25	0.82	1.19	0.93	0.32
30%	0.51	0.69	0.79	0.84	0.59	0.33	0.22	0.20	0.24	0.12	0.05	0.23	0.19	0.14	0.04	0.20	0.15	0.12	0.23	0.24	0.40	1.05	1.28	0.97	0.41
35%	1.03	1.19	1.30	1.14	0.66	0.79	0.24	0.20	0.26	0.16	0.06	0.24	0.21	0.18	0.07	0.23	0.19	0.15	0.27	0.28	0.46	1.48	1.38	1.03	0.55
40%	1.48	1.63	1.83	1.28	0.83	1.05	0.36	0.21	0.27	0.21	0.06	0.26	0.24	0.21	0.11	0.26	0.21	0.17	0.27	0.29	0.53	1.60	1.44	1.14	0.66
45%	1.82	2.27	2.29	1.45	0.99	1.33	0.63	0.21	0.28	0.25	0.07	0.36	0.28	0.22	0.15	0.31	0.24	0.20	0.28	0.34	0.66	1.71	1.73	1.27	0.81
50%	2.60	3.03	2.57	2.19	1.29	1.69	0.85	0.23	0.35	0.26	0.11	0.46	0.31	0.22	0.18	0.36	0.27	0.23	0.30	0.37	1.04	1.80	2.05	1.39	1.00
55%	3.19	3.75	3.55	3.02	1.45	2.14	1.00	0.23	0.41	0.27	0.15	0.52	0.34	0.23	0.21	0.53	0.33	0.25	0.36	0.55	1.48	2.18	2.31	1.71	1.26
60%	3.45	4.78	3.67	3.31	1.67	2.70	1.04	0.23	0.49	0.27	0.16	0.58	0.37	0.24	0.22	0.91	0.58	0.30	0.52	1.07	1.90	2.33	2.59	2.29	1.49
65%	3.73	4.93	3.91	3.94	1.85	3.29	1.39	0.27	0.57	0.31	0.16	0.81	0.42	0.28	0.24	1.00	0.94	0.47	0.67	1.35	2.21	2.65	2.88	3.07	1.72
70%	4.10	5.36	5.01	4.71	2.76	3.83	3.09	0.33	0.67	0.45	0.17	1.04	0.53	0.34	0.24	1.31	1.11	0.61	0.98	1.69	2.44	2.95	2.96	3.37	2.09
75%	5.61	6.47	5.98	5.30	3.00	4.33	3.76	0.40	0.78	0.59	0.17	2.23	0.60	0.40	0.25	1.61	1.53	0.71	1.56	2.05	2.47	3.24	3.32	4.07	2.52
80%	7.44	7.84	6.73	5.85	3.72	4.57	4.40	0.40	1.35	0.73	0.26	3.42	0.64	0.99	0.25	1.67	2.05	0.87	2.52	2.38	2.79	3.80	3.73	4.56	3.04
85%	9.48	9.57	7.39	6.41	6.00	4.64	4.79	1.27	2.48	1.03	0.44	5.99	1.12	1.58	0.27	1.74	2.59	1.30	5.13	2.91	3.24	5.33	4.11	6.60	3.98
90%	9.91	10.55	7.85	8.93	7.12	5.12	4.84	1.27	1.60	0.85	0.30	4.45	0.78	0.99	0.26	1.74	2.51	1.34	4.95	2.88	3.17	6.89	4.33	7.02	4.15

Table D.12: The Wind Direction Screened NO₂ Percentile by Hour of the Day and by Month Tables (July and August for entire 2014-2021 Period) with 25th percentile and 50th percentile Values Highlighted in “Red”

By Hour of the Day and WD Screened %ile NO ₂ Concentrations (ppb) in Fort McKay for the Month of July for the Period 2014-2021																									
Percentile	Hr of the day																								Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
10%	0.12	0.17	0.19	0.20	0.11	0.23	0.14	0.14	0.07	0.06		0.04	0.04	0.08	0.05	0.08	0.09	0.07	0.04	0.05	0.10	0.17	0.18	0.15	0.11
15%	0.17	0.21	0.26	0.25	0.18	0.27	0.17	0.16	0.08	0.07	0.04	0.07	0.08	0.10	0.11	0.09	0.11	0.09	0.07	0.07	0.17	0.23	0.22	0.28	0.15
20%	0.37	0.26	0.28	0.29	0.19	0.30	0.18	0.16	0.09	0.07	0.06	0.08	0.10	0.11	0.19	0.10	0.13	0.13	0.12	0.10	0.21	0.28	0.36	0.34	0.19
25%	0.57	0.35	0.32	0.33	0.33	0.46	0.20	0.24	0.10	0.07	0.07	0.08	0.10	0.15	0.21	0.11	0.15	0.13	0.18	0.13	0.23	0.33	0.57	0.38	0.24
30%	0.76	0.40	0.34	0.35	0.45	0.47	0.21	0.51	0.16	0.07	0.08	0.10	0.11	0.19	0.22	0.11	0.17	0.15	0.24	0.20	0.24	0.41	0.67	0.46	0.29
35%	1.35	0.67	0.39	0.38	0.56	0.50	0.24	0.57	0.18	0.08	0.09	0.11	0.12	0.20	0.23	0.15	0.20	0.16	0.34	0.29	0.28	0.65	0.70	0.65	0.38
40%	1.53	0.72	0.44	0.43	0.75	0.60	0.35	0.62	0.24	0.08	0.09	0.11	0.21	0.22	0.25	0.18	0.21	0.19	0.52	0.43	0.34	0.77	0.99	0.88	0.46
45%	1.88	0.80	0.54	0.57	1.10	0.70	0.47	0.69	0.33	0.09	0.09	0.18	0.23	0.25	0.25	0.21	0.24	0.22	0.58	0.51	0.71	0.88	1.21	1.29	0.58
50%	2.04	1.00	0.58	1.45	1.21	0.82	0.59	0.76	0.38	0.10	0.09	0.25	0.27	0.28	0.26	0.28	0.25	0.28	0.60	0.59	0.92	0.94	1.55	1.50	0.71
55%	2.60	1.27	1.22	1.72	1.34	1.64	0.72	0.92	0.44	0.14	0.12	0.30	0.32	0.29	0.26	0.33	0.29	0.36	0.61	0.67	0.99	0.98	1.98	1.84	0.89
60%	2.78	1.45	2.06	1.97	2.06	2.01	0.88	1.19	0.46	0.18	0.15	0.31	0.33	0.30	0.29	0.48	0.41	0.49	0.62	0.75	1.01	1.12	2.41	2.32	1.08
65%	3.12	2.05	2.66	2.16	3.45	2.30	1.15	1.40	0.77	0.19	0.17	0.34	0.38	0.32	0.43	0.58	0.46	0.51	0.69	0.89	1.04	2.65	3.03	3.03	1.41
70%	3.68	3.29	2.93	2.41	3.74	2.66	1.69	2.16	1.27	0.25	0.17	0.36	0.46	0.35	0.71	0.64	0.53	0.63	0.85	0.96	1.11	3.46	3.70	3.80	1.74
75%	3.87	5.58	3.58	3.00	4.60	2.89	2.56	3.05	1.44	0.34	0.17	0.54	0.50	0.46	1.09	0.72	0.58	1.04	1.33	1.03	1.33	3.77	5.27	4.36	2.21
80%	4.21	7.21	4.39	3.82	4.90	4.19	3.48	3.95	3.26	0.45	0.32	1.04	0.52	0.58	1.28	0.81	0.66	1.94	2.34	1.24	2.69	4.14	7.20	5.52	2.92
85%	4.83	7.73	5.58	7.18	6.60	5.12	4.59	4.56	5.29	0.83	0.47	1.24	2.10	0.65	1.38	0.99	0.67	3.24	5.03	1.62	3.26	4.46	8.40	5.70	3.81
90%	7.70	8.49	6.78	7.70	7.27	5.54	5.86	4.79	10.62	1.77		1.36	4.18	0.66	1.55	1.48	1.65	3.97	8.40	2.09	4.70	6.80	9.85	6.93	5.22
By Hour of the Day and WD Screened %ile NO ₂ Concentrations (ppb) in Fort McKay for the Month of August for the Period 2014-2021																									
Percentile	Hr of the day																								Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
10%	0.09	0.11	0.13	0.13	0.19	0.15	0.12	0.05	0.09	0.04	0.00	0.00	0.00	0.00	0.03	0.01	0.08	0.10	0.01	0.08	0.11	0.10	0.14	0.04	0.07
15%	0.13	0.14	0.17	0.16	0.23	0.25	0.14	0.07	0.11	0.10	0.01	0.05	0.00	0.01	0.08	0.03	0.09	0.10	0.04	0.12	0.14	0.14	0.15	0.15	0.11
20%	0.16	0.15	0.20	0.19	0.24	0.31	0.14	0.10	0.12	0.11	0.01	0.11	0.02	0.08	0.10	0.05	0.10	0.11	0.10	0.16	0.17	0.16	0.18	0.16	0.13
25%	0.18	0.18	0.31	0.27	0.27	0.48	0.20	0.14	0.13	0.12	0.06	0.11	0.06	0.11	0.11	0.08	0.10	0.12	0.11	0.17	0.21	0.18	0.21	0.16	0.17
30%	0.21	0.23	0.36	0.29	0.33	0.59	0.24	0.17	0.14	0.13	0.11	0.11	0.09	0.12	0.12	0.09	0.12	0.12	0.17	0.18	0.25	0.21	0.22	0.18	0.20
35%	0.39	0.54	0.43	0.31	0.49	0.69	0.27	0.17	0.15	0.15	0.11	0.12	0.10	0.14	0.16	0.09	0.13	0.13	0.26	0.21	0.26	0.30	0.28	0.24	0.26
40%	0.61	0.91	0.49	0.40	0.61	0.85	0.32	0.18	0.17	0.17	0.12	0.14	0.12	0.15	0.19	0.11	0.14	0.13	0.27	0.29	0.30	0.36	0.40	0.32	0.32
45%	1.00	1.22	0.90	0.46	0.74	1.00	0.36	0.26	0.19	0.17	0.12	0.14	0.13	0.17	0.20	0.12	0.14	0.16	0.28	0.32	0.55	0.50	0.74	0.55	0.43
50%	1.27	1.31	1.23	0.50	1.59	1.13	0.42	0.43	0.20	0.17	0.12	0.15	0.14	0.20	0.21	0.12	0.16	0.17	0.30	0.38	0.74	0.60	1.02	0.81	0.56
55%	1.44	1.37	1.44	0.86	2.09	1.68	0.49	0.52	0.20	0.18	0.12	0.21	0.14	0.21	0.24	0.13	0.19	0.20	0.31	0.46	0.90	0.70	1.26	1.04	0.68
60%	1.58	1.76	2.21	1.50	2.41	2.05	0.54	0.63	0.22	0.21	0.13	0.28	0.15	0.28	0.28	0.14	0.22	0.22	0.32	0.54	1.10	0.95	1.42	1.19	0.85
65%	2.27	1.87	2.70	1.66	2.60	2.32	0.80	0.93	0.23	0.38	0.14	0.53	0.18	0.37	0.33	0.14	0.34	0.29	0.36	0.71	1.40	1.22	1.73	1.76	1.05
70%	2.61	2.12	3.42	2.36	3.21	2.68	1.02	1.41	0.45	0.62	0.15	0.79	0.27	0.45	0.36	0.14	0.39	0.33	0.43	1.02	2.00	1.87	1.99	3.25	1.39
75%	3.09	3.26	3.57	2.59	4.03	2.91	1.62	2.15	0.71	0.88	0.53	0.99	0.33	0.70	0.41	0.15	1.14	0.34	0.47	1.08	2.61	3.27	3.00	3.41	1.80
80%	4.00	3.90	4.50	3.15	4.55	5.63	2.28	3.70	0.85	2.37	0.92	1.20	0.35	1.63	0.73	0.30	1.96	0.45	0.57	1.18	3.00	3.85	3.29	4.63	2.46
85%	4.39	4.43	4.82	4.94	4.83	5.93	2.61	5.40	1.69	4.48	1.13	2.74	0.71	4.11	1.71	0.88	2.23	0.75	0.64	1.28	4.45	6.11	3.63	6.77	3.36
90%	5.21	5.88	7.07	5.92	5.66	7.58	4.84	6.75	2.15	4.82	1.35	4.29	1.26	4.51	4.46	2.32	3.60	2.18	0.77	1.84	8.20	7.60	5.61	8.38	4.68

Table D.13: The Wind Direction Screened NO₂ Percentile by Hour of the Day and by Month Tables (September and October for entire 2014-2021 Period) with 25th percentile and 50th percentile Values Highlighted in “Red”

By Hour of the Day and WD Screened %ile NO ₂ Concentrations (ppb) in Fort McKay for the Month of September for the Period 2014-2021																									
Percentile	Hr of the day																								Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
10%	0.07	0.03	0.06	0.01	0.09	0.09	0.12	0.07	0.09	0.00	0.06	0.04	0.04	0.11	0.02	0.07	0.06	0.08	0.05	0.05	0.04	0.05	0.07	0.10	0.06
15%	0.09	0.08	0.11	0.08	0.12	0.11	0.13	0.10	0.11	0.04	0.11	0.08	0.10	0.11	0.05	0.10	0.07	0.09	0.09	0.06	0.09	0.08	0.15	0.12	0.10
20%	0.19	0.16	0.15	0.11	0.14	0.18	0.24	0.12	0.14	0.10	0.13	0.10	0.13	0.12	0.08	0.11	0.10	0.12	0.10	0.13	0.15	0.17	0.18	0.19	0.14
25%	0.23	0.20	0.18	0.15	0.16	0.21	0.33	0.17	0.16	0.13	0.14	0.10	0.15	0.12	0.12	0.11	0.12	0.14	0.13	0.15	0.17	0.19	0.20	0.21	0.16
30%	0.38	0.23	0.23	0.17	0.19	0.22	0.38	0.22	0.18	0.15	0.17	0.12	0.16	0.12	0.12	0.12	0.13	0.16	0.29	0.18	0.23	0.21	0.24	0.36	0.21
35%	0.56	0.28	0.36	0.17	0.25	0.29	0.60	0.26	0.19	0.15	0.18	0.13	0.16	0.12	0.12	0.12	0.14	0.19	0.38	0.22	0.28	0.28	0.31	0.82	0.27
40%	0.73	0.32	0.53	0.25	0.30	0.51	0.85	0.30	0.20	0.17	0.19	0.13	0.16	0.12	0.13	0.12	0.16	0.19	0.46	0.29	0.31	0.38	0.37	1.08	0.34
45%	1.17	0.38	0.71	0.30	0.33	0.68	1.12	0.36	0.22	0.19	0.19	0.15	0.16	0.13	0.13	0.12	0.16	0.20	0.54	0.39	0.48	0.53	0.49	1.30	0.43
50%	1.88	0.52	0.95	0.36	0.37	0.89	1.42	0.65	0.23	0.20	0.19	0.16	0.17	0.13	0.14	0.13	0.16	0.22	0.57	0.53	0.61	1.06	0.90	1.93	0.60
55%	2.58	0.98	1.33	0.39	0.81	1.12	1.73	0.79	0.26	0.21	0.20	0.17	0.17	0.14	0.15	0.14	0.16	0.25	0.59	1.12	0.90	1.35	1.40	2.65	0.82
60%	3.92	2.10	1.88	1.00	0.97	1.16	2.19	0.81	0.27	0.22	0.22	0.18	0.17	0.15	0.16	0.15	0.17	0.27	0.80	1.60	1.26	2.02	2.35	3.15	1.13
65%	4.41	2.75	2.19	1.52	1.49	1.69	3.13	0.93	0.29	0.26	0.24	0.20	0.17	0.16	0.17	0.17	0.17	0.33	1.16	1.97	1.33	3.18	3.09	3.56	1.44
70%	4.58	3.44	2.78	2.13	2.29	1.98	3.68	1.09	0.41	0.30	0.40	0.20	0.18	0.17	0.18	0.17	0.18	0.71	1.50	2.51	1.59	3.53	4.52	3.90	1.77
75%	5.70	3.84	4.33	2.95	2.83	2.58	4.10	1.75	0.55	0.32	0.60	0.22	0.19	0.18	0.21	0.18	0.20	1.13	1.57	2.67	2.11	3.74	5.14	5.49	2.19
80%	6.91	4.28	4.79	3.27	3.06	3.28	4.28	1.94	0.59	0.44	1.59	0.26	0.21	0.19	0.22	0.19	0.40	2.31	2.35	3.28	2.18	5.59	5.43	6.03	2.63
85%	8.02	6.03	5.20	3.54	3.71	4.93	4.97	2.30	0.81	0.51	3.32	0.41	0.28	0.22	0.23	0.21	0.56	5.34	6.45	3.72	2.99	7.92	6.37	7.42	3.56
90%	10.56	7.92	6.00	4.87	5.33	6.58	6.61	4.59	1.45	0.70	5.00	1.03	0.33	0.26	0.80	0.45	0.67	13.32	11.99	4.63	4.81	12.63	7.59	9.48	5.32
By Hour of the Day and WD Screened %ile NO ₂ Concentrations (ppb) in Fort McKay for the Month of October for the Period 2014-2021																									
Percentile	Hr of the day																								Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
10%	0.22	0.14	0.12	0.12	0.11	0.21	0.12	0.12	0.12	0.11	0.11	0.07	0.06	0.04	0.03	0.03	0.06	0.08	0.08	0.04	0.07	0.12	0.15	0.24	0.11
15%	0.27	0.18	0.12	0.15	0.15	0.22	0.16	0.14	0.13	0.14	0.13	0.07	0.11	0.06	0.06	0.08	0.09	0.12	0.09	0.10	0.11	0.13	0.20	0.27	0.14
20%	0.33	0.19	0.17	0.15	0.16	0.23	0.22	0.18	0.14	0.14	0.14	0.09	0.12	0.08	0.07	0.10	0.10	0.15	0.12	0.10	0.13	0.22	0.23	0.30	0.16
25%	0.35	0.19	0.22	0.17	0.18	0.26	0.28	0.38	0.19	0.15	0.14	0.11	0.12	0.09	0.10	0.11	0.11	0.16	0.13	0.12	0.15	0.25	0.28	0.37	0.19
30%	0.39	0.23	0.22	0.20	0.24	0.31	0.33	0.51	0.26	0.15	0.20	0.15	0.13	0.09	0.12	0.17	0.11	0.16	0.15	0.13	0.19	0.35	0.29	0.55	0.24
35%	0.52	0.25	0.23	0.21	0.29	0.43	0.49	0.55	0.35	0.16	0.26	0.24	0.16	0.10	0.13	0.21	0.12	0.17	0.17	0.14	0.31	0.48	0.33	0.89	0.30
40%	0.87	0.30	0.29	0.23	0.32	0.58	0.60	0.77	0.51	0.22	0.28	0.27	0.19	0.12	0.22	0.21	0.13	0.19	0.21	0.20	0.43	0.54	0.53	1.31	0.40
45%	1.16	0.36	0.32	0.26	0.36	0.76	0.74	0.94	0.67	0.36	0.30	0.28	0.21	0.15	0.29	0.24	0.15	0.22	0.29	0.29	0.49	0.64	0.59	1.86	0.50
50%	1.31	0.40	0.37	0.37	0.47	0.90	0.94	0.98	0.94	0.42	0.37	0.28	0.25	0.16	0.30	0.27	0.18	0.42	0.31	0.37	0.66	0.77	0.77	2.68	0.62
55%	1.55	0.49	0.43	0.54	0.75	1.03	1.08	1.70	0.98	0.48	0.45	0.29	0.27	0.22	0.31	0.40	0.21	0.61	0.58	0.39	0.75	0.92	2.69	3.01	0.84
60%	1.88	0.56	0.87	0.62	1.24	1.04	1.28	1.91	1.08	0.53	0.51	0.30	0.33	0.23	0.34	0.57	0.35	0.69	0.63	0.47	1.12	1.16	3.74	3.53	1.04
65%	2.29	0.76	1.98	0.75	1.62	1.23	1.73	3.01	1.22	0.63	0.51	0.30	0.40	0.25	0.39	0.82	0.54	1.09	0.79	0.65	3.13	2.77	5.04	3.89	1.49
70%	3.77	1.23	3.00	2.22	1.90	1.49	2.16	4.25	1.68	0.92	0.54	0.31	0.76	0.30	0.65	3.80	0.74	3.77	1.66	1.08	4.09	5.43	6.74	4.23	2.36
75%	4.27	1.72	4.32	2.38	2.13	3.15	3.10	4.68	2.96	1.91	1.87	0.43	2.01	0.33	1.54	8.13	3.47	4.83	4.59	1.47	5.24	5.52	9.74	5.12	3.54
80%	5.36	2.16	5.72	2.72	2.33	4.77	4.56	4.84	4.46	3.71	5.78	0.58	3.22	0.33	3.36	8.33	6.14	9.89	7.18	2.30	6.97	6.74	10.73	7.59	4.99
85%	8.51	2.93	6.76	2.91	4.67	4.90	5.46	5.34	5.32	4.61	6.81	0.73	5.13	0.98	6.27	9.28	6.15	14.49	9.76	6.53	9.25	12.04	13.06	8.68	6.69
90%	10.91	3.65	8.96	3.30	7.14	6.52	8.47	5.59	7.25	8.93	7.23	3.05	7.84	3.64	9.95	11.72	6.52	20.10	10.74	9.77	15.50	19.25	15.82	12.75	9.36

Table D.14: The Wind Direction Screened NO₂ Percentile by Hour of the Day and by Month Tables (November and December for entire 2014-2021 Period) with 25th percentile and 50th percentile Values Highlighted in “Red”

By Hour of the Day and WD Screened %ile NO ₂ Concentrations (ppb) in Fort McKay for the Month of November for the Period 2014-2021																									
Percentile	Hr of the day																								Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
10%	0.23	0.14	0.16	0.17	0.12	0.19	0.38	0.19	0.16	0.12						0.07	0.08	0.31	0.18	0.24	0.19	0.43	0.33	0.31	0.21
15%	0.27	0.33	0.31	0.25	0.21	0.26	0.42	0.23	0.25	0.16	0.05	0.15	0.07	0.31	0.06	0.09	0.15	0.32	0.24	0.36	0.37	0.48	0.40	0.35	0.25
20%	0.35	0.37	1.12	0.29	0.36	0.34	0.56	0.28	0.25	0.21	0.09	0.17	0.10	0.42	0.09	0.11	0.26	0.34	0.32	0.49	0.46	0.53	0.49	0.38	0.35
25%	0.40	0.46	1.39	0.88	0.36	0.44	0.79	0.61	0.31	0.27	0.13	0.19	0.12	0.53	0.13	0.15	0.47	0.37	0.32	0.59	0.53	0.77	0.49	0.62	0.47
30%	0.59	0.88	1.48	1.12	0.39	0.53	0.91	0.75	0.41	0.38	0.14	0.20	0.13	0.60	0.15	0.21	0.56	0.45	0.37	0.62	0.59	1.42	0.57	1.26	0.61
35%	0.70	1.65	1.68	1.21	1.07	1.04	1.00	0.79	0.49	0.51	0.15	0.22	0.16	0.66	0.18	0.28	0.57	0.56	0.45	0.62	0.64	1.77	0.89	2.05	0.81
40%	0.95	1.83	1.71	1.33	1.26	1.21	1.09	0.86	0.60	0.59	0.19	0.24	0.21	0.72	0.20	0.37	0.57	0.61	0.56	0.78	1.20	1.96	1.60	2.52	0.97
45%	1.27	2.75	2.16	3.13	1.49	1.38	1.30	0.88	0.83	0.62	0.26	0.28	0.28	0.78	0.23	0.47	0.57	0.78	0.69	1.07	2.86	2.69	4.00	3.04	1.41
50%	1.30	3.95	3.19	3.91	1.72	2.08	1.60	0.91	0.90	0.69	0.32	0.43	0.43	0.84	0.26	0.97	0.98	0.99	0.80	2.58	3.63	4.22	6.86	4.06	1.98
55%	2.27	4.94	4.05	4.62	2.09	2.73	1.82	0.96	1.12	0.70	0.38	0.57	0.58	0.85	0.42	1.47	1.40	1.44	1.07	3.96	4.35	5.31	9.98	5.42	2.60
60%	4.35	5.87	4.80	6.20	2.24	3.22	1.90	1.13	1.18	0.81	0.44	0.62	0.80	0.85	0.58	1.56	1.55	2.99	1.67	4.09	5.87	8.92	13.16	7.20	3.42
65%	5.81	6.88	5.45	10.38	2.73	4.95	2.35	1.50	1.31	1.00	0.55	0.66	1.03	0.91	0.70	2.13	2.96	5.38	5.94	4.73	8.77	11.57	15.67	9.42	4.70
70%	6.29	7.65	5.86	12.34	5.86	5.02	3.21	1.80	1.39	1.47	0.70	1.03	1.11	1.02	0.79	3.99	7.74	8.64	9.14	7.68	12.17	12.06	16.60	11.14	6.03
75%	6.89	8.28	9.74	13.71	9.58	8.16	3.94	2.15	1.72	2.75	0.86	1.58	1.12	1.14	0.88	5.70	11.43	13.68	11.02	15.32	14.91	14.52	17.38	15.09	7.98
80%	9.44	10.11	14.12	16.06	11.29	10.64	6.03	5.53	1.89	2.99	0.89	3.81	1.53	1.69	1.23	7.24	13.82	16.86	11.37	17.99	17.37	16.68	19.49	19.78	9.91
85%	14.08	12.32	16.28	17.53	19.17	14.55	7.69	9.24	4.96	4.33	0.93	8.14	2.45	2.24	1.59	11.32	14.85	21.10	20.37	18.89	19.58	17.93	20.46	21.94	12.58
90%	17.22	13.02	18.92	21.90	22.23	19.73	10.66	11.28	6.21	5.44						16.83	15.10	23.60	23.48	20.05	20.94	19.53	25.09	23.78	17.63
By Hour of the Day and WD Screened %ile NO ₂ Concentrations (ppb) in Fort McKay for the Month of December for the Period 2014-2021																									
Percentile	Hr of the day																								Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
10%	0.23	0.17	0.18	0.25	0.24	0.18	0.18	0.29	0.28	0.17		0.05		0.08	0.03	0.05	0.12	0.08	0.14	0.28	0.37	0.25	0.39	0.17	0.19
15%	0.28	0.25	0.51	0.42	0.38	0.25	0.21	0.30	0.31	0.34	0.13	0.13	0.09	0.13	0.03	0.08	0.16	0.14	0.21	0.37	0.40	0.30	0.77	0.26	0.27
20%	0.37	1.05	0.73	0.50	0.72	0.29	0.27	0.37	0.79	0.47	0.25	0.20	0.15	0.14	0.05	0.21	0.34	0.19	0.29	0.38	0.40	0.63	4.47	0.36	0.57
25%	0.42	2.20	1.07	0.99	1.07	0.31	0.27	0.53	0.93	0.59	0.34	0.27	0.21	0.22	0.09	0.55	0.41	0.24	0.47	0.66	0.49	2.04	18.30	0.57	1.39
30%	0.51	2.30	1.47	1.56	2.30	0.51	0.70	0.64	1.04	0.63	0.40	0.48	0.22	0.41	0.15	0.68	0.57	0.32	0.91	0.93	0.60	3.30	18.38	0.68	1.65
35%	0.84	2.91	1.90	2.10	2.73	0.81	0.75	2.09	2.10	0.71	0.65	0.64	0.24	0.50	0.21	0.76	0.73	0.44	1.53	1.08	1.36	5.91	19.22	0.75	2.12
40%	1.97	5.29	2.48	4.41	5.38	1.65	1.23	5.28	4.16	0.95	1.30	0.71	0.42	0.59	0.38	0.81	1.06	0.63	1.98	1.59	2.47	7.78	20.45	0.79	3.07
45%	2.74	8.89	2.54	7.12	5.89	2.67	4.44	7.56	5.86	1.86	1.91	1.09	0.76	0.74	0.60	0.84	1.73	0.85	2.13	2.28	3.00	9.25	21.48	1.26	4.06
50%	4.30	11.27	2.98	10.46	6.47	3.67	6.68	9.78	7.61	2.90	2.24	1.65	1.10	1.06	0.64	0.91	2.24	1.10	3.17	4.02	6.37	12.96	21.52	2.94	5.34
55%	5.83	12.67	5.03	12.59	9.17	3.71	8.94	10.66	9.13	4.53	2.57	3.94	2.82	2.53	0.71	1.44	3.08	1.67	14.43	12.58	11.11	16.46	21.70	3.73	7.54
60%	11.90	14.06	11.44	12.96	10.93	4.48	9.26	11.42	9.71	7.18	3.36	5.62	4.54	7.65	1.15	2.03	5.33	2.49	16.93	14.03	17.44	17.42	21.76	7.47	9.61
65%	14.74	14.87	14.09	13.20	12.99	4.87	13.43	11.80	10.30	7.65	4.20	6.08	5.98	10.03	1.51	2.52	9.01	2.77	18.84	22.02	19.30	17.69	21.89	10.74	11.27
70%	15.71	18.07	15.41	13.63	14.90	8.36	13.92	13.18	11.35	9.13	4.92	7.57	7.13	11.23	1.62	6.16	13.93	3.32	21.78	22.43	20.50	18.30	22.65	15.93	12.96
75%	16.45	19.06	16.36	14.89	14.96	10.63	14.17	15.17	12.43	11.39	5.57	9.57	8.29	12.73	3.16	19.63	18.40	13.71	23.75	22.75	21.57	18.68	24.96	16.73	15.21
80%	18.08	19.68	17.05	16.29	16.06	13.89	16.50	15.98	13.09	14.16	6.28	15.35	10.49	15.45	6.40	20.50	19.00	18.84	24.59	23.51	22.22	20.68	25.85	17.12	16.96
85%	19.68	21.33	18.40	18.61	18.40	14.78	17.77	18.40	15.10	16.32	7.05	20.36	12.69	18.80	9.38	22.26	21.51	23.20	25.97	23.98	25.76	23.01	27.24	18.57	19.11
90%	20.40	23.24	19.72	20.85	20.39	17.72	20.90	19.38	17.30	19.27		23.85		20.30	12.21	26.44	28.07	28.20	29.75	24.83	27.97	23.80	28.06	19.82	22.38

Appendix E SO₂

E.1 The Monthly/Annual Tables used to Estimate the “All-WD” 5th percentile and 10th percentile SO₂ Baselines and the Tables used to Estimate the WD Screened 25th percentile and 50th percentile SO₂ Baselines

Table E.1: The 5th percentile “All-WD” SO₂ Monthly/Annual Tables (January to March 2014-2021)

By Hour of the Day and By Year "All WD" 5%ile SO ₂ Concentration (ppb) in Fort McKay for the Month of January for the Period 2014-2021																													
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range	
Year	2014	0.23	0.23	0.23	0.27	0.23	0.27	0.24	0.33	0.3	0.12	0.24	0.29	0.09	0.13	0.12	0.13	0.09	0.24	0.24	0.22	0.17	0.17	0.25	0.13	0.21	0.07	(0.09-0.33)	
	2015	0.15	0.19	0.18	0.18	0.21	0.21	0.17	0.2	0.24	0.24	0.19	0.32	0.27	0.28	0.24	0.24	0.29	0.29	0.24	0.18	0.22	0.18	0.19	0.22	0.05	(0.15-0.32)		
	2016	0.12	0.15	0.15	0.12	0.12	0.12	0.12	0.13	0.15	0.15	0.16	0.15	0.15	0.14	0.19	0.17	0.12	0.13	0.1	0.12	0.12	0.1	0.11	0.12	0.13	0.02	(0.1-0.19)	
	2017	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)	
	2018	0.07	0.1	0.09	0.1	0.09	0.08	0.08	0.06	0.07	0.09	0.1	0.13	0.08	0.07	0.12	0.06	0.08	0.09	0.09	0.08	0.07	0.05	0.08	0.04	0.08	0.02	(0.04-0.13)	
	2019	0.23	0.22	0.25	0.27	0.21	0.22	0.23	0.23	0.24	0.24	0.26	0.28	0.29	0.13	0.13	0.25	0.27	0.24	0.24	0.25	0.24	0.23	0.25	0.24	0.24	0.04	(0.13-0.29)	
	2020	0.07	0.06	0.08	0.11	0.06	0.11	0.08	0.07	0.08	0.13	0.15	0.11	0.13	0.14	0.12	0.12	0.11	0.14	0.13	0.09	0.11	0.07	0.08	0.08	0.10	0.03	(0.06-0.15)	
2021	0.01	0.02	0	0.04	0.01	0.04	0.03	0.01	0	0.03	0.05	0.08	0.03	0.06	0.05	0.03	0.05	0.04	0.05	0.03	0.03	0.03	0.04	0.01	0.03	0.02	(0-0.08)		
																										0.13	0.08	(0.00-0.24)	
Average		0.11	0.12	0.12	0.14	0.12	0.13	0.12	0.13	0.14	0.13	0.14	0.17	0.13	0.12	0.12	0.13	0.13	0.15	0.14	0.13	0.12	0.11	0.12	0.10	0.13			
Std Dev		0.09	0.09	0.10	0.10	0.09	0.09	0.09	0.12	0.12	0.09	0.09	0.11	0.10	0.08	0.07	0.09	0.10	0.10	0.10	0.10	0.08	0.09	0.09	0.09	0.01			
Range		(0-0.23)	(0-0.23)	(0-0.25)	(0-0.27)	(0-0.23)	(0-0.27)	(0-0.24)	(0-0.33)	(0-0.3)	(0-0.24)	(0-0.26)	(0-0.32)	(0-0.29)	(0-0.28)	(0-0.24)	(0-0.25)	(0-0.29)	(0-0.29)	(0-0.29)	(0-0.25)	(0-0.24)	(0-0.23)	(0-0.25)	(0-0.24)	(0.10-0.17)			
By Hour of the Day and By Year "All WD" 5%ile SO ₂ Concentration (ppb) in Fort McKay for the Month of February for the Period 2014-2021																													
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range	
Year	2014	0.33	0.37	0.38	0.32	0.37	0.33	0.38	0.36	0.3	0.43	0.16	0.37	0.41	0.5	0.45	0.39	0.45	0.39	0.37	0.35	0.38	0.37	0.35	0.25	0.37	0.07	(0.16-0.5)	
	2015	0.12	0.26	0.17	0.18	0.12	0.12	0.09	0.03	0.13	0.35	0.15	0.15	0.3	0.16	0.25	0.18	0.26	0.2	0.23	0.21	0.23	0.08	0.15	0.14	0.18	0.07	(0.03-0.35)	
	2016	0.07	0.08	0.06	0.07	0.06	0.07	0.06	0.07	0.08	0.03	0.04	0.12	0.13	0.18	0.14	0.14	0.09	0.07	0.07	0.08	0.07	0.04	0.04	0.07	0.08	0.04	(0.03-0.18)	
	2017	0	0	0	0	0	0	0	0	0	0	0	0	0	0.02	0	0	0.01	0.01	0	0	0	0	0	0	0.00	0.00	(0-0.02)	
	2018	0.13	0.14	0.14	0.17	0.16	0.14	0.11	0.11	0.13	0.17	0.18	0.05	0.04	0.06	0.19	0.21	0.15	0.16	0.15	0.15	0.15	0.12	0.11	0.14	0.04	(0.04-0.21)		
	2019	0.17	0.16	0.17	0.17	0.18	0.17	0.17	0.17	0.15	0.17	0.2	0.14	0.17	0.18	0.16	0.25	0.21	0.18	0.18	0.18	0.11	0.15	0.17	0.15	0.17	0.03	(0.11-0.25)	
	2020	0.03	0.03	0.07	0.07	0.08	0.06	0.05	0.06	0.06	0.12	0.09	0.02	0.05	0.05	0.02	0	0.03	0.01	0.04	0.09	0.05	0.09	0.04	0.05	0.05	0.03	(0-0.12)	
2021	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)		
																										0.12	0.11	(0.00-0.37)	
Average		0.11	0.13	0.12	0.12	0.12	0.11	0.11	0.10	0.11	0.16	0.10	0.11	0.14	0.14	0.15	0.15	0.15	0.13	0.13	0.13	0.12	0.11	0.11	0.10	0.12			
Std Dev		0.11	0.13	0.12	0.11	0.12	0.11	0.12	0.12	0.10	0.16	0.08	0.12	0.15	0.16	0.15	0.14	0.15	0.13	0.13	0.12	0.13	0.12	0.12	0.08	0.02			
Range		(0-0.33)	(0-0.37)	(0-0.38)	(0-0.32)	(0-0.37)	(0-0.33)	(0-0.38)	(0-0.36)	(0-0.3)	(0-0.43)	(0-0.2)	(0-0.37)	(0-0.41)	(0-0.5)	(0-0.45)	(0-0.39)	(0-0.45)	(0-0.39)	(0-0.37)	(0-0.35)	(0-0.38)	(0-0.37)	(0-0.35)	(0-0.25)	(0.10-0.16)			
By Hour of the Day and By Year "All WD" 5%ile SO ₂ Concentration (ppb) in Fort McKay for the Month of March for the Period 2014-2021																													
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range	
Year	2014	0.15	0.2	0.15	0.23	0.23	0.11	0.24	0.17	0.29	0.3	0.34	0.37	0.32	0.32	0.3	0.44	0.41	0.31	0.25	0.26	0.2	0.19	0.29	0.18	0.26	0.08	(0.11-0.44)	
	2015	0.22	0.17	0.1	0.12	0.1	0.14	0.11	0.15	0.28	0.18	0.2	0.21	0.12	0.3	0.31	0.34	0.37	0.25	0.23	0.23	0.25	0.22	0.28	0.24	0.21	0.08	(0.1-0.37)	
	2016	0.11	0.11	0.09	0.11	0.13	0.1	0.08	0.1	0.04	0	0.12	0.15	0.13	0.15	0.18	0.13	0.11	0.12	0.09	0.09	0.11	0.09	0.13	0.08	0.11	0.04	(0-0.18)	
	2017	0	0	0	0	0	0	0	0	0.01	0	0.01	0	0.02	0.02	0.01	0	0	0	0	0	0	0	0	0	0	0.00	0.01	(0-0.02)
	2018	0.11	0.14	0.12	0.11	0.13	0.13	0.13	0.15	0.18	0.14	0.14	0.12	0.13	0.13	0.1	0.1	0.16	0.12	0.11	0.12	0.09	0.07	0.1	0.06	0.12	0.03	(0.06-0.18)	
	2019	0.11	0.09	0.14	0.1	0.13	0.1	0.08	0.14	0.16	0.23	0.2	0.24	0.21	0.19	0.2	0.16	0.18	0.14	0.14	0.18	0.14	0.11	0.12	0.15	0.04	(0.08-0.24)		
	2020	0.08	0.05	0.07	0.07	0.05	0.06	0.08	0.08	0.1	0.1	0.12	0.07	0.1	0.11	0.08	0.09	0.1	0.09	0.04	0.06	0.1	0.07	0.08	0.07	0.08	0.02	(0.04-0.12)	
2021	0	0	0	0	0	0	0	0	0	0.02	0.01	0.01	0	0	0.01	0	0	0.01	0	0	0	0	0	0	0	0.00	0.01	(0-0.02)	
																										0.12	0.09	(0.00-0.26)	
Average		0.10	0.10	0.08	0.09	0.10	0.08	0.09	0.10	0.14	0.12	0.14	0.15	0.13	0.15	0.15	0.16	0.17	0.13	0.11	0.12	0.11	0.10	0.12	0.09	0.12			
Std Dev		0.07	0.07	0.06	0.07	0.08	0.05	0.08	0.07	0.11	0.11	0.11	0.13	0.10	0.11	0.12	0.16	0.15	0.11	0.10	0.10	0.09	0.08	0.11	0.08	0.03			
Range		(0-0.22)	(0-0.2)	(0-0.15)	(0-0.23)	(0-0.23)	(0-0.14)	(0-0.24)	(0-0.17)	(0.01-0.29)	(0-0.3)	(0.01-0.34)	(0-0.37)	(0-0.32)	(0.01-0.32)	(0-0.31)	(0-0.44)	(0-0.41)	(0-0.31)	(0-0.25)	(0-0.26)	(0-0.25)	(0-0.22)	(0-0.29)	(0-0.24)	(0.08-0.17)			

