

OFFICE OF THE GOVERNOR
STATE OF MONTANA

GREG GIANFORTE
GOVERNOR



KRISTEN JURAS
LT. GOVERNOR

February 4, 2025

Mark Smith
Regional Administrator
United States Environmental Protection Agency
Region VIII, 8P-AR
1595 Wynkoop Street
Denver, Colorado 80202-1129

RE: Montana Initial Area Recommendations for the 2024 Revised Annual PM2.5 National Ambient Air Quality Standards

Dear Regional Administrator Smith:

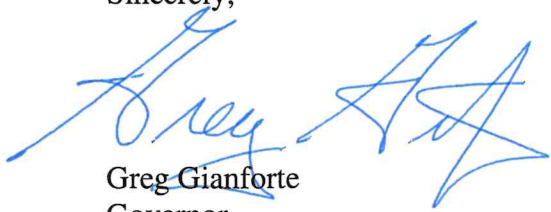
The Environmental Protection Agency (EPA) promulgated revisions to the National Ambient Air Quality Standards (NAAQS) for particulate matter smaller than 2.5 microns (PM2.5) on February 7, 2024 (89 Fed. Reg. 16202). Pursuant to 42 U.S. Code § 7407, Congress requires that Governors submit a list of areas designated as “attainment”, “nonattainment”, or “unclassifiable” in relation to a new or revised NAAQS. This list of designated areas is due no later than one year following the promulgation of a new or revised standard, with the deadline being February 7, 2025.

Montana hereby designates all areas (counties) within the state as “attainment” or “unclassifiable”, with the exception of the Libby Valley in Lincoln County. Enclosed are Montana’s official area designations for the 2024 revised PM2.5 NAAQS. This submittal includes our Technical Support Document, which outlines Montana’s rationale for these designations.

The proposed area designations were noticed for a 30-day public comment period, which ended on January 24, 2025. An opportunity for a public hearing was also provided. No comments were received from the public.

If you have any questions regarding this action, please contact the Department of Environmental Quality’s Air Quality Planning and Analysis Section Supervisor, Jennifer Harris, by telephone at (406)444-9741 or by email at jennifer.harris@mt.gov.

Sincerely,

A handwritten signature in blue ink, appearing to read "Greg Gianforte", followed by a large, stylized flourish or star-like mark.

Greg Gianforte
Governor

Air Quality | Montana Initial Area Recommendations for the 2024 Revised Annual PM2.5 Standards | Public Comment Period Ends January 24, 2025

DECEMBER 26 2024

The Montana Department of Environmental Quality (DEQ) is inviting public comment on the Montana Initial Area Recommendations for the 2024 Revised Annual PM2.5 National Ambient Air Quality Standards - Technical Support Document.

DEQ will accept public comment for 30 days beginning on Thursday, December 26, 2024, through Friday, January 24, 2025. All comments received will be included when the report is submitted for final review and submission to the EPA.

Associated Materials:

- [2024 PM 2.5 Area Designation Recommendation - Technical Support Document](#)

Comment Period Ends:

- January 24, 2025 11:59pm

Send Comments To:

- [Cory Mitchell](#)

OR

- DEQ Air Quality Bureau
PO Box 200901
Helena MT 59620-0901

Tags: Public Comment and Air



From: Montana DEQ <montanadeq@announcements.mt.gov>

Subject: Montana Initial Area Recommendations for the 2024 Revised Annual PM_{2.5} Standard - Technical Support Document



The Montana Department of Environmental Quality (DEQ) is inviting public comment on the Montana Initial Area Recommendations for the 2024 Revised Annual PM_{2.5} National Ambient Air Quality Standards - Technical Support Document.

DEQ will accept public comment for 30 days beginning on Thursday, December 26, 2024, through Friday, January 24, 2025. All comments received will be included when the report is submitted for final review and submission to the EPA.

Interested persons may view the proposed area recommendation technical support document on the DEQ's website at: <http://deq.mt.gov/Public/publiccomment> or may call the DEQ at to have copies made available for their inspection.

Interested parties may submit their comments concerning the proposal described above in writing to the DEQ by:

- addressing them to the Air Quality Bureau, MT DEQ, P.O. Box 200901, Helena, Montana 59620-0901;or
- sending them via e-mail to: cory.mitchell2@mt.gov.



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Montana Initial Area Designations

Technical Support Document

2024 Revised Annual PM_{2.5} National Ambient Air Quality Standards



December 26, 2024



Montana Department of Environmental Quality
Air Quality Bureau
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I. Executive Summary

On February 7, 2024, the United States (U.S.) Environmental Protection Agency (EPA) revised the National Ambient Air Quality Standard (NAAQS) for particulate matter smaller than 2.5 microns (PM_{2.5}), revising the annual primary (health-based) standard from 12.0 micrograms per cubic meter (µg/m³) to 9.0 µg/m³, expressed as the 3-year average of the annual mean concentrations. The primary 24-hour PM_{2.5} NAAQS has been retained, therefore Montana's initial statewide designations address only the revised primary annual PM_{2.5} NAAQS. The revision was published in the Federal Register (Fed. Reg.) at 89 Fed. Reg. 16202 (March 6, 2024).

According to 42 U.S. Code §7407, *et seq.*, Montana must submit to EPA an initial list of geographic areas that attain the standard, do not attain the standard, or are otherwise unclassifiable based on available information. Montana hereby designates all areas (Counties) within the state as "attainment" or "unclassifiable", aside from the Libby Valley that resides within Lincoln County, for the 2024 revised primary annual PM_{2.5} NAAQS. The evaluation provided herein substantiates Montana's area designations.

Designations for Counties

Based on available information, Montana (MT) Department of Environmental Quality (DEQ) determined that an initial designation of "attainment" is appropriate for nine Montana counties with active PM_{2.5} State or Local Air Monitoring Stations (SLAMS) and Special Purpose Monitors (SPMs) for the design value period of 2021 through 2023. Available monitoring data collected at qualifying SLAMS and SPMs supports a conclusion that ambient concentrations of PM_{2.5} in these counties attain the 2024 revised annual PM_{2.5} NAAQS. Counties designated as "attainment" include: Flathead, Lewis and Clark, Missoula, Ravalli, Richland, Silver Bow, Fergus, Powder River, and Yellowstone.

The only area to be designated "nonattainment" is the township of Libby, located in Lincoln County. Libby experiences elevated background concentrations of PM_{2.5} that can be attributed to multiple factors, including residential woodstove smoke, and the unique geography, topography, and meteorology of the area that contributes to strong valley temperature inversions. MT DEQ's five-factor analysis demonstrates the primary impact zone for PM_{2.5} is limited to the tight mountain valley surrounding Libby, and that previous/historical nonattainment area boundaries are still valid.

The remaining forty-six counties in Montana should be designated as "unclassifiable" or "attainment" due to a lack of appropriate and/or adequate monitoring data to determine NAAQS compliance.

II. Introduction

Attainment

Counties designated in attainment are based on monitoring data collected at regulatory air monitors with complete datasets between 2021 through 2023. This data supports findings that ambient concentrations of PM_{2.5} in nine counties (Figure 1 and Table 1) attain the 2024 revised annual PM_{2.5} NAAQS. After regulatorily significant exceptional events are removed, Frenchtown is also in attainment. Data, once finalized and certified, collected during the calendar year 2024 also supports Frenchtown's attainment designation.