Table E.2: The 5th percentile "All-WD" SO₂ Monthly/Annual Tables (April to June 2014-2021)

By Hour of the Day and By Year "All WD" 5%ile SO ₂ Concentration (ppb) in Fort McKay for the Month of April for the Period 2014-2021																												
Hour of the Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range	
Year	2014	0.15	0.21	0.27	0.16	0.09	0.11	0.1	0.12	0.22	0.24	0.32	0.39	0.32	0.27	0.32	0.1	0.08	0.29	0.28	0.19	0.11	0.17	0.07	0.17	0.20	0.09	(0.07-0.39)
	2015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0.09	0.03	0	0	0	0	0	0	0.01	0.02	(0-0.09)
	2016	0.06	0.06	0.07	0.06	0.06	0.06	0.04	0.07	0	0	0.01	0.05	0.08	0.11	0.07	0.07	0.04	0.03	0.05	0.03	0.04	0.07	0.06	0.05	0.05	0.03	(0-0.11)
	2017	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)
	2018	0.04	0.03	0.02	0.03	0.04	0.02	0	0.05	0.1	0.04	0.05	0.04	0.08	0.04	0.13	0.13	0.09	0.09	0.07	0.06	0.06	0.05	0.06	0.05	0.06	0.03	(0-0.13)
	2019	0.15	0.14	0.13	0.13	0.13	0.14	0.16	0.16	0.2	0.18	0.17	0.17	0.14	0.14	0.18	0.18	0.17	0.15	0.17	0.13	0.16	0.14	0.15	0.14	0.15	0.02	(0.13-0.2)
	2020	0.11	0.11	0.11	0.11	0.08	0.07	0.11	0.11	0.1	0.08	0.04	0.1	0.1	0.04	0.09	0.09	0.13	0.15	0.11	0.13	0.12	0.12	0.12	0.1	0.10	0.03	(0.04-0.15)
	2021	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)
																										0.07	0.07	(0.00-0.20)
Average	0.06	0.07	0.08	0.06	0.05	0.05	0.05	0.06	0.08	0.07	0.07	0.09	0.09	0.08	0.10	0.07	0.07	0.10	0.09	0.07	0.06	0.07	0.06	0.06	0.07			
Std Dev	0.07	0.08	0.09	0.06	0.05	0.05	0.06	0.06	0.09	0.09	0.11	0.13	0.11	0.09	0.11	0.07	0.06	0.10	0.10	0.07	0.06	0.07	0.06	0.07	0.01			
Range	(0-0.15)	(0-0.21)	(0-0.27)	(0-0.16)	(0-0.13)	(0-0.14)	(0-0.16)	(0-0.16)	(0-0.22)	(0-0.24)	(0-0.32)	(0-0.39)	(0-0.32)	(0-0.27)	(0-0.32)	(0-0.18)	(0-0.17)	(0-0.29)	(0-0.28)	(0-0.19)	(0-0.16)	(0-0.17)	(0-0.15)	(0-0.17)	(0.05-0.1)			

By Hour of the Day and By Year "All WD" 5%ile SO ₂ Concentration (ppb) in Fort McKay for the Month of May for the Period 2014-2021																												
Hour of the Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range	
Year	2014	0.25	0.24	0.22	0.15	0.24	0.19	0.29	0.32	0.22	0.15	0.11	0.09	0.24	0.28	0.34	0.3	0.31	0.29	0.34	0.33	0.26	0.24	0.35	0.27	0.25	0.07	(0.09-0.35)
	2015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.02	0	0	0	0.02	0	0	0	0	0.00	0.01	(0-0.02)
	2016	0.02	0.01	0.01	0.02	0.02	0.03	0.01	0.03	0.02	0.01	0.02	0.02	0.03	0	0	0.01	0.03	0.03	0.02	0.04	0.03	0.04	0.02	0.03	0.02	0.01	(0-0.04)
	2017	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)
	2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)
	2019	0.07	0.06	0.06	0.08	0.07	0.11	0.12	0.1	0.13	0.13	0.11	0.09	0.07	0.09	0.08	0.13	0.06	0.08	0.1	0.11	0.07	0.08	0.07	0.08	0.09	0.02	(0.06-0.13)
	2020	0.06	0.05	0.05	0.02	0.05	0.06	0.05	0.08	0.06	0.09	0.08	0.04	0.12	0.06	0.1	0.08	0.09	0.08	0.07	0.05	0.07	0.07	0.06	0.06	0.07	0.02	(0.02-0.12)
	2021	0	0	0	0	0	0	0	0.03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.01	(0-0.03)
																										0.05	0.08	(0.00-0.25)
Average	0.05	0.05	0.04	0.03	0.05	0.05	0.06	0.07	0.05	0.05	0.04	0.03	0.06	0.05	0.07	0.07	0.06	0.06	0.07	0.07	0.05	0.05	0.06	0.06	0.05			
Std Dev	0.09	0.08	0.08	0.05	0.08	0.07	0.10	0.11	0.08	0.06	0.05	0.04	0.09	0.10	0.12	0.11	0.11	0.10	0.12	0.11	0.09	0.08	0.12	0.09	0.01			
Range	(0-0.25)	(0-0.24)	(0-0.22)	(0-0.15)	(0-0.24)	(0-0.19)	(0-0.29)	(0-0.32)	(0-0.22)	(0-0.15)	(0-0.11)	(0-0.09)	(0-0.24)	(0-0.28)	(0-0.34)	(0-0.3)	(0-0.31)	(0-0.29)	(0-0.34)	(0-0.33)	(0-0.26)	(0-0.24)	(0-0.35)	(0-0.27)	(0.03-0.07)			

By Hour of the Day and By Year "All WD" 5%ile SO ₂ Concentration (ppb) in Fort McKay for the Month of June for the Period 2014-2021																												
Hour of the Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range	
Year	2014	0.28	0.3	0.29	0.31	0.26	0.33	0.32	0.35	0.3	0.36	0.34	0.33	0.21	0.21	0.28	0.32	0.33	0.38	0.28	0.32	0.27	0.31	0.22	0.27	0.30	0.04	(0.21-0.38)
	2015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)
	2016	0.03	0.03	0.03	0.03	0.02	0.02	0.01	0.02	0	0	0	0	0	0.04	0.02	0.03	0.05	0.03	0.03	0.02	0.02	0.04	0.05	0.06	0.02	0.02	(0-0.06)
	2017	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)
	2018	0.08	0.05	0.03	0.06	0.07	0.06	0.06	0.09	0.1	0.07	0.06	0.07	0.1	0.07	0.09	0.08	0.09	0.1	0.04	0.08	0.1	0.06	0.09	0.09	0.07	0.02	(0.03-0.1)
	2019	0.09	0.1	0.09	0.11	0.12	0.12	0.09	0.12	0.1	0.08	0.06	0.14	0.12	0.1	0.12	0.14	0.11	0.1	0.11	0.1	0.09	0.09	0.12	0.11	0.11	0.02	(0.06-0.14)
	2020	0.06	0.05	0.05	0.05	0.05	0.06	0.07	0.03	0.05	0.06	0.06	0.08	0.04	0.04	0.06	0.06	0.06	0.07	0.07	0.06	0.06	0.04	0.05	0.05	0.06	0.01	(0.03-0.08)
	2021	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)
																										0.07	0.09	(0.00-0.30)
Average	0.07	0.07	0.06	0.07	0.07	0.07	0.07	0.08	0.07	0.07	0.07	0.08	0.06	0.06	0.07	0.08	0.08	0.09	0.07	0.07	0.07	0.07	0.07	0.07	0.07			
Std Dev	0.09	0.10	0.10	0.10	0.09	0.11	0.11	0.12	0.10	0.12	0.12	0.11	0.08	0.07	0.10	0.11	0.11	0.13	0.09	0.11	0.09	0.10	0.08	0.09	0.01			
Range	(0-0.28)	(0-0.3)	(0-0.29)	(0-0.31)	(0-0.26)	(0-0.33)	(0-0.32)	(0-0.35)	(0-0.3)	(0-0.36)	(0-0.34)	(0-0.33)	(0-0.21)	(0-0.21)	(0-0.28)	(0-0.32)	(0-0.33)	(0-0.38)	(0-0.28)	(0-0.32)	(0-0.27)	(0-0.31)	(0-0.22)	(0-0.27)	(0.06-0.08)			

Table E.3: The 5th percentile “All-WD” SO₂ Monthly/Annual Tables (July to September 2014-2021)

By Hour of the Day and By Year "All WD" 5%ile SO ₂ Concentration (ppb) in Fort McKay for the Month of July for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	0.22	0.28	0.32	0.28	0.3	0.3	0.36	0.31	0.39	0.43	0.48	0.45	0.18	0.2	0.34	0.39	0.27	0.33	0.34	0.33	0.26	0.29	0.23	0.23	0.31	0.08	(0.18-0.48)
	2015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)
	2016	0.02	0.03	0.06	0.07	0.04	0.07	0.08	0.07	0.04	0.02	0.01	0.02	0.06	0.05	0.05	0.06	0.03	0.04	0.06	0.04	0.05	0.04	0.04	0.04	0.05	0.02	(0.01-0.08)
	2017	0.1	0.08	0.13	0.1	0.12	0.13	0.1	0.11	0.12	0.13	0.04	0.06	0.11	0.1	0.12	0.1	0.1	0.06	0.12	0.13	0.09	0.1	0.1	0.1	0.10	0.02	(0.04-0.13)
	2018	0.12	0.12	0.12	0.12	0.11	0.15	0.16	0.14	0.15	0.18	0.14	0.05	0.13	0.13	0.17	0.12	0.16	0.15	0.16	0.12	0.13	0.14	0.13	0.13	0.13	0.03	(0.05-0.18)
	2019	0.1	0.11	0.1	0.1	0.11	0.09	0.08	0.13	0.14	0.14	0.13	0.11	0.14	0.14	0.15	0.15	0.16	0.14	0.14	0.13	0.13	0.1	0.11	0.1	0.12	0.02	(0.08-0.16)
	2020	0.04	0.01	0.03	0.02	0.04	0.03	0.04	0.04	0.07	0.04	0.02	0	0	0	0	0.06	0.04	0.03	0.08	0.03	0.05	0	0.01	0.02	0.03	0.02	(0-0.08)
	2021	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)
																										0.09	0.10	(0.00-0.31)
Average		0.08	0.08	0.10	0.09	0.09	0.10	0.10	0.10	0.11	0.12	0.10	0.09	0.08	0.08	0.10	0.11	0.10	0.09	0.11	0.10	0.09	0.08	0.08	0.08	0.09		
Std Dev		0.08	0.09	0.10	0.09	0.10	0.10	0.12	0.10	0.13	0.14	0.16	0.15	0.07	0.08	0.12	0.13	0.10	0.11	0.11	0.11	0.10	0.09	0.10	0.08	0.08	0.01	
Range		(0-0.22)	(0-0.28)	(0-0.32)	(0-0.28)	(0-0.3)	(0-0.3)	(0-0.36)	(0-0.31)	(0-0.39)	(0-0.43)	(0-0.48)	(0-0.45)	(0-0.18)	(0-0.2)	(0-0.34)	(0-0.39)	(0-0.27)	(0-0.33)	(0-0.34)	(0-0.33)	(0-0.26)	(0-0.29)	(0-0.23)	(0-0.23)	(0.08-0.12)		

By Hour of the Day and By Year "All WD" 5%ile SO ₂ Concentration (ppb) in Fort McKay for the Month of August for the Period 2014-2021																													
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range	
Year	2014	0.29	0.32	0.35	0.28	0.32	0.34	0.27	0.36	0.44	0.46	0.5	0.38	0.36	0.13	0.15	0.15	0.42	0.26	0.36	0.4	0.33	0.33	0.35	0.27	0.33	0.09	(0.13-0.5)	
	2015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)
	2016	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0.03	0.03	0.03	0.01	0.01	0	0	0	0	0	0	0	0.01	0.01	(0-0.03)
	2017	0.13	0.13	0.12	0.13	0.15	0.15	0.14	0.15	0.15	0.16	0.15	0.15	0.14	0.13	0.13	0.16	0.14	0.14	0.14	0.14	0.13	0.16	0.1	0.14	0.14	0.01	(0.1-0.16)	
	2018	0.15	0.17	0.16	0.17	0.16	0.16	0.18	0.17	0.16	0.15	0.16	0.15	0.15	0.21	0.21	0.18	0.2	0.16	0.18	0.2	0.18	0.17	0.16	0.17	0.17	0.02	(0.15-0.21)	
	2019	0.09	0.1	0.09	0.1	0.09	0.11	0.08	0.1	0.1	0.09	0.12	0.11	0.03	0.11	0.09	0.09	0.1	0.11	0.12	0.12	0.09	0.1	0.07	0.09	0.10	0.02	(0.03-0.12)	
	2020	0.02	0.04	0.03	0.03	0.05	0.05	0.07	0.04	0.07	0.02	0.03	0.02	0.03	0.01	0.01	0.02	0.06	0.05	0.03	0.01	0.02	0.01	0.03	0.01	0.03	0.02	(0.01-0.07)	
	2021	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)	
																										0.10	0.11	(0-0.5)	
Average		0.09	0.10	0.09	0.09	0.10	0.10	0.09	0.10	0.12	0.11	0.12	0.10	0.09	0.08	0.08	0.08	0.12	0.09	0.10	0.11	0.09	0.10	0.09	0.09	0.10			
Std Dev		0.10	0.11	0.12	0.10	0.11	0.12	0.10	0.12	0.15	0.16	0.17	0.13	0.13	0.08	0.08	0.08	0.14	0.09	0.13	0.14	0.12	0.12	0.12	0.10	0.01			
Range		(0-0.29)	(0-0.32)	(0-0.35)	(0-0.28)	(0-0.32)	(0-0.34)	(0-0.27)	(0-0.36)	(0-0.44)	(0-0.46)	(0-0.5)	(0-0.38)	(0-0.36)	(0-0.21)	(0-0.21)	(0-0.18)	(0-0.42)	(0-0.26)	(0-0.36)	(0-0.4)	(0-0.33)	(0-0.33)	(0-0.35)	(0-0.27)	(0.08-0.12)			

By Hour of the Day and By Year "All WD" 5%ile SO ₂ Concentration (ppb) in Fort McKay for the Month of September for the Period 2014-2021																													
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range	
Year	2014	0.26	0.32	0.36	0.37	0.35	0.32	0.28	0.41	0.32	0.13	0.12	0.31	0.25	0.15	0.42	0.32	0.33	0.27	0.28	0.29	0.36	0.35	0.21	0.28	0.29	0.08	(0.12-0.42)	
	2015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)
	2016	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0	0	0.01	0.00	0.00	(0-0.01)	
	2017	0.08	0.09	0.08	0.07	0.09	0.1	0.09	0.07	0.09	0.12	0.09	0.08	0.09	0.04	0.08	0.08	0.09	0.09	0.1	0.08	0.08	0.05	0.06	0.06	0.06	0.08	0.02	(0.04-0.12)
	2018	0.05	0.06	0.05	0.06	0.04	0.07	0.1	0.07	0.08	0.03	0.08	0.08	0.07	0.08	0.12	0.09	0.09	0.09	0.07	0.07	0.08	0.04	0.07	0.08	0.04	0.07	0.02	(0.03-0.12)
	2019	0.08	0.07	0.09	0.08	0.11	0.09	0.09	0.09	0.09	0.1	0.07	0.03	0.01	0.06	0.08	0.09	0.09	0.12	0.1	0.11	0.1	0.06	0.07	0.03	0.05	0.08	0.03	(0.01-0.12)
	2020	0.03	0.03	0.03	0.02	0.03	0.01	0.01	0.04	0.05	0.05	0.05	0.05	0.04	0.01	0.05	0.09	0.07	0.07	0.05	0.06	0.01	0.02	0.03	0.03	0.04	0.02	(0.01-0.09)	
	2021	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)	
																										0.07	0.09	(0.00-0.29)	
Average		0.06	0.07	0.08	0.08	0.08	0.07	0.07	0.09	0.08	0.05	0.05	0.07	0.06	0.05	0.10	0.09	0.09	0.08	0.07	0.08	0.07	0.07	0.05	0.06	0.07			
Std Dev		0.09	0.11	0.12	0.12	0.12	0.11	0.10	0.14	0.11	0.05	0.05	0.10	0.08	0.05	0.14	0.10	0.11	0.09	0.09	0.10	0.12	0.12	0.07	0.09	0.01			
Range		(0-0.26)	(0-0.32)	(0-0.36)	(0-0.37)	(0-0.35)	(0-0.32)	(0-0.28)	(0-0.41)	(0-0.32)	(0-0.13)	(0-0.12)	(0-0.31)	(0-0.25)	(0-0.15)	(0-0.42)	(0-0.32)	(0-0.33)	(0-0.27)	(0-0.28)	(0-0.29)	(0-0.36)	(0-0.35)	(0-0.21)	(0-0.28)	(0.04-0.10)			

Table E.4: The 5th percentile “All-WD” SO₂ Monthly/Annual Tables (October to December 2014-2021)

By Hour of the Day and By Year "All WD" 5%ile SO ₂ Concentration (ppb) in Fort McKay for the Month of October for the Period 2014-2021																												
Hour of the Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range	
Year	2014	0.36	0.38	0.38	0.26	0.36	0.37	0.31	0.35	0.39	0.38	0.35	0.32	0.15	0.13	0.12	0.06	0.06	0.12	0.13	0.15	0.33	0.41	0.32	0.34	0.27	0.12	(0.06-0.41)
	2015	0.01	0	0.01	0.03	0.04	0.01	0.02	0.04	0.04	0	0	0.02	0	0	0	0.03	0.04	0.07	0.04	0.04	0.04	0.02	0.01	0.02	0.02	(0-0.07)	
	2016	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)
	2017	0.06	0.07	0.1	0.09	0.09	0.06	0.09	0.08	0.1	0.03	0.04	0.02	0.16	0.11	0.08	0.08	0.08	0.1	0.07	0.07	0.05	0.02	0.04	0.05	0.07	0.03	(0.02-0.16)
	2018	0.16	0.13	0.16	0.13	0.12	0.12	0.11	0.13	0.13	0.16	0.19	0.22	0.15	0.16	0.13	0.08	0.07	0.13	0.12	0.13	0.12	0.13	0.11	0.14	0.13	0.03	(0.07-0.22)
	2019	0.11	0.05	0.07	0.09	0.09	0.09	0.07	0.09	0.1	0.12	0.11	0.07	0.06	0.1	0.06	0.11	0.06	0.08	0.03	0.08	0.07	0.07	0.09	0.07	0.08	0.02	(0.03-0.12)
	2020	0.02	0.03	0.01	0.03	0.02	0.02	0.01	0.01	0.02	0.02	0	0	0	0	0	0.04	0.03	0.03	0.04	0.01	0.01	0.05	0.01	0.03	0.02	0.01	(0-0.05)
2021	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0	0	0.01	0	0.00	0.00	(0-0.01)	
																									0.08	0.09	(0.00-0.12)	
Average	0.09	0.08	0.09	0.08	0.09	0.08	0.08	0.09	0.10	0.09	0.09	0.08	0.07	0.06	0.05	0.05	0.04	0.06	0.06	0.06	0.08	0.09	0.08	0.08	0.08			
Std Dev	0.12	0.13	0.13	0.09	0.12	0.12	0.10	0.12	0.13	0.13	0.13	0.12	0.08	0.07	0.06	0.04	0.03	0.05	0.05	0.06	0.11	0.14	0.11	0.11	0.02			
Range	(0-0.36)	(0-0.38)	(0-0.38)	(0-0.26)	(0-0.36)	(0-0.37)	(0-0.31)	(0-0.35)	(0-0.39)	(0-0.38)	(0-0.35)	(0-0.32)	(0-0.16)	(0-0.16)	(0-0.13)	(0-0.11)	(0-0.08)	(0-0.13)	(0-0.13)	(0-0.15)	(0-0.33)	(0-0.41)	(0-0.32)	(0-0.34)	(0.04-0.10)			

By Hour of the Day and By Year "All WD" 5%ile SO ₂ Concentration (ppb) in Fort McKay for the Month of November for the Period 2014-2021																												
Hour of the Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range	
Year	2014	0.25	0.32	0.33	0.3	0.28	0.31	0.22	0.25	0.27	0.31	0.3	0.3	0.29	0.24	0.12	0.1	0.28	0.24	0.22	0.26	0.24	0.27	0.25	0.22	0.26	0.06	(0.1-0.33)
	2015	0.13	0.15	0.12	0.12	0.14	0.13	0.14	0.14	0.15	0.16	0.15	0.18	0.17	0.15	0.18	0.14	0.18	0.15	0.15	0.17	0.14	0.13	0.12	0.09	0.15	0.02	(0.09-0.18)
	2016	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)
	2017	0.08	0.1	0.08	0.1	0.08	0.09	0.09	0.08	0.09	0.07	0.11	0.11	0.04	0.1	0.09	0.09	0.1	0.12	0.09	0.09	0.07	0.07	0.08	0.08	0.09	0.02	(0.04-0.12)
	2018	0.09	0.08	0.07	0.1	0.1	0.08	0.11	0.1	0.1	0.09	0.11	0.07	0.11	0.08	0.06	0.02	0.07	0.07	0.1	0.1	0.05	0.07	0.06	0.07	0.08	0.02	(0.02-0.11)
	2019	0.1	0.1	0.07	0.02	0.04	0.02	0.03	0.02	0.02	0.06	0.03	0.02	0.02	0.06	0.08	0.06	0.09	0.09	0.09	0.04	0.08	0.04	0.09	0.04	0.05	0.03	(0.02-0.1)
	2020	0	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0.01)
2021	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)	
																									0.08	0.08	(0.00-0.26)	
Average	0.08	0.09	0.08	0.08	0.08	0.08	0.07	0.07	0.08	0.09	0.09	0.09	0.08	0.08	0.07	0.05	0.09	0.08	0.08	0.08	0.07	0.07	0.08	0.06	0.08			
Std Dev	0.09	0.11	0.11	0.10	0.10	0.11	0.08	0.09	0.10	0.10	0.10	0.11	0.11	0.08	0.07	0.05	0.10	0.09	0.08	0.09	0.08	0.09	0.08	0.07	0.01			
Range	(0-0.25)	(0-0.32)	(0-0.33)	(0-0.3)	(0-0.28)	(0-0.31)	(0-0.22)	(0-0.25)	(0-0.27)	(0-0.31)	(0-0.3)	(0-0.3)	(0-0.29)	(0-0.24)	(0-0.18)	(0-0.14)	(0-0.28)	(0-0.24)	(0-0.22)	(0-0.26)	(0-0.24)	(0-0.27)	(0-0.25)	(0-0.22)	(0.05-0.09)			

By Hour of the Day and By Year "All WD" 5%ile SO ₂ Concentration (ppb) in Fort McKay for the Month of December for the Period 2014-2021																												
Hour of the Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range	
Year	2014	0.35	0.32	0.31	0.25	0.35	0.31	0.26	0.32	0.39	0.3	0.42	0.43	0.4	0.19	0.18	0.17	0.13	0.16	0.3	0.38	0.37	0.4	0.38	0.36	0.31	0.09	(0.13-0.43)
	2015	0.16	0.14	0.17	0.14	0.18	0.23	0.2	0.2	0.18	0.19	0.2	0.22	0.09	0.2	0.22	0.22	0.19	0.16	0.19	0.14	0.15	0.15	0.13	0.17	0.18	0.03	(0.09-0.23)
	2016	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)
	2017	0.11	0.1	0.09	0.11	0.13	0.13	0.07	0.08	0.07	0.08	0.09	0.03	0.07	0.08	0.07	0.12	0.09	0.1	0.12	0.13	0.11	0.08	0.12	0.09	0.09	0.02	(0.03-0.13)
	2018	0.08	0.07	0.1	0.09	0.09	0.11	0.09	0.09	0.04	0.08	0.12	0.14	0.18	0.1	0.11	0.08	0.12	0.11	0.07	0.08	0.09	0.06	0.11	0.11	0.10	0.03	(0.04-0.18)
	2019	0.11	0.14	0.17	0.16	0.14	0.17	0.17	0.14	0.17	0.16	0.19	0.21	0.18	0.17	0.18	0.18	0.13	0.14	0.14	0.14	0.13	0.11	0.12	0.11	0.15	0.03	(0.11-0.21)
	2020	0	0	0	0	0	0	0.01	0.01	0.01	0.03	0.01	0.01	0	0.01	0	0	0.02	0	0.01	0	0	0	0	0	0.01	0.01	(0-0.03)
2021	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)	
																									0.10	0.10	(0.00-0.31)	
Average	0.10	0.10	0.11	0.09	0.11	0.12	0.10	0.11	0.11	0.11	0.13	0.13	0.12	0.09	0.10	0.10	0.09	0.08	0.10	0.11	0.11	0.10	0.11	0.11	0.10			
Std Dev	0.12	0.11	0.11	0.09	0.12	0.12	0.10	0.11	0.13	0.11	0.14	0.15	0.14	0.09	0.09	0.09	0.07	0.07	0.11	0.13	0.12	0.13	0.13	0.12	0.01			
Range	(0-0.35)	(0-0.32)	(0-0.31)	(0-0.25)	(0-0.35)	(0-0.31)	(0-0.26)	(0-0.32)	(0-0.39)	(0-0.3)	(0-0.42)	(0-0.43)	(0-0.4)	(0-0.2)	(0-0.22)	(0-0.22)	(0-0.19)	(0-0.16)	(0-0.3)	(0-0.38)	(0-0.37)	(0-0.4)	(0-0.38)	(0-0.36)	(0.08-0.13)			

Table E.5: The 10th percentile “All-WD” SO₂ Monthly/Annual Tables (January to March 2014-2021)

By Hour of the Day and By Year "All WD" 10%ile SO ₂ Concentration (ppb) in Fort McKay for the Month of January for the Period 2014-2021																												
Hour of the Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range	
Year	2014	0.26	0.27	0.28	0.28	0.27	0.31	0.27	0.34	0.35	0.36	0.36	0.34	0.38	0.32	0.25	0.29	0.21	0.31	0.27	0.26	0.26	0.24	0.33	0.26	0.29	0.04	(0.21-0.38)
	2015	0.22	0.26	0.23	0.25	0.25	0.27	0.21	0.3	0.26	0.31	0.32	0.34	0.42	0.38	0.36	0.34	0.35	0.3	0.34	0.31	0.28	0.24	0.27	0.21	0.29	0.06	(0.21-0.42)
	2016	0.19	0.22	0.18	0.15	0.14	0.14	0.12	0.16	0.16	0.19	0.21	0.2	0.2	0.17	0.23	0.2	0.17	0.15	0.13	0.16	0.16	0.14	0.16	0.17	0.03	0.03	(0.12-0.23)
	2017	0	0	0	0.01	0.01	0.01	0	0	0	0	0	0	0	0	0.09	0.01	0	0	0	0	0	0	0	0	0.01	0.02	(0-0.09)
	2018	0.12	0.16	0.11	0.12	0.12	0.09	0.09	0.1	0.1	0.11	0.13	0.16	0.11	0.14	0.12	0.14	0.11	0.11	0.11	0.09	0.11	0.08	0.1	0.11	0.11	0.02	(0.08-0.16)
	2019	0.26	0.24	0.28	0.29	0.25	0.25	0.26	0.27	0.26	0.27	0.29	0.29	0.29	0.27	0.26	0.26	0.28	0.27	0.24	0.26	0.25	0.26	0.28	0.26	0.27	0.02	(0.24-0.29)
	2020	0.11	0.13	0.1	0.13	0.14	0.15	0.12	0.1	0.12	0.14	0.15	0.15	0.14	0.19	0.17	0.15	0.17	0.16	0.14	0.14	0.14	0.11	0.13	0.09	0.14	0.02	(0.09-0.19)
	2021	0.06	0.04	0.03	0.06	0.05	0.06	0.06	0.04	0.02	0.07	0.06	0.15	0.11	0.16	0.13	0.07	0.07	0.07	0.06	0.05	0.08	0.06	0.05	0.03	0.07	0.04	(0.02-0.16)
																										0.17	0.10	(0.01-0.29)
Average	0.15	0.17	0.15	0.16	0.15	0.16	0.14	0.16	0.16	0.18	0.19	0.20	0.21	0.20	0.20	0.18	0.17	0.17	0.16	0.16	0.16	0.14	0.16	0.14	0.17			
Std Dev	0.10	0.10	0.11	0.10	0.10	0.11	0.10	0.13	0.12	0.12	0.13	0.12	0.15	0.12	0.09	0.11	0.11	0.11	0.11	0.11	0.11	0.10	0.10	0.12	0.10	0.02		
Range	(0-0.26)	(0-0.27)	(0-0.28)	(0.01-0.29)	(0.01-0.27)	(0.01-0.31)	(0-0.27)	(0-0.34)	(0-0.35)	(0-0.36)	(0-0.36)	(0-0.34)	(0-0.42)	(0-0.38)	(0.09-0.36)	(0.01-0.34)	(0-0.35)	(0-0.31)	(0-0.34)	(0-0.31)	(0-0.28)	(0-0.26)	(0-0.33)	(0-0.26)	(0.14-0.21)			

By Hour of the Day and By Year "All WD" 10%ile SO ₂ Concentration (ppb) in Fort McKay for the Month of February for the Period 2014-2021																													
Hour of the Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range		
Year	2014	0.38	0.44	0.42	0.37	0.42	0.4	0.45	0.38	0.39	0.46	0.45	0.46	0.48	0.51	0.49	0.4	0.47	0.45	0.42	0.45	0.41	0.45	0.47	0.34	0.43	0.04	(0.34-0.51)	
	2015	0.22	0.32	0.24	0.28	0.23	0.18	0.28	0.22	0.3	0.43	0.43	0.39	0.46	0.43	0.48	0.41	0.39	0.27	0.3	0.31	0.31	0.27	0.18	0.25	0.32	0.09	(0.18-0.48)	
	2016	0.09	0.1	0.07	0.09	0.08	0.1	0.08	0.1	0.1	0.11	0.11	0.16	0.14	0.18	0.17	0.15	0.12	0.08	0.1	0.1	0.09	0.06	0.06	0.08	0.11	0.03	(0.06-0.18)	
	2017	0	0	0	0	0	0	0	0	0	0	0.02	0.02	0.02	0.05	0.04	0	0.03	0.05	0	0.01	0	0	0	0	0	0.01	0.02	(0-0.05)
	2018	0.15	0.15	0.17	0.17	0.17	0.16	0.13	0.14	0.15	0.17	0.2	0.16	0.15	0.17	0.21	0.22	0.18	0.18	0.17	0.17	0.17	0.16	0.15	0.13	0.17	0.02	(0.13-0.22)	
	2019	0.18	0.2	0.19	0.19	0.21	0.19	0.2	0.18	0.2	0.21	0.27	0.21	0.23	0.26	0.22	0.27	0.25	0.19	0.2	0.22	0.17	0.17	0.18	0.17	0.21	0.03	(0.17-0.27)	
	2020	0.08	0.04	0.1	0.09	0.1	0.1	0.07	0.09	0.09	0.15	0.13	0.13	0.16	0.15	0.1	0.11	0.11	0.03	0.08	0.16	0.13	0.14	0.12	0.08	0.11	0.03	(0.03-0.16)	
	2021	0	0	0	0	0	0	0	0	0	0	0	0	0.02	0.02	0.01	0.01	0	0	0	0	0	0	0	0	0.00	0.01	(0-0.02)	
																										0.17	0.14	(0.00-0.43)	
Average	0.14	0.16	0.15	0.15	0.15	0.14	0.15	0.14	0.15	0.19	0.20	0.19	0.21	0.22	0.22	0.20	0.19	0.16	0.16	0.18	0.16	0.16	0.15	0.13	0.17				
Std Dev	0.13	0.16	0.14	0.13	0.14	0.13	0.15	0.12	0.14	0.17	0.17	0.16	0.18	0.17	0.18	0.16	0.17	0.15	0.15	0.15	0.14	0.15	0.15	0.12	0.03				
Range	(0-0.38)	(0-0.44)	(0-0.42)	(0-0.37)	(0-0.42)	(0-0.4)	(0-0.45)	(0-0.38)	(0-0.39)	(0-0.46)	(0-0.45)	(0-0.46)	(0.02-0.48)	(0.02-0.51)	(0.01-0.49)	(0-0.41)	(0-0.47)	(0-0.45)	(0-0.42)	(0-0.45)	(0-0.41)	(0-0.45)	(0-0.47)	(0-0.34)	(0.13-0.22)				

By Hour of the Day and By Year "All WD" 10%ile SO ₂ Concentration (ppb) in Fort McKay for the Month of March for the Period 2014-2021																													
Hour of the Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range		
Year	2014	0.42	0.32	0.22	0.25	0.3	0.2	0.28	0.2	0.33	0.39	0.37	0.44	0.39	0.41	0.37	0.51	0.44	0.47	0.4	0.32	0.25	0.23	0.36	0.32	0.34	0.09	(0.2-0.51)	
	2015	0.25	0.2	0.16	0.21	0.14	0.16	0.15	0.2	0.42	0.28	0.31	0.25	0.25	0.35	0.39	0.37	0.39	0.37	0.28	0.31	0.29	0.27	0.3	0.27	0.27	0.08	(0.14-0.42)	
	2016	0.14	0.12	0.12	0.12	0.14	0.12	0.1	0.11	0.1	0.11	0.15	0.17	0.17	0.17	0.18	0.13	0.15	0.13	0.15	0.11	0.12	0.11	0.13	0.11	0.13	0.02	(0.1-0.18)	
	2017	0	0	0	0	0	0.01	0	0	0.02	0	0.04	0	0.04	0.05	0.02	0.03	0.02	0.01	0.01	0	0	0.01	0	0	0	0.01	0.02	(0-0.05)
	2018	0.13	0.14	0.13	0.15	0.15	0.15	0.16	0.17	0.19	0.18	0.19	0.18	0.17	0.19	0.15	0.17	0.17	0.2	0.12	0.15	0.11	0.13	0.11	0.1	0.15	0.03	(0.1-0.2)	
	2019	0.14	0.11	0.19	0.15	0.15	0.12	0.1	0.15	0.19	0.25	0.24	0.25	0.23	0.2	0.21	0.18	0.23	0.21	0.16	0.19	0.19	0.18	0.12	0.14	0.18	0.04	(0.1-0.25)	
	2020	0.09	0.08	0.08	0.09	0.07	0.07	0.1	0.11	0.14	0.13	0.16	0.12	0.12	0.13	0.11	0.13	0.13	0.14	0.08	0.11	0.1	0.1	0.09	0.09	0.11	0.02	(0.07-0.16)	
	2021	0	0	0	0	0	0	0	0	0.02	0.02	0.04	0	0	0.03	0	0.03	0.02	0.03	0.01	0	0	0	0	0	0.01	0.01	(0-0.04)	
																										0.15	0.11	(0.01-0.27)	
Average	0.15	0.12	0.11	0.12	0.12	0.10	0.11	0.12	0.18	0.17	0.19	0.18	0.17	0.19	0.18	0.19	0.19	0.20	0.15	0.15	0.13	0.13	0.14	0.13	0.15				
Std Dev	0.14	0.11	0.08	0.09	0.10	0.07	0.09	0.08	0.14	0.13	0.12	0.14	0.12	0.13	0.14	0.17	0.15	0.16	0.13	0.12	0.11	0.10	0.13	0.11	0.03				
Range	(0-0.42)	(0-0.32)	(0-0.22)	(0-0.25)	(0-0.3)	(0-0.2)	(0-0.28)	(0-0.2)	(0.02-0.42)	(0-0.39)	(0.04-0.37)	(0-0.44)	(0-0.39)	(0.03-0.41)	(0-0.39)	(0.03-0.51)	(0.02-0.44)	(0.01-0.47)	(0.01-0.4)	(0-0.32)	(0-0.29)	(0-0.27)	(0-0.36)	(0-0.32)	(0.10-0.20)				

Table E.6: The 10th percentile “All-WD” SO₂ Monthly/Annual Tables (April to June 2014-2021)