Figure 1 - Design Values for Regulatory PM_{2.5} Monitors in Attainment

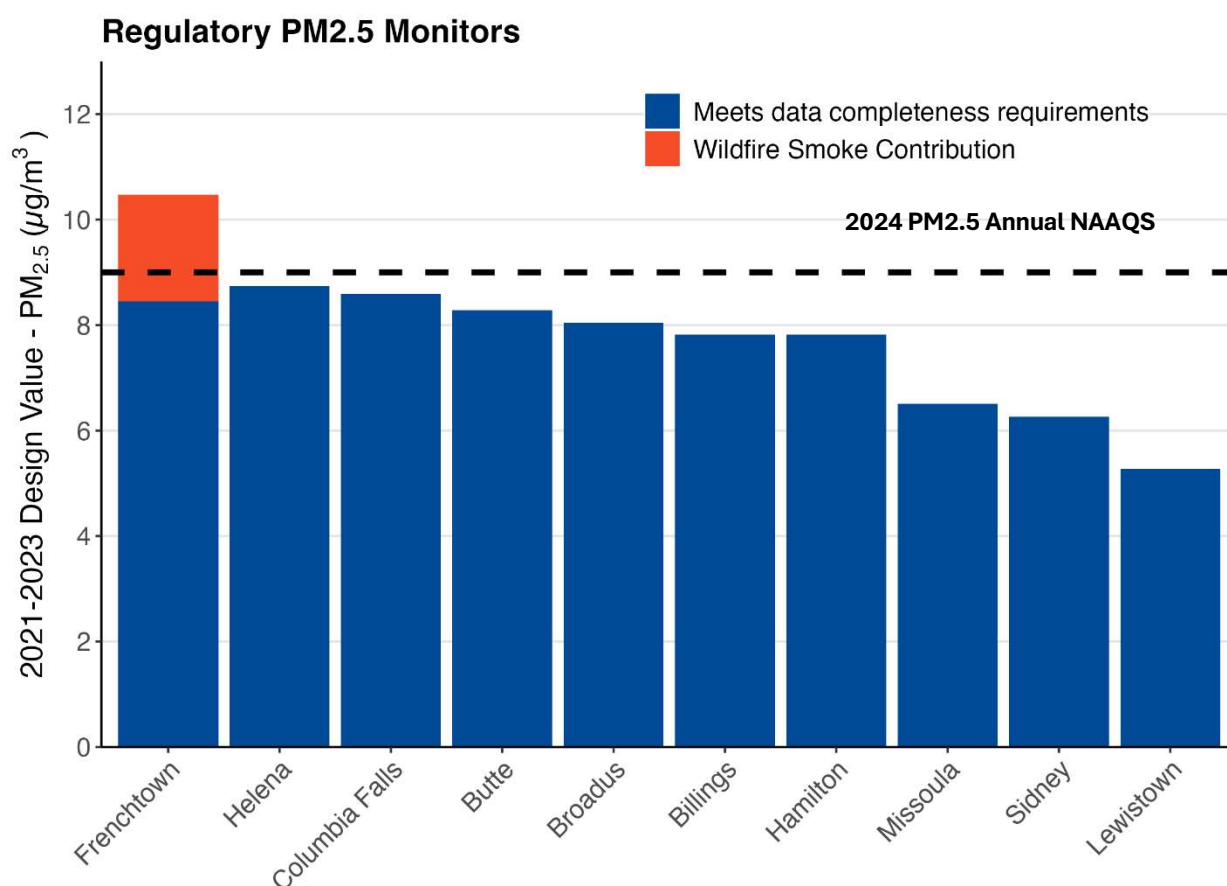


Table 1 -Regulatory Monitors with Data Completeness 2021-2023

County	Location	Site	Design Value
Missoula County	Frenchtown	30-063-0037	10.5 (8.4) ¹
	Missoula	30-063-0024	6.5
Lewis & Clark County	Helena (Rossiter)	30-049-0026	8.7
Flathead County	Columbia Falls (Flathead Valley)	30-029-0049	8.6
Silver Bow County	Butte	30-093-0005	8.3
Powder River Co	Broadus	30-093-0005	8.3
Yellowstone County	Billings	30-111-0066	7.8
Ravalli County	Hamilton	30-081-0007	7.8
Richland County	Sidney	30-083-002	6.2
Fergus County	Lewistown	30-027-0006	5.4

Nonattainment

The only area in the state to qualify for a designation of nonattainment is the town of Libby, within Lincoln County. Historically, Libby has struggled to meet PM NAAQS standards largely because of the intense wintertime temperature inversions the valley experiences, and the pervasive use of woodstoves for residential heating. The town of Libby is considered an environmental justice (EJ) disadvantaged community that meets more than one burden threshold and the associated socioeconomic threshold according to EPA’s Climate and Economic Justice Screening Tool (CEJST).

A five-factor analysis performed by MT DEQ (detailed below), demonstrates the previous/historical PM_{2.5} nonattainment area boundary remains valid, and MT DEQ provides evidence to support its continued use.

Unclassifiable

The remaining forty-six counties either have no monitor, a non-regulatory monitor, or a regulatory monitor with an incomplete data set for the 2021-2023 design value period, which means they do not meet regulatory requirements of 40 Code of Federal Regulations (CFR) part 58 for formal designations of attainment. All regulatory monitors with incomplete data sets in the “unclassifiable section” support values under the new PM_{2.5} NAAQS. MT DEQ recommends these remaining counties be designated “unclassifiable”.

¹ The Frenchtown design value is 8.4 with the exclusion of wildfire regulatorily significant exceptional events that were submitted in a formal demonstration to EPA.

III. Monitoring Data Analysis

MT DEQ currently operates sixteen SLAMS and eight SPMs for PM_{2.5}. Figure 2 shows the location of regulatory PM_{2.5} monitors in the state that were active during the design value period 2021-2023. Non-regulatory monitors (e.g., sensors) and new regulatory monitors added after calendar year 2023, are not represented below. SLAMS are configured for, and operate, following Federal Reference or Federal Equivalent Methods (FRM and FEM, respectively), therefore providing certifiable data suitable for NAAQS compliance comparisons. A portion of the State's SPMs also can be used to support area designations, per 40 CFR 58.20(c) which states, "All data from an SPM using an FRM or FEM which has operated for more than 24 months are eligible for comparison to the relevant NAAQS...". However, some SPMs in the state are not configured for FRM or FEM methods and therefore produce non-regulatory data unsuitable for NAAQS compliance comparisons and designations.