By Hour of the Day and By Year "All WD" 10%ile SO ₂ Concentration (ppb) in Fort McKay for the Month of April for the Period 2014-2021																														
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range		
Year	2014	0.4	0.35	0.27	0.22	0.16	0.14	0.17	0.27	0.41	0.39	0.41	0.45	0.36	0.4	0.34	0.25	0.41	0.34	0.25	0.3	0.25	0.19	0.25	0.31	0.09	(0.14-0.45)			
	2015	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0	0	0.03	0.02	0.1	0.04	0.02	0	0.05	0	0	0.01	0.02	(0-0.1)		
	2016	0.08	0.08	0.08	0.11	0.08	0.07	0.08	0.09	0.06	0	0.05	0.12	0.11	0.12	0.1	0.07	0.05	0.05	0.06	0.05	0.06	0.09	0.08	0.07	0.08	0.03	(0-0.12)		
	2017	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)		
	2018	0.06	0.04	0.05	0.05	0.06	0.05	0.02	0.06	0.16	0.11	0.14	0.09	0.11	0.11	0.14	0.14	0.1	0.12	0.09	0.08	0.08	0.07	0.07	0.08	0.09	0.04	(0.02-0.16)		
	2019	0.18	0.17	0.15	0.16	0.14	0.15	0.19	0.19	0.22	0.22	0.22	0.2	0.15	0.16	0.19	0.19	0.19	0.16	0.19	0.17	0.19	0.16	0.17	0.17	0.18	0.02	(0.14-0.22)		
	2020	0.13	0.11	0.12	0.14	0.11	0.1	0.12	0.13	0.13	0.11	0.1	0.12	0.12	0.11	0.13	0.1	0.16	0.17	0.11	0.14	0.14	0.14	0.13	0.11	0.12	0.02	(0.1-0.17)		
	2021	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)		
																										0.10	0.10	(0.00-0.31)		
	Average	0.11	0.09	0.08	0.09	0.07	0.06	0.07	0.09	0.12	0.10	0.12	0.12	0.12	0.11	0.12	0.11	0.10	0.13	0.10	0.09	0.10	0.10	0.08	0.09	0.10				
	Std Dev	0.14	0.12	0.09	0.08	0.06	0.06	0.08	0.10	0.14	0.14	0.14	0.14	0.15	0.12	0.13	0.11	0.09	0.13	0.11	0.09	0.11	0.09	0.08	0.09	0.02				
	Range	(0-0.4)	(0-0.35)	(0-0.27)	(0-0.22)	(0-0.16)	(0-0.15)	(0-0.19)	(0-0.27)	(0-0.41)	(0-0.39)	(0-0.41)	(0-0.41)	(0-0.45)	(0-0.36)	(0-0.4)	(0-0.34)	(0-0.25)	(0-0.41)	(0-0.34)	(0-0.25)	(0-0.3)	(0-0.25)	(0-0.19)	(0-0.25)	(0.06-0.13)				
By Hour of the Day and By Year "All WD" 10%ile SO2 Concentration (ppb) in Fort McKay for the Month of May for the Period 2014-2021																														
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range		
Year	2014	0.25	0.26	0.28	0.28	0.3	0.31	0.34	0.36	0.29	0.38	0.32	0.23	0.26	0.38	0.37	0.34	0.35	0.34	0.36	0.4	0.32	0.32	0.39	0.3	0.32	0.05	(0.23-0.4)		
	2015	0	0	0	0	0	0	0	0.01	0	0	0.09	0.03	0	0.02	0.05	0.04	0.01	0.04	0	0.05	0.02	0	0	0	0	0.02	0.02	(0-0.09)	
	2016	0.04	0.04	0.03	0.04	0.03	0.04	0.03	0.05	0.05	0.05	0.04	0.07	0.04	0.03	0.02	0.03	0.05	0.04	0.04	0.05	0.04	0.05	0.03	0.04	0.04	0.01	(0.02-0.07)		
	2017	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)		
	2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)		
	2019	0.09	0.07	0.09	0.1	0.1	0.12	0.15	0.12	0.18	0.16	0.14	0.13	0.11	0.11	0.08	0.13	0.15	0.13	0.12	0.12	0.09	0.09	0.09	0.09	0.12	0.03	(0.07-0.18)		
	2020	0.06	0.06	0.07	0.05	0.07	0.08	0.1	0.09	0.09	0.1	0.1	0.11	0.12	0.1	0.11	0.11	0.09	0.09	0.09	0.07	0.08	0.08	0.07	0.07	0.09	0.02	(0.05-0.12)		
	2021	0	0	0	0	0	0	0.02	0.05	0.02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.01	(0-0.05)		
																										0.07	0.10	(0.00-0.32)		
	Average	0.06	0.05	0.06	0.06	0.06	0.07	0.08	0.09	0.08	0.09	0.09	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.07	0.07	0.07	0.06	0.07				
	Std Dev	0.09	0.09	0.10	0.10	0.10	0.11	0.12	0.12	0.11	0.13	0.11	0.08	0.09	0.13	0.12	0.12	0.12	0.12	0.12	0.13	0.11	0.11	0.13	0.10	0.01				
	Range	(0-0.25)	(0-0.26)	(0-0.28)	(0-0.28)	(0-0.3)	(0-0.31)	(0-0.34)	(0-0.36)	(0-0.29)	(0-0.38)	(0-0.32)	(0-0.23)	(0-0.26)	(0-0.38)	(0-0.37)	(0-0.34)	(0-0.35)	(0-0.34)	(0-0.36)	(0-0.4)	(0-0.32)	(0-0.32)	(0-0.39)	(0-0.3)	0.05-0.09)				
By Hour of the Day and By Year "All WD" 10%ile SO ₂ Concentration (ppb) in Fort McKay for the Month of June for the Period 2014-2021																														
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range		
Year	2014	0.33	0.38	0.42	0.38	0.33	0.37	0.33	0.4	0.47	0.42	0.41	0.4	0.27	0.33	0.3	0.35	0.42	0.39	0.39	0.34	0.39	0.37	0.29	0.3	0.37	0.05	(0.27-0.47)		
	2015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0.00	0.00	(0-0.01)	
	2016	0.07	0.04	0.06	0.05	0.03	0.02	0.04	0.06	0.03	0.01	0.01	0	0	0.05	0.03	0.05	0.07	0.05	0.05	0.04	0.05	0.07	0.06	0.07	0.04	0.02	(0-0.07)		
	2017	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)	
	2018	0.09	0.09	0.04	0.07	0.07	0.07	0.08	0.13	0.15	0.09	0.11	0.1	0.11	0.11	0.12	0.1	0.11	0.06	0.11	0.11	0.09	0.11	0.1	0.10	0.02	(0.04-0.15)			
	2019	0.12	0.11	0.13	0.11	0.12	0.13	0.12	0.13	0.12	0.12	0.14	0.15	0.14	0.16	0.12	0.14	0.13	0.11	0.13	0.11	0.11	0.14	0.14	0.13	0.13	0.01	(0.11-0.16)		
	2020	0.07	0.08	0.08	0.06	0.06	0.07	0.08	0.06	0.07	0.11	0.08	0.1	0.05	0.07	0.07	0.1	0.08	0.09	0.1	0.08	0.07	0.06	0.06	0.05	0.08	0.02	(0.05-0.11)		
	2021	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)		
																										0.09	0.11	(0.00-0.37)		
	Average	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.10	0.11	0.09	0.09	0.09	0.07	0.09	0.08	0.09	0.10	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.09				
	Std Dev	0.11	0.13	0.14	0.13	0.11	0.13	0.11	0.13	0.16	0.14	0.14	0.14	0.10	0.11	0.10	0.12	0.14	0.13	0.13	0.13	0.11	0.13	0.12	0.10	0.10	0.01			
	Range	(0-0.33)	(0-0.38)	(0-0.42)	(0-0.38)	(0-0.33)	(0-0.37)	(0-0.33)	(0-0.4)	(0-0.47)	(0-0.42)	(0-0.41)	(0-0.4)	(0-0.27)	(0-0.33)	(0-0.3)	(0-0.35)	(0-0.42)	(0-0.39)	(0-0.39)	(0-0.34)	(0-0.39)	(0-0.37)	(0-0.29)	(0-0.3)	(0.07-0.10)				

Table E.7: The 10th percentile “All-WD” SO₂ Monthly/Annual Tables (July to September 2014-2021)

By Hour of the Day and By Year "All WD" 10%ile SO2 Concentration (ppb) in Fort McKay for the Month of July for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	0.36	0.37	0.4	0.42	0.39	0.41	0.51	0.44	0.43	0.48	0.5	0.47	0.4	0.43	0.41	0.42	0.39	0.35	0.39	0.4	0.33	0.37	0.37	0.35	0.41	0.05	(0.33-0.51)
	2015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)
	2016	0.06	0.04	0.07	0.09	0.08	0.09	0.08	0.08	0.06	0.04	0.03	0.05	0.07	0.06	0.1	0.08	0.07	0.06	0.07	0.06	0.07	0.06	0.05	0.07	0.07	0.02	(0.03-0.1)
	2017	0.11	0.13	0.14	0.15	0.14	0.14	0.15	0.17	0.13	0.15	0.13	0.14	0.13	0.14	0.14	0.11	0.14	0.12	0.14	0.17	0.13	0.12	0.12	0.14	0.14	0.02	(0.11-0.17)
	2018	0.15	0.13	0.14	0.12	0.11	0.16	0.17	0.16	0.17	0.19	0.15	0.11	0.15	0.18	0.17	0.15	0.19	0.17	0.19	0.14	0.14	0.16	0.16	0.15	0.15	0.02	(0.11-0.19)
	2019	0.12	0.12	0.12	0.11	0.12	0.11	0.12	0.15	0.17	0.15	0.15	0.15	0.15	0.15	0.15	0.16	0.17	0.18	0.16	0.15	0.16	0.14	0.14	0.11	0.14	0.02	(0.11-0.18)
	2020	0.08	0.06	0.06	0.05	0.05	0.05	0.08	0.05	0.08	0.1	0.04	0	0.05	0	0	0.1	0.06	0.07	0.08	0.05	0.06	0.04	0.03	0.05	0.05	0.03	(0-0.1)
	2021	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)
																										0.12	0.12	(0.00-0.41)
Average		0.11	0.11	0.12	0.12	0.11	0.12	0.14	0.13	0.13	0.14	0.13	0.12	0.12	0.12	0.12	0.13	0.13	0.12	0.13	0.12	0.11	0.11	0.11	0.11	0.12		
Std Dev		0.11	0.12	0.13	0.13	0.12	0.13	0.16	0.14	0.14	0.16	0.16	0.16	0.13	0.15	0.14	0.13	0.13	0.11	0.13	0.13	0.11	0.12	0.12	0.11	0.01		
Range		(0-0.36)	(0-0.37)	(0-0.4)	(0-0.42)	(0-0.39)	(0-0.41)	(0-0.51)	(0-0.44)	(0-0.43)	(0-0.48)	(0-0.5)	(0-0.47)	(0-0.4)	(0-0.43)	(0-0.41)	(0-0.42)	(0-0.39)	(0-0.35)	(0-0.39)	(0-0.4)	(0-0.33)	(0-0.37)	(0-0.37)	(0-0.35)	(0.11-0.14)		
By Hour of the Day and By Year "All WD" 10%ile SO2 Concentration (ppb) in Fort McKay for the Month of August for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	0.4	0.43	0.42	0.41	0.38	0.37	0.39	0.57	0.6	0.56	0.52	0.46	0.45	0.42	0.4	0.31	0.47	0.36	0.37	0.4	0.35	0.38	0.42	0.3	0.42	0.08	(0.3-0.6)
	2015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)
	2016	0	0	0	0	0	0	0.02	0.01	0.03	0	0	0	0.01	0.04	0.05	0.05	0.04	0.02	0	0	0.02	0	0	0.01	0.01	0.02	(0-0.05)
	2017	0.14	0.14	0.13	0.15	0.15	0.17	0.16	0.17	0.16	0.17	0.16	0.16	0.16	0.15	0.17	0.17	0.14	0.18	0.15	0.14	0.14	0.16	0.15	0.16	0.16	0.01	(0.13-0.18)
	2018	0.17	0.18	0.16	0.18	0.17	0.17	0.19	0.2	0.17	0.19	0.19	0.18	0.18	0.22	0.22	0.2	0.21	0.19	0.21	0.21	0.21	0.19	0.18	0.2	0.19	0.02	(0.16-0.22)
	2019	0.11	0.1	0.09	0.11	0.1	0.11	0.09	0.13	0.12	0.16	0.16	0.13	0.07	0.15	0.12	0.11	0.13	0.15	0.14	0.14	0.13	0.11	0.09	0.11	0.12	0.02	(0.07-0.16)
	2020	0.07	0.06	0.04	0.05	0.06	0.08	0.08	0.08	0.1	0.05	0.12	0.03	0.06	0.05	0.02	0.05	0.08	0.09	0.07	0.05	0.06	0.02	0.04	0.04	0.06	0.02	(0.02-0.12)
	2021	0	0	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0.01	0	0	0	0	0	0	0	0	0.00	0.00	(0-0.01)
																										0.12	0.13	(0.00-0.42)
Average		0.11	0.11	0.11	0.11	0.11	0.11	0.12	0.15	0.15	0.14	0.14	0.12	0.12	0.13	0.12	0.11	0.13	0.12	0.12	0.12	0.11	0.11	0.11	0.10	0.12		
Std Dev		0.13	0.14	0.14	0.14	0.13	0.13	0.13	0.19	0.19	0.19	0.17	0.16	0.15	0.14	0.14	0.11	0.15	0.12	0.13	0.14	0.12	0.13	0.14	0.11	0.01		
Range		(0-0.4)	(0-0.43)	(0-0.42)	(0-0.41)	(0-0.38)	(0-0.37)	(0-0.39)	(0-0.57)	(0-0.6)	(0-0.56)	(0-0.52)	(0-0.46)	(0-0.45)	(0-0.42)	(0-0.4)	(0-0.31)	(0-0.47)	(0-0.36)	(0-0.37)	(0-0.4)	(0-0.35)	(0-0.38)	(0-0.42)	(0-0.3)	(0.10-0.15)		
By Hour of the Day and By Year "All WD" 10%ile SO2 Concentration (ppb) in Fort McKay for the Month of September for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	0.4	0.42	0.41	0.41	0.46	0.4	0.34	0.42	0.43	0.31	0.34	0.42	0.37	0.34	0.42	0.34	0.4	0.36	0.34	0.39	0.38	0.39	0.41	0.33	0.38	0.04	(0.31-0.46)
	2015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)
	2016	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0	0	0.01	0.03	0	0	0	0.01	0.01	0	0.02	0.00	0.01	(0-0.03)
	2017	0.09	0.09	0.09	0.09	0.1	0.11	0.1	0.1	0.1	0.13	0.11	0.09	0.1	0.09	0.11	0.11	0.1	0.1	0.09	0.09	0.08	0.08	0.11	0.06	0.10	0.01	(0.06-0.13)
	2018	0.12	0.07	0.1	0.13	0.08	0.1	0.11	0.08	0.11	0.11	0.15	0.15	0.15	0.13	0.14	0.11	0.12	0.09	0.09	0.09	0.13	0.11	0.1	0.1	0.11	0.02	(0.07-0.15)
	2019	0.09	0.11	0.12	0.1	0.11	0.12	0.13	0.12	0.12	0.1	0.13	0.07	0.09	0.1	0.11	0.12	0.12	0.13	0.12	0.11	0.11	0.1	0.08	0.08	0.11	0.02	(0.07-0.13)
	2020	0.07	0.05	0.04	0.03	0.07	0.02	0.02	0.06	0.06	0.08	0.11	0.09	0.07	0.1	0.08	0.09	0.07	0.08	0.06	0.1	0.06	0.06	0.04	0.05	0.07	0.02	(0.02-0.11)
	2021	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)
																										0.10	0.12	(0.00-0.38)
Average		0.10	0.09	0.10	0.10	0.10	0.09	0.09	0.10	0.10	0.09	0.11	0.10	0.10	0.10	0.11	0.10	0.11	0.10	0.09	0.10	0.10	0.09	0.09	0.08	0.10		
Std Dev		0.13	0.14	0.14	0.14	0.15	0.13	0.12	0.14	0.14	0.10	0.11	0.14	0.12	0.11	0.14	0.11	0.13	0.12	0.11	0.13	0.13	0.13	0.14	0.11	0.01		
Range		(0-0.4)	(0-0.42)	(0-0.41)	(0-0.41)	(0-0.46)	(0-0.4)	(0-0.34)	(0-0.42)	(0-0.43)	(0-0.31)	(0-0.34)	(0-0.42)	(0-0.37)	(0-0.34)	(0-0.42)	(0-0.34)	(0-0.4)	(0-0.36)	(0-0.34)	(0-0.39)	(0-0.38)	(0-0.39)	(0-0.41)	(0-0.33)	(0.08-0.11)		

Table E.8: The 10th percentile “All-WD” SO₂ Monthly/Annual Tables (October to December 2014-2021)

By Hour of the Day and By Year "All WD" 10%ile SO ₂ Concentration (ppb) in Fort McKay for the Month of October for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	0.36	0.4	0.43	0.39	0.47	0.43	0.38	0.44	0.43	0.41	0.43	0.49	0.37	0.28	0.27	0.41	0.41	0.38	0.4	0.39	0.42	0.46	0.43	0.41	0.40	0.05	(0.27-0.49)
	2015	0.04	0.07	0.04	0.05	0.09	0.06	0.05	0.1	0.13	0	0.08	0.06	0.06	0.04	0.04	0.03	0.06	0.06	0.08	0.08	0.07	0.05	0.04	0.02	0.06	0.03	(0-0.13)
	2016	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)
	2017	0.07	0.1	0.11	0.13	0.12	0.14	0.1	0.15	0.13	0.07	0.09	0.09	0.17	0.15	0.11	0.13	0.12	0.11	0.13	0.11	0.06	0.04	0.07	0.09	0.11	0.03	(0.04-0.17)
	2018	0.17	0.24	0.21	0.19	0.2	0.19	0.2	0.21	0.2	0.18	0.21	0.25	0.22	0.18	0.17	0.18	0.13	0.17	0.15	0.17	0.16	0.17	0.16	0.17	0.19	0.03	(0.13-0.25)
	2019	0.11	0.09	0.08	0.14	0.13	0.14	0.11	0.13	0.12	0.13	0.11	0.08	0.07	0.13	0.1	0.11	0.11	0.12	0.08	0.15	0.1	0.1	0.11	0.11	0.11	0.02	(0.07-0.15)
	2020	0.05	0.04	0.03	0.06	0.05	0.03	0.06	0.06	0.07	0.08	0.04	0.01	0.03	0.05	0.07	0.06	0.06	0.04	0.04	0.06	0.06	0.05	0.06	0.05	0.05	0.02	(0.01-0.08)
	2021	0	0.03	0	0	0	0	0	0	0.01	0	0	0	0	0	0	0	0	0	0.01	0.05	0	0.01	0.04	0.01	0.01	0.01	(0-0.05)
																										0.12	0.12	(0.01-0.40)
Average		0.10	0.12	0.11	0.12	0.13	0.12	0.11	0.14	0.14	0.11	0.12	0.12	0.12	0.10	0.10	0.12	0.11	0.11	0.11	0.13	0.11	0.11	0.11	0.11	0.12		
Std Dev		0.12	0.13	0.15	0.13	0.15	0.14	0.13	0.14	0.14	0.14	0.14	0.17	0.13	0.10	0.09	0.14	0.13	0.12	0.13	0.12	0.14	0.15	0.14	0.14	0.01		
Range		(0-0.36)	(0-0.4)	(0-0.43)	(0-0.39)	(0-0.47)	(0-0.43)	(0-0.38)	(0-0.44)	(0-0.43)	(0-0.41)	(0-0.43)	(0-0.49)	(0-0.37)	(0-0.28)	(0-0.27)	(0-0.41)	(0-0.41)	(0-0.38)	(0-0.4)	(0-0.39)	(0-0.42)	(0-0.46)	(0-0.43)	(0-0.41)	(0.10-0.14)		

By Hour of the Day and By Year "All WD" 10%ile SO ₂ Concentration (ppb) in Fort McKay for the Month of November for the Period 2014-2021																													
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range	
Year	2014	0.27	0.33	0.36	0.31	0.33	0.33	0.23	0.26	0.3	0.35	0.33	0.33	0.32	0.33	0.29	0.3	0.31	0.33	0.31	0.28	0.28	0.3	0.25	0.29	0.31	0.03	(0.23-0.36)	
	2015	0.15	0.16	0.14	0.17	0.15	0.15	0.16	0.16	0.17	0.17	0.19	0.19	0.2	0.2	0.18	0.15	0.2	0.16	0.16	0.19	0.15	0.14	0.14	0.13	0.17	0.02	(0.13-0.2)	
	2016	0	0	0	0	0	0	0	0	0	0	0.03	0	0.02	0.01	0.02	0.03	0.02	0	0	0	0	0	0	0	0.01	0.01	(0-0.03)	
	2017	0.09	0.12	0.1	0.11	0.09	0.11	0.11	0.1	0.12	0.12	0.13	0.13	0.07	0.12	0.12	0.11	0.11	0.14	0.12	0.11	0.1	0.11	0.1	0.09	0.11	0.02	(0.07-0.14)	
	2018	0.11	0.12	0.08	0.1	0.12	0.09	0.11	0.11	0.11	0.1	0.11	0.12	0.11	0.12	0.1	0.11	0.1	0.1	0.09	0.12	0.11	0.08	0.09	0.08	0.11	0.10	0.01	(0.08-0.12)
	2019	0.12	0.11	0.09	0.08	0.12	0.12	0.07	0.07	0.07	0.1	0.05	0.06	0.11	0.13	0.14	0.09	0.12	0.11	0.12	0.12	0.1	0.12	0.14	0.12	0.10	0.03	(0.05-0.14)	
	2020	0	0	0.03	0.02	0.03	0.01	0	0.01	0.02	0.03	0.02	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0.02	0.01	0.01	(0-0.03)
	2021	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)	
																										0.10	0.10	(0.00-0.31)	
Average		0.09	0.11	0.10	0.10	0.11	0.10	0.09	0.09	0.10	0.11	0.11	0.10	0.11	0.11	0.11	0.10	0.11	0.10	0.10	0.10	0.09	0.10	0.09	0.10	0.10			
Std Dev		0.09	0.11	0.12	0.10	0.11	0.11	0.08	0.09	0.10	0.11	0.11	0.12	0.11	0.11	0.10	0.10	0.11	0.11	0.11	0.10	0.10	0.10	0.09	0.10	0.01			
Range		(0-0.27)	(0-0.33)	(0-0.36)	(0-0.31)	(0-0.33)	(0-0.33)	(0-0.23)	(0-0.26)	(0-0.3)	(0-0.35)	(0-0.33)	(0-0.33)	(0-0.32)	(0-0.33)	(0-0.29)	(0-0.3)	(0-0.31)	(0-0.33)	(0-0.31)	(0-0.28)	(0-0.28)	(0-0.3)	(0-0.25)	(0-0.29)	(0.08-0.11)			

By Hour of the Day and By Year "All WD" 10%ile SO ₂ Concentration (ppb) in Fort McKay for the Month of December for the Period 2014-2021																													
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range	
Year	2014	0.43	0.42	0.36	0.32	0.38	0.39	0.3	0.35	0.42	0.42	0.43	0.46	0.45	0.41	0.41	0.37	0.37	0.45	0.35	0.44	0.41	0.43	0.39	0.46	0.40	0.04	(0.3-0.46)	
	2015	0.17	0.18	0.18	0.19	0.19	0.24	0.23	0.2	0.19	0.2	0.22	0.23	0.18	0.22	0.23	0.23	0.21	0.19	0.19	0.21	0.18	0.18	0.17	0.19	0.20	0.02	(0.17-0.24)	
	2016	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)
	2017	0.13	0.11	0.15	0.13	0.14	0.18	0.15	0.12	0.11	0.1	0.13	0.09	0.2	0.14	0.12	0.14	0.17	0.16	0.16	0.16	0.16	0.12	0.15	0.1	0.14	0.03	(0.09-0.2)	
	2018	0.09	0.08	0.11	0.12	0.12	0.12	0.1	0.1	0.08	0.09	0.17	0.2	0.2	0.18	0.15	0.1	0.14	0.12	0.09	0.13	0.1	0.13	0.12	0.14	0.12	0.03	(0.08-0.2)	
	2019	0.13	0.18	0.18	0.17	0.18	0.19	0.17	0.16	0.19	0.16	0.24	0.22	0.2	0.21	0.23	0.21	0.15	0.15	0.15	0.18	0.17	0.15	0.15	0.15	0.18	0.03	(0.13-0.24)	
	2020	0	0.01	0	0.02	0.01	0.01	0.02	0.03	0.02	0.03	0.03	0.03	0.04	0.04	0.01	0.04	0.05	0	0.03	0	0	0	0	0	0	0.02	0.02	(0-0.05)
	2021	0	0	0	0	0	0	0	0	0	0	0.03	0.01	0.02	0.03	0	0.01	0.01	0	0	0.01	0	0	0	0	0.01	0.01	(0-0.03)	
																										0.13	0.13	(0.00-0.40)	
Average		0.12	0.12	0.12	0.12	0.13	0.14	0.12	0.12	0.13	0.13	0.16	0.16	0.16	0.15	0.14	0.14	0.14	0.13	0.12	0.14	0.13	0.13	0.12	0.13	0.13			
Std Dev		0.14	0.14	0.12	0.11	0.13	0.14	0.11	0.12	0.14	0.14	0.14	0.16	0.15	0.13	0.14	0.13	0.12	0.15	0.12	0.15	0.14	0.14	0.13	0.15	0.01			
Range		(0-0.43)	(0-0.42)	(0-0.36)	(0-0.32)	(0-0.38)	(0-0.39)	(0-0.3)	(0-0.35)	(0-0.42)	(0-0.42)	(0-0.43)	(0-0.46)	(0-0.45)	(0-0.41)	(0-0.41)	(0-0.37)	(0-0.37)	(0-0.45)	(0-0.35)	(0-0.44)	(0-0.41)	(0-0.43)	(0-0.39)	(0-0.46)	(0.12-0.16)			

By Hour of the Day and By Year "All WD" 10%ile SO ₂ Concentration (ppb) in Fort McKay for the Month of October for the Period 2014-2021																													
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range	
Year	2014	0.36	0.4	0.43	0.39	0.47	0.43	0.38	0.44	0.43	0.41	0.43	0.49	0.37	0.28	0.27	0.41	0.41	0.38	0.4	0.39	0.42	0.46	0.43	0.41	0.40	0.05	(0.27-0.49)	
	2015	0.04	0.07	0.04	0.05	0.09	0.06	0.05	0.1	0.13	0	0.08	0.06	0.06	0.04	0.04	0.03	0.06	0.06	0.08	0.08	0.07	0.05	0.04	0.02	0.06	0.03	(0.0-0.13)	
	2016	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)	
	2017	0.07	0.1	0.11	0.13	0.12	0.14	0.1	0.15	0.13	0.07	0.09	0.09	0.17	0.15	0.11	0.13	0.12	0.11	0.13	0.11	0.06	0.04	0.07	0.09	0.11	0.03	(0.04-0.17)	
	2018	0.17	0.24	0.21	0.19	0.2	0.19	0.2	0.21	0.2	0.18	0.21	0.25	0.22	0.18	0.17	0.18	0.13	0.17	0.15	0.17	0.16	0.17	0.16	0.17	0.19	0.03	(0.13-0.25)	
	2019	0.11	0.09	0.08	0.14	0.13	0.14	0.11	0.13	0.12	0.13	0.11	0.08	0.07	0.13	0.1	0.11	0.11	0.12	0.08	0.15	0.1	0.1	0.11	0.11	0.11	0.02	(0.07-0.15)	
	2020	0.05	0.04	0.03	0.06	0.05	0.03	0.06	0.06	0.07	0.08	0.04	0.01	0.03	0.05	0.07	0.06	0.06	0.04	0.04	0.06	0.06	0.05	0.06	0.05	0.05	0.02	(0.01-0.08)	
	2021	0	0.03	0	0	0	0	0	0	0	0.01	0	0	0	0	0	0	0	0	0	0.01	0.05	0	0.01	0.04	0.01	0.01	0.01	(0-0.05)
																										0.12	0.13	(0-0.49)	
	Average	0.10	0.12	0.11	0.12	0.13	0.12	0.11	0.14	0.14	0.11	0.12	0.12	0.12	0.10	0.10	0.12	0.11	0.11	0.11	0.13	0.11	0.11	0.11	0.11	0.12			
	Std Dev	0.12	0.13	0.15	0.13	0.15	0.14	0.13	0.14	0.14	0.14	0.14	0.17	0.13	0.10	0.09	0.14	0.13	0.12	0.13	0.12	0.14	0.15	0.14	0.14	0.01			
	Range	(0-0.36)	(0-0.4)	(0-0.43)	(0-0.39)	(0-0.47)	(0-0.43)	(0-0.38)	(0-0.44)	(0-0.43)	(0-0.41)	(0-0.43)	(0-0.49)	(0-0.37)	(0-0.28)	(0-0.27)	(0-0.41)	(0-0.41)	(0-0.38)	(0-0.4)	(0-0.39)	(0-0.42)	(0-0.46)	(0-0.43)	(0-0.41)			(0.10-0.14)	
By Hour of the Day and By Year "All WD" 10%ile SO ₂ Concentration (ppb) in Fort McKay for the Month of November for the Period 2014-2021																													
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range	
Year	2014	0.27	0.33	0.36	0.31	0.33	0.33	0.23	0.26	0.3	0.35	0.33	0.33	0.32	0.33	0.29	0.3	0.31	0.33	0.31	0.28	0.28	0.3	0.25	0.29	0.31	0.03	(0.23-0.36)	
	2015	0.15	0.16	0.14	0.17	0.15	0.15	0.16	0.16	0.17	0.17	0.19	0.19	0.2	0.2	0.18	0.15	0.2	0.16	0.16	0.19	0.15	0.14	0.14	0.13	0.17	0.02	(0.13-0.2)	
	2016	0	0	0	0	0	0	0	0	0	0	0.03	0	0.02	0.01	0.02	0.03	0.02	0	0	0	0	0	0	0	0.01	0.01	(0-0.03)	
	2017	0.09	0.12	0.1	0.11	0.09	0.11	0.11	0.1	0.12	0.12	0.13	0.13	0.07	0.12	0.12	0.11	0.11	0.14	0.12	0.11	0.1	0.11	0.1	0.09	0.11	0.02	(0.07-0.14)	
	2018	0.11	0.12	0.08	0.1	0.12	0.09	0.11	0.11	0.1	0.11	0.12	0.11	0.12	0.1	0.11	0.1	0.1	0.09	0.12	0.11	0.08	0.09	0.08	0.11	0.10	0.01	(0.08-0.12)	
	2019	0.12	0.11	0.09	0.08	0.12	0.12	0.07	0.07	0.07	0.1	0.05	0.06	0.11	0.13	0.14	0.09	0.12	0.11	0.12	0.12	0.1	0.12	0.14	0.12	0.10	0.03	(0.05-0.14)	
	2020	0	0	0.03	0.02	0.03	0.01	0	0.01	0.02	0.03	0.02	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0.02	0.01	0.01	(0-0.03)
	2021	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)	
																										0.10	0.10	(0-0.36)	
	Average	0.09	0.11	0.10	0.10	0.11	0.10	0.09	0.09	0.10	0.11	0.11	0.10	0.11	0.11	0.11	0.10	0.11	0.10	0.10	0.10	0.09	0.10	0.09	0.10	0.10			
	Std Dev	0.09	0.11	0.12	0.10	0.11	0.11	0.08	0.09	0.10	0.11	0.11	0.12	0.11	0.11	0.10	0.10	0.11	0.11	0.11	0.10	0.10	0.10	0.09	0.10	0.01			
	Range	(0-0.27)	(0-0.33)	(0-0.36)	(0-0.31)	(0-0.33)	(0-0.33)	(0-0.23)	(0-0.26)	(0-0.3)	(0-0.35)	(0-0.33)	(0-0.33)	(0-0.32)	(0-0.33)	(0-0.29)	(0-0.3)	(0-0.31)	(0-0.33)	(0-0.31)	(0-0.28)	(0-0.28)	(0-0.3)	(0-0.25)	(0-0.29)			(0.08-0.11)	
By Hour of the Day and By Year "All WD" 10%ile SO ₂ Concentration (ppb) in Fort McKay for the Month of December for the Period 2014-2021																													
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range	
Year	2014	0.43	0.42	0.36	0.32	0.38	0.39	0.3	0.35	0.42	0.42	0.43	0.46	0.45	0.41	0.41	0.37	0.37	0.45	0.35	0.44	0.41	0.43	0.39	0.46	0.40	0.04	(0.3-0.46)	
	2015	0.17	0.18	0.18	0.19	0.19	0.24	0.23	0.2	0.19	0.2	0.22	0.23	0.18	0.22	0.23	0.23	0.21	0.19	0.19	0.21	0.18	0.18	0.17	0.19	0.20	0.02	(0.17-0.24)	
	2016	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00	(0-0)	
	2017	0.13	0.11	0.15	0.13	0.14	0.18	0.15	0.12	0.11	0.1	0.13	0.09	0.2	0.14	0.12	0.14	0.17	0.16	0.16	0.16	0.16	0.12	0.15	0.1	0.14	0.03	(0.09-0.2)	
	2018	0.09	0.08	0.11	0.12	0.12	0.12	0.1	0.1	0.08	0.09	0.17	0.2	0.2	0.18	0.15	0.1	0.14	0.12	0.09	0.13	0.1	0.13	0.12	0.14	0.12	0.03	(0.08-0.2)	
	2019	0.13	0.18	0.18	0.17	0.18	0.19	0.17	0.16	0.19	0.16	0.24	0.22	0.2	0.21	0.23	0.21	0.15	0.15	0.15	0.18	0.17	0.15	0.15	0.15	0.18	0.03	(0.13-0.24)	
	2020	0	0.01	0	0.02	0.01	0.01	0.02	0.03	0.02	0.03	0.03	0.03	0.04	0.04	0.01	0.04	0.05	0	0.03	0	0	0	0	0	0.02	0.02	(0-0.05)	
	2021	0	0	0	0	0	0	0	0	0	0	0.03	0.01	0.02	0.03	0.04	0.01	0.01	0	0	0.01	0	0	0	0	0.01	0.01	0.01	(0-0.03)
																										0.13	0.13	(0-0.46)	
	Average	0.12	0.12	0.12	0.12	0.13	0.14	0.12	0.12	0.13	0.13	0.16	0.16	0.16	0.15	0.14	0.14	0.14	0.13	0.12	0.14	0.13	0.13	0.12	0.13	0.13			
	Std Dev	0.14	0.14	0.12	0.11	0.13	0.14	0.11	0.12	0.14	0.14	0.14	0.16	0.15	0.13	0.14	0.13	0.12	0.15	0.12	0.15	0.14	0.14	0.13	0.15	0.01			
	Range	(0-0.43)	(0-0.42)	(0-0.36)	(0-0.32)	(0-0.38)	(0-0.39)	(0-0.3)	(0-0.35)	(0-0.42)	(0-0.42)	(0-0.43)	(0-0.46)	(0-0.45)	(0-0.41)	(0-0.41)	(0-0.37)	(0-0.37)	(0-0.45)	(0-0.35)	(0-0.44)	(0-0.41)	(0-0.43)	(0-0.39)	(0-0.46)			(0.12-0.16)	

Table E.9: The Wind Direction Screened SO₂ Percentile by Hour of the Day and by Month Tables (January and February for entire 2014-2021 Period) with 25th percentile and 50th percentile Values Highlighted in “Red”

By Hour of the Day and WD Screened %ile SO ₂ Concentrations (ppb) in Fort McKay for the Month of January for the Period 2014-2021																									
Percentile	Hr of the day																								Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
5%	0.24	0.14	0.17	0.10	0.18	0.08	0.00	0.11	0.11	0.17	0.19	0.18	0.11	0.13	0.21	0.18	0.21	0.05	0.09	0.01	0.05	0.04	0.07	0.07	0.12
10%	0.25	0.18	0.18	0.12	0.18	0.09	0.04	0.13	0.14	0.19	0.20	0.20	0.12	0.16	0.35	0.25	0.26	0.07	0.12	0.05	0.08	0.08	0.10	0.08	0.15
15%	0.26	0.20	0.18	0.12	0.19	0.12	0.09	0.13	0.15	0.20	0.21	0.23	0.12	0.20	0.49	0.32	0.30	0.10	0.17	0.14	0.10	0.13	0.13	0.16	0.19
20%	0.28	0.22	0.19	0.16	0.20	0.14	0.12	0.14	0.15	0.21	0.21	0.26	0.13	0.25	0.57	0.37	0.33	0.12	0.22	0.18	0.16	0.17	0.23	0.24	0.22
25%	0.29	0.24	0.20	0.20	0.23	0.16	0.13	0.17	0.17	0.22	0.22	0.29	0.14	0.34	0.63	0.39	0.36	0.22	0.27	0.18	0.23	0.21	0.25	0.27	0.25
30%	0.30	0.28	0.22	0.24	0.24	0.16	0.16	0.17	0.18	0.23	0.22	0.32	0.26	0.47	0.69	0.42	0.38	0.31	0.31	0.22	0.24	0.24	0.25	0.30	0.28
35%	0.30	0.33	0.28	0.27	0.24	0.18	0.19	0.18	0.20	0.23	0.23	0.36	0.38	0.57	0.75	0.44	0.40	0.34	0.34	0.26	0.27	0.26	0.28	0.34	0.32
40%	0.31	0.35	0.33	0.30	0.24	0.19	0.23	0.19	0.21	0.27	0.23	0.43	0.50	0.60	0.80	0.45	0.40	0.36	0.39	0.28	0.28	0.26	0.38	0.40	0.35
45%	0.32	0.35	0.36	0.32	0.24	0.20	0.24	0.25	0.24	0.32	0.30	0.49	0.63	0.64	0.85	0.46	0.40	0.40	0.46	0.30	0.28	0.30	0.38	0.45	0.38
50%	0.32	0.35	0.37	0.32	0.25	0.22	0.25	0.32	0.27	0.37	0.45	0.56	0.75	0.79	0.91	0.47	0.40	0.44	0.48	0.33	0.35	0.34	0.41	0.49	0.42
55%	0.45	0.44	0.38	0.32	0.26	0.23	0.28	0.35	0.31	0.38	0.59	0.63	0.77	0.95	0.94	0.48	0.43	0.46	0.50	0.39	0.41	0.36	0.45	0.56	0.47
60%	0.59	0.53	0.42	0.34	0.38	0.27	0.34	0.37	0.35	0.41	0.69	0.69	0.78	1.04	0.98	0.48	0.45	0.49	0.54	0.44	0.45	0.36	0.49	0.68	0.52
65%	0.68	0.58	0.47	0.38	0.48	0.38	0.39	0.38	0.37	0.44	0.74	0.76	0.80	1.11	1.01	0.48	0.48	0.49	0.59	0.47	0.61	0.45	0.53	0.71	0.57
70%	0.72	0.58	0.52	0.41	0.51	0.52	0.46	0.54	0.39	0.58	0.79	0.85	0.81	1.15	1.03	0.55	0.52	0.50	0.66	0.48	0.62	0.50	0.60	0.83	0.63
75%	0.76	0.58	0.66	0.44	0.61	0.54	0.59	0.79	0.41	0.67	0.91	0.94	0.83	1.18	1.04	0.64	0.56	0.60	0.74	0.49	0.78	0.51	0.67	0.87	0.70
80%	0.84	1.74	0.78	0.47	0.78	0.59	0.80	0.79	0.43	0.75	1.06	1.04	0.92	1.20	1.04	0.74	0.60	0.71	0.84	0.68	1.08	0.52	0.69	0.92	0.83
85%	0.93	2.89	0.80	0.50	0.89	0.76	0.84	0.79	0.60	0.86	1.21	1.13	1.01	1.23	1.09	0.88	1.07	1.10	0.88	0.85	1.39	0.88	0.73	0.94	1.01
90%	1.20	3.48	1.17	0.53	0.97	0.91	0.88	0.79	0.77	0.87	1.31	1.23	1.10	1.77	1.21	1.09	2.39	1.49	0.89	0.98	1.68	1.15	0.95	0.98	1.24
95%	1.63	3.50	1.73	0.92	1.16	1.00	0.98	1.27	0.84	0.99	1.41	1.32	1.19	4.13	1.34	1.30	3.71	3.60	0.90	1.09	1.98	1.74	1.16	1.08	1.67
100%	2.07	3.52	2.49	1.50	1.37	1.10	1.16	1.99	0.91	1.25	1.51	1.42	1.28	6.49	1.46	1.52	5.03	5.72	0.91	1.17	2.23	3.05	1.18	1.23	2.15
By Hour of the Day and WD Screened %ile SO ₂ Concentrations (ppb) in Fort McKay for the Month of February 2014-2021																									
Percentile	Hr of the day																								Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
5%	0.02	0.00	0.03	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.02	0.00	0.00	0.01	0.03	0.04	0.03	0.00	0.04	0.07	0.02	0.00	0.00	0.02
10%	0.04	0.01	0.06	0.08	0.01	0.00	0.00	0.00	0.02	0.00	0.06	0.03	0.00	0.00	0.03	0.05	0.08	0.05	0.00	0.06	0.09	0.07	0.01	0.00	0.03
15%	0.05	0.03	0.06	0.11	0.01	0.00	0.00	0.00	0.04	0.00	0.08	0.05	0.01	0.00	0.04	0.08	0.11	0.08	0.02	0.06	0.12	0.12	0.03	0.05	0.05
20%	0.06	0.05	0.07	0.14	0.02	0.00	0.02	0.01	0.06	0.01	0.10	0.08	0.05	0.04	0.05	0.11	0.14	0.10	0.06	0.09	0.12	0.14	0.08	0.05	0.07
25%	0.06	0.06	0.10	0.17	0.03	0.04	0.05	0.03	0.10	0.02	0.11	0.12	0.09	0.07	0.06	0.11	0.14	0.12	0.09	0.13	0.14	0.16	0.09	0.06	0.09
30%	0.06	0.15	0.14	0.21	0.05	0.13	0.08	0.09	0.15	0.03	0.12	0.16	0.13	0.10	0.07	0.11	0.15	0.14	0.10	0.15	0.17	0.20	0.10	0.09	0.12
35%	0.09	0.20	0.17	0.24	0.07	0.20	0.12	0.16	0.16	0.04	0.22	0.22	0.14	0.13	0.09	0.12	0.15	0.15	0.12	0.18	0.20	0.22	0.12	0.13	0.15
40%	0.11	0.21	0.19	0.26	0.15	0.22	0.20	0.17	0.17	0.04	0.33	0.28	0.16	0.16	0.13	0.12	0.16	0.15	0.16	0.28	0.23	0.23	0.14	0.16	0.18
45%	0.14	0.22	0.23	0.27	0.20	0.22	0.24	0.20	0.20	0.05	0.34	0.33	0.19	0.17	0.16	0.15	0.17	0.17	0.22	0.36	0.26	0.28	0.19	0.19	0.21
50%	0.18	0.23	0.27	0.27	0.25	0.23	0.28	0.24	0.26	0.05	0.36	0.36	0.23	0.18	0.23	0.17	0.19	0.30	0.31	0.45	0.30	0.34	0.22	0.21	0.26
55%	0.19	0.25	0.27	0.29	0.25	0.24	0.32	0.31	0.31	0.05	0.42	0.39	0.28	0.19	0.30	0.20	0.19	0.44	0.31	0.52	0.34	0.38	0.25	0.22	0.29
60%	0.20	0.27	0.28	0.34	0.32	0.25	0.37	0.40	0.35	0.06	0.48	0.42	0.32	0.25	0.33	0.23	0.19	0.59	0.36	0.54	0.36	0.44	0.31	0.26	0.33
65%	0.21	0.29	0.38	0.36	0.37	0.30	0.46	0.46	0.37	0.12	0.53	0.46	0.37	0.35	0.36	0.32	0.20	0.75	0.48	0.56	0.44	0.48	0.33	0.26	0.38
70%	0.21	0.31	0.48	0.38	0.38	0.37	0.48	0.48	0.40	0.24	0.58	0.50	0.41	0.44	0.40	0.40	0.21	0.82	0.60	0.63	0.56	0.48	0.35	0.27	0.43
75%	0.25	0.34	0.56	0.41	0.45	0.43	0.49	0.49	0.48	0.36	0.62	0.56	0.47	0.47	0.44	0.49	0.22	0.83	0.61	0.74	0.73	0.59	0.42	0.29	0.49
80%	0.30	0.38	0.65	0.46	0.52	0.48	0.52	0.52	0.53	0.42	0.65	0.63	0.53	0.48	0.48	0.58	0.23	1.16	1.90	0.98	0.82	0.78	0.62	0.45	0.63
85%	0.36	0.42	0.65	0.52	0.56	0.50	0.61	0.64	0.59	0.48	0.68	0.71	0.60	0.48	0.50	2.18	0.26	1.87	2.79	1.27	0.89	0.85	0.76	0.75	0.83
90%	0.42	0.45	0.66	0.59	0.58	0.55	0.66	1.33	0.65	0.52	0.71	1.32	0.74	0.52	1.35	3.78	0.30	2.64	3.83	1.47	1.30	0.94	0.83	0.77	1.12
95%	0.54	0.56	0.68	0.66	0.62	0.56	0.70	2.24	0.67	0.54	0.82	2.02	0.91	0.56	5.10	5.38	0.44	3.60	7.07	1.88	2.25	2.25	0.94	0.79	1.74
100%	0.65	0.72	0.71	0.73	0.64	0.62	0.75	3.01	0.78	0.57	0.93	2.73	1.07	0.61	8.85	6.97	0.58	4.56	16.07	3.81	3.64	2.34	1.21	2.72	2.72

Table E.10: The Wind Direction Screened SO₂ Percentile by Hour of the Day and by Month Tables (March and April for entire 2014-2021 Period) with 25th percentile and 50th percentile Values Highlighted in “Red”

By Hour of the Day and WD Screened %ile SO ₂ Concentrations (ppb) in Fort McKay for the Month of March for the Period 2014-2021																									
Percentile	Hr of the day																								Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
5%	0.00	0.07	0.04	0.00	0.03	0.00	0.07	0.04	0.10	0.06	0.04	0.21	0.11	0.09	0.07	0.15	0.14	0.08	0.12	0.14	0.12	0.10	0.07	0.00	0.08
10%	0.00	0.08	0.07	0.01	0.07	0.00	0.09	0.07	0.19	0.13	0.04	0.22	0.18	0.12	0.14	0.17	0.18	0.10	0.15	0.16	0.15	0.14	0.11	0.01	0.11
15%	0.03	0.08	0.08	0.02	0.12	0.00	0.10	0.09	0.24	0.18	0.05	0.23	0.24	0.16	0.20	0.18	0.22	0.16	0.17	0.16	0.15	0.16	0.14	0.05	0.13
20%	0.09	0.08	0.12	0.07	0.12	0.04	0.12	0.11	0.29	0.19	0.10	0.24	0.28	0.20	0.23	0.18	0.24	0.22	0.19	0.18	0.16	0.17	0.16	0.10	0.16
25%	0.10	0.15	0.18	0.10	0.14	0.05	0.15	0.15	0.31	0.19	0.15	0.25	0.29	0.23	0.25	0.18	0.25	0.22	0.21	0.20	0.20	0.17	0.17	0.13	0.18
30%	0.10	0.20	0.20	0.11	0.17	0.05	0.17	0.15	0.32	0.20	0.19	0.26	0.30	0.25	0.27	0.24	0.27	0.22	0.23	0.20	0.23	0.17	0.22	0.19	0.20
35%	0.11	0.23	0.23	0.14	0.19	0.10	0.19	0.15	0.33	0.23	0.21	0.27	0.32	0.28	0.27	0.29	0.28	0.22	0.25	0.22	0.24	0.22	0.29	0.21	0.23
40%	0.13	0.23	0.25	0.17	0.20	0.10	0.20	0.16	0.34	0.26	0.23	0.28	0.34	0.30	0.27	0.33	0.30	0.23	0.28	0.23	0.27	0.27	0.35	0.23	0.25
45%	0.20	0.24	0.27	0.18	0.23	0.14	0.21	0.18	0.35	0.30	0.24	0.29	0.36	0.32	0.28	0.37	0.32	0.23	0.30	0.23	0.31	0.34	0.47	0.26	0.28
50%	0.40	0.25	0.37	0.18	0.26	0.16	0.22	0.20	0.35	0.34	0.25	0.30	0.39	0.35	0.30	0.40	0.33	0.23	0.30	0.26	0.31	0.39	0.52	0.26	0.30
55%	0.56	0.31	0.46	0.18	0.27	0.17	0.23	0.35	0.35	0.37	0.26	0.33	0.53	0.37	0.33	0.53	0.33	0.23	0.30	0.28	0.31	0.44	0.55	0.32	0.35
60%	0.70	0.42	0.48	0.21	0.30	0.22	0.26	0.45	0.38	0.39	0.26	0.36	0.68	0.40	0.36	0.66	0.33	0.24	0.32	0.30	0.33	0.48	0.59	0.34	0.39
65%	0.78	0.56	0.56	0.22	0.30	0.23	0.28	0.45	0.41	0.40	0.27	0.39	0.82	0.43	0.39	0.73	0.33	0.27	0.37	0.33	0.38	0.50	0.62	0.37	0.43
70%	0.80	0.62	0.62	0.24	0.35	0.27	0.30	0.48	0.42	0.40	0.27	0.42	1.32	0.46	0.43	0.74	0.44	0.30	0.41	0.37	0.51	0.52	0.66	0.41	0.49
75%	0.83	0.62	0.65	0.24	0.40	0.36	0.31	0.53	0.43	0.43	0.31	0.44	2.00	0.48	0.55	0.76	0.61	0.32	0.47	0.38	0.66	0.53	0.73	0.41	0.56
80%	0.90	0.63	0.70	0.28	0.41	0.38	0.37	0.54	0.43	0.48	0.37	0.47	2.68	0.53	0.70	0.92	0.77	0.34	0.54	0.38	0.81	0.66	0.86	0.47	0.65
85%	0.94	0.71	0.74	0.30	0.50	0.40	0.48	0.57	0.43	0.52	0.44	0.50	3.23	0.58	0.85	1.09	0.91	0.34	0.62	0.40	0.86	0.85	0.91	0.65	0.74
90%	1.01	0.76	0.77	0.67	0.60	0.44	0.66	0.63	0.44	0.57	0.57	0.53	3.53	0.63	0.93	1.28	1.01	0.34	0.66	0.59	0.86	0.91	1.22	0.78	0.85
95%	1.36	0.78	0.85	0.78	0.84	0.70	0.75	0.77	0.48	0.63	0.72	0.56	3.83	0.68	1.00	1.51	1.11	0.58	0.71	0.74	1.04	1.04	1.52	0.84	0.99
100%	2.49	0.79	1.08	0.84	1.38	0.88	0.76	0.94	0.51	0.68	0.87	0.59	4.13	0.72	1.06	1.73	1.21	0.82	0.75	0.86	1.25	1.21	1.97	0.96	1.19
By Hour of the Day and WD Screened %ile SO ₂ Concentrations (ppb) in Fort McKay for the Month of April for the Period 2014-2021																									
Percentile	Hr of the day																								Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
5%	0.04	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.03	0.04	0.02	0.01	0.05	0.00	0.00	0.00	0.05	0.05	0.03	0.00	0.01	0.04	0.01	0.00	0.02
10%	0.06	0.00	0.03	0.01	0.00	0.07	0.00	0.00	0.06	0.05	0.04	0.02	0.05	0.00	0.00	0.00	0.05	0.10	0.03	0.00	0.02	0.07	0.03	0.00	0.03
15%	0.07	0.00	0.07	0.03	0.00	0.09	0.00	0.00	0.09	0.06	0.06	0.03	0.05	0.00	0.00	0.00	0.07	0.10	0.03	0.00	0.05	0.09	0.08	0.02	0.04
20%	0.11	0.02	0.08	0.07	0.01	0.10	0.00	0.02	0.10	0.08	0.08	0.04	0.06	0.00	0.00	0.03	0.09	0.10	0.03	0.00	0.09	0.11	0.09	0.07	0.06
25%	0.13	0.03	0.09	0.11	0.04	0.11	0.00	0.04	0.11	0.10	0.09	0.04	0.06	0.00	0.01	0.03	0.12	0.11	0.03	0.00	0.14	0.12	0.09	0.08	0.07
30%	0.14	0.04	0.11	0.12	0.06	0.12	0.03	0.07	0.12	0.11	0.10	0.04	0.06	0.00	0.02	0.04	0.14	0.14	0.05	0.01	0.16	0.13	0.10	0.09	0.08
35%	0.14	0.06	0.12	0.13	0.10	0.14	0.09	0.08	0.13	0.11	0.11	0.06	0.06	0.00	0.03	0.07	0.16	0.17	0.07	0.04	0.17	0.13	0.14	0.12	0.10
40%	0.16	0.11	0.13	0.13	0.14	0.14	0.11	0.08	0.14	0.11	0.12	0.11	0.07	0.01	0.06	0.07	0.18	0.19	0.08	0.06	0.18	0.14	0.18	0.15	0.12
45%	0.17	0.14	0.14	0.14	0.15	0.14	0.12	0.08	0.16	0.12	0.15	0.17	0.09	0.03	0.08	0.08	0.20	0.20	0.10	0.09	0.19	0.14	0.19	0.17	0.13
50%	0.18	0.15	0.15	0.16	0.15	0.16	0.13	0.09	0.18	0.12	0.18	0.23	0.10	0.06	0.09	0.09	0.20	0.21	0.11	0.11	0.20	0.15	0.20	0.20	0.15
55%	0.20	0.17	0.17	0.18	0.17	0.16	0.15	0.10	0.19	0.12	0.21	0.23	0.14	0.11	0.10	0.11	0.20	0.21	0.12	0.13	0.21	0.17	0.21	0.20	0.16
60%	0.22	0.18	0.18	0.20	0.18	0.16	0.16	0.12	0.21	0.14	0.25	0.23	0.18	0.15	0.11	0.15	0.20	0.21	0.13	0.14	0.22	0.17	0.22	0.21	0.18
65%	0.22	0.20	0.19	0.20	0.19	0.17	0.17	0.13	0.23	0.18	0.25	0.23	0.21	0.19	0.14	0.20	0.21	0.21	0.15	0.15	0.26	0.18	0.24	0.23	0.20
70%	0.24	0.24	0.21	0.21	0.20	0.20	0.19	0.17	0.25	0.21	0.25	0.23	0.22	0.23	0.15	0.21	0.23	0.22	0.16	0.16	0.33	0.20	0.26	0.25	0.22
75%	0.25	0.25	0.24	0.21	0.20	0.22	0.20	0.22	0.27	0.23	0.26	0.23	0.24	0.26	0.17	0.22	0.25	0.22	0.18	0.17	0.39	0.23	0.26	0.27	0.23
80%	0.41	0.30	0.27	0.22	0.21	0.25	0.21	0.27	0.29	0.25	0.26	0.23	0.25	0.27	0.18	0.23	0.27	0.22	0.19	0.18	0.74	0.26	0.28	0.28	0.27
85%	0.44	0.36	0.31	0.28	0.21	0.29	0.24	0.34	0.30	0.27	0.27	0.23	0.25	0.27	0.20	0.27	0.27	0.26	0.20	0.18	1.09	0.29	0.31	0.29	0.31
90%	0.57	0.41	0.35	0.47	0.22	0.39	0.28	0.44	0.31	0.31	0.28	0.24	0.29	0.28	0.20	0.32	0.31	0.31	0.22	0.19	1.45	0.34	0.40	0.34	0.37
95%	0.69	0.41	0.46	0.77	0.23	0.58	0.36	0.54	0.32	0.35	0.29	0.24	0.36	0.29	0.56	0.51	0.44	0.49	0.24	0.21	1.83	0.36	0.47	0.49	0.48
100%	1.18	0.45	0.74	1.01	0.28	0.86	0.45	0.64	0.33	0.40	0.30	0.25	0.43	0.30	1.10	0.86	0.58	0.69	0.27	0.22	2.21	0.38	0.52	0.86	0.64

Table E.11: The Wind Direction Screened SO₂ Percentile by Hour of the Day and by Month Tables (May and June for entire 2014-2021 Period) with 25th percentile and 50th percentile Values Highlighted in “Red”

By Hour of the Day and WD Screened %ile SO ₂ Concentrations (ppb) in Fort McKay for the Month of May for the Period 2014-2021																									
Percentile	Hr of the day																								Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
5%	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.01	0.03	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.03	0.03	0.00	0.00	0.01
10%	0.00	0.01	0.00	0.00	0.00	0.00	0.04	0.03	0.04	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.01	0.00	0.07	0.06	0.00	0.02	0.01
15%	0.03	0.05	0.00	0.00	0.00	0.04	0.08	0.04	0.04	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.01	0.00	0.10	0.07	0.00	0.02	0.02
20%	0.04	0.06	0.02	0.06	0.01	0.07	0.11	0.05	0.05	0.04	0.03	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.02	0.00	0.13	0.07	0.02	0.04	0.04
25%	0.05	0.07	0.03	0.06	0.03	0.08	0.12	0.06	0.05	0.06	0.04	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.03	0.00	0.14	0.11	0.06	0.06	0.05
30%	0.06	0.07	0.05	0.07	0.05	0.10	0.12	0.06	0.05	0.06	0.04	0.00	0.03	0.00	0.00	0.00	0.06	0.00	0.04	0.02	0.14	0.14	0.10	0.07	0.06
35%	0.08	0.08	0.06	0.08	0.06	0.12	0.15	0.06	0.05	0.06	0.04	0.01	0.06	0.00	0.02	0.02	0.06	0.00	0.05	0.04	0.15	0.14	0.11	0.08	0.07
40%	0.10	0.09	0.06	0.10	0.08	0.14	0.25	0.08	0.05	0.07	0.04	0.02	0.08	0.00	0.08	0.04	0.07	0.02	0.07	0.06	0.16	0.16	0.12	0.10	0.09
45%	0.12	0.13	0.07	0.11	0.13	0.14	0.30	0.12	0.06	0.08	0.04	0.04	0.08	0.01	0.13	0.05	0.09	0.06	0.14	0.08	0.30	0.20	0.14	0.12	0.11
50%	0.13	0.18	0.07	0.17	0.16	0.16	0.32	0.16	0.06	0.10	0.04	0.06	0.08	0.02	0.13	0.05	0.12	0.10	0.22	0.09	0.44	0.24	0.14	0.13	0.14
55%	0.14	0.22	0.07	0.29	0.24	0.17	0.33	0.18	0.07	0.11	0.06	0.06	0.08	0.03	0.14	0.07	0.15	0.11	0.29	0.10	0.58	0.25	0.14	0.15	0.17
60%	0.15	0.24	0.13	0.32	0.27	0.20	0.34	0.20	0.07	0.12	0.08	0.07	0.08	0.03	0.14	0.10	0.17	0.11	0.36	0.10	0.72	0.28	0.15	0.15	0.19
65%	0.20	0.30	0.15	0.33	0.29	0.23	0.35	0.24	0.10	0.17	0.10	0.07	0.09	0.08	0.15	0.10	0.18	0.12	0.37	0.10	1.14	0.32	0.17	0.17	0.23
70%	0.24	0.36	0.19	0.35	0.30	0.24	0.35	0.31	0.13	0.28	0.11	0.09	0.09	0.12	0.16	0.10	0.19	0.14	0.37	0.10	1.55	0.35	0.18	0.19	0.27
75%	0.34	0.38	0.27	0.39	0.35	0.25	0.35	0.37	0.17	0.38	0.13	0.11	0.10	0.16	0.17	0.10	0.19	0.16	0.38	0.10	1.97	0.38	0.19	0.23	0.32
80%	0.44	0.44	0.29	0.41	0.42	0.30	0.41	0.41	0.20	0.46	0.13	0.13	0.11	0.20	0.17	0.11	0.20	0.16	0.38	0.23	2.38	0.43	0.23	0.24	0.37
85%	0.70	0.45	0.31	0.51	0.46	0.42	0.47	0.44	0.26	0.54	0.14	0.19	0.11	0.21	0.18	0.12	0.22	0.16	0.47	0.36	3.74	0.52	0.30	0.29	0.48
90%	0.76	0.50	0.40	0.63	0.52	0.54	0.54	0.51	0.32	0.62	0.14	0.33	0.13	0.22	0.24	0.13	0.24	0.16	0.56	0.48	5.09	0.72	0.43	0.32	0.61
95%	1.03	0.70	0.46	0.80	0.64	0.72	0.58	0.61	0.38	0.71	0.14	0.48	0.16	0.23	0.50	0.17	0.26	0.18	0.65	0.61	6.44	0.85	0.54	0.60	0.77
100%	1.28	0.93	0.92	0.90	0.85	0.87	0.62	0.70	0.44	0.80	0.15	0.62	0.18	0.24	0.76	0.20	0.28	0.20	0.74	0.74	7.79	0.87	0.61	1.22	0.95

By Hour of the Day and WD Screened %ile SO ₂ Concentrations (ppb) in Fort McKay for the Month of June for the Period 2014-2021																									
Percentile	Hr of the day																								Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
5%	0.00	0.02	0.03	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10%	0.06	0.03	0.03	0.02	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.03	0.00	0.02	0.01	0.01	0.01
15%	0.07	0.06	0.04	0.05	0.01	0.00	0.04	0.00	0.04	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.06	0.00	0.00	0.08	0.00	0.04	0.04	0.03	0.02
20%	0.07	0.07	0.06	0.06	0.04	0.03	0.07	0.00	0.06	0.00	0.02	0.00	0.00	0.00	0.00	0.08	0.08	0.00	0.00	0.10	0.00	0.05	0.10	0.04	0.04
25%	0.11	0.10	0.08	0.09	0.06	0.09	0.08	0.04	0.08	0.00	0.02	0.00	0.00	0.00	0.00	0.10	0.08	0.00	0.00	0.11	0.00	0.10	0.15	0.08	0.06
30%	0.12	0.11	0.10	0.10	0.11	0.11	0.10	0.09	0.10	0.00	0.04	0.01	0.04	0.00	0.00	0.11	0.08	0.00	0.00	0.11	0.03	0.10	0.15	0.10	0.07
35%	0.13	0.14	0.15	0.13	0.14	0.12	0.13	0.13	0.13	0.00	0.07	0.02	0.09	0.01	0.00	0.11	0.09	0.00	0.04	0.11	0.08	0.14	0.16	0.12	0.09
40%	0.15	0.15	0.17	0.16	0.15	0.13	0.14	0.14	0.16	0.00	0.09	0.04	0.11	0.06	0.00	0.11	0.10	0.00	0.07	0.12	0.10	0.16	0.16	0.13	0.11
45%	0.16	0.17	0.18	0.18	0.19	0.13	0.15	0.15	0.18	0.00	0.11	0.09	0.12	0.10	0.00	0.12	0.12	0.10	0.07	0.14	0.11	0.17	0.17	0.15	0.13
50%	0.17	0.19	0.21	0.18	0.20	0.14	0.16	0.17	0.19	0.01	0.12	0.14	0.13	0.14	0.00	0.14	0.16	0.13	0.08	0.14	0.11	0.17	0.17	0.16	0.14
55%	0.18	0.22	0.21	0.20	0.22	0.15	0.17	0.17	0.19	0.01	0.13	0.14	0.19	0.15	0.02	0.22	0.17	0.14	0.09	0.14	0.11	0.20	0.19	0.16	0.16
60%	0.19	0.22	0.22	0.22	0.22	0.19	0.18	0.17	0.20	0.07	0.14	0.15	0.25	0.16	0.05	0.27	0.18	0.14	0.10	0.14	0.12	0.22	0.21	0.16	0.17
65%	0.21	0.24	0.23	0.23	0.24	0.21	0.18	0.18	0.21	0.14	0.14	0.15	0.28	0.17	0.07	0.31	0.19	0.15	0.12	0.15	0.13	0.23	0.21	0.19	0.19
70%	0.24	0.25	0.25	0.23	0.25	0.23	0.19	0.20	0.23	0.16	0.15	0.16	0.30	0.20	0.10	0.36	0.23	0.16	0.13	0.16	0.13	0.28	0.23	0.21	0.21
75%	0.24	0.29	0.27	0.24	0.27	0.24	0.20	0.21	0.24	0.16	0.15	0.17	0.32	0.24	0.12	0.39	0.30	0.22	0.13	0.26	0.35	0.29	0.24	0.21	0.24
80%	0.26	0.31	0.30	0.28	0.35	0.25	0.22	0.21	0.26	0.18	0.16	0.21	0.39	0.27	0.12	0.87	0.38	0.37	0.19	0.38	0.83	0.33	0.26	0.21	0.32
85%	0.27	0.42	0.35	0.30	0.37	0.30	0.25	0.22	0.28	0.23	0.17	0.24	0.45	0.33	0.12	2.53	0.52	0.38	0.29	0.53	1.10	0.42	0.28	0.25	0.44
90%	0.41	0.48	0.48	0.44	0.52	0.53	0.28	0.32	0.30	0.35	0.17	1.31	0.49	0.42	0.13	2.96	0.77	0.40	0.70	0.85	1.25	0.45	0.34	0.42	0.62
95%	0.48	0.57	0.59	0.54	0.64	0.63	0.50	0.48	0.31	0.71	0.18	3.42	0.50	0.51	0.15	4.94	1.03	0.42	1.02	1.80	2.30	0.59	0.38	0.63	0.97
100%	0.49	0.67	0.66	0.69	0.67	1.04	0.65	0.70	0.33	1.08	0.18	5.53	0.52	0.60	0.17	9.22	1.29	0.44	1.26	3.29	3.54	1.48	0.84	1.98	1.55

Table E.12: The Wind Direction Screened SO₂ Percentile by Hour of the Day and by Month Tables (July and August for entire 2014-2021 Period) with 25th percentile and 50th percentile Values Highlighted in “Red”

By Hour of the Day and WD Screened %ile SO ₂ Concentrations (ppb) in Fort McKay for the Month of July for the Period 2014-2021																									
Percentile	Hr of the day																								Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
5%	0.00	0.00	0.00	0.01	0.00	0.00	0.03	0.00	0.00	0.00	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.01
10%	0.00	0.03	0.00	0.03	0.02	0.03	0.07	0.06	0.00	0.00	0.02	0.07	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.04	0.08	0.00	0.07	0.00	0.02
15%	0.00	0.06	0.02	0.10	0.04	0.07	0.12	0.09	0.00	0.04	0.03	0.11	0.04	0.04	0.00	0.00	0.00	0.00	0.00	0.07	0.13	0.00	0.11	0.03	0.05
20%	0.02	0.08	0.07	0.11	0.06	0.11	0.14	0.11	0.01	0.08	0.04	0.12	0.06	0.06	0.00	0.00	0.04	0.00	0.00	0.08	0.13	0.01	0.12	0.10	0.06
25%	0.06	0.11	0.10	0.13	0.07	0.13	0.15	0.11	0.01	0.08	0.04	0.13	0.07	0.07	0.01	0.02	0.08	0.00	0.01	0.09	0.13	0.03	0.13	0.11	0.08
30%	0.08	0.11	0.14	0.14	0.10	0.15	0.16	0.12	0.06	0.08	0.06	0.16	0.09	0.09	0.04	0.06	0.11	0.02	0.02	0.11	0.14	0.08	0.14	0.12	0.10
35%	0.10	0.13	0.15	0.16	0.12	0.15	0.17	0.13	0.13	0.10	0.07	0.17	0.09	0.10	0.12	0.07	0.16	0.09	0.04	0.15	0.14	0.10	0.15	0.14	0.12
40%	0.12	0.15	0.16	0.17	0.15	0.16	0.18	0.16	0.18	0.12	0.09	0.19	0.10	0.13	0.14	0.09	0.16	0.11	0.07	0.17	0.18	0.12	0.16	0.15	0.14
45%	0.12	0.16	0.17	0.18	0.16	0.17	0.18	0.20	0.19	0.13	0.13	0.19	0.11	0.14	0.15	0.10	0.17	0.12	0.12	0.18	0.20	0.14	0.18	0.16	0.16
50%	0.13	0.17	0.19	0.20	0.16	0.19	0.19	0.20	0.20	0.13	0.17	0.20	0.13	0.14	0.15	0.13	0.18	0.15	0.14	0.20	0.22	0.14	0.19	0.17	0.17
55%	0.16	0.18	0.20	0.20	0.16	0.19	0.20	0.21	0.21	0.17	0.19	0.21	0.14	0.15	0.16	0.15	0.21	0.15	0.15	0.22	0.24	0.17	0.19	0.19	0.18
60%	0.17	0.19	0.21	0.21	0.17	0.20	0.20	0.23	0.22	0.21	0.22	0.25	0.15	0.18	0.17	0.16	0.22	0.16	0.15	0.22	0.30	0.18	0.20	0.21	0.20
65%	0.18	0.19	0.22	0.21	0.20	0.21	0.21	0.24	0.31	0.23	0.25	0.26	0.17	0.22	0.19	0.17	0.23	0.16	0.16	0.23	0.31	0.22	0.20	0.22	0.22
70%	0.21	0.21	0.25	0.21	0.22	0.22	0.25	0.24	0.37	0.25	0.28	0.26	0.22	0.24	0.22	0.18	0.27	0.16	0.18	0.28	0.32	0.24	0.21	0.24	0.24
75%	0.25	0.23	0.27	0.24	0.26	0.23	0.27	0.26	0.40	0.26	0.30	0.27	0.27	0.24	0.23	0.20	0.31	0.26	0.22	0.32	0.33	0.26	0.22	0.31	0.27
80%	0.27	0.28	0.29	0.29	0.28	0.24	0.28	0.29	0.44	0.28	0.37	0.37	0.27	0.36	0.27	0.21	0.34	0.37	0.30	0.39	0.35	0.37	0.24	0.33	0.31
85%	0.42	0.30	0.39	0.35	0.34	0.28	0.29	0.37	0.44	0.33	0.44	0.50	0.30	0.45	0.39	0.23	0.39	0.40	0.40	0.46	0.41	0.39	0.27	0.37	0.37
90%	0.52	0.38	0.45	0.41	0.40	0.32	0.37	0.70	0.66	0.39	0.48	0.51	0.39	0.46	0.50	0.33	0.46	0.44	0.44	0.70	0.44	0.41	0.30	0.40	0.45
95%	0.84	0.45	0.53	0.46	0.49	0.42	0.57	0.87	2.37	0.44	0.49	0.52	0.49	0.51	0.58	0.44	0.51	0.95	1.15	1.25	0.67	0.56	0.31	0.44	0.68
100%	1.15	0.61	0.86	0.73	0.71	0.62	0.93	1.43	6.88	0.49	0.51	0.52	0.50	0.59	0.59	0.55	0.54	2.11	2.43	1.91	0.70	1.13	0.77	1.34	1.19
By Hour of the Day and WD Screened %ile SO ₂ Concentrations (ppb) in Fort McKay for the Month of August for the Period 2014-2021																									
Percentile	Hr of the day																								Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
5%	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.02	0.02	0.00	0.03	0.04	0.00	0.02	0.00	0.02	0.02	0.00	0.01	0.00	0.00	0.00	0.00	0.01
10%	0.03	0.02	0.03	0.00	0.04	0.00	0.00	0.00	0.03	0.03	0.01	0.06	0.07	0.02	0.03	0.00	0.03	0.02	0.00	0.04	0.00	0.01	0.00	0.00	0.02
15%	0.04	0.05	0.04	0.03	0.05	0.00	0.01	0.01	0.03	0.05	0.03	0.09	0.09	0.10	0.04	0.01	0.05	0.05	0.01	0.06	0.01	0.02	0.01	0.01	0.04
20%	0.05	0.06	0.05	0.06	0.08	0.02	0.01	0.02	0.05	0.05	0.07	0.13	0.11	0.12	0.05	0.03	0.06	0.07	0.02	0.07	0.02	0.03	0.03	0.02	0.05
25%	0.09	0.07	0.06	0.06	0.09	0.03	0.03	0.04	0.06	0.06	0.11	0.16	0.13	0.13	0.07	0.04	0.07	0.08	0.03	0.07	0.04	0.04	0.04	0.05	0.07
30%	0.10	0.09	0.09	0.08	0.10	0.05	0.06	0.05	0.07	0.08	0.11	0.16	0.14	0.14	0.07	0.05	0.09	0.09	0.05	0.12	0.06	0.05	0.07	0.07	0.08
35%	0.13	0.11	0.10	0.09	0.11	0.11	0.07	0.06	0.08	0.12	0.12	0.16	0.15	0.15	0.07	0.06	0.11	0.12	0.05	0.14	0.09	0.06	0.09	0.11	0.10
40%	0.14	0.13	0.13	0.11	0.14	0.12	0.09	0.07	0.11	0.13	0.12	0.17	0.16	0.17	0.08	0.06	0.12	0.13	0.07	0.14	0.12	0.11	0.13	0.12	0.12
45%	0.15	0.14	0.14	0.13	0.15	0.15	0.13	0.08	0.15	0.14	0.14	0.20	0.16	0.18	0.10	0.07	0.13	0.13	0.08	0.16	0.13	0.11	0.14	0.13	0.13
50%	0.17	0.16	0.16	0.14	0.15	0.17	0.15	0.10	0.17	0.17	0.15	0.22	0.16	0.19	0.12	0.11	0.15	0.14	0.08	0.17	0.13	0.12	0.16	0.17	0.15
55%	0.18	0.16	0.17	0.15	0.16	0.18	0.16	0.19	0.19	0.19	0.17	0.24	0.19	0.19	0.13	0.16	0.19	0.15	0.08	0.19	0.15	0.13	0.17	0.17	0.17
60%	0.19	0.16	0.17	0.17	0.17	0.19	0.18	0.22	0.19	0.19	0.19	0.25	0.21	0.20	0.14	0.17	0.20	0.17	0.11	0.20	0.16	0.13	0.17	0.19	0.18
65%	0.20	0.16	0.19	0.18	0.20	0.21	0.19	0.24	0.20	0.21	0.21	0.29	0.28	0.21	0.17	0.21	0.18	0.14	0.21	0.17	0.13	0.18	0.24	0.20	0.20
70%	0.22	0.18	0.20	0.19	0.23	0.22	0.22	0.25	0.20	0.25	0.23	0.35	0.38	0.34	0.18	0.18	0.21	0.18	0.14	0.23	0.17	0.15	0.19	0.27	0.22
75%	0.29	0.21	0.22	0.20	0.24	0.25	0.26	0.27	0.23	0.27	0.24	0.41	0.49	0.53	0.19	0.18	0.23	0.19	0.15	0.25	0.18	0.17	0.21	0.30	0.26
80%	0.37	0.24	0.23	0.22	0.28	0.30	0.29	0.54	0.32	0.28	0.25	0.49	0.51	0.64	0.20	0.19	0.31	0.23	0.20	0.28	0.19	0.19	0.23	0.34	0.30
85%	0.43	0.32	0.27	0.27	0.42	0.37	0.32	0.73	0.44	0.91	0.26	0.57	0.54	0.76	0.24	0.19	0.33	0.24	0.23	0.32	0.23	0.20	0.35	0.42	0.39
90%	0.54	0.44	0.42	0.41	0.56	0.41	0.51	0.83	0.56	1.90	1.20	2.57	1.14	0.86	0.33	0.21	0.51	0.25	0.25	0.39	0.33	0.27	0.47	0.50	0.66
95%	0.71	0.61	0.55	0.55	0.71	0.61	0.64	0.89	0.67	4.33	3.08	6.48	2.31	1.11	0.95	0.33	1.24	0.28	0.38	0.43	0.41	0.36	0.67	0.66	1.21
100%	0.93	0.87	1.05	0.82	0.95	0.87	1.01	0.99	0.78	7.09	4.96	10.40	3.49	1.43	1.82	0.44	3.07	0.37	0.51	0.48	0.52	0.77	1.19	1.32	1.92

Table E.13: The Wind Direction Screened SO₂ Percentile by Hour of the Day and by Month Tables (September and October for entire 2014-2021 Period) with 25th percentile and 50th percentile Values Highlighted in “Red”

By Hour of the Day and WD Screened %ile SO ₂ Concentrations (ppb) in Fort McKay for the Month of September for the Period 2014-2021																									
Percentile	Hr of the day																								Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
5%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.01	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10%	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.03	0.01	0.00	0.05	0.02	0.01	0.00	0.02	0.00	0.00	0.00	0.00	0.01
15%	0.00	0.00	0.00	0.01	0.00	0.05	0.00	0.00	0.00	0.00	0.01	0.02	0.05	0.04	0.01	0.08	0.03	0.04	0.00	0.03	0.00	0.03	0.00	0.00	0.02
20%	0.00	0.00	0.00	0.00	0.03	0.02	0.06	0.04	0.01	0.01	0.00	0.04	0.03	0.07	0.07	0.03	0.09	0.05	0.05	0.00	0.03	0.01	0.04	0.00	0.00
25%	0.02	0.02	0.01	0.05	0.03	0.07	0.06	0.04	0.07	0.03	0.08	0.05	0.08	0.09	0.04	0.09	0.09	0.06	0.01	0.05	0.02	0.05	0.01	0.00	0.05
30%	0.04	0.07	0.02	0.07	0.04	0.10	0.07	0.10	0.12	0.04	0.10	0.08	0.08	0.12	0.06	0.09	0.13	0.07	0.03	0.06	0.02	0.07	0.02	0.02	0.07
35%	0.07	0.09	0.03	0.08	0.08	0.11	0.09	0.13	0.12	0.06	0.10	0.08	0.09	0.12	0.07	0.10	0.14	0.08	0.08	0.06	0.03	0.08	0.03	0.03	0.08
40%	0.08	0.10	0.07	0.09	0.12	0.15	0.10	0.15	0.13	0.08	0.11	0.10	0.11	0.12	0.10	0.11	0.16	0.12	0.10	0.07	0.04	0.10	0.05	0.05	0.10
45%	0.11	0.12	0.08	0.10	0.13	0.16	0.13	0.15	0.14	0.10	0.12	0.11	0.11	0.13	0.11	0.11	0.17	0.14	0.12	0.09	0.06	0.11	0.06	0.06	0.11
50%	0.13	0.13	0.11	0.13	0.15	0.17	0.15	0.15	0.15	0.12	0.13	0.12	0.12	0.14	0.12	0.12	0.18	0.15	0.15	0.12	0.10	0.13	0.10	0.10	0.13
55%	0.14	0.16	0.14	0.15	0.15	0.18	0.17	0.16	0.16	0.13	0.15	0.13	0.13	0.15	0.12	0.13	0.18	0.16	0.16	0.14	0.11	0.16	0.12	0.10	0.15
60%	0.15	0.17	0.15	0.16	0.17	0.19	0.18	0.17	0.16	0.13	0.16	0.14	0.16	0.16	0.14	0.15	0.18	0.18	0.17	0.17	0.12	0.18	0.14	0.12	0.16
65%	0.17	0.18	0.15	0.19	0.18	0.19	0.20	0.17	0.18	0.14	0.17	0.16	0.20	0.17	0.14	0.17	0.20	0.20	0.17	0.18	0.13	0.22	0.18	0.14	0.17
70%	0.19	0.19	0.16	0.21	0.22	0.20	0.21	0.18	0.19	0.17	0.19	0.18	0.21	0.18	0.15	0.19	0.21	0.21	0.20	0.19	0.16	0.24	0.21	0.17	0.19
75%	0.23	0.23	0.18	0.22	0.24	0.20	0.22	0.20	0.21	0.21	0.20	0.20	0.22	0.18	0.17	0.19	0.22	0.21	0.27	0.21	0.19	0.25	0.23	0.20	0.21
80%	0.27	0.23	0.19	0.25	0.28	0.22	0.23	0.23	0.23	0.24	0.20	0.22	0.23	0.18	0.20	0.20	0.22	0.22	0.40	0.27	0.22	0.30	0.25	0.23	0.24
85%	0.35	0.26	0.22	0.28	0.31	0.24	0.25	0.23	0.24	0.25	0.22	0.23	0.27	0.24	0.26	0.21	0.23	0.25	0.62	0.43	0.29	0.33	0.30	0.24	0.28
90%	0.59	0.30	0.24	0.29	0.37	0.30	0.28	0.27	0.27	0.27	0.25	0.25	0.34	0.30	0.31	0.25	0.25	0.35	0.79	0.59	0.36	0.68	0.34	0.30	0.35
95%	0.79	0.58	0.29	0.38	0.46	0.37	0.40	0.37	0.42	0.30	0.28	0.28	0.37	0.33	0.34	0.28	0.61	14.53	5.60	0.86	0.53	1.57	0.66	0.67	1.30
100%	1.61	0.69	0.60	0.49	0.61	0.60	0.63	0.48	0.45	0.37	0.32	0.30	0.38	0.35	0.34	0.30	0.97	35.77	16.61	1.03	1.01	3.04	1.08	1.27	2.89
By Hour of the Day and WD Screened %ile SO ₂ Concentrations (ppb) in Fort McKay for the Month of October for the Period 2014-2021																									
Percentile	Hr of the day																								Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
5%	0.00	0.04	0.09	0.01	0.00	0.08	0.00	0.01	0.02	0.00	0.07	0.00	0.00	0.00	0.07	0.04	0.02	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.02
10%	0.04	0.07	0.12	0.06	0.07	0.10	0.00	0.08	0.03	0.00	0.10	0.00	0.01	0.01	0.07	0.05	0.03	0.02	0.03	0.00	0.00	0.03	0.01	0.02	0.04
15%	0.05	0.07	0.13	0.09	0.13	0.12	0.02	0.12	0.05	0.01	0.10	0.00	0.03	0.03	0.09	0.06	0.05	0.04	0.03	0.01	0.00	0.05	0.03	0.05	0.06
20%	0.08	0.09	0.15	0.12	0.14	0.13	0.10	0.13	0.09	0.05	0.10	0.01	0.06	0.06	0.10	0.06	0.07	0.06	0.05	0.02	0.02	0.07	0.06	0.09	0.08
25%	0.11	0.10	0.15	0.13	0.14	0.14	0.11	0.14	0.14	0.06	0.11	0.03	0.09	0.07	0.10	0.08	0.10	0.07	0.09	0.03	0.04	0.09	0.09	0.12	0.10
30%	0.15	0.13	0.18	0.15	0.15	0.15	0.12	0.16	0.14	0.08	0.11	0.05	0.11	0.08	0.10	0.10	0.10	0.09	0.09	0.05	0.07	0.10	0.10	0.16	0.11
35%	0.17	0.14	0.21	0.17	0.17	0.16	0.14	0.20	0.14	0.08	0.12	0.06	0.12	0.09	0.11	0.11	0.11	0.11	0.10	0.10	0.11	0.11	0.12	0.17	0.13
40%	0.20	0.15	0.28	0.19	0.17	0.18	0.14	0.22	0.15	0.09	0.13	0.07	0.14	0.10	0.11	0.11	0.11	0.12	0.10	0.14	0.12	0.12	0.14	0.22	0.15
45%	0.22	0.20	0.30	0.23	0.24	0.19	0.14	0.23	0.16	0.10	0.14	0.07	0.15	0.11	0.18	0.12	0.14	0.12	0.11	0.15	0.13	0.14	0.16	0.25	0.17
50%	0.25	0.25	0.31	0.25	0.25	0.20	0.15	0.24	0.17	0.12	0.16	0.09	0.17	0.15	0.22	0.14	0.17	0.13	0.14	0.15	0.13	0.15	0.16	0.25	0.18
55%	0.25	0.26	0.36	0.27	0.26	0.22	0.15	0.25	0.17	0.18	0.17	0.11	0.20	0.16	0.23	0.17	0.17	0.15	0.14	0.16	0.18	0.16	0.17	0.26	0.20
60%	0.26	0.29	0.38	0.29	0.28	0.24	0.20	0.29	0.18	0.23	0.18	0.12	0.21	0.17	0.24	0.19	0.18	0.15	0.14	0.17	0.20	0.18	0.20	0.28	0.22
65%	0.27	0.29	0.41	0.30	0.31	0.26	0.26	0.31	0.19	0.24	0.20	0.13	0.21	0.19	0.30	0.20	0.19	0.15	0.17	0.22	0.22	0.26	0.23	0.28	0.24
70%	0.28	0.32	0.49	0.32	0.35	0.29	0.28	0.33	0.20	0.26	0.23	0.15	0.21	0.21	0.32	0.21	0.24	0.18	0.19	0.28	0.23	0.27	0.26	0.29	0.27
75%	0.28	0.35	0.53	0.34	0.40	0.31	0.29	0.35	0.24	0.29	0.24	0.18	0.23	0.22	0.35	0.29	0.30	0.23	0.22	0.32	0.37	0.29	0.29	0.32	0.30
80%	0.36	0.39	0.56	0.38	0.51	0.44	0.31	0.43	0.28	0.29	0.27	0.22	0.26	0.24	0.43	0.37	0.34	0.31	0.26	0.41	0.43	0.29	0.36	0.36	0.35
85%	0.41	0.45	0.61	0.47	0.61	0.50	0.32	0.54	0.30	0.30	0.33	0.25	0.31	0.33	0.61	0.93	0.63	0.53	0.49	0.49	0.45	0.30	0.43	0.41	0.46
90%	0.44	0.51	0.63	0.55	0.70	0.61	0.36	0.62	0.41	0.45	0.44	0.28	0.35	0.40	0.79	1.48	1.42	0.84	0.53	0.64	0.55	0.35	0.52	0.45	0.60
95%	0.53	0.52	0.69	0.83	0.94	0.76	0.41	0.75	0.57	0.47	0.51	0.39	0.42	0.60	1.01	2.79	2.12	1.80	0.88	0.71	0.71	0.57	0.61	0.52	0.84
100%	0.88	0.59	0.81	1.01	1.08	0.78	0.46	0.83	0.67	1.93	0.52	0.51	0.51	1.29	2.16	4.11	2.78	3.94	1.08	0.96	0.87	1.23	3.39	0.93	1.39