Figure 2 - Regulatory PM_{2.5} Monitors Active During the Design Value Period

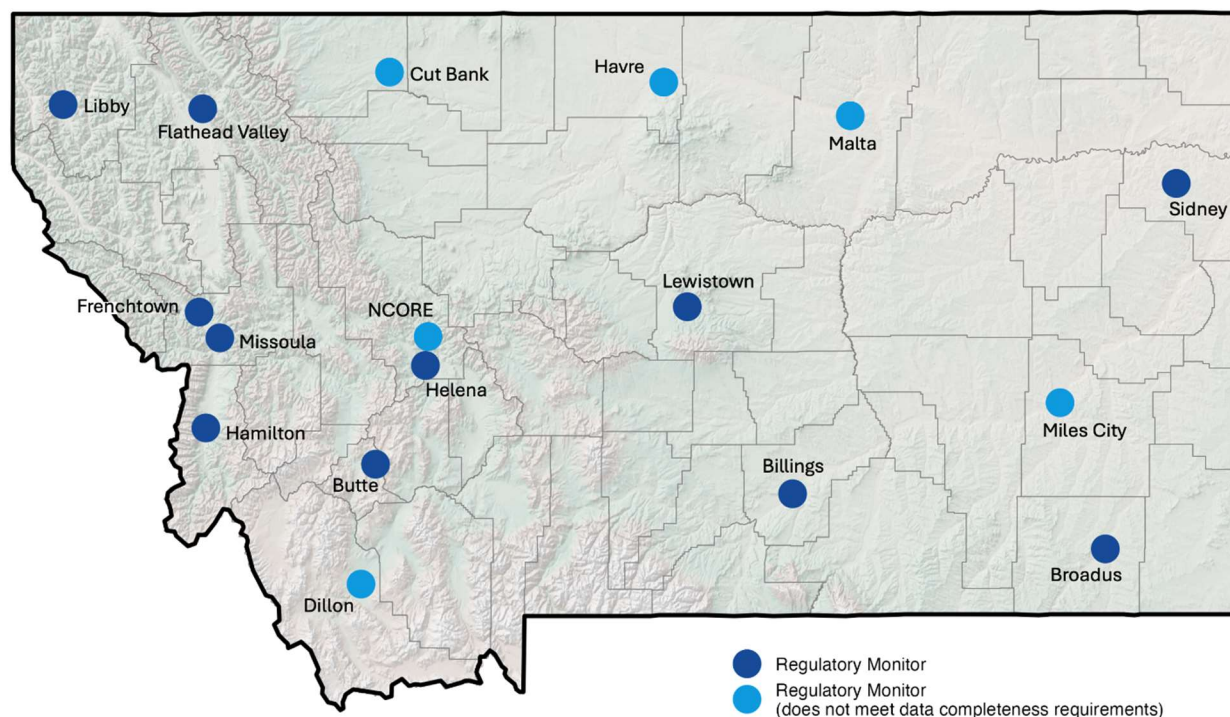


Figure 3 (below) shows data obtained from all sites that produced complete or incomplete data eligible for NAAQS comparison between 2021 and 2023. Data shown in Figure 3 demonstrates most monitoring sites are in compliance with the 2024 revised annual PM_{2.5} NAAQS, excluding Frenchtown and Libby. As discussed previously, several of Montana's SLAMS did not meet data completeness requirements for the design value period of 2021-2023 (lighter blue in Figures 2 and 3). Due to a lack of data completeness, these SLAMS cannot be used to designate the areas as attainment; however, they do support a designation of unclassifiable.