Table E.14: The Wind Direction Screened SO₂ Percentile by Hour of the Day and by Month Tables (September and October for entire 2014-2021 Period) with 25th percentile and 50th percentile Values Highlighted in “Red”

By Hour of the Day and WD Screened %ile SO ₂ Concentrations (ppb) in Fort McKay for the Month of November for the Period 2014-2021																									
Percentile	Hr of the day																								Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
5%	0.00	0.02	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.06	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.05	0.00	0.00	0.06	0.01
10%	0.04	0.04	0.04	0.04	0.01	0.01	0.07	0.01	0.05	0.07	0.01	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.04	0.12	0.10	0.06	0.00	0.08	0.03
15%	0.10	0.08	0.05	0.08	0.02	0.03	0.10	0.05	0.08	0.09	0.02	0.00	0.04	0.00	0.00	0.00	0.01	0.00	0.12	0.13	0.11	0.10	0.00	0.10	0.06
20%	0.12	0.10	0.06	0.09	0.04	0.07	0.12	0.08	0.11	0.10	0.02	0.00	0.05	0.00	0.02	0.00	0.02	0.01	0.13	0.13	0.13	0.11	0.00	0.11	0.07
25%	0.13	0.12	0.07	0.10	0.07	0.11	0.13	0.09	0.14	0.11	0.04	0.00	0.05	0.01	0.05	0.02	0.05	0.03	0.14	0.14	0.14	0.11	0.01	0.12	0.08
30%	0.13	0.13	0.11	0.12	0.12	0.13	0.14	0.14	0.16	0.12	0.05	0.01	0.07	0.02	0.08	0.03	0.09	0.09	0.14	0.15	0.15	0.13	0.04	0.13	0.10
35%	0.13	0.14	0.15	0.14	0.16	0.15	0.16	0.15	0.16	0.13	0.06	0.03	0.11	0.02	0.10	0.04	0.12	0.11	0.15	0.15	0.16	0.14	0.07	0.14	0.12
40%	0.13	0.15	0.17	0.16	0.17	0.22	0.20	0.16	0.17	0.13	0.07	0.06	0.16	0.04	0.11	0.05	0.14	0.12	0.16	0.15	0.16	0.16	0.10	0.16	0.14
45%	0.14	0.17	0.18	0.18	0.20	0.22	0.22	0.18	0.19	0.13	0.09	0.08	0.19	0.05	0.11	0.12	0.16	0.14	0.17	0.17	0.16	0.17	0.12	0.18	0.16
50%	0.14	0.19	0.19	0.19	0.20	0.23	0.23	0.19	0.19	0.14	0.10	0.11	0.19	0.07	0.12	0.19	0.19	0.14	0.18	0.18	0.17	0.18	0.15	0.18	0.17
55%	0.17	0.20	0.22	0.20	0.22	0.24	0.23	0.20	0.20	0.16	0.11	0.13	0.20	0.10	0.13	0.19	0.21	0.15	0.20	0.18	0.18	0.21	0.18	0.19	0.18
60%	0.18	0.22	0.25	0.23	0.23	0.28	0.24	0.21	0.20	0.18	0.11	0.15	0.21	0.13	0.14	0.19	0.22	0.16	0.21	0.19	0.18	0.27	0.18	0.23	0.20
65%	0.18	0.22	0.26	0.24	0.23	0.28	0.25	0.21	0.23	0.20	0.12	0.17	0.24	0.17	0.15	0.19	0.23	0.17	0.21	0.21	0.18	0.31	0.18	0.25	0.21
70%	0.20	0.23	0.31	0.25	0.24	0.29	0.26	0.22	0.25	0.21	0.13	0.20	0.27	0.19	0.16	0.19	0.25	0.17	0.22	0.23	0.18	0.33	0.20	0.26	0.23
75%	0.20	0.25	0.37	0.25	0.27	0.30	0.27	0.23	0.33	0.21	0.13	0.20	0.35	0.20	0.17	0.19	0.27	0.18	0.27	0.25	0.21	0.37	0.20	0.28	0.25
80%	0.21	0.29	0.38	0.25	0.31	0.31	0.29	0.27	0.41	0.24	0.14	0.21	0.45	0.22	0.18	0.20	0.37	0.19	0.32	0.27	0.25	0.38	0.24	0.30	0.28
85%	0.23	0.31	0.40	0.28	0.33	0.31	0.33	0.29	0.43	0.31	0.17	0.21	0.55	0.23	0.20	0.27	0.58	0.21	0.35	0.40	0.27	0.40	0.31	0.42	0.33
90%	0.41	0.36	0.43	0.46	0.37	0.32	0.36	0.30	0.50	0.38	0.25	0.23	0.64	0.26	0.27	0.34	0.77	0.30	0.40	0.50	0.27	0.52	0.41	0.53	0.40
95%	0.54	0.60	0.53	0.59	0.53	0.44	0.39	0.38	0.65	0.45	0.33	0.25	0.72	0.28	0.34	0.39	0.87	0.48	0.47	0.61	0.28	0.54	0.48	0.63	0.49
100%	0.55	0.64	0.67	0.66	0.67	0.77	0.51	0.71	0.74	0.53	0.42	0.27	0.81	0.31	0.41	0.43	0.98	0.57	0.57	0.73	0.28	0.63	0.53	0.77	0.59
By Hour of the Day and WD Screened %ile SO ₂ Concentrations (ppb) in Fort McKay for the Month of December for the Period 2014-2021																									
Percentile	Hr of the day																								Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
5%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10%	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.03	0.07	0.08	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
15%	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.04	0.10	0.09	0.05	0.01	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.01
20%	0.03	0.00	0.00	0.00	0.01	0.02	0.02	0.00	0.02	0.02	0.02	0.05	0.12	0.10	0.11	0.05	0.05	0.00	0.02	0.00	0.03	0.02	0.00	0.00	0.03
25%	0.07	0.00	0.03	0.00	0.03	0.02	0.04	0.01	0.05	0.04	0.05	0.10	0.15	0.12	0.11	0.09	0.09	0.02	0.06	0.02	0.07	0.03	0.06	0.02	0.05
30%	0.10	0.02	0.06	0.01	0.04	0.06	0.07	0.03	0.09	0.06	0.07	0.15	0.17	0.14	0.11	0.12	0.12	0.05	0.08	0.07	0.14	0.03	0.12	0.06	0.08
35%	0.10	0.06	0.07	0.02	0.06	0.06	0.08	0.04	0.12	0.08	0.11	0.18	0.18	0.17	0.13	0.16	0.12	0.08	0.12	0.12	0.17	0.04	0.13	0.12	0.10
40%	0.12	0.12	0.13	0.03	0.07	0.09	0.10	0.11	0.15	0.09	0.16	0.21	0.20	0.18	0.15	0.19	0.16	0.08	0.15	0.13	0.19	0.11	0.16	0.12	0.13
45%	0.13	0.15	0.15	0.07	0.12	0.10	0.14	0.16	0.19	0.11	0.21	0.23	0.21	0.19	0.15	0.23	0.17	0.11	0.18	0.15	0.20	0.15	0.19	0.12	0.16
50%	0.15	0.18	0.18	0.13	0.15	0.16	0.17	0.18	0.20	0.14	0.26	0.25	0.21	0.31	0.16	0.28	0.18	0.13	0.26	0.20	0.20	0.18	0.21	0.12	0.19
55%	0.21	0.21	0.18	0.19	0.17	0.17	0.20	0.20	0.20	0.18	0.26	0.29	0.21	0.43	0.19	0.29	0.18	0.14	0.27	0.22	0.23	0.21	0.22	0.15	0.22
60%	0.30	0.24	0.23	0.24	0.20	0.19	0.24	0.22	0.20	0.23	0.26	0.33	0.24	0.45	0.21	0.29	0.19	0.17	0.28	0.23	0.25	0.24	0.28	0.16	0.24
65%	0.33	0.28	0.26	0.27	0.25	0.23	0.26	0.24	0.21	0.24	0.26	0.33	0.30	0.46	0.24	0.30	0.24	0.17	0.28	0.24	0.28	0.28	0.37	0.23	0.27
70%	0.37	0.31	0.28	0.30	0.27	0.26	0.27	0.27	0.24	0.25	0.27	0.33	0.35	0.46	0.28	0.30	0.29	0.18	0.31	0.25	0.32	0.33	0.37	0.27	0.30
75%	0.44	0.34	0.35	0.34	0.34	0.26	0.30	0.29	0.27	0.26	0.28	0.40	0.47	0.47	0.32	0.32	0.31	0.19	0.41	0.26	0.33	0.35	0.41	0.35	0.33
80%	0.47	0.39	0.44	0.39	0.37	0.30	0.33	0.31	0.28	0.27	0.29	0.47	0.61	0.47	0.35	0.35	0.34	0.19	0.49	0.27	0.35	0.39	0.46	0.47	0.38
85%	0.50	0.41	0.44	0.41	0.40	0.31	0.34	0.32	0.32	0.30	0.31	0.52	0.75	0.49	0.40	0.43	0.46	0.24	0.52	0.33	0.39	0.44	0.52	0.56	0.42
90%	0.54	0.47	0.45	0.82	0.48	0.33	0.42	0.38	0.41	0.59	0.34	0.58	0.78	0.52	0.44	0.54	0.67	0.32	0.61	0.54	0.41	0.52	0.54	0.62	0.51
95%	0.55	0.59	0.47	0.90	0.86	0.41	0.80	0.53	0.58	0.87	0.37	0.60	0.80	0.59	0.54	0.65	0.91	0.39	0.82	0.83	0.48	0.53	0.62	0.62	0.64
100%	0.58	0.84	0.98	3.15	3.19	0.43	1.51	0.67	0.90	1.14	0.41	0.62	0.81	0.68	0.64	0.74	1.17	0.41	1.23	1.30	0.54	0.58	0.79	0.64	1.00

Appendix F $PM_{2.5}$

F.1 The Monthly/Annual Tables used to Estimate the “All-WD” 5th percentile and 10th percentile $PM_{2.5}$ Baselines and the Tables used to Estimate the WD Screened 25th percentile and 50th percentile $PM_{2.5}$ Baselines

Table F.1: The 5th percentile PM_{2.5} "All-WD" Monthly/Annual Tables (January to March 2014-2021)

By Hour of the Day and By Year "All WD" 5%ile PM _{2.5} Concentration in Fort McKay for the Month of January for the Period 2014-2021																												
Hour of the Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range	
Year	2014	1.56	1.65	1.98	1.64	1.71	1.74	2.03	2.79	2.33	1.83	1.68	0.67	1.8	1.59	1.46	1.61	1.62	1.69	1.78	1.3	1.62	1.29	1.58	1.73	1.70	0.38	(0.67-2.79)
	2015	1.61	1.59	1.72	1.21	1.07	1.18	1.23	0.87	0.96	0.74	0.78	0.85	0.79	1.28	0.13	0.06	1.31	1.58	1.5	1.37	1.26	1.52	1.34	1.1	1.13	0.43	(0.06-1.72)
	2016	0.4	0.59	0.81	0.61	0.76	0.87	0.73	0.69	0.64	0.88	1.31	1.45	1.4	0	0.57	1.35	1.19	1.64	1.33	1.6	1.34	1.35	0.83	0.84	0.97	0.42	(0-1.64)
	2017	1.59	1.17	1.61	1.51	1.4	0.82	0.83	0.88	1.26	1.27	0.49	0.34	0.75	0.63	0.49	1.47	1.54	1.87	1.3	0.93	0.61	1.17	1.25	1.73	1.12	0.43	(0.34-1.87)
	2018	1.15	1.23	1.06	1.15	1.35	1.36	1.53	1.51	1.49	1.74	1.79	1.75	1.32	1.98	1.63	1.91	1.88	1.66	1.42	1.61	1.24	1.19	1.15	1.05	1.46	0.28	(1.05-1.98)
	2019	2.09	1.09	0.98	1.33	1.55	1.71	1.64	1.36	1.71	1.37	1.6	1.54	1.04	0.22	0.17	0.68	1.41	1.22	1.62	1.28	1.95	1.22	2.07	2.13	1.37	0.51	(0.17-2.13)
	2020	1.53	2.62	1.39	1.41	1.7	1.22	2.08	2.15	1.66	1.57	1.63	1.62	1.87	1.43	1.46	1.41	1.43	1.99	2.27	2.45	2.31	2.59	1.8	2.81	1.85	0.46	(1.22-2.81)
2021	0.87	0.59	0.57	0.72	0.69	0.77	0.95	1.13	1.24	1.18	1.23	0.98	1.15	1.35	1.44	1.08	1.31	1.15	1.23	1.1	1.43	1.11	1	0.97	1.05	0.25	(0.57-1.44)	
																									1.33	0.30	(0.97-1.85)	
Average	1.35	1.32	1.27	1.20	1.28	1.21	1.38	1.42	1.41	1.32	1.31	1.15	1.27	1.06	0.92	1.20	1.46	1.60	1.56	1.46	1.47	1.43	1.38	1.55		1.33		
Std Dev	0.52	0.66	0.49	0.36	0.40	0.38	0.53	0.72	0.51	0.39	0.46	0.51	0.42	0.70	0.64	0.59	0.22	0.29	0.34	0.46	0.51	0.49	0.42	0.68		0.16		
Range	(0.4-2.09)	(0.59-2.62)	(0.61-1.98)	(0.61-1.64)	(0.69-1.71)	(0.77-1.74)	(0.73-2.08)	(0.69-2.79)	(0.64-2.33)	(0.74-1.83)	(0.49-1.79)	(0.34-1.75)	(0.75-1.87)	(0-1.98)	(0.13-1.63)	(0.06-1.91)	(1.19-1.88)	(1.15-1.99)	(1.23-2.27)	(0.93-2.45)	(0.61-2.31)	(1.11-2.59)	(0.83-2.07)	(0.84-2.81)		0.92-1.6		

By Hour of the Day and By Year "All WD" 5%ile PM _{2.5} Concentration in Fort McKay for the Month of February for the Period 2014-2021																												
Hour of the Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range	
Year	2014	1.8	1.53	1.4	1.46	1.29	1.37	1.45	1.63	1.72	1.47	1.46	1.29	1.43	1.55	0.85	1.3	1.49	1.85	1.44	1.23	1.42	1.4	1.48	1.85	1.47	0.21	(0.85-1.85)
	2015	1.96	1.65	1.68	2	1.51	1.67	1.8	1.66	1.76	1.01	1.15	1.02	1.07	1.25	0.96	0.93	1.74	1.44	0.79	1.09	1	0.81	0.73	1.52	1.34	0.40	(0.73-2)
	2016	1.46	1.2	1.79	1.91	1.83	1.43	1.68	1.73	1.97	1.47	1.36	1.18	0.6	0.62	0.89	0.99	0.68	0.75	1.07	1.34	1.02	1.26	1.21	1.72	1.30	0.42	(0.6-1.97)
	2017	0.85	1.67	1.91	1.55	1.16	1.18	1.32	1.23	1.48	1.49	1.71	1.19	1	1.25	1.09	1.5	1.18	1.24	1.75	1.16	0.69	1	1.24	1.4	1.30	0.29	(0.69-1.91)
	2018	0.66	0.62	0.71	0.52	0.48	0.39	0.36	0.36	0.34	0.44	0.24	0.42	0.59	0.17	0.52	0.48	0.42	0.6	0.57	0.72	0.4	0.47	0.55	0.56	0.48	0.14	(0.17-0.72)
	2019	2.01	1.7	1.69	1.89	2.23	2.6	1.58	2.33	2.49	1.93	1.78	2.22	2.47	1.81	1.72	2.16	2.46	2.44	2.75	1.96	1.46	1.65	1.79	2	2.05	0.36	(1.46-2.75)
	2020	2.11	1.53	2.24	1.82	1.49	1.44	1.76	1.94	1.44	1.55	2.42	1.24	1.58	1.74	1	1.78	1.65	1.32	1.51	3.55	2.45	3.45	3.5	1.98	1.94	0.70	(1-3.55)
2021	1.64	2.12	2.62	2.91	2.87	2.92	2.77	1.79	2.14	1.51	2.38	2.5	1.63	1.97	1.41	1.58	1.39	1.27	2.1	1.7	0.8	1.5	2.08	1.8	1.98	0.58	(0.8-2.92)	
																									1.48	0.48	(0.48-2.05)	
Average	1.56	1.50	1.76	1.76	1.61	1.63	1.59	1.58	1.67	1.36	1.56	1.38	1.30	1.30	1.06	1.34	1.38	1.36	1.50	1.59	1.16	1.44	1.57	1.60		1.48		
Std Dev	0.54	0.44	0.57	0.66	0.72	0.80	0.66	0.58	0.64	0.45	0.70	0.67	0.62	0.62	0.37	0.53	0.64	0.58	0.71	0.88	0.63	0.90	0.93	0.47		0.18		
Range	(0.66-2.11)	(0.62-2.12)	(0.71-2.62)	(0.52-2.91)	(0.48-2.87)	(0.39-2.92)	(0.36-2.77)	(0.36-2.33)	(0.34-2.49)	(0.44-1.93)	(0.24-2.42)	(0.42-2.5)	(0.59-2.47)	(0.17-1.97)	(0.52-1.72)	(0.48-2.16)	(0.42-2.46)	(0.6-2.44)	(0.57-2.75)	(0.72-3.55)	(0.4-2.45)	(0.47-3.45)	(0.55-3.5)	(0.56-2)		1.1-1.6		

By Hour of the Day and By Year "All WD" 5%ile PM _{2.5} Concentration in Fort McKay for the Month of March for the Period 2014-2021																												
Hour of the Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range	
Year	2014	1.2	2.36	1.29	1.58	1.46	1.63	1.45	1.7	1.47	1.5	0.94	1.17	0.7	0.6	0.6	0.7	0.82	1.06	1.14	1.31	1.69	2.57	1.91	1.59	1.35	0.51	(0.6-2.57)
	2015	1.02	1	1.16	1.57	1.44	1.85	1.7	2.18	1.83	1.3	0.49	0.29	0.28	0.15	0.29	0.06	0.16	0.29	0.4	0.46	0.65	1.28	1.2	1.24	0.93	0.64	(0.06-2.18)
	2016	1.09	0.8	1.2	0.99	1.35	1.14	1.21	1.45	1.14	1	0.77	0.64	0.42	0.27	0.18	0.26	0.42	0.59	0.33	0.33	0.43	0.43	0.65	0.49	0.73	0.39	(0.18-1.45)
	2017	1.58	1.38	1.72	2.12	2.09	2.12	2.09	1.87	2.34	1.51	1.44	2.74	1.76	2.22	1.18	1.55	1.7	1.34	1.93	1.42	1.28	1.33	1.38	2.37	1.77	0.42	(1.18-2.74)
	2018	0.94	0.94	0.87	0.9	0.85	1.01	0.97	1.41	1.39	1.22	1.2	0.97	1.19	1.16	0.75	0.49	0.37	0.37	0.56	0.72	0.55	0.83	0.89	0.9	0.89	0.29	(0.37-1.41)
	2019	1.49	1.67	1.88	1.39	1.73	1.44	1.58	1.49	1.74	2.09	1.2	1.48	1.29	1.45	0.85	1.31	1.46	1.4	1.27	1.58	1.34	2.37	1.17	1.27	1.50	0.31	(0.85-2.37)
	2020	2.05	2.21	1.7	2.32	1.87	1.73	1.38	2	1.38	1.54	1.57	2.66	2.04	1.85	1.57	1.67	1.86	2.91	1.85	3.31	2.22	2.03	1.59	3.04	2.01	0.52	(1.38-3.31)
2021	1.88	1.61	1.59	1.07	1.68	2.75	1.84	2.08	2.71	1.65	1.07	1.02	1.23	1.16	1.17	1.85	1.73	1.58	1.92	2.25	1.81	2.59	2.29	2.36	1.79	0.52	(1.02-2.75)	
																									1.37	0.45	(0.73-2.01)	
Average	1.41	1.50	1.43	1.49	1.56	1.71	1.53	1.77	1.75	1.48	1.09	1.37	1.11	1.11	0.82	0.99	1.07	1.19	1.18	1.42	1.25	1.68	1.39	1.66		1.37		
Std Dev	0.41	0.58	0.35	0.52	0.38	0.56	0.36	0.30	0.53	0.32	0.35	0.89	0.62	0.74	0.47	0.69	0.70	0.85	0.68	0.99	0.65	0.83	0.53	0.86		0.26		
Range	(0.94-2.05)	(0.8-2.36)	(0.87-1.88)	(0.9-2.32)	(0.85-2.09)	(1.01-2.75)	(0.97-2.09)	(1.41-2.18)	(1.14-2.71)	(1-2.09)	(0.49-1.57)	(0.29-2.74)	(0.28-2.04)	(0.15-2.22)	(0.18-1.57)	(0.06-1.85)	(0.16-1.86)	(0.29-2.91)	(0.33-1.93)	(0.33-3.31)	(0.43-2.22)	(0.43-2.59)	(0.65-2.29)	(0.49-3.04)		0.82-1.77		

Table F.2: The 5th percentile PM_{2.5} "All-WD" Monthly/Annual Tables (April to June 2014-2021)

By Hour of the Day and By Year "All WD" 5%ile PM _{2.5} Concentration in Fort McKay for the Month of April for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	2.44	2.6	1.7	2.46	2.18	1.99	1.77	2.15	1.67	2.04	1.36	1.3	1.43	0.8	1.22	0.87	1	1.04	1.3	1.75	1.84	2.26	2.44	1.83	1.73	0.54	(0.8-2.6)
	2015	0.86	0.87	0.89	1.23	1.2	1.43	1.73	1.37	1.33	0.98	0.74	0.51	0.17			0.14		0	0.13	0.26	0.95	0.51	0.76	1.51	0.84	0.55	(0-1.73)
	2016	1.74	1.84	2.02	2.65	2.01	1.63	1.67	1.64	0.62	1.03	1.01	1.14	1.64	1.35	0.64	0.43	0.36	0.54	0.91	1.73	1.73	1.29	1.97	2.11	1.40	0.61	(0.36-2.65)
	2017		0.13	0.08		0.22	1.06	0.61	1.19	1.33	1.43	0.67	0.24	0.24	0.58	0.71	0.3	0.19	0.37	0.65	1.18	1.06	0.41	0.29	0.15	0.60	0.44	(0-1.43)
	2018																											
	2019	1.35	1.4	1.71	1.67	1.54	1.53	1.16	1.07	1.3	1.2	1.47	1.26	1.05	0.67	1.08	0.98	1.09	0.91	1.11	1.78	1.32	1.13	1.44	1.36	1.27	0.27	(0.67-1.78)
	2020	2.14	2.38	2.84	2.34	1.59	1.86	1.37	1.45	1.71	1.75	1.48	1.06	0.6	0.8	1.01	0.8	1.01	1.12	1.05	1.52	2.01	2.16	1.68	1.71	1.56	0.57	(0.6-2.84)
2021	2.23	1.87	1.64	1.16	1.06	1.46	1.48	1.52	1.53	2.51	1.59	1.11	1.29	1.64	1.58	2.14	2.28	2.31	1.52	1.59	2.36	1.06	2.02	1.55	1.69	0.43	(1.06-2.51)	
																								1.30	0.40	(0.60-1.73)		
Average		1.79	1.58	1.55	1.92	1.40	1.57	1.40	1.48	1.36	1.56	1.19	0.95	0.92	0.97	1.04	0.81	0.99	0.90	0.95	1.40	1.61	1.26	1.51	1.46	1.32		
Std Dev		0.55	0.80	0.81	0.59	0.61	0.28	0.38	0.33	0.34	0.53	0.35	0.38	0.54	0.39	0.32	0.62	0.67	0.68	0.42	0.50	0.48	0.67	0.70	0.58	0.31		
Range		(0.86-2.23)	(0.13-2.38)	(0.08-2.84)	(1.07-2.65)	(0.22-2.01)	(1.06-2.75)	(0.61-1.84)	(1.07-2.08)	(0.62-2.71)	(0.98-2.51)	(0.67-1.59)	(0.24-1.26)	(0.17-1.64)	(0.58-1.64)	(0.64-1.58)	(0.14-2.14)	(0.19-2.28)	(0.37-2.31)	(0.13-1.92)	(0.26-2.25)	(0.95-2.36)	(0.41-2.59)	(0.29-2.29)	(0.15-2.36)	0.81-1.92		
By Hour of the Day and By Year "All WD" 5%ile PM _{2.5} Concentration in Fort McKay for the Month of May for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	0.23	0.22											0.15	0.27	0.25	0.54	0.41	0.5	0.57	0.65	0.76	1.08	0.98	0.42	0.50	0.29	(0.15-1.08)
	2015	1.55	2.54	2.74	1.66	1.35	1.78	2.3	1.84	1.49	1.34	1.73	1.54	1.11	1.26	1.29	1.12	1.06	1.03	1.27	1.18	1.51	2	1.45	2.09	1.59	0.46	(1.03-2.74)
	2016	0.43	0.52	0.57	0.62	0.67	0.62	0.69	0.69	0.56	0.7	0.64	0.62	0.69	0.79	0.51	0.46	0.54	0.6	0.56	0.66	0.74	0.53	0.27	0.34	0.58	0.12	(0.27-0.79)
	2017	0.41	0.39	0.32	0.46	0.34	0.56	0.32	0.39	0.14	0.45	0.54	0.57	0.18	0.36	0.29	0.27	0.24	0.16	0.3	0.3	0.57	1.1	0.23	0.14	0.38	0.20	(0.14-1.1)
	2018																											
	2019	2.29	3.12	2.5	2.42	1.8	1.44	2	1.19	1.25	1.02	1.42	2.41	1.68	2.3	2.85	2.11	3.06	2.98	2.5	2.78	3.35	2.57	1.84	2.26	2.21	0.65	(1.02-3.35)
	2020	0.92	0.75	0.76	1	0.66	0.56	0.68	0.81	1.2	1.14	1.08	0.63	0.99	0.95	1.07	1.06	0.57	0.63	0.74	0.65	0.79	0.75	0.92	0.82	0.84	0.19	(0.56-1.2)
2021	0.94	0.56	0.56	1.01	0.82	1.03	0.64	2.19	2.72	3	3.08	2.37	2.38	2.06	1.23	1.7	2.27	3.14	2.04	2.11	1.31	1.41	1.75	0.69	1.71	0.84	(0.56-3.14)	
																								1.12	0.66	0.38-2.21		
Average		0.97	1.16	1.24	1.20	0.94	1.00	1.11	1.19	1.23	1.28	1.42	1.36	1.03	1.14	1.07	1.04	1.16	1.29	1.14	1.19	1.29	1.35	1.06	0.97	1.16		
Std Dev		0.73	1.17	1.08	0.73	0.54	0.52	0.83	0.70	0.89	0.90	0.93	0.88	0.80	0.79	0.90	0.68	1.08	1.24	0.84	0.92	0.97	0.72	0.66	0.86	0.13		
Range		(0.23-2.29)	(0.22-3.12)	(0.32-2.74)	(0.46-2.42)	(0.34-1.8)	(0.56-1.78)	(0.32-2.3)	(0.39-2.19)	(0.14-2.72)	(0.45-3)	(0.54-3.08)	(0.57-2.41)	(0.15-2.38)	(0.27-2.3)	(0.25-2.85)	(0.27-2.11)	(0.24-3.06)	(0.16-3.14)	(0.3-2.5)	(0.57-2.78)	(0.53-3.35)	(0.23-2.57)	(0.14-1.84)	2.26)	0.94-1.42		
By Hour of the Day and By Year "All WD" 5%ile PM _{2.5} Concentration in Fort McKay for the Month of June for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	1.26	1.43	1.3	1.18	1.2	0.51	0.42	0.59	0.42	0.82	0.91	1.53	1.14	1.42	1.44	0.69	0.63	0.54	0.65	0.59	0.85	0.62	0.41	0.66	0.88	0.38	(0.41-1.53)
	2015	2.28	2.1	4.32	4.4	4.53	1.79	2.61	2.31	2.21	2.27	0.57	1.52	1.87	1.27	0.81	1.17	1.6	1.48	1.71	1.69	1.99	3.01	2.11	2.02	2.15	1.03	(0.57-4.53)
	2016	1.49	1.34	1.32	1.4	0.89	0.76	0.73	0.75	0.85	0.66	0.61	0.42	1.01	1.35	1.28	1.27	1.18	1.08	1.02	1.27	1.59	1.6	1.54	1.38	1.12	0.34	(0.42-1.6)
	2017	1.21	0.72	0.61	0.7	0.93	0.96	0.9	0.44	0.06	0.4	0.32	0.11	0	0.47	0.57	0.32	0.54	1.09	1.38	1.45	1.36	1.27	1.46	1.18	0.77	0.46	(0-1.46)
	2018	1.34	1.14	1.26	1.15	1.08	1.02	1.09	0.94	1.06	0.97	1.06	0.89	1.27	1.03	1.08	1.2	1.25	0.89	1.06	1.21	1.33	1.27	1.35	1.21	1.13	0.14	(0.89-1.35)
	2019	1.83	2	1.25	1.4	1.37	1.67	1.82	1.63	1.48	1.9	2.6	2.22	2.31	1.79	1.76	2.61	2.81	3.49	1.85	2.19	1.75	1.25	1.46	1.17	1.90	0.56	(1.17-3.49)
	2020	1.8	2.54	1.98	1.57	1.41	1.8	1.66	1.45	1.57	1.62	1.38	1.77	1.59	1.74	1.62	1.44	1.59	1.58	2.48	2.01	1.68	2.09	2.53	1.5	1.77	0.34	(1.38-2.54)
2021	1.19	1.31	1.72	1.35	1.89	1.55	2.42	1.82	2.16	2.16	1.42	1.63	1.46	1.73	1.82	1.78	1.88	1.55	1.55	1.63	1.23	1.32	1.41	1.25	1.63	0.32	(1.19-2.42)	
																								1.42	0.48	(0.77-2.15)		
Average		1.55	1.57	1.72	1.64	1.66	1.26	1.46	1.24	1.23	1.35	1.11	1.26	1.33	1.35	1.30	1.31	1.44	1.46	1.46	1.51	1.47	1.55	1.53	1.30	1.42		
Std Dev		0.39	0.59	1.12	1.14	1.20	0.50	0.80	0.66	0.77	0.73	0.72	0.72	0.68	0.44	0.45	0.69	0.73	0.89	0.57	0.50	0.35	0.72	0.61	0.38	0.16		
Range		(1.19-2.28)	(0.72-2.54)	(0.61-4.32)	(0.7-4.4)	(0.89-4.53)	(0.51-1.8)	(0.42-2.61)	(0.44-2.31)	(0.06-2.21)	(0.4-2.27)	(0.32-2.6)	(0.11-2.22)	(0-2.31)	(0.47-1.79)	(0.57-1.82)	(0.32-2.61)	(0.54-2.81)	(0.54-3.49)	(0.65-2.48)	(0.59-2.19)	(0.85-1.99)	(0.62-3.01)	(0.41-2.53)	2.02)	(1.19-1.72)		

Table F.3: The 5th percentile PM_{2.5} "All-WD" Monthly/Annual Tables (July to September 2014-2021)

By Hour of the Day and By Year "All WD" 5%ile PM _{2.5} Concentration in Fort McKay for the Month of July for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	2.25	2.62	3.48	2.41	1.79	1.33	1.64	1.56	1.61	1.36	0.62	0.42	0.6	0.4	0.68	0.92	1.17	1.02	1.4	1.22	1.05	1.6	1.98	1.5	1.44	0.74	(0.4-3.48)
	2015	1.4	1.72	1.99	1.33	2.07	1.71	1.78	1.88	1.75	0.74	0.77	0.91	0.73	0.55	1	1.01	0.92	1.04	0.74	0.83	0.99	0.76	1.02	1.18	1.20	0.47	(0.55-2.07)
	2016	1.29	1.5	1.6	2.09	1.5	2.25	1.54	1.44	1.28	1.1	0.88	0.98	1.36	1.4	1.36	1.2	1.16	1.43	1.62	1.46	1.01	1.5	2.01	1.18	1.42	0.33	(0.88-2.25)
	2017	1.07	1.35	1.29	2.38	1.91	1.99	1.32	1.06	0.94	0.75	0.66	0.9	0.85	0.91	1.23	0.59	0.77	1.52	1.16	0.85	1.17	1.46	1.27	1.31	1.20	0.43	(0.59-2.38)
	2018	1.6	1.93	2.1	2.32	2.36	2.11	1.41	1.84	1.5	1.87	1.91	0.88	0.96	2.16	1.22	1.31	1.69	1.47	1.52	1.55	1.67	2.54	1.83	2.64	1.77	0.46	(0.88-2.64)
	2019	2.3	2.01	1.74	1.28	1.46	1.77	1.43	2.47	1.72	2.19	1.63	1.43	2.29	1.51	1.41	1.33	1.47	2.44	1.58	1.38	2.51	1.46	1.56	1.76	1.76	0.40	(1.28-2.51)
	2020	3.03	1.66	1.9	2.24	2.05	2.78	1.38	2.36	1.76	2.74	2.78	2.15	1.4	1.68	2.09	2.18	1.72	1.43	1.48	1.77	1.46	1.78	1.64	1.57	1.96	0.49	(1.38-3.03)
	2021	1.33	1.56	1.75	1.25	1.04	1.73	1.3	2.05	3.2	2.6	1.86	2.74	1.9	1.66	2.43	2.77	2.2	1.48	1.13	1.35	1.55	1.47	1.89	1.56	1.83	0.57	(1.04-3.2)
																										1.57	0.27	(1.20-1.96)
Average		1.78	1.79	1.98	1.91	1.77	1.96	1.48	1.83	1.72	1.67	1.39	1.30	1.26	1.28	1.43	1.41	1.39	1.48	1.33	1.30	1.43	1.57	1.65	1.59		1.57	
Std Dev		0.67	0.40	0.65	0.53	0.42	0.44	0.17	0.47	0.66	0.80	0.78	0.77	0.59	0.61	0.57	0.71	0.47	0.44	0.30	0.33	0.51	0.49	0.35	0.47		0.23	
Range		(1.07-3.03)	(1.35-2.62)	(1.29-3.48)	(1.25-2.41)	(1.04-2.36)	(1.33-2.78)	(1.3-1.78)	(1.06-2.47)	(0.94-3.2)	(0.74-2.74)	(0.62-2.78)	(0.42-2.29)	(0.6-2.16)	(0.4-2.43)	(0.68-2.77)	(0.59-2.2)	(0.77-2.44)	(1.02-1.62)	(0.74-1.77)	(0.83-2.51)	(0.99-2.54)	(0.76-2.01)	(1.02-2.64)	(1.18-2.64)		(1.26-1.98)	
By Hour of the Day and By Year "All WD" 5%ile PM _{2.5} Concentration in Fort McKay for the Month of August for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	1.67	1.57	2.13	2.17	3.33	1.51	2	2.84	1.71	1.41	1.68	1.34	1.58	0.85	0.37	0.46	1.57	1.58	1.35	1.55	2.73	2.54	1.88	1.63	1.73	0.68	(0.37-3.33)
	2015	1.7	1.83	1.39	1.2	1.28	1.73	1.33	1.57	1.41	0.97	1.01	1.19	1.36	1.13	0.42	1.23	0.92	1.38	1.41	1.79	1.56	1.56	1.61	1.39	1.35	0.32	(0.42-1.83)
	2016	2.57	2.63	3.05	2.67	2.78	2.82	2.23	2.79	2.66	1.15	0.74	1.07	2.21	1.71	2.02	1.95	2.05	2.22	2.05	1.82	1.55	2.12	3.04	2.09	2.17	0.62	(0.74-3.05)
	2017	1.81	1.71	2.24	1.61	2.21	1.93	1.63	1.85	1.14	1.22	1.6	1.07	1.57	1.55	1.44	0.88	1.49	1.44	1.66	1.88	2.03	1.83	2.3	1.82	1.66	0.36	(0.88-2.3)
	2018	1.85	2.56	3.28	2.07	3.48	2.11	1.36	1.16	1.68	1.5	2.55	2.01	2.68	2.85	3.23	2.86	2.89	2.45	2.43	2.88	2.05	2.7	2.12	3.01	2.41	0.62	(1.16-3.48)
	2019	1.87	2.01	1.82	1.85	1.82	1.6	1.46	1.46	1.05	1.19	1.12	1.4	1.38	1.37	1.68	1.47	1.64	1.31	1.47	1.39	1.99	2.65	1.95	1.91	1.62	0.36	(1.05-2.65)
	2020	2.02	2.07	2.15	1.74	1.59	1.79	1.4	1.73	1.66	0.68	0.95	1.26	0.85	1.05	1.07	1.31	1.38	1.08	1.15	1.34	1.46	1.78	1.95	1.95	1.48	0.41	(0.68-2.15)
	2021	1.74	2.5	1.74	2.38	1.42	1.94	1.83	1.21	2.41	1.72	1.58	1.36	1.13	1.56	1.22	1.7	2.24	1.51	2.5	1.98	1.37	1.53	1.6	2.11	1.76	0.42	(1.13-2.5)
																										1.77	0.33	(1.352-41)
Average		1.90	2.11	2.23	1.96	2.24	1.93	1.66	1.83	1.72	1.23	1.40	1.34	1.60	1.51	1.43	1.48	1.77	1.62	1.75	1.83	1.84	2.09	2.06	1.99		1.77	
Std Dev		0.29	0.41	0.64	0.46	0.86	0.41	0.33	0.65	0.57	0.32	0.58	0.30	0.59	0.62	0.92	0.72	0.61	0.47	0.51	0.48	0.45	0.49	0.46	0.48		0.28	
Range		(1.67-2.57)	(1.57-2.63)	(1.39-3.28)	(1.2-2.67)	(1.28-3.48)	(1.51-2.82)	(1.33-2.23)	(1.16-2.84)	(1.05-2.66)	(0.68-1.72)	(0.74-2.55)	(1.07-2.01)	(0.85-2.68)	(0.85-2.85)	(0.37-3.23)	(0.46-2.86)	(0.92-2.89)	(1.08-2.45)	(1.15-2.5)	(1.34-2.88)	(1.37-2.73)	(1.53-2.7)	(1.6-3.04)	(1.39-3.01)		(1.23-2.24)	
By Hour of the Day and By Year "All WD" 5%ile PM _{2.5} Concentration in Fort McKay for the Month of September for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	1.57	1.63	1.92	2.01	2	1.37	1.7	1.57	1.39	1.43	0.77	0.75	0.89	0.64	0.64	0.86	1.05	0.67	0.38	0.84	1.36	1.25	1.77	1.56	1.25	0.48	(0.38-2.01)
	2015	2.57	2.59	2.4	2.33	2.52	2.7	2.45	2.34	2.03	1.59	1.62	1.61	1.37	1.34	1.25	1.41	1.72	1.67	2.37	2.37	2.37	2.35	2.63	2.47	2.09	0.48	(1.25-2.7)
	2016	0.97	0.98	0.97	1.09	1.05	1.04	1.01	0.87	1	0.98	1.01	1.18	1.12	0.72	0.31	0.77	0.69	0.71	0.77	1.02	1.14	0.92	0.89	0.91	0.92	0.19	(0.31-1.18)
	2017	0.36	0.55	0.58	0.47	0.47	0.48	0.64	0.72	0.76	1.12	0.4	0.56	0.96	1.14	0.79	0.65	0.81	0.9	1.05	1.24	1	0.88	0.79	0.68	0.75	0.25	(0.36-1.24)
	2018	1.24	0.83	1.24	1.12	1.54	1.14	1.16	0.85	0.94	1.29	1.19	0.81	0.88	0.95	0.71	0.8	0.75	0.83	0.99	0.81	0.86	1.16	1.3	1.11	1.02	0.22	(0.71-1.54)
	2019	1.58	1.38	1.39	1.16	1.51	1.54	1.39	1.66	1.58	1.32	1.55	2.06	0.92	1.58	1.28	1.35	1.82	1.17	2.08	1.01	0.98	1.83	1.85	2.14	1.51	0.34	(0.92-2.14)
	2020	1.57	1.34	1.35	1.63	1.56	1.6	1.39	1.47	1.34	1.2	1.17	1.13	0.95	1.17	0.92	1.05	1.09	1	1.36	1.45	1.36	1.28	1.68	1.78	1.33	0.24	(0.92-1.78)
	2021	0.77	0.68	0.88	0.61	0.78	0.9	0.89	0.86	0.76	1.01	1.4	1.26	1.39	1.33	1.22	1.36	1.16	0.93	0.98	1.03	1.02	0.97	1.71	0.68	1.02	0.28	(0.61-1.71)
																										1.24	0.39	(0.75-2.09)
Average		1.33	1.25	1.34	1.30	1.43	1.35	1.33	1.29	1.23	1.24	1.14	1.17	1.06	1.11	0.89	1.03	1.14	0.99	1.25	1.22	1.26	1.33	1.58	1.42		1.24	
Std Dev		0.67	0.66	0.59	0.65	0.66	0.66	0.56	0.56	0.44	0.21	0.41	0.49	0.21	0.32	0.34	0.30	0.43	0.32	0.67	0.51	0.48	0.51	0.59	0.68		0.15	
Range		(0.36-2.57)	(0.55-2.59)	(0.58-2.4)	(0.47-2.33)	(0.47-2.52)	(0.48-2.7)	(0.64-2.45)	(0.72-2.34)	(0.76-2.03)	(0.98-1.59)	(0.4-1.62)	(0.56-2.06)	(0.88-1.39)	(0.64-1.58)	(0.31-1.28)	(0.65-1.41)	(0.69-1.82)	(0.67-1.67)	(0.38-2.37)	(0.81-2.37)	(0.86-2.37)	(0.88-2.35)	(0.79-2.63)	(0.68-2.47)		(0.89-1.58)	