Figure 3 - PM_{2.5} Design Values for Regulatory Monitors 2021-2023

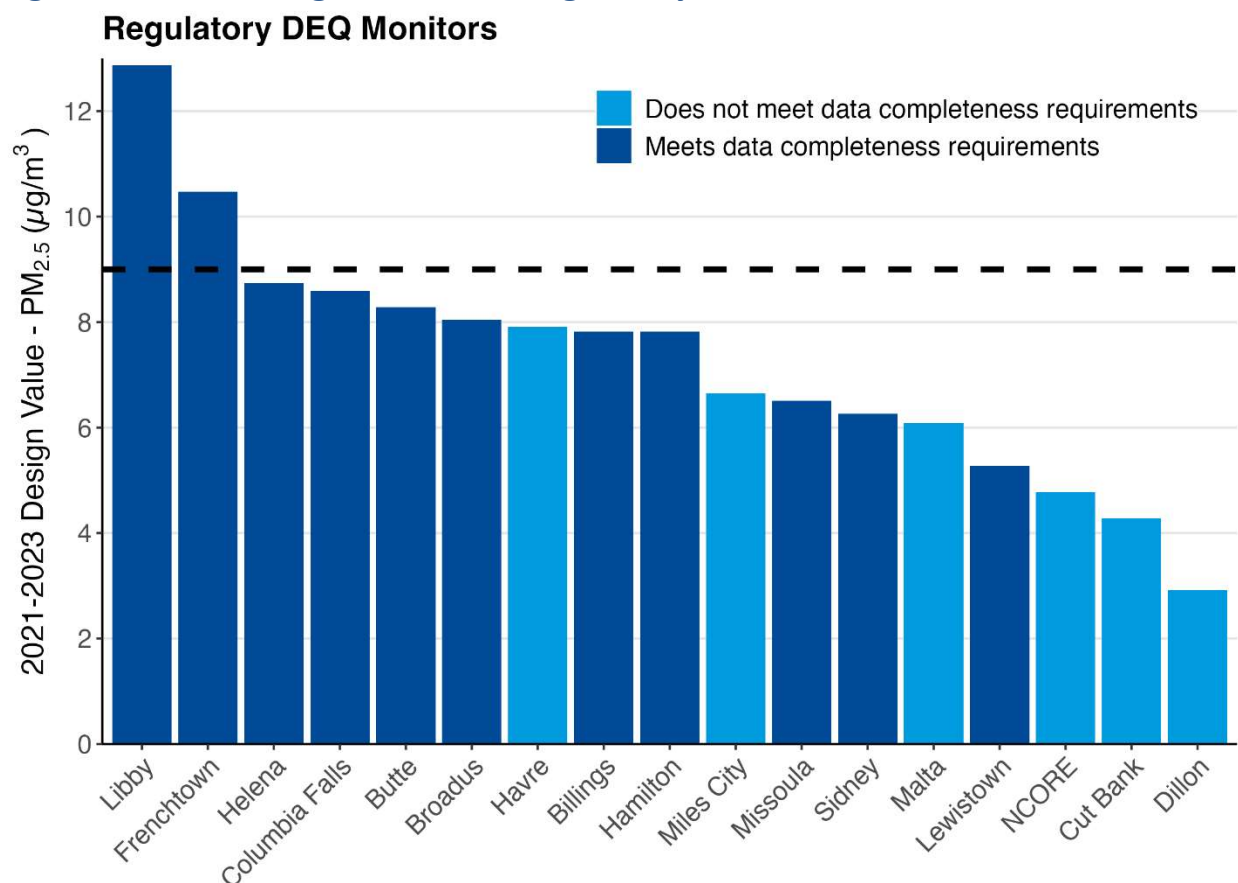
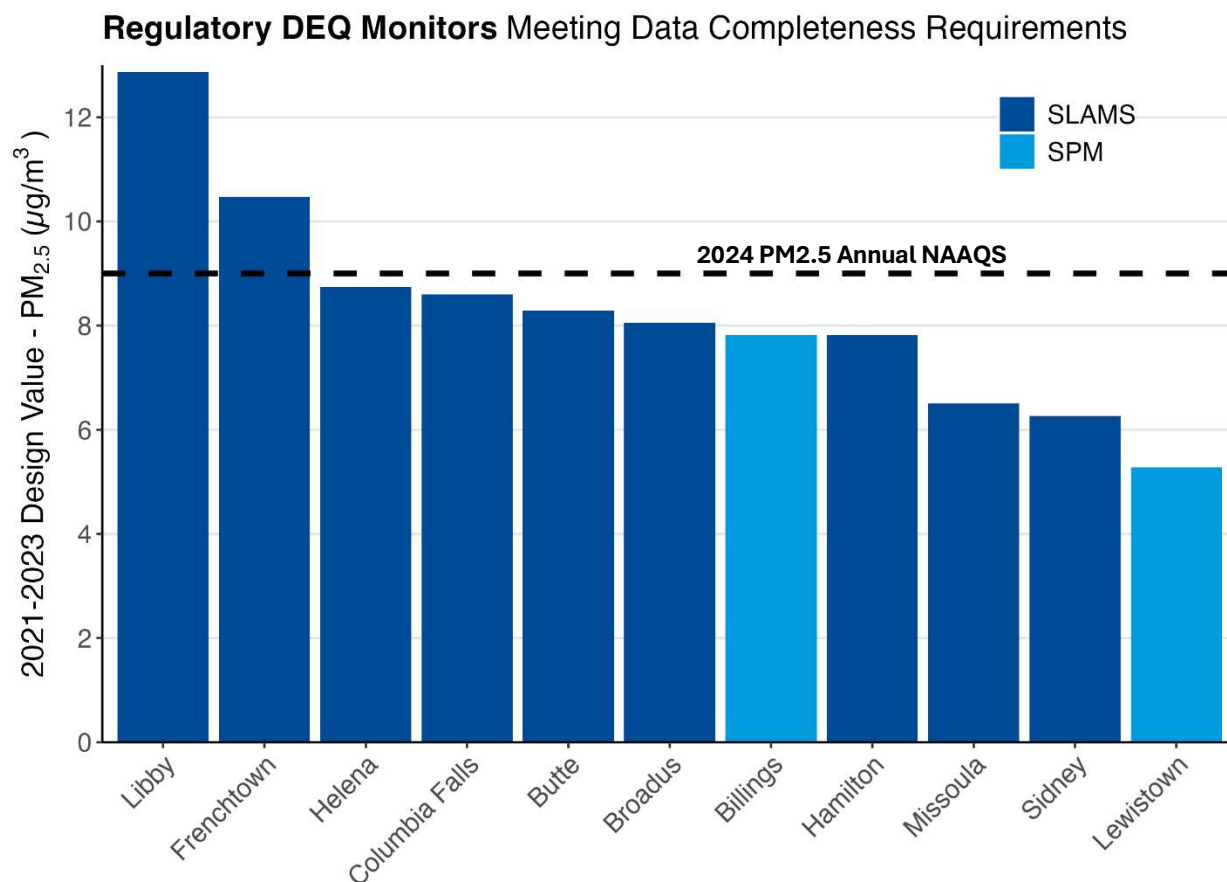