Table F.4: The 5th percentile PM_{2.5} "All-WD" Monthly/Annual Tables (October to December 2014-2021)

By Hour of the Day and By Year "All WD" 5%ile PM _{2.5} Concentration in Fort McKay for the Month of October for the Period 2014-2021																											
Hour of the Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	0.49	0.62	0.7	0.7	0.98	0.98	1.3	1.24	1.14	0.99	0.4	0.49	0.55	0.46	0.85	1.03	0.57	0.97	1.26	0.9	1.12	0.49	0.77	0.6	0.82	0.28 (0.4-1.3)
	2015	0.63	0.5	0.55	0.72	0.82	0.86	0.75	0.69	0.5	0.41	0.25	0.27	0.09	0	0	0	0	0	0.12	0.41	0.84	0.48	0.75	0.6	0.43	0.31 (0-0.86)
	2016	0.75	0.85	0.82	0.84	0.93	0.89	0.91	0.9	0.87	0.63	0.69	0.72	0.61	0.52	0.47	0.54	0.44	0.43	0.45	0.34	0.47	0.46	0.51	0.66	0.65	0.19 (0.34-0.93)
	2017	0.5	0.53	0.55	0.58	0.71	0.67	0.67	0.7	0.63	0.59	0.64	0.84	0.56	0.82	0.6	0.6	0.55	0.52	0.47	0.43	0.43	0.49	0.56	0.6	0.59	0.11 (0.43-0.84)
	2018	1.05	0.76	1.17	1.21	1.27	1.16	1.01	1.05	1	0.88	1.27	0.83	1.2	1.89	1.37	1.97	1.36	1.28	1.43	1.35	1.26	1.21	1.18	1.36	1.23	0.28 (0.76-1.97)
	2019	0.57	0.65	0.56	0.38	0.35	0.47	0.53	0.56	0.42	0.55	1.14	0.63	0.97	0.79	0.81	0.63	0.42	0.3	0.28	0.56	0.48	0.46	0.59	0.57	0.57	0.20 (0.28-1.14)
	2020	0.55	0.61	0.64	0.7	0.8	0.69	0.82	0.75	0.71	0.85	0.68	0.52	0.38	0.46	0.57	0.61	0.49	0.47	0.47	0.56	0.59	0.67	0.59	0.5	0.61	0.12 (0.38-0.85)
	2021	1.3	1.65	1.51	1.78	1.67	1.56	1.68	1.47	1.63	1.26	1.27	1.51	1.31	1.39	1.34	1.18	1.31	1.27	1.11	1.28	1.3	1.24	1.38	1.29	1.40	0.18 (1.11-1.78)
																									0.79	0.32	(0.43-1.40)
Average		0.73	0.77	0.81	0.86	0.94	0.91	0.96	0.92	0.86	0.77	0.79	0.73	0.79	0.75	0.82	0.64	0.66	0.70	0.73	0.81	0.69	0.79	0.77			0.79
Std Dev		0.29	0.37	0.35	0.44	0.39	0.34	0.37	0.31	0.39	0.28	0.39	0.37	0.42	0.60	0.45	0.58	0.46	0.47	0.49	0.40	0.37	0.34	0.32	0.34		0.09
Range		(0.49-1.3)	(0.5-1.65)	(0.55-1.51)	(0.38-1.78)	(0.35-1.67)	(0.47-1.56)	(0.53-1.68)	(0.42-1.47)	(0.36-1.63)	(0.41-1.26)	(0.25-1.27)	(0.27-1.51)	(0.09-1.31)	(0-1.89)	(0-1.37)	(0-1.97)	(0-1.36)	(0-1.28)	(0.12-1.43)	(0.34-1.35)	(0.43-1.3)	(0.46-1.24)	(0.51-1.38)	(0.5-1.36)		(0.64-0.96)
By Hour of the Day and By Year "All WD" 5%ile PM _{2.5} Concentration in Fort McKay for the Month of November for the Period 2014-2021																											
Hour of the Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	0.77	0.73	0.57	0.72	0.48	0.49	0.56	0.74	0.63	0.92	1.03	0.77	0.58	0.25	0.29	1.4	1.6	1.83	1.62	1.33	1.61	1.1	1.23	1.14	0.93	0.45 (0.25-1.83)
	2015	1.66	1.6	1.6	1.4	1.34	1.35	1.73	1.78	1.21	1.53	1.25	1.27	1.26	0.89	0.83	0.92	1.05	1.69	1.21	1.09	1.15	1.35	1.34	1.54	1.34	0.27 (0.83-1.78)
	2016	0.42	0.5	0.55	0.62	0.81	0.79	0.78	0.8	0.96	0.39	0.35	0.83	0.58	0.64	0.59	0.66	0.69	0.77	0.68	0.93	1.08	0.7	0.67	0.55	0.68	0.18 (0.35-1.08)
	2017	0.94	0.96	1.05	1.12	0.97	0.81	0.87	0.79	0.82	0.86	0.88	0.9	1.08	1.04	1.6	1.17	1.19	1.12	1.16	1.18	1.05	1.33	1.32	1.01	1.05	0.19 (0.79-1.6)
	2018	1.23	1.31	1.33	1.67	1.71	1.82	1.35	1.48	1.43	1.61	1.26	1.34	1.11	1.45	1.73	1.84	1.61	2.17	1.61	2.22	1.54	1.79	1.89	1.28	1.57	0.29 (1.11-2.22)
	2019	1.41	2.15	1.3	1.34	1.04	1.52	0.9	1.08	1	1.11	1.33	1.53	1.15	1.29	1.52	1.24	2.57	1.47	1.49	1.79	1.65	1.3	2.04	1.44	1.44	0.39 (0.9-2.57)
	2020	1.42	1.51	1.29	1.66	1.92	1.47	1.63	1.51	1.5	1.31	1.42	1.46	1.48	1.18	0.34	0.81	1.25	1.4	1.59	1.56	1.82	1.39	2.03	2.2	1.46	0.37 (0.34-2.2)
	2021	1.16	1.39	0.86	0.94	1.23	1.18	1.47	1.77	1.55	1.3	1.29	0.63	1.13	1.01	0.96	0.83	1.32	0.92	0.73	1.01	0.75	0.82	1.09	1.41	1.11	0.29 (0.63-1.77)
																									1.20	0.29	(0.68-1.57)
Average		1.13	1.27	1.07	1.18	1.19	1.18	1.16	1.24	1.14	1.13	1.10	1.09	1.05	0.97	0.98	1.11	1.41	1.42	1.26	1.39	1.33	1.22	1.45	1.32		1.20
Std Dev		0.40	0.53	0.38	0.40	0.47	0.45	0.44	0.44	0.34	0.40	0.35	0.35	0.31	0.38	0.57	0.39	0.55	0.47	0.39	0.44	0.37	0.35	0.49	0.47		0.14
Range		(0.42-1.66)	(0.5-2.15)	(0.55-1.6)	(0.62-1.67)	(0.48-1.92)	(0.49-1.82)	(0.56-1.73)	(0.74-1.78)	(0.63-1.55)	(0.39-1.61)	(0.35-1.42)	(0.63-1.53)	(0.58-1.48)	(0.25-1.45)	(0.29-1.73)	(0.66-1.84)	(0.69-2.57)	(0.77-2.17)	(0.68-1.62)	(0.93-2.22)	(0.75-1.82)	(0.7-1.79)	(0.67-2.04)	(0.55-2.2)		(0.97-1.45)
By Hour of the Day and By Year "All WD" 5%ile PM _{2.5} Concentration in Fort McKay for the Month of December for the Period 2014-2021																											
Hour of the Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	1.48	0.99	1.15	1.41	1.31	0.97	1.1	1.03	0.96	1.2	1.04	1.07	1.25	0.26	0.35	0.69	0.67	0.61	0.96	1.27	0.98	1.46	1.82	1.18	1.05	0.35 (0.26-1.82)
	2015	1.43	1.48	1.41	1.26	1.51	1.48	1.49	1.59	1.3	1.3	1.4	1.47	1.27	1	1.02	1.17	2.46	2.19	2.53	1.94	2.07	1.58	1.65	1.5	1.56	0.40 (1-2.53)
	2016	2.1	2.06	1.66	1.75	1.87	1.96	1.31	1.2	1.53	0.82	1.23	1.32	0.87	1.1	0.96	0.79	1.13	1.53	1.62	1.57	1.68	1.54	1.61	1.5	1.45	0.38 (0.79-2.1)
	2017	0.42	0.21	0.31	0.4	0.54	0.55	0.59	0.58	0.84	0.55	0.48	0.18	0.15	0.07	0	0.19	0.16	0.15	0.21	0.18	0.15	0.57	0.32	0	0.33	0.22 (0-0.84)
	2018	2.38	1.41	1.82	2.1	2.13	2.12	2.7	3.02	3.41	3.04	1.74	1.25	0.59	1.9	2.42	1.98	1.47	1.84	2.55	2.02	2.88	2.07	4.29	2.34	2.23	0.77 (0.59-4.29)
	2019	1.48	1.83	1.52	3.99	2.94	3.14	1.74	2.88	2.18	4	3.23	2.94	1.55	1.81	3.1	3.44	1.66	1.93	1.34	2.23	1.7	1.62	3.73	3.83	2.49	0.91 (1.34-4)
	2020	0.9	0.76	0.38	0.82	1	1.13	1.26	1.11	1.08	0.94	1.57	1.17	0.88	1.96	1.27	1.85	1.51	1.81	1.23	0.76	1.74	0.89	1.34	1.01	1.18	0.39 (0.38-1.96)
	2021	1.61	2.46	2.28	2.66	1.88	1.7	1.53	1.35	1.75	1.54	1.58	2.4	1.53	2.49	1.28	1.41	1.35	2.31	1.65	2.06	2.05	1.89	2.52	1.99	1.89	0.43 (1.28-2.66)
																									1.52	0.65	(0.33-2.49)
Average		1.48	1.40	1.32	1.80	1.65	1.63	1.47	1.60	1.63	1.67	1.53	1.48	1.01	1.32	1.30	1.44	1.30	1.55	1.51	1.50	1.66	1.45	2.16	1.67		1.52
Std Dev		0.62	0.73	0.68	1.13	0.74	0.80	0.61	0.89	0.84	1.21	0.79	0.85	0.48	0.86	1.02	1.01	0.68	0.77	0.78	0.72	0.81	0.50	1.30	1.12		0.22
Range		(0.42-2.38)	(0.21-2.46)	(0.31-2.28)	(0.4-3.99)	(0.54-2.94)	(0.55-3.14)	(0.59-2.7)	(0.58-3.02)	(0.84-3.41)	(0.55-4)	(0.48-3.23)	(0.18-2.94)	(0.15-1.55)	(0.07-2.49)	(0-3.1)	(0.19-3.44)	(0.16-2.46)	(0.15-2.31)	(0.21-2.55)	(0.18-2.23)	(0.15-2.88)	(0.57-2.07)	(0.32-4.29)	(0-3.83)		(1.01-2.16)

Table F.5: The 10th percentile PM_{2.5} "All-WD" Monthly/Annual Tables (January to March)

By Hour of the Day and By Year "All WD" 10%ile PM _{2.5} Concentrations (µg/m ³) in Fort McKay for the Month of January for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	3.2	1.77	2.73	2.57	2.57	2.16	2.6	3.42	3.24	3.25	3.12	1.75	1.93	1.65	1.67	1.68	1.65	1.8	2.2	1.64	2.19	1.59	2.49	3.19	2.34	0.64	(1.59-3.42)
	2015	1.64	2.2	1.86	1.31	1.5	1.9	1.85	1.3	1.58	1.15	0.87	0.89	1.29	1.39	1.27	1.21	1.81	1.98	1.95	1.76	1.62	1.56	1.56	1.35	1.53	0.34	(0.87-2.2)
	2016	1.53	1.16	1.32	1.13	1.46	1.16	1.31	1.43	1.49	1.4	1.74	1.49	1.54	1.41	1.32	1.58	1.39	1.72	1.64	1.77	1.44	1.56	1.16	1.39	1.44	0.18	(1.13-1.77)
	2017	1.71	1.6	2.13	1.71	2.17	1.19	1.55	1.43	1.35	1.53	1.37	1.26	1.45	1.24	1.32	1.55	1.69	1.94	1.63	1.28	1.48	1.2	1.53	1.98	1.55	0.28	(1.19-2.17)
	2018	1.38	1.52	1.53	1.61	1.6	1.56	1.8	1.69	1.69	1.99	1.88	1.98	1.89	2.41	2.26	2.25	1.92	1.67	1.79	1.64	1.73	1.24	1.15	1.77	0.32	(1.15-2.41)	
	2019	2.71	2.24	2.32	2.26	2.13	2.22	2.17	1.55	2.45	1.89	1.97	1.82	1.36	0.68	0.54	1.68	1.74	1.81	2.66	1.53	3.14	1.55	3.11	2.71	2.01	0.65	(0.54-3.14)
	2020	1.94	3.83	1.7	1.82	1.89	1.32	2.39	2.63	2.38	1.87	2.27	2.48	2.63	2.36	1.74	1.86	1.77	2.81	2.76	2.58	3.27	3.18	3.83	4.33	2.49	0.76	(1.32-4.33)
	2021	1.11	0.92	0.8	0.88	0.8	1.14	1.24	1.13	1.39	1.4	1.35	1.32	1.68	1.52	1.58	1.41	1.38	1.5	1.62	1.7	1.78	1.56	1.38	1.34	1.33	0.28	(0.8-1.78)
																										1.81	0.40	(1.33-2.49)
Average		1.90	1.91	1.80	1.66	1.77	1.58	1.86	1.82	1.95	1.81	1.82	1.62	1.72	1.58	1.46	1.65	1.71	1.94	2.02	1.76	2.07	1.74	2.04	2.18	1.81		
Std Dev		0.71	0.90	0.60	0.56	0.55	0.45	0.49	0.79	0.67	0.65	0.68	0.49	0.43	0.57	0.49	0.31	0.26	0.38	0.47	0.37	0.74	0.60	0.99	1.14	0.17		
Range		(1.11-3.2)	(0.92-3.83)	(0.8-2.73)	(0.88-2.57)	(0.8-2.57)	(1.14-2.22)	(1.14-2.6)	(1.13-3.42)	(1.35-3.24)	(1.15-3.25)	(0.87-2.48)	(0.89-2.63)	(1.29-2.41)	(0.68-2.26)	(0.54-2.25)	(1.21-2.22)	(1.38-2.81)	(1.5-2.76)	(1.62-2.58)	(1.28-3.27)	(1.44-3.18)	(1.2-3.83)	(1.16-4.33)	(1.15-2.18)			
By Hour of the Day and By Year "All WD" 10%ile PM _{2.5} Concentration (µg/m ³) in Fort McKay for the Month of February for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	2.18	1.91	1.48	1.74	1.65	1.77	1.58	2.51	2.08	1.74	1.74	1.58	1.55	2	1.25	1.53	1.69	2.14	1.66	1.38	1.7	1.55	1.57	1.95	1.75	0.28	(1.25-2.51)
	2015	2.3	2.28	2.14	2.15	1.73	2.05	2.08	2.22	2.72	1.28	1.99	1.75	1.54	1.54	1.58	1.6	2.13	2.65	2.02	2.2	2	1.94	1.79	1.8	1.98	0.35	(1.28-2.72)
	2016	1.49	1.48	1.9	2.34	2.08	1.81	1.9	1.86	2.26	1.7	1.41	1.51	0.91	1.29	1.34	1.13	1.3	1.5	1.33	1.56	1.14	1.45	1.31	1.82	1.58	0.36	(0.91-2.34)
	2017	1.33	1.75	2.19	1.62	1.45	1.46	1.7	1.58	2.09	2.19	2.16	1.34	1.56	1.86	1.28	1.86	1.24	1.39	2.04	1.29	1.38	1.29	1.77	1.88	1.65	0.32	(1.24-2.19)
	2018	0.73	0.78	0.84	0.68	0.61	0.5	0.48	0.49	0.58	0.49	0.45	0.59	0.63	0.49	0.54	0.56	0.51	0.68	0.82	0.82	0.44	0.69	0.67	0.73	0.62	0.13	(0.44-0.84)
	2019	2.94	1.94	1.84	2.26	3.08	3.37	1.92	3.22	3.52	2.95	2.27	3.27	3.12	2.61	1.91	2.75	3.05	3.04	2.92	2.69	2.06	2.1	3.05	2.83	2.70	0.52	(1.84-3.52)
	2020	2.89	2.35	3.55	2.65	2.54	1.69	2.48	3.16	1.96	1.95	3.66	1.43	3.34	2.33	1.54	2.28	2.29	2.11	1.56	3.64	3.41	4.12	3.54	2.79	2.64	0.77	(1.43-4.12)
	2021	2.46	2.74	2.83	3.26	3.22	3.31	3.07	2.61	3.09	2.52	3.26	2.73	1.81	2.98	1.72	2.44	2.68	2.88	3.29	2.56	1.62	2.56	3.37	2.32	2.72	0.50	(1.62-3.37)
																										1.95	0.68	(0.62-2.72)
Average		2.04	1.90	2.10	2.09	2.05	2.00	1.90	2.21	2.29	1.85	2.12	1.78	1.81	1.89	1.40	1.77	1.86	2.05	1.96	2.02	1.72	1.96	2.13	2.02	1.95		
Std Dev		0.79	0.60	0.82	0.77	0.88	0.95	0.75	0.90	0.88	0.76	1.01	0.84	0.96	0.79	0.41	0.72	0.84	0.82	0.81	0.93	0.86	1.04	1.05	0.67	0.19		
Range		(0.73-2.94)	(0.78-2.74)	(0.84-3.55)	(0.68-3.26)	(0.61-3.22)	(0.5-3.37)	(0.48-3.07)	(0.49-3.22)	(0.58-3.52)	(0.49-2.95)	(0.45-3.66)	(0.59-3.27)	(0.63-3.34)	(0.49-2.98)	(0.54-1.91)	(0.56-2.75)	(0.51-3.05)	(0.68-3.04)	(0.82-3.29)	(0.82-3.64)	(0.44-3.41)	(0.69-4.12)	(0.67-3.54)	(0.73-2.83)	(1.40-2.29)		
By Hour of the Day and By Year "All WD" 10%ile PM _{2.5} Concentration (µg/m ³) in Fort McKay for the Month of March for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	2.24	2.96	2.93	2.75	1.7	3.83	1.95	3.58	2.57	2.22	1.49	1.51	0.89	0.69	0.72	0.85	0.95	1.19	1.32	1.41	1.87	2.68	2.69	2.67	1.99	0.91	(0.69-3.83)
	2015	1.67	1.63	1.46	1.84	1.76	2.32	2.26	2.85	2.21	1.35	0.56	0.56	0.62	0.49	0.65	0.23	0.48	0.58	1.16	1.4	1.72	1.67	1.41	1.26	1.34	0.70	(0.23-2.85)
	2016	1.34	1.33	1.36	1.27	1.39	1.38	1.37	1.47	1.42	1.61	1.33	1.33	0.93	0.66	0.51	0.52	0.58	0.62	0.67	0.72	0.79	1.13	1.19	0.93	1.08	0.36	(0.51-1.61)
	2017	3.15	2.99	2.45	3.14	2.89	2.86	2.84	3	3.28	3.32	1.78	2.87	2.75	2.94	2.28	1.95	2.71	1.72	2.42	2.68	1.43	3.17	1.98	3.53	2.67	0.56	(1.43-3.53)
	2018	0.97	1.1	1.17	0.96	1.19	1.19	1.35	1.62	1.49	1.36	1.4	1.26	1.34	1.18	0.84	0.56	0.48	0.57	0.64	0.81	0.88	0.89	0.96	1	1.05	0.31	(0.48-1.62)
	2019	1.99	1.89	1.97	1.59	1.95	2.32	1.86	1.97	2.29	2.39	1.43	1.62	1.6	1.79	1.24	1.67	1.77	1.86	1.46	2.11	1.47	2.81	1.38	1.66	1.84	0.37	(1.24-2.81)
	2020	2.29	3.86	1.89	2.62	2.29	2.39	1.82	4.45	4.79	1.7	2.25	4.29	4.34	3.15	2.91	1.77	3.69	4.2	2.3	4.12	2.77	4.22	3.33	3.26	3.11	0.99	(1.7-4.79)
	2021	1.93	2.42	2.35	1.64	2.48	3.29	2.49	2.96	3.12	1.95	1.42	1.8	1.35	1.86	2.62	2.56	2.22	1.97	2.33	2.52	2.85	2.84	2.34	2.59	2.33	0.51	(1.35-3.29)
																										1.93	0.70	(1.05-3.11)
Average		1.95	2.27	1.95	1.98	1.96	2.45	1.99	2.74	2.65	1.99	1.46	1.91	1.73	1.60	1.47	1.26	1.61	1.59	1.54	1.97	1.72	2.43	1.91	2.11	1.93		
Std Dev		0.66	0.95	0.61	0.77	0.57	0.89	0.52	1.02	1.09	0.66	0.47	1.16	1.24	1.03	0.98	0.83	1.19	1.21	0.73	1.13	0.77	1.12	0.83	1.03	0.38		
Range		(0.97-3.15)	(1.1-3.86)	(1.17-2.93)	(0.96-3.14)	(1.19-2.89)	(1.19-3.83)	(1.35-2.84)	(1.47-4.45)	(1.42-4.79)	(1.35-3.32)	(0.56-2.25)	(0.56-4.29)	(0.62-4.34)	(0.49-3.15)	(0.51-2.91)	(0.23-2.56)	(0.48-3.69)	(0.57-4.2)	(0.64-2.42)	(0.72-4.12)	(0.79-2.85)	(0.89-4.22)	(0.96-3.33)	(0.93-1.26)			

Table F.6: The 10th percentile PM_{2.5} “All-WD” Monthly/Annual Tables (April to June)

By Hour of the Day and By Year "All WD" 10%ile PM _{2.5} Concentration (µg/m ³) in Fort McKay for the Month of April for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	2.96	2.73	2.66	2.81	3.29	3.38	1.9	3.56	2.14	2.5	1.64	1.53	1.51	1.11	1.28	0.94	1.26	1.34	1.73	1.93	1.92	2.57	2.75	2.55	2.17	0.75	(0.94-3.56)
	2015	1.65	1.52	1.15	1.29	1.74	2.28	2.51	2.3	1.57	1.13	0.86	0.59	0.42	0.24		0.41	0.39	0.41	0.35	0.39	1.56	1.5	1.12	1.86	1.19	0.68	(0.23-2.51)
	2016	2.34	2.14	2.42	2.89	2.48	2.28	1.92	1.76	1.44	1.29	1.37	1.39	1.72	1.45	0.9	1.28	0.95	1.15	1.14	1.91	1.88	1.67	2.49	2.45	1.78	0.55	(0.9-2.89)
	2017	0.19	0.71	0.56	0.28	0.83	1.21	1.15	1.68	1.61	1.84	1.62	0.86	0.56	0.81	1.27	0.9	0.84	0.63	1.3	1.47	1.4	1.16	1.16	0.66	1.03	0.44	(0.19-1.84)
	2018	0.62	0.78	0.18	0.1	0.43	0.76	0.82	0.6	0.65	1.06		0.23	0.17	0.26				0.52	0.51	0.86	1.21	0.77	1.3	1.06	0.64	0.34	(0.1-1.3)
	2019	1.68	2.12	2.12	1.84	1.72	1.68	1.49	1.26	1.41	1.35	1.72	1.6	1.48	1.23	1.68	1.76	1.71	1.59	1.38	2.39	1.9	2.17	1.91	1.66	1.70	0.29	(1.23-2.39)
	2020	2.45	3.26	3.39	3.35	1.86	2.58	1.6	2.64	1.86	1.88	2.2	1.74	1.37	1.3	1.54	0.95	1.21	2.13	1.68	2.47	2.44	2.53	1.76	2.21	2.10	0.65	(0.95-3.39)
	2021	2.51	2.59	3.14	1.61	1.41	2.34	1.49	1.85	1.88	3.23	1.68	1.51	2.53	2.47	2.11	2.58	3.17	3.28	2.82	1.68	3.25	1.45	2.37	2.24	2.30	0.62	(1.41-3.28)
																										1.61	0.56	(0.64-2.3)
	Average	1.80	1.98	1.95	1.77	1.72	2.06	1.61	1.95	1.57	1.78	1.58	1.18	1.22	1.11	1.46	1.26	1.36	1.38	1.36	1.64	1.94	1.73	1.86	1.84	1.63		
	Std Dev	0.91	0.86	1.12	1.12	0.84	0.77	0.48	0.84	0.42	0.71	0.37	0.52	0.73	0.67	0.38	0.66	0.83	0.90	0.72	0.67	0.61	0.60	0.59	0.63	0.28		
	Range	(0.19-2.96)	(0.71-3.26)	(0.18-3.39)	(0.1-3.35)	(0.43-3.29)	(0.76-3.38)	(0.82-2.51)	(0.6-3.56)	(0.65-2.14)	(1.06-3.23)	(0.86-2.2)	(0.23-1.74)	(0.17-2.53)	(0.24-2.47)	(0.9-2.11)	(0.41-2.58)	(0.39-3.17)	(0.41-3.28)	(0.35-2.82)	(0.39-2.47)	(1.21-3.25)	(0.77-2.57)	(1.12-2.75)	(0.66-2.55)	(1.11-2.06)		

By Hour of the Day and By Year "All WD" 10%ile PM _{2.5} Concentration (µg/m ³) in Fort McKay for the Month of May for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	1.12	1.12	1.29	1.74	1.16	1.7	1.55					0.89	0.9	0.65	0.51	0.77	0.74	0.9	1.19	1.22	0.95	1.36	1.37	1.37	1.13	0.34	(0.51-1.74)
	2015	2.9	3.43	3.8	2.19	1.71	2.37	2.64	2.18	1.7	1.46	2.38	2.15	1.76	1.57	2.29	1.15	1.18	1.22	1.3	1.35	1.91	2.85	1.63	3.11	2.09	0.74	(1.15-3.8)
	2016	0.69	0.79	0.88	0.82	0.76	0.72	0.76	0.81	0.68	0.73	0.75	0.78	0.76	0.93	0.77	0.57	0.68	0.66	0.77	0.85	1	0.81	0.67	0.63	0.76	0.10	(0.57-1)
	2017	0.85	0.82	0.56	0.82	0.47	0.65	0.37	1.22	0.94	1.1	0.96	0.9	0.52	0.43	0.67	0.63	0.42	0.51	0.53	0.7	0.76	1.52	0.78	0.64	0.74	0.27	(0.37-1.52)
	2018																											
	2019	3.25	3.34	3.16	2.81	2.36	1.53	3.36	1.32	1.46	1.37	2.33	3.74	3.62	3.26	2.92	3.1	3.45	3.3	3.24	2.82	3.38	3.44	2.59	3.14	2.85	0.74	(1.32-3.74)
	2020	1.58	1.35	2.88	2.57	1.53	1.74	1.17	1.26	1.38	1.53	1.54	0.98	1.96	1.94	1.85	1.46	1.25	1.29	1.42	2.28	2.16	1.95	1.42	1.32	1.66	0.46	(0.98-2.88)
	2021	2.28	1.31	1.97	1.68	1.76	1.73	1.46	3.13	3.54	3.84	4.17	4.15	3.64	3	1.84	2.58	2.82	3.98	3.34	2.7	1.9	1.56	2.27	2.52	2.63	0.92	(1.31-4.17)
																										1.69	0.80	(0.74-2.85)
	Average	1.81	1.74	2.08	1.80	1.39	1.49	1.62	1.65	1.62	1.67	2.02	1.94	1.88	1.68	1.55	1.47	1.51	1.69	1.68	1.70	1.72	1.93	1.53	1.82	1.71		
	Std Dev	1.02	1.15	1.23	0.79	0.64	0.61	1.05	0.85	1.01	1.10	1.25	1.45	1.30	1.12	0.92	1.00	1.16	1.37	1.14	0.88	0.92	0.91	0.71	1.09	0.18		
	Range	(0.69-3.25)	(0.79-3.43)	(0.56-3.8)	(0.82-2.81)	(0.47-2.36)	(0.65-2.37)	(0.37-3.36)	(0.81-3.13)	(0.68-3.54)	(0.73-3.84)	(0.75-4.17)	(0.78-4.15)	(0.52-3.64)	(0.43-3.26)	(0.51-2.92)	(0.57-3.1)	(0.42-3.45)	(0.51-3.98)	(0.53-3.34)	(0.7-2.82)	(0.76-3.38)	(0.81-3.44)	(0.67-2.59)	(0.63-3.14)	(1.39-2.08)		

By Hour of the Day and By Year "All WD" 10%ile PM _{2.5} Concentration (µg/m ³) in Fort McKay for the Month of June for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	1.62	1.65	2.8	1.22	1.64	1.16	0.92	0.84	1.21	0.99	1.23	1.61	1.32	1.84	1.68	1.94	1.77	1.31	1.34	1.17	1.28	1.3	1.22	1.31	1.43	0.41	(0.84-2.8)
	2015	3.28	4.26	4.9	5.2	4.95	2.66	2.94	2.64	3.25	3.13	1.52	1.8	2.28	1.38	1.27	1.33	1.93	1.83	1.89	2.66	2.82	3.71	2.85	2.27	2.78	1.15	(1.27-5.2)
	2016	1.96	2.14	1.57	1.56	1.39	1.43	1.1	1.58	1.49	1.48	1.39	1.21	1.38	1.44	1.41	1.52	1.44	1.53	1.52	1.51	1.87	1.92	1.88	1.63	1.56	0.24	(1.1-2.14)
	2017	1.85	1.69	0.85	1.2	1.38	1.16	1.39	0.75	0.35	0.7	0.51	0.7	0.6	0.86	0.95	0.84	1.43	1.83	1.64	1.55	1.65	1.7	1.53	1.72	1.20	0.47	(0.35-1.85)
	2018	1.61	1.32	1.55	1.4	1.27	1.33	1.41	1.46	1.48	1.4	1.72	1.11	1.38	1.27	1.35	1.27	1.47	0.99	1.19	1.52	1.72	1.52	1.42	1.59	1.41	0.18	(0.99-1.72)
	2019	2.34	3.97	1.6	2.06	2.42	2.32	3.37	1.92	2.77	3.1	4.28	4.22	4.9	2.75	3.5	4.12	3.53	3.73	3.23	2.43	1.96	2.15	1.53	1.3	2.90	0.99	(1.3-4.9)
	2020	2.55	2.97	2.54	2.47	2.52	2.23	2.19	1.82	1.95	1.93	1.49	1.97	1.84	1.76	1.86	1.89	2.49	2.27	2.78	2.88	2.53	2.73	3.51	1.79	2.29	0.48	(1.49-3.51)
	2021	1.43	2.03	1.77	1.41	2.8	1.9	2.9	2.21	3.39	2.63	1.64	1.84	2.15	2.1	2.21	2.42	2.35	1.96	2.22	1.88	1.38	1.47	2.11	1.48	2.07	0.51	(1.38-3.39)
																										1.95	0.61	(1.20-2.90)
	Average	2.08	2.50	2.20	2.07	2.30	1.77	2.03	1.65	1.99	1.92	1.72	1.81	1.98	1.68	1.78	1.92	2.05	1.93	1.98	1.95	1.90	2.06	2.01	1.64	1.95		
	Std Dev	0.62	1.11	1.25	1.34	1.23	0.58	0.95	0.64	1.07	0.94	1.10	1.07	1.29	0.58	0.80	1.01	0.72	0.83	0.72	0.63	0.53	0.81	0.79	0.31	0.20		
	Range	(1.43-3.28)	(1.32-4.26)	(0.85-4.9)	(1.2-5.2)	(1.27-4.95)	(1.16-2.66)	(0.92-3.37)	(0.75-2.64)	(0.35-3.39)	(0.7-3.13)	(0.51-4.28)	(0.7-4.22)	(0.6-4.9)	(0.86-2.75)	(0.95-3.5)	(0.84-4.12)	(1.43-3.53)	(0.99-3.73)	(1.19-3.23)	(1.17-2.88)	(1.28-2.82)	(1.3-3.71)	(1.22-3.51)	(1.3-2.27)	(1.64-2.50)		

Table F.7: The 10th percentile PM_{2.5} "All-WD" Monthly/Annual Tables (July to September)

By Hour of the Day and By Year "All WD" 10%ile PM _{2.5} Concentration (µg/m ³) in Fort McKay for the Month of July for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	2.65	2.98	3.63	3.18	2.13	2.48	1.84	2.14	1.95	2.29	0.97	1.53	1.25	1.14	1.18	1.16	1.37	1.23	1.56	1.37	2.18	2.35	2.76	1.95	1.97	0.72	(0.97-3.63)
	2015	1.56	1.93	2.99	1.55	2.45	2.34	1.84	2.23	1.78	1.75	0.93	1.14	1.12	0.86	1.46	1.15	1.22	1.39	1.13	1.31	1.41	0.96	1.17	1.51	1.55	0.53	(0.86-2.99)
	2016	1.61	1.76	1.71	2.9	2.38	3.23	1.94	2.24	1.46	1.38	1.35	1.35	1.63	1.58	1.52	1.78	1.81	1.92	2.68	2.36	1.27	1.96	2.75	1.85	1.93	0.54	(1.27-3.23)
	2017	1.74	2.24	1.96	2.75	2.58	2.43	1.92	1.73	1.34	0.97	0.86	1.22	1	1.25	1.25	1.1	1.53	2.23	1.19	1.49	1.19	1.68	1.74	1.58	1.62	0.53	(0.86-2.75)
	2018	2.45	2.49	2.72	2.43	3.47	2.69	1.72	2.63	2.27	2.69	2.56	1.81	1.62	2.77	1.59	1.59	2.28	2.14	2.18	2.28	1.92	3.95	2.24	3.82	2.43	0.63	(1.59-3.95)
	2019	2.94	2.64	2.27	2.99	1.75	1.85	1.76	3.64	2.83	2.83	1.96	1.58	3.15	1.89	1.53	1.59	1.99	4.14	3.63	1.8	4.82	1.75	1.91	2.59	2.49	0.89	(1.53-4.82)
	2020	3.8	3.65	3.4	3.4	2.93	3.36	1.93	3.31	3.48	3.66	3.96	3.14	2.32	2.78	2.25	3.33	1.85	2.12	2.92	2.15	2.94	3.27	2.67	3.62	3.01	0.62	(1.85-3.96)
	2021	1.65	1.87	2.17	1.84	1.92	1.98	2.12	3.47	3.55	3.54	3.28	3.12	3.31	2.19	3.29	3.8	3.72	2.38	1.48	1.73	1.72	1.98	2.58	2.87	2.57	0.77	(1.48-3.8)
																									2.20	0.48	(1.55-3.01)	
Average		2.30	2.45	2.61	2.63	2.45	2.55	1.88	2.67	2.33	2.39	1.98	1.86	1.93	1.81	1.76	1.94	1.97	2.19	2.10	1.81	2.18	2.24	2.23	2.47	2.20		
Std Dev		0.81	0.64	0.69	0.65	0.56	0.54	0.12	0.71	0.87	0.98	1.18	0.81	0.90	0.73	0.70	1.04	0.79	0.88	0.91	0.41	1.21	0.95	0.58	0.90	0.29		
Range		(1.56-3.8)	(1.76-3.65)	(1.71-3.63)	(1.55-3.4)	(1.75-3.47)	(1.85-3.36)	(1.72-3.12)	(1.73-3.64)	(1.34-3.55)	(0.97-3.66)	(0.86-3.96)	(1.14-3.14)	(1-3.31)	(0.86-2.78)	(1.18-3.29)	(1.1-3.8)	(1.22-3.72)	(1.23-4.14)	(1.13-3.63)	(1.31-2.36)	(1.19-4.82)	(0.96-3.95)	(1.17-2.76)	(1.51-3.82)	(1.76-2.67)		

By Hour of the Day and By Year "All WD" 10%ile PM _{2.5} Concentration (µg/m ³) in Fort McKay for the Month of August for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	1.91	1.96	2.64	3.99	4.12	3.27	3.3	3.14	1.96	1.7	1.79	1.35	1.85	1.78	1.37	1.64	1.71	1.67	1.51	1.7	3.73	3.17	2.6	2.22	2.34	0.86	(1.35-4.12)
	2015	2.26	1.95	1.62	1.97	2	1.96	2.38	2.25	1.67	1.22	1.31	1.38	1.62	1.16	1.35	1.42	1.85	1.89	1.58	1.81	1.95	2.4	2.27	1.73	1.79	0.37	(1.16-2.4)
	2016	3.93	3.43	3.75	3.26	3.48	3.55	2.72	3.12	2.69	2.6	1.98	2.27	2.32	1.86	2.35	2.43	2.41	2.28	2.15	2.26	2.36	2.65	3.26	2.78	2.75	0.59	(1.86-3.93)
	2017	2.45	2.72	2.99	2.14	2.73	2.38	1.73	2.52	1.45	1.42	1.7	1.39	1.71	1.65	1.67	1.76	1.66	1.74	1.68	2.35	2.37	2.62	2.83	1.93	2.07	0.50	(1.39-2.99)
	2018	2.64	4.34	4.26	3.59	4.28	3.27	1.48	1.87	2	2.14	2.9	2.46	3.49	3.31	3.57	2.94	3.39	3.15	3.45	4.64	2.76	3.75	2.75	5.36	3.24	0.93	(1.48-5.36)
	2019	2.48	2.79	2.6	2.52	2.49	2.34	1.52	1.51	1.59	1.22	1.56	1.45	1.77	1.5	1.8	1.79	1.66	1.89	2.12	1.63	2.29	2.91	2.33	2.24	2.00	0.48	(1.22-2.91)
	2020	2.29	2.31	2.47	2.17	1.82	1.99	1.73	1.96	2.17	1.95	1.77	1.38	1.11	1.44	1.32	1.75	1.58	1.49	1.72	1.59	1.79	2.68	2.2	2.54	1.88	0.41	(1.11-2.68)
	2021	2.15	2.86	2.15	2.46	1.81	2.49	2.78	2.17	2.7	1.95	1.94	2.94	1.77	2	2.46	2.24	2.38	2.13	2.6	2.68	2.65	1.68	2.56	2.77	2.35	0.37	(1.68-2.94)
																									2.30	0.46	(1.79-2.34)	
Average		2.51	2.80	2.81	2.76	2.84	2.66	2.21	2.32	2.03	1.78	1.87	1.83	1.96	1.84	1.99	2.00	2.08	2.03	2.10	2.33	2.49	2.73	2.60	2.70	2.30		
Std Dev		0.61	0.80	0.85	0.75	1.00	0.62	0.68	0.58	0.47	0.48	0.47	0.63	0.70	0.65	0.78	0.50	0.62	0.52	0.66	1.01	0.60	0.60	0.35	1.14	0.37		
Range		(1.91-3.93)	(1.95-4.34)	(1.62-4.26)	(1.97-3.99)	(1.81-4.28)	(1.96-3.55)	(1.48-3.3)	(1.51-3.14)	(1.45-2.7)	(1.22-2.6)	(1.31-2.9)	(1.35-2.94)	(1.11-3.49)	(1.16-3.31)	(1.32-3.57)	(1.42-2.94)	(1.58-3.39)	(1.49-3.15)	(1.51-3.45)	(1.59-4.64)	(1.79-3.73)	(1.68-3.75)	(2.2-3.26)	(1.73-5.36)	(1.78-2.84)		

By Hour of the Day and By Year "All WD" 10%ile PM _{2.5} Concentration (µg/m ³) in Fort McKay for the Month of September for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	1.83	1.96	2.13	2.14	2.16	1.57	1.97	1.83	1.76	1.48	1.28	1.5	1.47	1.25	1.28	1.29	1.65	1.07	0.96	1.51	1.58	1.64	2.1	2.09	1.65	0.35	(0.96-2.16)
	2015	2.84	3.07	2.65	2.54	2.7	2.81	2.54	2.42	2.21	1.93	1.79	1.69	1.52	1.62	1.41	1.46	1.83	1.81	2.72	2.76	2.87	2.94	2.83	2.87	2.33	0.55	(1.41-3.07)
	2016	0.98	1.19	1.13	1.3	1.16	1.25	1.25	1.1	1.25	1.23	1.24	1.65	1.45	1.07	0.74	0.79	0.82	0.87	0.97	1.41	1.45	1.2	0.97	0.95	1.14	0.23	(0.74-1.65)
	2017	0.81	0.81	0.73	0.78	0.91	1.3	1.13	1.11	1.31	1.55	1.16	1.3	1.13	1.33	1.19	1.08	0.96	1.11	1.22	1.89	1.6	1.19	1.17	1.2	1.17	0.27	(0.73-1.89)
	2018	1.38	1.3	1.57	1.54	1.71	1.3	1.51	1.22	1.15	1.33	1.29	1.38	1.36	1.41	1.14	1.29	1.22	0.99	1.2	1.25	1.14	1.22	1.36	1.27	1.31	0.16	(0.99-1.71)
	2019	1.93	1.61	1.8	1.71	1.65	1.69	2.29	1.86	2.25	1.76	2.35	2.58	1.12	2.21	2.14	1.53	1.91	1.92	2.58	1.19	2.06	2.55	2.66	3.23	2.02	0.49	(1.12-3.23)
	2020	1.71	2.08	2.21	2.12	2.15	1.69	1.76	1.72	1.64	1.61	1.34	1.59	1.2	1.21	1.1	1.31	1.36	1.19	1.41	1.53	1.83	2.08	2.43	2.35	1.69	0.39	(1.1-2.43)
	2021	1.42	1.38	1.65	1.55	1.46	1.54	1.67	1.55	1.19	1.52	1.52	1.38	1.47	1.53	1.45	1.55	1.4	1.26	1.21	1.25	1.37	1.36	1.83	1.49	1.46	0.15	(1.19-1.83)
																									1.60	0.39	(1.14-2.33)	
Average		1.61	1.68	1.73	1.71	1.74	1.64	1.77	1.60	1.60	1.55	1.50	1.63	1.34	1.45	1.31	1.29	1.39	1.28	1.53	1.60	1.74	1.77	1.92	1.93	1.60		
Std Dev		0.63	0.70	0.61	0.55	0.58	0.50	0.49	0.45	0.45	0.22	0.40	0.41	0.17	0.35	0.40	0.25	0.39	0.38	0.70	0.52	0.54	0.68	0.70	0.84	0.18		
Range		(0.81-2.84)	(0.81-3.07)	(0.73-2.65)	(0.78-2.54)	(0.91-2.7)	(1.25-2.81)	(1.13-2.54)	(1.1-2.42)	(1.15-2.25)	(1.23-1.93)	(1.16-2.35)	(1.3-2.58)	(1.12-1.52)	(1.07-2.21)	(0.74-1.45)	(0.79-1.55)	(0.82-1.91)	(0.87-1.92)	(0.96-2.72)	(1.19-2.76)	(1.14-2.87)	(1.19-2.94)	(0.97-2.83)	(0.95-3.23)	(1.28-1.93)		

Table F.8: The 10th percentile PM_{2.5} "All-WD" Monthly/Annual Tables (October to December)

By Hour of the Day and By Year "All WD" 10%ile PM _{2.5} Concentration (µg/m3) in Fort McKay for the Month of October for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	0.89	0.84	0.78	0.98	1.15	1.13	1.89	1.47	1.29	1.23	0.58	0.69	1.28	1.24	1.14	1.19	0.81	1.23	1.5	1.33	1.64	1.15	1.25	0.81	1.15	0.31	(0.58-1.89)
	2015	0.7	0.82	0.88	0.87	1.25	1.26	0.84	0.88	0.55	0.77	0.53	0.45	0.32	0	0	0	0	0	0.49	0.96	1.33	0.56	0.83	0.8	0.63	0.41	(0-1.33)
	2016	0.88	1.17	1.13	0.96	0.97	0.93	0.93	0.98	1.16	0.79	0.94	0.85	0.84	0.84	0.56	0.59	0.47	0.47	0.64	0.47	0.68	0.76	0.78	0.92	0.82	0.21	(0.47-1.17)
	2017	0.66	0.74	0.7	0.69	0.75	0.82	0.81	0.82	0.82	0.8	0.85	0.96	0.96	0.94	0.94	0.87	0.67	0.58	0.58	0.53	0.52	0.53	0.58	0.63	0.74	0.15	(0.52-0.97)
	2018	1.15	1.12	1.43	1.31	1.36	1.32	1.52	1.23	1.16	1.14	1.49	1.35	2.24	2.54	1.66	2.59	1.57	1.37	1.87	1.42	1.7	1.28	1.24	1.51	1.52	0.41	(1.12-2.59)
	2019	0.74	0.81	0.79	0.7	0.74	0.86	0.66	0.93	1.18	1.23	1.32	1.16	1.19	0.93	0.94	0.77	0.77	0.5	0.47	0.74	0.63	0.62	0.72	0.78	0.84	0.23	(0.47-1.32)
	2020	0.62	0.67	0.7	0.85	0.9	0.88	0.87	0.96	0.95	0.99	0.91	0.78	0.61	0.67	0.63	0.73	0.72	0.69	0.68	0.72	0.76	0.91	0.73	0.57	0.77	0.12	(0.57-0.99)
	2021	1.48	1.96	1.87	2.14	1.72	1.96	2.2	1.53	1.99	1.48	1.82	1.58	1.58	1.53	1.41	1.68	1.4	1.57	1.35	1.85	1.49	1.32	1.42	1.54	1.66	0.25	(1.32-2.2)
																									1.02	0.36		(0.64-1.66)
Average		0.89	1.02	1.04	1.06	1.11	1.15	1.22	1.10	1.14	1.05	1.06	0.98	1.13	1.09	0.91	1.05	0.80	0.80	0.95	1.00	1.09	0.89	0.94	0.95	1.02		
Std Dev		0.29	0.42	0.42	0.48	0.34	0.38	0.58	0.27	0.42	0.26	0.45	0.37	0.60	0.74	0.52	0.79	0.50	0.53	0.54	0.49	0.49	0.32	0.31	0.37	0.11		
Range		(0.62-1.48)	(0.67-1.96)	(0.7-1.87)	(0.69-2.14)	(0.74-1.72)	(0.82-1.96)	(0.66-2.2)	(0.82-1.53)	(0.55-1.99)	(0.77-1.48)	(0.53-1.82)	(0.45-1.58)	(0.32-2.24)	(0-2.54)	(0-1.66)	(0-2.59)	(0-1.57)	(0-1.57)	(0.47-1.87)	(0.47-1.85)	(0.52-1.7)	(0.53-1.32)	(0.58-1.42)	(0.57-1.54)	(0.80-1.22)		

By Hour of the Day and By Year "All WD" 10%ile PM _{2.5} Concentration (µg/m ³) in Fort McKay for the Month of November for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	1.43	1.32	1.21	1.33	1.26	1.16	1.34	1.33	0.96	1.34	1.16	1.17	0.85	0.93	0.78	1.59	1.77	2.17	1.71	1.68	1.75	1.62	1.7	1.93	1.40	0.35	(0.78-2.17)
	2015	2.14	2.21	1.83	1.89	1.47	1.5	1.91	1.85	1.65	1.77	1.35	1.45	1.48	0.98	0.88	1.17	1.4	1.72	1.77	1.38	1.23	1.45	1.44	1.68	1.57	0.33	(0.88-2.21)
	2016	0.52	0.8	0.75	0.69	1.23	0.98	0.89	1.09	1.16	0.92	0.83	0.97	0.8	0.88	0.81	0.75	0.86	1.13	0.83	1.29	1.49	0.86	0.97	0.92	0.93	0.21	(0.52-1.49)
	2017	1.33	1.15	1.33	1.19	1.13	0.94	0.96	0.88	1.11	1.09	0.95	0.97	1.47	1.18	1.77	1.19	1.25	1.23	1.19	1.25	1.24	1.46	1.54	1.25	1.21	0.21	(0.88-1.77)
	2018	1.45	1.63	1.47	1.78	2.73	2.16	1.48	1.81	1.96	2.48	1.55	1.52	1.61	2.59	2.11	2.44	2.64	3.72	1.81	2.71	2.19	1.96	2.35	1.45	2.07	0.56	(1.45-3.72)
	2019	2.24	2.9	1.44	1.84	1.63	1.62	1.58	1.49	1.42	1.41	1.56	1.82	1.39	1.92	1.68	1.41	3.57	1.57	1.74	2.11	1.89	1.61	2.98	1.94	1.87	0.55	(1.39-3.57)
	2020	1.77	1.75	1.44	1.97	1.98	1.77	1.78	1.64	2.15	1.39	1.65	1.61	1.56	1.29	0.92	0.95	2.39	2.45	1.65	1.67	2.18	2.38	2.22	2.34	1.79	0.42	(0.92-2.45)
	2021	1.85	1.77	1.22	1.24	1.64	1.51	1.68	2.26	1.66	1.83	1.77	1.48	1.56	1.74	1.39	2.07	2.67	1.19	1.55	1.37	1.1	1.15	1.66	1.56	1.62	0.36	(1.1-2.67)
																									1.56	0.34		(0.93-1.87)
Average		1.59	1.69	1.34	1.49	1.63	1.46	1.45	1.54	1.51	1.53	1.35	1.37	1.34	1.44	1.29	1.45	2.07	1.90	1.53	1.68	1.63	1.56	1.86	1.63	1.56		
Std Dev		0.55	0.65	0.31	0.45	0.52	0.42	0.37	0.44	0.42	0.49	0.34	0.31	0.33	0.60	0.52	0.57	0.90	0.88	0.34	0.50	0.43	0.47	0.63	0.44	0.19		
Range		(0.52-2.24)	(0.8-2.9)	(0.75-1.83)	(0.69-1.97)	(1.13-2.73)	(0.94-2.16)	(0.89-1.91)	(0.88-2.26)	(0.96-2.15)	(0.92-2.48)	(0.83-1.77)	(0.97-1.82)	(0.8-1.61)	(0.88-2.59)	(0.78-2.11)	(0.75-2.44)	(0.86-3.57)	(1.13-3.72)	(0.83-1.81)	(1.25-2.71)	(1.1-2.19)	(0.86-2.38)	(0.97-2.98)	(0.92-2.34)	(1.23-2.07)		

By Hour of the Day and By Year "All WD" 10%ile PM _{2.5} Concentration (µg/m ³) in Fort McKay for the Month of December for the Period 2014-2021																												
Hour of the Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Ave.	Std Dev.	Range
Year	2014	1.96	1.37	1.18	1.6	1.44	1.22	1.36	1.3	1.59	1.26	1.71	1.87	1.76	0.99	0.83	1.36	1.29	1.3	1.23	1.49	1.92	1.66	3.11	1.31	1.50	0.44	(0.83-3.11)
	2015	1.56	1.69	1.65	1.87	1.89	1.62	1.62	1.85	1.37	1.55	1.44	2.49	1.56	1.23	1.25	1.46	2.65	2.54	2.59	2.17	2.48	1.99	1.72	1.68	1.83	0.44	(1.23-2.65)
	2016	2.57	2.5	1.99	2.1	2.11	2.2	1.63	1.36	1.78	1.57	1.6	1.71	1.43	1.68	1.42	1.75	1.33	2	1.98	2.14	2.14	1.94	1.93	1.9	1.87	0.33	(1.33-2.57)
	2017	0.78	0.67	0.91	0.95	0.89	0.75	0.78	0.85	1.15	0.87	0.82	0.43	0.33	0.17	0.16	0.22	0.18	0.23	0.83	0.31	0.44	1.28	0.68	0.83	0.65	0.33	(0.16-1.28)
	2018	3.33	2.74	2.82	3.33	2.71	3.54	3.54	3.53	3.99	3.31	2.75	2.34	2.12	2.87	3.44	3.34	1.55	1.88	3.82	2.68	4.14	3.4	4.75	2.98	3.12	0.73	(1.55-4.75)
	2019	1.62	3.94	1.77	4.3	4.24	3.65	3.62	3.8	3.67	4.58	3.69	3.4	1.72	2.25	4.32	4.48	2.47	2.82	1.77	4.18	3.74	1.86	4.35	4.46	3.36	1.03	(1.62-4.58)
	2020	1.19	1.13	0.76	1.35	1.44	2.31	2.15	1.74	1.64	1.43	1.83	1.5	1.35	2.4	1.74	2.27	2.22	2.39	1.92	1.7	2.7	1.82	2.26	1.74	1.79	0.48	(0.76-2.7)
	2021	2.53	2.79	2.4	3.14	2.3	2.55	1.89	1.92	2.34	2.22	2.12	2.48	2.56	2.81	2.55	1.81	2.59	2.58	1.96	2.55	2.28	2.43	2.82	2.63	2.43	0.33	(1.81-3.14)
																									2.07	0.82		(0.65-3.36)
Average		1.94	2.10	1.69	2.33	2.13	2.23	2.07	2.04	2.19	2.10	2.00	2.03	1.60	1.80	1.96	2.09	1.79	1.97	2.01	2.15	2.48	2.05	2.70	2.19	2.07		
Std Dev		0.83	1.08	0.72	1.15	1.03	1.03	1.01	1.06	1.07	1.25	0.88	0.87	0.65	0.95	1.39	1.31	0.86	0.85	0.90	1.11	1.14	0.63	1.36	1.14	0.24		
Range		(0.78-3.33)	(0.67-3.94)	(0.76-2.82)	(0.95-4.3)	(0.89-4.24)	(0.75-3.65)	(0.78-3.62)	(0.85-3.8)	(1.15-3.99)	(0.87-4.58)	(0.82-3.69)	(0.43-3.4)	(0.33-2.56)	(0.17-4.32)	(0.16-4.48)	(0.22-2.65)	(0.18-2.47)	(0.23-2.82)	(0.83-1.77)	(0.31-4.18)	(0.44-3.74)	(1.28-1.86)	(0.68-4.35)	(0.83-4.46)	(1.60-2.70)		

By Hour of the Day and WD Screened %ile PM _{2.5} Concentrations (µg/m ³) in Fort McKay for the Month of January for the Period 2014-2021																								
Percentile	Hr of the day																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
5%	0.51	0.21	0.23	0.24	1.72	0.94	0.81	0.62	0.78	1.39	1.71	2.54	1.75	1.77	0.29	0.75	2.78	1.46	0.74	1.72	2.04	1.39	1.11	0.56
10%	0.57	0.24	0.27	0.25	1.84	1.30	1.15	0.85	1.43	1.70	1.75	2.60	1.87	1.86	0.31	1.11	2.79	2.49	1.01	1.99	2.59	1.59	1.57	0.81
15%	0.69	0.30	0.35	0.28	2.00	1.52	1.38	0.96	1.50	1.74	1.82	2.67	1.99	1.92	0.34	1.46	2.81	2.54	1.32	2.25	2.75	1.81	2.15	0.94
20%	0.88	0.40	0.60	0.83	2.16	1.66	1.63	1.27	1.58	1.89	2.07	2.73	2.10	1.95	0.38	1.69	2.83	2.59	1.59	2.43	2.87	2.35	2.60	1.00
25%	1.06	0.49	1.20	1.63	2.30	2.16	2.12	1.69	1.59	1.96	2.31	2.80	2.22	1.99	0.44	1.86	2.88	2.68	1.79	2.58	3.10	2.88	2.64	1.07
30%	1.27	0.50	1.75	1.65	2.37	2.40	2.28	1.92	1.61	2.03	2.51	2.86	2.23	2.11	0.50	2.03	2.92	2.77	2.21	2.64	3.37	3.20	2.77	1.23
35%	1.48	0.51	1.83	1.71	2.40	2.48	2.31	2.08	1.75	2.19	2.62	2.92	2.25	2.24	0.65	2.16	2.97	2.90	2.81	2.76	3.50	3.44	2.91	1.34
40%	1.67	0.79	1.84	1.88	2.50	2.61	2.39	2.09	1.89	2.32	2.73	2.99	2.27	2.80	0.99	2.23	3.02	3.03	2.98	3.03	3.65	3.72	3.00	2.24
45%	1.83	1.34	1.90	2.29	2.63	2.82	2.42	2.28	2.21	2.41	2.93	3.05	2.28	3.77	1.33	2.29	3.54	3.03	2.98	3.23	4.23	3.94	3.34	2.94
50%	2.00	1.90	2.02	2.82	2.76	2.94	2.57	2.57	2.53	2.44	3.23	3.12	2.30	4.75	1.67	2.36	4.06	3.03	3.13	3.40	4.56	4.02	3.59	3.28
55%	2.32	2.45	2.46	4.29	3.01	3.33	2.87	2.60	3.07	2.44	3.54	3.16	2.33	4.87	1.83	2.49	4.58	3.11	3.29	3.89	4.60	4.09	3.74	3.49
60%	2.65	3.01	2.70	5.50	4.49	3.53	3.34	2.81	3.60	3.13	4.11	3.21	2.37	4.98	1.98	2.63	5.10	3.20	3.51	4.61	4.61	4.30	3.81	3.96
65%	2.93	3.47	2.78	6.21	5.59	4.18	3.52	3.37	3.93	4.17	4.90	3.26	2.40	5.09	2.14	2.77	7.04	3.74	3.68	5.78	4.62	4.73	3.98	4.90
70%	3.15	3.85	2.90	6.66	5.68	5.16	3.98	3.67	4.26	4.21	5.68	3.31	2.43	5.21	2.20	3.38	8.99	4.29	3.72	6.65	4.75	4.94	4.98	6.16
75%	3.37	4.23	3.39	6.99	6.08	5.52	4.80	3.86	5.00	4.81	6.84	3.35	2.46	5.32	2.22	4.24	10.93	5.25	3.95	7.37	5.04	5.87	6.58	6.39
80%	4.31	6.84	4.26	8.65	6.84	7.16	6.09	3.90	5.74	5.46	8.14	3.40	2.66	5.81	2.24	5.10	12.87	6.21	4.41	8.11	7.15	8.46	8.56	7.46
85%	5.24	9.46	5.74	9.87	7.26	7.79	7.43	4.05	5.75	5.72	9.45	3.45	2.86	6.31	3.28	5.98	14.17	11.49	6.72	8.88	8.54	8.56	8.96	8.67
90%	5.89	10.78	7.73	10.21	7.51	8.15	8.45	4.43	5.76	6.04	10.03	3.50	3.06	18.77	6.38	6.90	15.46	16.76	10.08	9.73	10.57	10.25	10.51	9.91
95%	6.26	10.79	9.24	11.45	9.55	8.92	9.32	11.69	6.84	7.30	10.50	3.54	3.26	43.20	9.48	7.82	16.75	23.37	15.67	10.58	16.47	12.83	12.75	13.31
100%	6.62	10.80	9.98	13.14	12.00	10.76	10.21	22.39	7.91	9.79	10.96	3.59	3.46	67.63	12.59	8.73	18.05	29.97	21.75	11.44	23.91	15.63	15.17	24.53
Average																								
By Hour of the Day and WD Screened %ile PM _{2.5} Concentrations (ug/m3) in Fort McKay for the Month of February for the Period 2014-2021																								
Percentile	Hr of the day																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
5%	0.56	0.58	0.71	0.51	1.20	0.90	0.92	1.16	0.80	1.10	0.40	0.68	0.71	0.80	0.62	0.47	0.48	0.55	0.94	1.01	0.58	1.16	1.05	0.71
10%	0.72	0.71	0.71	0.66	1.46	1.00	1.48	1.37	1.22	1.27	0.67	0.69	0.78	0.99	0.64	0.50	0.58	0.63	1.28	1.27	0.84	1.38	1.19	0.95
15%	2.06	0.72	0.87	0.73	1.86	1.08	1.57	1.67	1.44	1.38	0.79	0.71	0.86	1.10	0.77	0.54	0.63	0.75	1.79	1.83	1.26	1.98	1.59	1.54
20%	3.40	1.05	1.02	1.09	2.11	1.29	1.71	2.19	1.56	1.46	0.86	0.78	1.00	1.12	1.01	0.57	0.63	0.88	2.34	2.62	1.32	3.47	2.56	2.06
25%	3.68	1.54	1.54	1.46	2.14	1.51	2.30	2.47	1.74	1.53	0.99	0.85	1.14	1.14	1.26	0.58	0.64	0.99	2.71	3.34	1.44	4.11	2.77	2.31
30%	3.97	2.10	2.05	1.83	2.75	1.88	2.61	2.60	2.06	1.88	1.18	0.92	1.27	1.33	1.40	0.58	0.75	1.09	2.91	3.74	1.73	5.01	3.09	3.52
35%	4.47	2.60	2.46	2.00	3.05	2.16	2.85	2.83	2.68	2.23	1.37	0.96	1.33	1.51	1.53	0.59	0.87	1.32	3.02	3.98	2.07	5.08	3.36	3.80
40%	4.98	2.93	2.87	2.26	3.10	2.53	3.47	3.37	2.80	2.55	1.59	1.01	1.39	1.62	1.73	0.60	0.94	1.83	3.12	4.05	2.87	5.36	3.42	4.09
45%	5.37	3.15	3.03	2.78	3.23	2.81	3.93	3.63	3.10	2.82	1.85	1.12	1.44	1.65	1.97	0.76	0.97	2.29	3.45	4.29	4.71	5.70	4.26	4.29
50%	5.76	3.32	3.18	3.00	3.36	2.97	4.18	3.95	3.45	3.09	2.52	1.30	1.49	1.67	2.21	0.92	1.00	2.41	3.64	4.57	5.73	6.04	4.63	4.53
55%	6.03	3.77	3.49	3.12	3.69	3.36	4.59	4.28	3.67	3.29	3.20	1.48	1.53	1.78	2.52	1.08	1.10	2.52	3.92	5.09	6.32	6.86	4.76	4.58
60%	6.30	4.08	3.79	3.21	4.60	3.88	5.10	4.57	3.88	3.49	3.42	1.97	1.87	1.88	2.83	1.24	1.20	2.65	4.54	6.19	6.32	9.57	4.87	4.81
65%	6.74	4.12	4.56	3.64	4.79	4.17	5.42	4.66	4.60	3.81	3.59	2.69	2.43	2.17	3.11	1.40	1.26	2.78	4.80	7.93	7.20	11.16	5.81	6.46
70%	7.19	4.62	5.33	4.20	5.00	4.37	5.46	4.69	5.23	4.24	3.93	3.42	2.99	2.64	3.35	1.57	1.26	3.19	4.95	8.06	8.32	12.15	6.24	6.51
75%	7.67	5.36	5.68	4.66	5.34	4.65	5.55	4.72	7.11	4.68	4.35	3.76	3.29	3.11	3.59	1.73	1.27	3.74	5.29	8.16	8.72	12.64	6.34	6.71
80%	8.16	8.80	6.02	5.44	6.16	5.01	6.16	4.78	7.78	6.33	5.94	3.96	3.49	3.39	4.01	1.90	1.85	4.22	6.13	8.24	10.03	12.93	6.35	7.77
85%	8.82	11.57	6.13	6.42	7.01	5.20	7.91	5.71	7.86	7.99	9.02	4.16	3.69	3.68	4.43	4.09	2.43	4.59	8.94	8.42	12.09	13.77	7.43	8.75
90%	9.48	12.97	6.24	7.13	10.16	6.26	8.08	6.42	8.00	9.01	11.62	6.96	3.94	3.97	6.28	6.28	2.72	5.03	10.83	8.65	16.25	13.98	8.36	9.21
95%	10.79	13.59	12.95	8.46	15.72	7.15	9.02	7.20	8.31	9.40	12.56	10.20	4.20	4.27	9.55	8.48	2.75	5.69	17.62	22.87	30.17	14.55	8.93	13.97
100%	12.10	13.83	19.66	10.34	17.91	9.61	12.08	8.35	8.79	9.78	13.50	13.43	4.46	4.56	12.82	10.67	2.77	6.35	35.12	102.53	52.46	19.36	8.94	14.97
Average																								

Table F.10: The Wind Direction Screened PM_{2.5} Percentile by Hour of the Day and by Month Tables (March and April for entire 2014-2021 Period) with 25th percentile and 50th percentile Values Highlighted in “Red”

By Hour of the Day and WD Screened %ile PM2.5 Concentrations (ug/m3) in Fort McKay for the Month of March for the Period 2014-2021																									
Percentile	Hr of the day																								Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
5%	1.58	1.48	1.25	1.30	2.01	2.11	1.21	1.21	1.07	0.73	1.10	1.56	1.07	0.20	0.10	0.92	1.12	0.89	0.64	1.02	2.00	0.31	0.43	1.02	1.10
10%	2.09	1.68	1.46	2.03	2.37	2.42	1.38	1.41	1.33	0.74	1.26	1.60	1.24	0.29	0.12	1.00	1.22	1.10	1.05	1.23	2.73	0.55	1.49	1.27	1.38
15%	2.44	1.77	1.81	2.50	2.76	2.70	1.62	1.61	1.60	0.78	1.42	1.64	1.42	0.37	0.18	1.07	1.31	1.17	1.43	1.39	3.05	0.99	2.08	1.80	1.62
20%	2.79	1.82	2.12	3.47	3.52	2.93	1.88	2.39	1.87	0.97	1.53	1.69	1.62	0.45	0.47	1.10	1.39	1.24	1.59	1.44	3.29	1.20	2.40	2.61	1.91
25%	2.99	1.89	2.29	3.58	3.54	3.95	2.12	3.46	2.21	1.16	1.64	1.73	1.84	0.53	0.76	1.11	1.46	1.30	1.75	1.63	3.39	1.56	2.55	3.00	2.14
30%	4.49	2.61	2.50	3.96	3.69	4.20	2.29	3.73	2.62	1.31	1.79	1.77	2.06	0.69	1.00	1.11	1.53	1.36	1.90	2.08	3.47	2.20	2.64	3.42	2.43
35%	5.26	3.80	2.99	4.79	3.86	4.37	3.37	3.96	2.90	1.36	2.02	1.82	2.36	0.86	1.12	1.12	1.70	1.70	2.02	2.37	3.53	2.50	2.86	3.62	2.76
40%	6.02	5.28	3.27	5.59	3.94	4.95	4.26	4.10	2.94	1.41	2.26	1.86	2.81	1.02	1.24	1.13	2.06	2.04	2.13	2.59	3.65	2.67	3.52	3.95	3.11
45%	7.03	6.18	3.40	6.57	4.79	5.34	4.36	4.34	2.99	1.47	2.48	1.91	3.26	1.18	1.32	1.13	2.43	2.17	2.38	2.72	3.78	2.70	4.24	4.38	3.44
50%	8.13	6.73	3.57	7.69	5.19	5.43	4.44	4.64	3.09	1.56	2.66	1.95	3.72	1.35	1.32	1.14	2.80	2.29	2.80	2.81	4.06	2.81	5.12	4.51	3.74
55%	8.54	7.01	4.23	7.91	5.48	5.54	4.55	4.67	3.19	1.65	2.84	2.03	4.06	1.85	1.33	1.19	2.86	2.35	3.22	2.90	4.39	2.96	6.19	4.76	3.99
60%	9.06	7.12	5.68	8.02	6.01	6.13	4.76	4.88	3.30	1.73	3.06	2.10	4.40	2.36	1.65	1.25	2.92	2.41	3.56	3.01	5.00	3.11	6.70	5.82	4.34
65%	9.51	7.87	7.60	8.51	8.35	7.03	4.92	5.43	3.41	1.80	3.31	2.18	4.74	2.86	2.20	1.30	2.99	2.59	3.84	3.30	5.54	3.69	6.82	6.61	4.85
70%	9.99	8.39	7.79	8.85	9.21	7.07	5.22	7.30	3.66	1.87	3.55	2.26	5.35	3.37	2.76	1.52	3.26	2.78	4.12	3.89	5.86	4.35	6.92	6.92	5.26
75%	10.92	8.67	8.24	8.93	9.47	7.43	6.45	9.83	3.98	2.03	4.02	2.33	6.08	3.87	2.95	1.83	3.64	3.02	5.50	5.61	6.12	4.38	8.64	7.36	5.89
80%	11.53	8.72	8.50	9.41	10.01	8.82	7.67	10.70	4.50	2.23	4.57	2.41	6.82	4.24	2.99	2.14	4.01	3.25	7.34	6.52	6.32	5.10	9.63	8.42	6.49
85%	15.59	10.45	8.76	9.88	10.63	9.68	8.86	11.60	5.28	2.43	5.12	2.49	7.57	4.60	3.04	2.43	4.47	3.79	9.17	6.95	6.93	6.65	10.71	10.18	7.39
90%	19.04	11.95	9.17	13.06	12.79	10.09	9.67	12.54	9.79	2.52	6.70	2.56	8.36	4.96	5.14	2.69	5.07	4.33	10.07	7.72	7.78	12.84	11.40	12.03	8.84
95%	29.36	18.67	13.01	13.46	19.31	13.56	10.42	13.54	27.35	2.59	8.44	2.64	9.15	5.33	7.58	2.96	5.68	4.35	10.81	8.66	12.98	18.08	14.09	15.03	11.96
100%	65.63	36.08	32.14	34.42	32.99	14.00	11.14	14.56	44.91	2.67	10.19	2.72	9.94	5.69	10.02	3.22	6.28	4.37	11.56	9.75	19.14	22.51	14.48	21.87	18.34
By Hour of the Day and WD Screened %ile PM2.5 Concentrations (ug/m3) in Fort McKay for the Month of April for the Period 2014-2021																									
Percentile	Hr of the day																								Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
5%	1.75	1.51	1.10	1.12	0.95	0.96	0.69	1.09	1.13	0.97	1.14	0.67	0.73	0.32	0.34	0.44	0.49	0.39	0.46	0.36	0.66	0.74	1.30	1.54	0.87
10%	2.09	1.76	1.72	1.44	0.99	1.20	1.00	1.13	1.17	1.11	1.23	0.76	0.84	0.37	0.44	0.52	0.55	0.45	0.62	0.37	0.85	0.96	1.80	2.17	1.06
15%	2.53	1.83	1.81	1.65	1.24	1.50	1.25	1.17	1.21	1.24	1.32	0.86	0.92	0.47	0.52	0.55	0.58	0.52	0.77	0.45	1.02	1.03	1.89	2.72	1.21
20%	2.77	1.89	1.87	1.71	1.62	1.65	1.42	1.20	1.29	1.28	1.41	0.99	0.97	0.55	0.57	0.65	0.61	0.59	0.84	0.89	1.18	1.09	2.27	3.04	1.35
25%	2.96	2.49	2.27	1.75	1.69	1.84	1.46	1.21	1.38	1.33	1.49	1.14	1.02	0.61	0.59	0.79	0.64	0.65	0.91	1.33	1.34	1.13	2.79	3.11	1.50
30%	3.08	2.69	2.46	2.23	1.75	2.06	1.66	1.23	1.47	1.43	1.57	1.30	1.05	0.70	0.61	0.92	0.67	0.70	0.96	1.74	1.43	1.43	3.78	4.02	1.71
35%	3.33	2.72	2.85	2.83	2.10	2.29	1.99	1.26	1.55	1.66	1.66	1.42	1.07	0.82	0.65	0.97	0.72	0.77	0.96	2.06	1.51	1.94	4.56	4.56	1.93
40%	3.92	2.91	3.17	3.22	2.37	2.34	2.13	1.33	1.62	1.89	1.74	1.46	1.15	0.86	0.83	1.21	0.76	0.90	0.96	2.38	1.57	2.15	4.90	4.98	2.11
45%	4.47	3.13	3.35	3.36	2.50	2.44	2.21	1.40	1.69	2.02	1.80	1.51	1.28	0.88	1.06	1.40	1.07	1.06	1.13	2.67	1.60	2.25	5.13	5.29	2.28
50%	4.84	3.42	3.47	3.41	2.73	2.66	2.36	1.47	1.77	2.03	1.86	1.56	1.41	1.08	1.53	1.48	1.38	1.52	1.53	2.92	1.63	2.64	5.30	5.37	2.47
55%	5.21	3.67	3.78	3.61	3.25	3.02	2.50	1.75	1.92	2.05	1.92	1.60	1.43	1.32	2.01	1.77	1.39	1.98	1.92	3.18	1.66	3.06	5.55	5.87	2.73
60%	5.84	3.89	4.43	3.76	3.53	3.31	2.55	2.03	2.07	2.08	1.98	1.63	1.45	1.75	2.35	2.06	1.40	2.15	2.16	3.56	1.69	3.43	5.92	6.72	2.99
65%	5.94	4.54	4.97	3.85	3.75	3.53	2.86	2.31	2.22	2.12	2.05	1.66	1.69	2.07	2.63	2.34	1.75	2.29	2.27	4.05	2.06	3.91	6.54	7.22	3.28
70%	6.11	5.52	5.11	4.05	3.98	3.77	3.89	2.72	2.44	2.16	2.12	1.82	2.17	2.11	2.69	2.52	2.10	2.63	2.39	4.53	2.75	4.68	7.59	7.55	3.64
75%	6.55	6.42	5.21	4.69	4.17	5.10	5.13	3.20	2.69	2.22	2.18	2.04	2.64	2.21	2.73	2.72	2.59	3.08	2.52	4.74	3.44	5.17	8.85	8.74	4.13
80%	7.09	7.45	5.74	6.38	4.29	6.56	6.62	3.68	2.93	2.29	2.25	2.27	2.76	2.39	2.74	2.94	3.08	3.33	2.65	4.83	3.94	5.32	9.09	9.10	4.57
85%	7.58	7.80	6.94	7.46	4.64	7.26	7.26	4.21	3.28	2.36	2.32	2.49	2.87	2.86	3.14	3.21	3.15	3.34	2.79	4.93	4.43	5.47	9.79	9.31	4.95
90%	8.96	8.55	7.59	11.34	4.99	7.36	7.41	4.84	3.81	2.64	2.39	2.70	2.96	3.50	3.76	3.27	3.22	3.36	3.26	7.07	6.07	5.62	11.41	10.88	5.71
95%	11.63	9.50	12.71	16.92	5.49	8.06	8.68	5.47	4.35	2.95	2.45	2.92	3.03	6.33	6.22	3.41	5.47	3.40	3.79	9.56	8.84	6.58	26.71	13.49	7.83
100%	12.76	9.85	12.92	18.68	6.70	9.69	10.21	6.10	4.89	3.26	2.52	3.14	3.09	9.64	9.09	3.70	7.71	3.45	4.31	12.04	11.60	7.72	48.86	14.96	9.87

Table F.11: The Wind Direction Screened PM_{2.5} Percentile by Hour of the Day and by Month Tables (May and June for entire 2014-2021 Period) with 25th percentile and 50th percentile Values Highlighted in “Red”

By Hour of the Day and WD Screened %ile PM2.5 Concentrations (ug/m3) in Fort McKay for the Month of May the Period 2014-2021																									
Percentile	Hr of the day																								Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
5%	0.89	0.31	0.59	1.31	0.48	1.05	0.63	0.23	0.47	0.49	0.88	0.93	0.67	1.38	1.13	0.19	0.43	0.13	0.17	0.41	1.77	1.48	0.95	0.33	0.72
10%	1.66	2.01	1.91	1.81	1.00	1.70	0.65	0.37	0.50	0.64	1.13	1.07	0.91	1.52	1.18	0.38	0.76	0.25	0.28	0.44	1.98	1.67	1.27	0.59	1.07
15%	2.04	2.74	2.28	1.86	1.86	2.08	0.75	0.51	0.54	0.74	1.39	1.21	1.04	1.66	1.29	0.55	1.09	0.46	0.39	0.48	2.20	1.72	1.77	1.12	1.32
20%	2.55	2.82	2.99	1.92	2.04	2.25	1.01	0.66	0.57	0.77	1.64	1.35	1.06	1.81	1.43	0.72	1.42	0.74	0.50	0.51	2.41	1.81	2.15	1.49	1.53
25%	2.81	3.02	3.14	2.14	2.25	2.45	1.54	0.81	0.58	0.81	1.90	1.39	1.08	1.93	1.56	0.82	1.66	1.02	0.62	0.54	2.71	2.13	2.65	1.86	1.73
30%	3.10	3.38	3.44	2.60	2.46	2.76	2.03	0.89	0.58	0.90	1.91	1.44	1.31	2.05	1.68	0.91	1.90	1.09	0.84	0.73	3.00	2.65	3.35	2.01	1.96
35%	3.74	3.77	4.00	3.20	2.97	2.80	2.48	0.97	0.59	1.00	1.92	1.48	1.54	2.17	1.82	0.94	2.14	1.16	1.06	0.91	3.30	3.45	3.87	2.20	2.23
40%	4.25	4.38	4.20	3.67	3.56	3.25	2.61	1.21	0.60	1.11	1.93	1.53	1.66	2.29	2.02	0.96	2.39	1.22	1.28	1.10	3.59	3.95	4.79	2.37	2.50
45%	5.31	4.59	4.63	4.35	3.95	3.52	2.62	1.59	0.68	1.25	1.94	1.73	1.66	2.32	2.21	1.12	2.53	1.27	1.50	1.28	3.62	4.22	6.70	2.58	2.80
50%	5.64	4.67	4.73	4.49	4.93	4.39	2.98	1.98	0.77	1.40	1.95	1.93	1.66	2.35	2.44	1.28	2.68	1.31	1.72	1.46	3.66	4.28	7.41	2.89	3.04
55%	5.73	4.91	4.77	4.57	5.05	5.25	3.34	2.15	0.86	1.64	1.97	2.12	1.89	2.37	2.66	1.80	2.83	2.28	2.20	1.73	3.69	5.56	7.68	3.57	3.36
60%	5.98	5.40	5.13	5.07	5.37	5.54	3.47	2.32	0.94	1.88	1.98	2.32	2.13	2.40	2.77	2.32	2.98	3.26	2.68	2.00	3.72	6.43	7.72	3.92	3.66
65%	6.39	5.97	5.96	5.66	5.59	6.07	3.84	2.51	1.18	2.15	2.00	3.17	2.73	2.95	2.86	2.64	3.05	4.37	3.17	2.26	4.41	7.23	8.65	4.75	4.15
70%	6.77	6.08	6.32	6.42	5.86	6.18	4.87	2.73	1.42	2.45	2.01	4.01	3.71	3.50	3.06	2.95	3.12	5.62	3.65	2.53	5.11	9.37	9.93	5.26	4.70
75%	7.10	6.71	6.73	6.97	6.42	6.59	6.23	2.94	1.66	2.76	2.03	4.86	4.69	4.05	3.30	3.56	3.19	6.87	4.13	2.79	5.80	9.98	10.92	6.01	5.26
80%	7.60	8.80	7.83	8.27	8.80	8.01	7.98	3.08	1.90	2.95	2.26	5.71	4.75	4.60	3.48	4.17	3.26	7.76	4.19	2.99	6.49	12.37	12.76	6.20	6.09
85%	10.22	11.44	8.51	9.06	10.97	10.72	12.75	3.22	22.67	3.14	2.49	5.84	4.82	4.85	3.57	5.20	3.91	8.65	4.25	3.19	6.86	20.74	15.34	8.63	8.38
90%	18.22	17.76	8.83	10.74	17.00	13.29	19.24	4.15	43.44	3.77	2.72	5.98	4.88	5.09	3.79	6.23	4.56	9.68	4.31	3.38	7.22	24.89	20.39	10.14	11.24
95%	33.57	45.71	12.20	17.66	41.48	45.81	52.98	5.88	64.22	4.82	2.95	6.11	4.94	5.34	4.44	7.35	5.22	10.84	4.37	3.58	7.58	43.59	24.00	18.37	19.71
100%	190.95	142.76	29.36	20.49	110.28	225.99	92.77	7.62	84.99	5.87	3.18	6.25	5.01	5.59	5.09	8.46	5.87	12.00	4.44	3.77	7.95	82.61	26.39	138.02	51.07
By Hour of the Day and WD Screened %ile PM2.5 Concentrations (ug/m3) in Fort McKay for the Month of June for the Period 2014-2021																									
Percentile	Hr of the day																								Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
5%	2.02	1.68	1.07	1.11	1.09	0.37	0.57	0.31	1.11	0.07	0.27	1.19	0.00	0.31	0.14	0.44	0.71	0.73	1.13	1.29	1.86	1.32	2.35	1.74	0.95
10%	2.50	2.25	1.37	1.17	1.28	0.71	0.62	0.44	1.29	0.07	0.41	1.63	0.00	0.61	0.28	0.66	1.10	0.90	1.50	1.65	1.97	1.80	2.69	2.36	1.22
15%	2.77	2.39	1.99	2.50	2.28	1.78	1.89	0.65	1.46	0.58	0.58	1.93	0.93	0.92	0.43	0.72	1.10	0.98	1.53	1.74	2.07	2.11	3.46	2.83	1.65
20%	2.93	2.97	2.84	3.17	3.05	2.27	2.56	0.75	1.55	1.59	0.92	2.10	1.86	1.16	0.59	0.83	1.39	1.00	1.56	1.77	2.25	2.59	3.87	3.67	2.05
25%	3.48	3.16	3.35	4.00	3.26	2.38	2.74	1.07	1.65	2.61	1.25	2.26	2.19	1.36	0.75	1.00	2.19	1.56	1.60	1.81	2.58	3.74	4.24	3.91	2.42
30%	4.06	3.76	4.21	4.35	3.63	2.83	3.25	1.45	1.83	2.76	1.64	2.50	2.52	1.57	0.80	1.17	2.93	1.85	1.67	1.86	2.81	4.09	4.41	4.46	2.77
35%	5.46	4.01	4.33	4.40	4.42	3.24	3.92	1.71	2.24	2.91	2.16	2.73	3.02	1.77	0.84	1.26	3.64	1.96	1.78	2.18	2.95	5.30	4.80	4.68	3.15
40%	6.22	5.60	4.81	4.80	5.30	4.03	4.02	2.28	2.65	3.20	2.68	3.02	3.52	1.97	0.93	1.66	4.02	1.99	2.07	2.47	3.18	5.80	5.11	5.59	3.62
45%	7.31	6.35	6.72	5.15	5.82	4.49	4.04	3.27	3.82	3.64	3.18	3.37	3.71	2.17	1.08	2.29	4.28	2.57	2.77	2.59	3.43	6.30	6.18	6.14	4.19
50%	8.06	7.29	6.84	5.59	7.27	4.92	4.09	4.73	5.99	4.08	3.64	3.71	3.89	2.37	1.22	3.13	4.42	2.87	2.95	2.81	3.47	6.64	7.31	7.25	4.77
55%	9.00	8.52	8.70	5.76	8.11	7.42	4.32	5.74	8.16	4.11	4.10	3.95	4.14	2.90	1.27	4.42	4.57	3.08	3.06	3.06	3.51	7.53	8.35	8.24	5.50
60%	9.35	9.39	9.96	7.52	9.08	8.52	4.95	6.40	9.71	4.14	4.96	4.20	4.40	3.44	1.33	5.08	5.00	3.35	3.45	3.28	3.80	8.54	9.76	8.42	6.17
65%	11.52	9.72	10.82	8.94	9.86	9.51	5.26	6.95	10.80	4.28	6.12	5.28	4.63	3.97	1.46	5.29	5.32	3.61	3.83	4.99	4.09	9.25	10.22	10.14	6.91
70%	12.02	10.78	12.73	10.22	10.22	10.23	6.39	8.31	11.89	4.53	7.27	7.20	4.87	5.06	1.67	5.55	5.38	3.85	4.26	7.00	4.44	10.69	10.76	10.36	7.74
75%	13.04	11.73	13.48	11.33	11.19	10.47	8.16	8.81	13.52	4.78	7.77	9.12	5.01	6.42	1.88	6.98	5.77	4.01	4.93	7.00	5.25	11.97	11.09	11.09	8.53
80%	14.19	12.56	13.68	13.13	13.17	12.24	10.35	9.07	15.36	6.55	8.00	9.96	5.16	7.78	2.07	9.29	6.56	4.02	5.81	12.38	6.61	13.66	11.67	15.13	9.93
85%	16.41	14.07	14.84	14.52	13.30	15.26	13.27	9.60	17.21	8.32	8.24	10.81	5.22	8.94	2.26	12.61	9.56	4.31	6.78	20.57	8.16	14.44	13.44	16.16	11.60
90%	17.96	15.23	16.10	16.44	16.34	21.24	16.78	9.93	19.63	10.13	10.44	11.25	5.29	9.67	2.68	17.75	13.82	5.78	7.24	22.25	9.81	15.59	23.49	18.14	13.87
95%	29.77	17.15	17.31	18.92	18.81	28.53	19.94	11.14	22.14	11.99	12.97	11.30	11.88	10.41	3.33	20.94	15.11	9.74	52.28	24.14	10.38	20.79	29.36	26.85	18.97
100%	43.91	27.20	34.65	44.80	23.99	147.60	23.95	13.57	24.66	13.85	15.51	11.35	18.48	11.15	3.97	21.11	15.74	17.49	135.54	26.20	10.72	27.12	33.10	50.64	33.18

Table F.12: The Wind Direction Screened PM_{2.5} Percentile by Hour of the Day and by Month Tables (July and August for entire 2014-2021 Period) with 25th percentile and 50th percentile Values Highlighted in “Red”

By Hour of the Day and WD Screened %ile PM2.5 Concentrations (ug/m3) in Fort McKay for the Month of July for the Period 2014-2021																								
Percentile	Hr of the day																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Average																								
5%	1.47	0.99	0.67	0.83	1.58	0.92	0.79	0.88	0.86	0.28	0.54	0.83	0.39	1.25	0.58	0.78	0.95	0.89	0.99	0.89	1.03	0.86	1.37	1.52
10%	2.66	1.90	0.95	2.17	2.35	1.49	0.79	1.10	0.98	0.56	0.57	1.27	0.67	1.69	0.67	0.93	1.24	1.06	1.15	0.95	1.13	1.23	2.11	1.79
15%	2.74	2.90	2.09	2.42	2.75	2.16	1.06	1.47	1.08	0.58	0.64	1.72	0.97	2.26	0.80	1.14	1.30	1.08	1.18	1.02	1.28	1.62	2.65	2.20
20%	3.45	3.16	2.71	3.12	3.27	2.77	1.50	2.61	1.30	0.59	0.75	1.92	1.27	2.66	0.81	1.21	1.55	1.12	1.23	1.12	1.39	2.39	4.07	3.11
25%	3.85	3.23	3.15	3.17	3.84	3.07	1.89	3.52	1.35	0.77	0.86	2.12	1.35	2.97	1.43	1.44	2.30	1.25	1.28	1.24	1.68	3.62	4.42	3.88
30%	4.09	4.10	3.77	3.32	4.71	3.30	2.08	4.55	2.21	0.94	0.89	2.32	1.70	3.18	2.09	1.67	3.36	1.38	1.34	1.37	2.85	4.25	5.57	4.28
35%	4.71	4.66	4.56	3.71	4.98	3.46	2.37	4.71	3.10	0.96	0.91	2.39	2.13	3.35	2.28	1.76	4.20	1.41	2.08	1.58	3.67	4.95	6.18	4.61
40%	5.24	5.42	4.96	4.34	5.69	4.18	2.78	4.88	3.25	0.98	1.12	2.47	2.55	3.43	2.40	1.79	4.48	1.50	3.07	3.48	4.17	5.56	6.41	4.92
45%	6.74	5.97	5.22	5.25	6.14	4.48	4.14	5.40	3.34	1.08	1.50	2.62	2.86	3.56	2.75	1.89	4.64	2.30	4.37	4.32	4.30	6.10	7.58	5.89
50%	6.94	6.35	6.11	5.37	6.36	5.23	5.05	6.02	3.40	1.18	1.89	3.09	2.92	3.72	3.41	2.09	5.57	4.02	4.67	4.56	4.82	6.96	7.95	6.17
55%	7.79	6.91	6.17	5.63	6.73	5.53	5.55	6.37	3.79	1.67	3.50	3.58	3.18	4.62	4.29	4.33	6.86	4.40	4.75	4.82	5.62	7.54	8.69	6.79
60%	8.47	7.95	6.73	6.32	7.24	6.19	6.33	6.80	4.84	2.16	5.11	3.81	3.58	5.35	5.27	5.87	7.15	5.12	5.07	5.40	5.87	9.37	9.45	7.59
65%	9.63	8.61	7.43	6.78	7.46	6.58	7.50	7.66	4.87	3.48	6.13	3.91	4.14	5.77	6.21	7.00	7.73	6.05	5.40	6.21	6.74	12.11	11.58	8.64
70%	10.09	9.02	8.15	7.00	8.48	7.08	7.71	8.59	5.57	4.79	6.55	4.08	4.78	6.19	6.55	8.94	8.64	6.65	5.98	6.24	8.34	12.91	13.03	9.92
75%	10.90	9.19	9.75	7.24	12.12	8.10	8.18	10.75	6.63	5.07	6.97	4.98	5.37	6.61	6.89	9.94	9.18	7.26	7.94	6.30	8.82	14.65	14.17	13.69
80%	14.45	10.18	12.63	7.71	15.60	9.65	10.77	13.03	7.74	5.35	7.64	5.50	6.64	6.79	7.52	10.97	11.41	7.75	9.32	6.77	10.02	18.09	18.53	16.81
85%	19.01	10.75	14.54	8.11	18.82	10.84	12.67	17.34	8.34	5.98	8.30	5.78	7.89	7.00	8.89	13.04	17.71	7.96	10.35	8.64	12.89	19.89	21.58	21.66
90%	21.51	12.20	26.43	10.73	23.53	15.48	15.01	19.09	10.42	6.62	8.78	6.02	9.36	7.26	10.39	17.22	25.11	15.42	11.49	16.00	20.51	27.28	26.88	24.07
95%	25.67	15.00	31.35	12.52	29.98	24.07	21.54	29.91	13.14	7.83	9.09	6.23	40.10	11.27	11.27	52.54	26.25	24.32	20.07	28.77	23.65	31.43	30.09	23.29
100%	29.75	27.48	42.62	29.82	34.74	54.92	32.07	39.48	15.68	9.03	9.39	6.44	158.00	17.16	11.31	128.92	29.62	33.50	35.02	29.07	46.09	46.38	52.56	51.91
By Hour of the Day and WD Screened %ile PM2.5 Concentrations (ug/m3) in Fort McKay for the Month of August for the Period 2014-2021																								
Percentile	Hr of the day																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Average																								
5%	2.42	2.44	2.30	2.52	2.24	2.24	2.06	1.89	1.00	0.72	0.77	0.66	1.14	0.95	0.89	0.97	1.29	1.27	1.28	1.78	2.00	2.46	2.27	2.23
10%	2.52	2.83	2.48	2.55	2.63	2.55	2.41	2.09	1.59	0.91	0.98	0.74	1.26	1.09	1.04	1.02	1.48	1.43	1.42	2.14	2.24	2.65	2.67	2.53
15%	3.30	3.21	2.63	3.78	2.98	3.33	2.72	2.21	2.04	1.01	1.07	0.97	1.34	1.16	1.33	1.14	1.61	1.62	1.45	2.64	2.40	2.89	2.91	2.89
20%	3.61	3.77	2.96	4.00	3.22	3.56	3.13	2.30	2.13	1.37	1.11	1.24	1.40	1.35	1.36	1.26	1.90	1.92	1.55	3.11	2.84	2.95	3.03	3.02
25%	4.18	4.34	3.71	4.13	3.50	3.62	3.41	2.51	2.31	1.86	1.42	1.36	1.50	1.71	1.64	1.34	2.30	2.05	1.73	3.26	2.92	3.06	3.50	3.36
30%	4.44	4.42	4.23	4.24	3.66	3.98	3.52	2.71	2.67	2.18	1.93	1.37	1.64	2.09	2.32	1.42	2.53	2.46	1.97	3.29	3.15	3.17	4.13	3.63
35%	4.60	4.56	4.42	4.32	3.93	4.27	3.67	3.07	2.73	2.49	2.29	1.60	1.75	2.31	2.60	1.53	2.74	2.52	2.30	3.39	3.60	3.33	4.43	4.17
40%	5.18	4.74	4.74	4.52	4.12	4.39	3.77	3.30	2.88	2.82	2.35	2.25	1.80	2.77	2.90	1.64	2.96	2.54	2.45	3.67	3.83	3.96	4.62	4.62
45%	5.35	5.07	5.41	5.35	4.67	4.97	4.02	3.34	3.35	2.93	2.41	2.90	1.87	3.10	3.37	1.72	3.05	2.65	2.73	3.72	4.43	4.33	5.14	4.84
50%	6.07	5.18	5.65	5.61	4.90	5.26	4.16	3.35	3.47	2.94	2.42	3.48	2.05	3.19	3.60	1.80	3.17	2.87	3.24	4.03	4.52	4.35	5.51	5.41
55%	6.53	5.41	5.84	6.07	5.57	5.44	4.51	3.53	3.54	3.35	2.43	4.06	2.23	5.52	3.95	1.93	3.31	2.90	3.58	4.41	4.62	5.30	5.75	6.08
60%	6.72	5.82	5.96	6.41	6.20	5.95	5.23	3.69	3.73	3.84	2.91	4.38	2.26	6.55	4.96	2.07	3.40	3.55	3.89	4.55	5.10	5.46	5.82	6.20
65%	7.79	6.35	6.28	7.25	6.73	6.48	5.66	3.95	3.89	4.49	3.45	4.67	2.27	6.66	5.32	2.13	3.51	3.56	4.39	4.64	6.02	5.66	6.59	6.65
70%	10.17	6.69	7.21	7.67	7.83	7.16	6.23	4.37	4.02	4.84	3.82	4.76	2.41	7.05	5.48	2.19	4.03	3.64	4.64	4.84	6.68	6.14	7.22	6.84
75%	10.89	7.17	8.01	8.61	10.28	8.76	7.77	4.99	4.04	5.03	4.11	4.76	2.63	7.49	6.17	2.96	4.30	3.90	4.80	5.50	7.71	6.56	7.49	7.34
80%	12.06	8.35	9.07	11.41	11.90	10.48	8.79	5.96	5.69	6.05	4.48	5.46	3.51	8.81	6.52	3.74	7.17	3.92	5.61	6.72	8.71	7.90	10.61	8.05
85%	13.61	10.01	12.31	16.88	15.77	11.16	14.17	6.93	8.61	18.56	4.93	7.03	5.22	12.27	6.68	4.32	10.15	4.53	8.31	7.35	9.41	8.53	13.10	9.51
90%	20.51	11.84	14.47	23.53	22.88	14.69	26.94	11.80	14.69	54.06	18.71	8.26	6.60	18.23	7.20	4.91	19.39	4.96	9.60	14.96	10.09	10.83	32.47	12.00
95%	61.88	17.15	24.68	70.65	26.51	20.53	80.12	24.07	34.85	71.76	79.14	8.27	6.82	28.42	12.10	6.11	38.91	14.61	11.81	27.33	11.54	16.90	81.73	20.96
100%	166.84	103.55	114.01	153.25	157.45	25.74	119.20	46.85	67.08	80.55	139.57	8.29	7.03	43.71	20.76	7.31	45.32	36.64	17.33	77.63	15.74	131.02	235.39	235.79

Table F.13: The Wind Direction Screened PM_{2.5} Percentile by Hour of the Day and by Month Tables (September and October for entire 2014-2021 Period) with 25th percentile and 50th percentile Values Highlighted in “Red”

By Hour of the Day and WD Screened %ile PM2.5 Concentrations (ug/m3) in Fort McKay for the Month of September for the Period 2014-2021																									
Percentile	Hr of the day																								Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
5%	0.92	0.81	0.81	0.90	1.11	0.97	1.18	0.94	0.84	0.84	1.02	1.11	1.07	1.10	1.06	0.98	1.08	0.70	0.64	0.87	1.05	0.98	0.93	1.25	0.97
10%	0.98	1.02	0.91	1.13	1.42	1.10	1.61	1.11	1.16	1.01	1.07	1.28	1.20	1.16	1.13	1.07	1.13	0.89	0.81	0.95	1.24	1.30	1.03	1.39	1.13
15%	1.21	1.54	1.14	1.49	1.67	1.31	2.55	1.37	1.19	1.04	1.23	1.45	1.31	1.18	1.16	1.19	1.16	1.05	0.99	1.04	1.36	1.52	1.17	1.57	1.33
20%	1.50	1.95	1.40	1.59	1.83	1.67	2.68	1.51	1.28	1.13	1.41	1.64	1.49	1.21	1.23	1.25	1.20	1.12	1.12	1.59	1.78	2.13	1.56	2.36	1.57
25%	1.80	2.03	1.54	1.75	2.27	2.14	2.70	1.68	1.37	1.24	1.52	1.67	1.58	1.37	1.28	1.28	1.22	1.13	1.42	2.15	2.16	2.39	1.85	2.80	1.76
30%	2.83	2.22	1.56	1.84	2.54	2.56	2.93	1.76	1.47	1.27	1.58	1.69	1.65	1.54	1.29	1.34	1.23	1.14	1.98	2.59	2.29	2.43	2.10	2.89	1.95
35%	3.35	2.61	2.05	2.32	2.90	2.66	3.08	1.93	1.62	1.39	1.64	1.71	1.75	1.56	1.42	1.38	1.25	1.23	2.52	3.22	2.67	2.59	2.73	3.27	2.20
40%	3.56	2.83	2.71	2.68	3.31	2.79	3.21	2.07	1.68	1.78	1.78	1.77	1.80	1.57	1.53	1.40	1.26	1.47	2.93	3.72	2.92	3.05	3.12	3.70	2.44
45%	3.77	3.15	3.32	2.94	3.42	2.82	3.48	2.25	1.71	2.01	1.98	1.91	1.84	1.61	1.58	1.47	1.38	1.61	3.04	4.06	3.07	3.23	3.46	3.87	2.62
50%	3.99	3.47	3.43	3.43	3.58	2.98	3.53	2.32	1.81	2.21	1.99	2.01	1.87	1.65	1.63	1.56	1.49	1.70	3.09	4.27	3.19	3.42	3.58	4.18	2.77
55%	4.20	3.74	3.65	3.54	3.77	3.29	3.74	2.47	1.91	2.47	2.33	2.14	1.96	1.95	1.74	1.60	1.56	1.77	3.18	4.34	3.33	3.70	4.06	5.00	2.98
60%	4.45	4.40	3.88	3.60	4.15	3.46	3.90	3.09	2.09	2.69	2.39	2.38	2.00	2.25	2.03	1.63	1.64	1.83	3.47	4.44	3.73	4.38	4.21	5.45	3.23
65%	4.81	4.61	4.37	3.90	4.50	3.60	4.36	3.31	2.39	3.02	2.42	3.13	2.01	2.33	2.19	1.64	1.75	1.89	3.62	4.60	4.31	4.78	4.51	5.83	3.49
70%	4.90	5.03	4.65	4.55	4.81	4.18	4.44	3.38	2.68	3.36	2.76	3.40	2.13	2.41	2.29	1.72	1.86	2.56	3.78	4.77	4.73	5.44	5.03	6.04	3.79
75%	5.25	5.90	4.73	5.06	5.05	4.53	4.97	3.64	2.92	3.62	3.16	3.46	2.41	2.51	2.33	1.82	2.21	3.54	4.26	5.05	4.93	5.64	5.67	6.07	4.11
80%	7.73	6.94	4.95	5.31	6.07	4.79	5.10	4.65	3.87	4.00	3.64	3.53	2.68	2.61	2.39	2.27	2.56	4.21	4.61	5.29	5.19	6.33	6.18	6.26	4.63
85%	9.84	8.16	5.69	5.35	6.48	4.88	5.87	4.83	4.65	4.86	4.23	3.60	2.74	2.79	2.46	2.74	2.67	4.94	5.10	6.00	5.31	7.42	7.08	7.34	5.21
90%	10.87	9.43	7.10	7.75	6.71	5.17	6.19	5.03	5.28	5.12	5.12	3.95	3.29	2.97	2.47	3.23	2.78	5.80	8.18	6.33	5.84	9.51	7.95	9.51	6.07
95%	13.96	11.91	8.79	8.94	8.13	5.87	7.27	5.38	6.70	6.96	8.85	4.52	4.74	5.02	2.77	4.10	3.34	16.37	20.14	6.70	7.81	13.82	11.72	11.05	8.54
100%	32.02	17.19	13.23	10.59	12.04	6.71	7.40	5.75	24.77	27.02	24.31	5.30	7.25	7.07	3.33	5.16	3.90	31.80	39.73	7.20	9.21	48.04	20.09	16.23	16.06
By Hour of the Day and WD Screened %ile PM2.5 Concentrations (ug/m3) in Fort McKay for the Month of October for the Period 2014-2021																									
Percentile	Hr of the day																								Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
5%	0.53	0.30	0.49	0.55	0.44	0.51	0.43	0.41	0.84	0.66	0.39	0.29	0.35	0.36	0.32	0.35	0.27	0.37	0.41	0.34	0.42	0.28	0.59	0.40	0.43
10%	0.72	0.42	0.64	0.62	0.71	0.62	0.45	0.79	1.05	0.83	0.57	0.45	0.46	0.42	0.48	0.64	0.43	0.51	0.43	0.38	0.52	0.43	0.88	0.66	0.59
15%	0.92	0.52	0.69	0.79	0.81	0.71	0.67	0.94	1.17	0.91	0.71	0.55	0.48	0.53	0.70	0.67	0.49	0.56	0.51	0.55	0.67	0.75	1.14	0.81	0.72
20%	1.08	0.65	1.00	0.91	0.90	0.81	1.01	1.14	1.26	1.14	0.87	0.60	0.63	0.63	0.88	0.71	0.57	0.66	0.52	0.58	0.78	1.04	1.17	1.26	0.87
25%	1.44	0.86	1.10	1.11	1.00	1.11	1.16	1.35	1.26	1.15	0.94	0.63	0.75	0.76	0.92	0.76	0.65	0.88	0.53	0.63	0.81	1.17	1.23	1.59	0.99
30%	1.55	0.98	1.58	1.29	1.06	1.12	1.27	1.60	1.37	1.18	0.99	0.77	0.81	0.86	0.93	0.82	0.69	1.32	0.63	0.67	0.85	1.27	1.43	1.85	1.12
35%	2.17	1.06	2.16	1.40	1.17	1.49	1.44	1.87	1.42	1.18	1.07	0.90	0.87	0.91	1.03	0.82	0.73	1.54	0.68	0.75	0.94	1.67	1.51	2.01	1.28
40%	2.67	1.66	2.35	1.79	1.34	1.75	1.77	2.02	1.47	1.84	1.09	1.02	0.94	1.04	1.17	0.82	0.75	1.67	0.77	0.92	1.03	2.11	1.73	2.54	1.51
45%	2.89	1.93	2.50	2.01	1.42	1.83	1.99	2.44	1.52	2.25	1.44	1.27	1.03	1.32	1.30	0.91	0.78	1.68	0.98	1.14	1.56	2.43	1.85	2.76	1.72
50%	3.01	2.28	2.96	2.15	1.63	2.08	2.12	2.61	1.53	2.25	2.24	1.58	1.16	1.81	1.40	0.99	0.81	2.78	0.98	1.19	2.31	2.76	2.59	2.89	2.00
55%	3.32	2.55	3.19	2.32	1.71	2.28	2.48	2.73	1.64	2.34	2.24	1.73	1.27	1.90	1.46	1.52	1.05	3.96	1.28	1.66	2.83	3.10	2.77	3.36	2.28
60%	3.54	2.96	3.69	2.37	2.21	3.10	3.18	2.93	2.47	2.40	2.41	1.99	1.31	1.95	1.48	2.05	1.39	4.24	1.70	2.46	4.34	3.49	2.86	3.65	2.67
65%	3.85	3.47	3.84	2.47	2.54	3.83	3.61	3.47	3.08	2.44	2.65	2.50	1.36	1.97	1.63	3.26	1.90	4.73	3.95	3.33	4.51	3.95	2.99	4.13	3.14
70%	4.28	4.01	4.61	3.20	3.32	4.41	3.88	3.80	3.26	2.48	2.70	2.88	1.46	2.00	2.07	4.47	2.50	5.35	4.74	3.66	5.19	3.99	3.26	5.48	3.62
75%	5.22	4.14	5.49	3.57	4.06	5.31	4.12	3.94	3.48	3.89	2.94	3.19	1.81	2.13	2.90	4.49	3.15	6.12	6.32	3.77	7.56	4.23	5.38	6.68	4.33
80%	5.59	4.35	6.34	4.11	4.69	5.47	4.53	4.15	3.60	3.91	3.22	3.40	2.75	2.34	3.05	4.52	3.34	7.27	9.65	4.52	8.21	5.08	6.21	7.45	4.91
85%	6.07	4.95	6.82	5.45	5.03	5.76	4.86	4.73	4.37	3.95	3.41	3.70	3.97	2.67	3.38	5.99	3.56	9.01	10.93	5.86	9.14	5.67	8.99	8.24	5.69
90%	6.28	5.22	7.45	6.94	6.64	6.20	5.16	6.04	4.86	4.50	4.94	4.19	4.06	2.86	3.74	7.46	3.85	14.91	15.34	10.39	10.96	5.86	9.77	8.97	6.94
95%	6.61	5.98	8.92	7.78	11.30	7.17	6.47	8.92	7.71	5.89	8.97	4.76	4.31	4.21	5.21	8.71	6.37	18.18	21.28	11.18	11.60	6.58	11.27	9.69	8.71
100%	7.09	9.24	11.26	8.63	18.76	9.36	8.43	18.47	19.08	9.24	16.03	5.36	4.70	7.12	10.07	9.95	9.99	19.19	39.84	11.73	11.93	9.55	14.91	13.41	12.64

Table F.14: The Wind Direction Screened PM_{2.5} Percentile by Hour of the Day and by Month Tables (November and December for entire 2014-2021 Period) with 25th percentile and 50th percentile Values Highlighted in “Red”

By Hour of the Day and WD Screened %ile PM2.5 Concentrations (ug/m3) in Fort McKay for the Month of November for the Period 2014-2021																									
Percentile	Hr of the day																								Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
5%	1.29	0.91	0.84	1.62	1.33	1.47	0.71	0.70	0.64	0.54	0.90	1.15	1.08	1.19	0.77	0.63	0.97	1.23	0.65	1.23	1.22	0.86	1.99	0.97	1.04
10%	1.50	1.95	1.07	1.95	1.34	1.55	0.89	0.74	0.71	0.68	0.97	1.32	1.22	1.26	0.78	0.82	1.06	1.28	0.92	1.42	1.32	1.05	2.65	1.58	1.25
15%	1.72	2.39	1.20	2.47	1.47	1.66	1.14	0.93	0.74	0.95	1.05	1.55	1.34	1.34	0.80	1.00	1.11	1.45	1.44	1.63	1.69	1.16	2.89	2.01	1.46
20%	2.07	2.74	1.94	2.63	1.80	1.92	1.42	1.35	0.89	1.07	1.19	2.08	1.36	1.72	0.85	1.19	1.17	1.69	1.49	1.86	2.17	1.99	3.52	2.25	1.76
25%	2.21	2.84	2.99	2.72	2.16	2.13	1.78	1.81	1.07	1.24	1.33	2.61	1.39	2.26	0.93	1.47	1.89	1.98	1.74	2.59	2.84	2.99	3.96	3.03	2.17
30%	2.26	2.93	3.00	2.74	2.34	2.24	2.36	1.92	1.21	1.49	1.46	3.15	1.45	2.79	1.01	1.76	2.61	2.41	2.36	2.92	3.30	3.57	4.05	3.52	2.45
35%	2.29	3.00	3.02	3.09	2.57	2.38	3.01	2.11	1.29	2.43	1.54	3.70	1.58	3.26	1.09	1.96	2.70	2.76	3.08	3.07	3.58	3.99	4.20	3.76	2.73
40%	2.49	3.08	3.08	3.42	3.11	2.71	3.09	2.34	1.49	3.27	1.62	4.24	1.71	3.60	1.19	2.15	2.79	2.83	3.86	3.28	3.84	4.23	4.50	3.84	2.99
45%	2.66	3.27	3.75	3.59	3.20	3.07	3.33	2.60	2.25	3.63	1.77	4.57	1.98	3.95	1.29	2.23	3.57	3.33	4.72	3.41	4.08	4.36	5.14	3.91	3.32
50%	2.77	3.68	4.74	3.85	3.33	3.30	3.51	3.00	2.49	3.83	2.03	4.61	2.42	4.29	1.38	2.31	4.35	3.97	5.87	3.78	4.50	4.72	5.36	4.19	3.68
55%	3.67	4.31	4.76	4.09	3.48	3.41	3.61	3.31	3.36	4.18	2.28	4.64	2.87	4.74	1.51	2.53	5.47	4.44	7.32	4.17	4.93	5.51	5.54	5.91	4.17
60%	4.65	4.78	4.93	4.12	3.55	3.45	3.80	3.39	3.61	5.14	2.79	5.03	3.15	5.19	1.65	2.74	6.59	4.67	9.51	4.37	5.33	6.20	5.99	6.97	4.65
65%	5.53	4.90	5.37	4.45	3.81	3.45	4.14	3.50	3.69	5.63	3.48	5.67	3.30	5.64	1.78	3.21	6.84	5.00	13.24	4.53	5.93	6.87	6.37	7.54	5.16
70%	5.55	5.15	5.73	4.93	4.01	3.47	4.19	3.81	4.28	6.01	4.17	6.32	3.46	6.41	2.12	3.67	7.10	5.37	17.01	4.68	7.09	7.92	6.72	7.86	5.71
75%	5.99	5.58	6.04	5.58	4.52	3.60	4.59	5.76	4.90	6.87	4.70	6.79	3.57	7.34	2.58	4.59	7.25	6.19	17.34	5.15	9.11	8.18	6.97	8.19	6.31
80%	6.53	6.36	6.35	6.66	6.31	3.91	5.16	6.88	5.92	7.89	5.18	7.19	3.66	8.27	3.03	5.50	7.39	6.46	18.24	6.23	12.17	8.67	7.17	9.57	7.11
85%	6.91	8.27	6.87	7.99	8.85	4.48	6.27	8.86	8.10	9.00	5.65	7.59	3.76	9.60	3.84	5.65	7.97	6.61	19.41	8.09	18.55	9.13	7.34	10.00	8.28
90%	7.60	9.72	7.79	8.96	10.53	6.12	7.28	9.90	10.44	10.24	5.92	8.09	4.17	11.74	5.34	5.79	8.55	7.30	19.64	10.06	26.83	9.50	7.40	11.56	9.60
95%	9.78	10.26	8.26	10.49	12.66	7.72	7.45	11.37	10.52	11.86	6.16	8.60	4.64	13.87	6.84	6.68	9.99	8.70	20.77	17.31	41.66	12.25	9.34	14.09	11.72
100%	13.87	12.49	8.51	12.50	15.35	8.17	8.23	15.41	10.96	13.80	6.39	9.12	5.10	16.01	8.34	7.56	11.43	10.08	22.66	35.05	57.96	14.70	12.88	15.21	14.66
By Hour of the Day and WD Screened %ile PM2.5 Concentrations (ug/m3) in Fort McKay for the Month of December for the Period 2014-2021																									
Percentile	Hr of the day																								Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
5%	0.94	1.74	1.06	0.44	1.19	0.45	0.66	0.83	1.19	0.92	0.97	0.72	0.53	0.33	0.44	0.19	0.16	0.16	0.66	0.88	0.19	0.52	1.87	1.24	0.76
10%	1.20	2.26	1.31	1.37	1.80	1.09	0.79	0.98	1.32	1.26	1.28	1.30	0.88	0.48	0.71	0.32	0.42	0.19	0.80	1.29	0.70	1.70	2.13	1.57	1.13
15%	1.39	2.64	1.59	1.82	2.00	1.22	0.90	1.38	1.64	1.50	1.54	1.40	1.23	0.65	1.13	0.53	0.73	0.24	0.95	1.45	1.41	1.92	2.28	1.79	1.39
20%	1.73	2.74	1.99	1.88	2.10	1.36	1.14	1.95	1.92	2.06	1.75	1.49	1.58	0.81	1.59	0.78	1.01	0.50	1.31	1.69	1.68	1.94	2.98	1.90	1.66
25%	1.95	2.77	2.01	2.18	2.30	1.67	1.44	2.20	2.04	2.30	1.96	1.96	1.93	1.24	1.81	1.01	1.33	0.94	1.81	2.03	2.09	1.95	4.14	1.98	1.96
30%	2.39	2.94	2.38	2.45	2.69	1.86	1.90	2.35	2.16	2.38	2.16	2.42	2.19	1.87	1.84	1.21	1.90	1.44	2.43	2.14	2.26	2.01	5.30	2.22	2.29
35%	2.64	3.14	2.76	2.63	2.83	1.96	2.46	2.49	2.28	2.40	2.35	2.46	2.24	2.55	1.90	1.32	2.30	1.93	3.41	2.22	2.84	2.03	6.01	2.27	2.56
40%	2.76	3.26	2.99	2.87	3.23	2.12	2.90	2.83	2.41	2.58	2.47	2.50	2.29	3.33	2.02	1.75	2.55	2.54	4.97	3.11	3.17	2.10	6.82	2.56	2.92
45%	2.86	3.73	3.45	2.96	3.40	2.66	3.43	3.09	2.82	2.82	2.53	3.22	2.38	4.06	2.13	2.19	2.78	2.93	5.23	4.02	3.51	2.22	7.33	2.64	3.27
50%	3.33	4.44	3.61	3.13	3.61	3.08	3.76	3.28	3.05	3.09	2.58	3.95	2.52	4.39	2.21	2.55	3.18	2.97	5.37	4.85	4.06	2.96	7.41	2.82	3.59
55%	3.45	5.14	3.94	3.44	3.86	3.28	4.03	3.49	3.13	3.16	3.08	4.08	2.66	4.73	2.29	2.91	3.70	3.04	5.71	5.38	4.10	3.66	7.70	3.16	3.88
60%	3.78	5.59	4.01	3.79	4.27	3.40	4.18	3.60	3.27	3.42	3.57	4.21	3.04	5.03	2.63	3.18	4.04	3.63	6.56	5.92	4.34	3.71	7.93	3.60	4.20
65%	3.92	6.39	4.95	5.06	4.61	3.74	4.26	3.83	3.46	3.78	3.82	4.22	3.60	5.32	2.99	3.42	4.39	4.62	6.87	7.56	4.42	3.76	8.23	4.08	4.64
70%	4.34	6.99	5.64	5.77	4.89	4.15	4.49	4.43	3.90	3.96	3.82	4.24	4.16	5.89	3.62	3.85	5.13	5.69	7.38	8.05	4.86	3.89	9.13	4.39	5.11
75%	5.35	7.69	6.22	5.89	5.07	4.28	4.75	5.04	3.98	4.51	3.82	5.35	4.48	6.60	4.38	4.25	6.79	6.41	9.57	9.42	6.31	4.08	9.68	4.45	5.76
80%	6.52	8.81	6.41	6.43	5.40	4.39	5.28	5.59	4.41	5.15	4.73	6.46	4.71	7.26	5.34	5.12	7.82	7.05	14.94	10.21	8.16	4.30	10.17	4.62	6.64
85%	7.44	8.97	6.73	7.02	6.73	4.94	5.93	7.91	5.53	5.60	5.64	7.03	4.93	7.88	6.55	7.21	8.10	7.85	15.65	10.92	10.08	5.43	10.85	5.05	7.50
90%	8.68	10.19	7.98	7.98	7.75	5.17	6.42	10.18	6.78	6.28	6.42	7.60	5.61	8.42	7.52	9.20	8.94	8.87	16.36	12.21	10.78	7.77	14.31	5.81	8.63
95%	10.99	11.72	10.13	8.99	8.09	7.77	8.15	12.08	8.68	6.74	7.06	7.73	6.35	8.72	7.61	11.74	12.90	10.83	24.03	29.86	11.11	10.96	17.43	7.20	11.12
100%	13.46	12.80	10.52	34.01	29.10	9.97	9.42	23.96	16.27	6.86	7.70	7.86	7.10	9.02	7.70	15.01	23.79	14.01	45.60	120.16	12.64	12.97	19.48	10.21	19.98