Figure 4 (below) shows only data from SLAMS (dark blue) and SPMs (lighter blue) that meet data completeness requirements during the 2021-2023 design value period. The data shown in Figure 4 demonstrates nine sites in compliance with the 2024 revised annual PM_{2.5} NAAQS, except Frenchtown, before exceptional events are considered, and Libby.

Figure 4 - PM_{2.5} Design Values for Regulatory Monitors Meeting Data Completeness Requirements 2021-2023



Montana is regularly impacted by smoke from wildfires both within and outside of the state. When ambient air monitoring data is impacted by wildfires, MT DEQ flags this data as impacted by an “exceptional event”. Any hourly measured concentration believed to be impacted by wildfire smoke receives an informational qualifier (known colloquially as an “I flag”). If, upon further analysis, I-flagged values are determined to contribute in a regulatorily significant manner to a NAAQS violation, the I flags are switched to “R flags”. R flags indicate data “requested for exclusion”. Days with regulatorily significant impacts from exceptional events, such as wildfire smoke, may be excluded from design value calculations for compliance determination if the event is “not reasonably controllable or preventable, is an event caused by human activity that is unlikely to recur at a particular location or a natural event, and is determined by the EPA in accordance with 40 CFR 50.14 to be an exceptional event.” The figures and design value calculations presented here either include or exclude data that have been flagged (either I or R flags), as impacted by exceptional events. Whether or not the flagged data is included or excluded is indicated for each individual plot or type of analysis herein.

MT DEQ’s Exceptional Events Demonstration for Exceedances of the Annual PM_{2.5} NAAQS in

Montana Due to Wildfire Smoke 2021-2023, shows that regulatory ambient air quality monitors in Libby and Frenchtown were impacted by smoke from wildfires on many days from 2021-2023, causing both sites to exceed the 2024 annual PM_{2.5} standard of 9.0 µg/m³. Contributing to these NAAQS exceedances were local, regional, and international wildfires detailed in the demonstration document for those years. The 2021-2023 exceptional events demonstration for both Libby and Frenchtown requests exclusion of only the regulatorily significant wildfire smoke-affected days at each site. While many regulatorily significant days were submitted, 102 days for Libby and 116 days for Frenchtown, there are still more days across the three-year design value period that were affected by wildfire smoke, as reflected in MT DEQ's certified Air Quality System (AQS) dataset with I flags.

Figure 5 represents the complete compliance-level PM_{2.5} ambient monitoring dataset for the design value period of 2021-2023 with wildfire contributions indicated (R- and I-flagged days in pink). If wildfire impacts are accounted for, all SLAMS and SPMs meeting data completeness requirements for the 2021-2023 design value period demonstrate compliance with the 2024 revised annual PM_{2.5} NAAQS of 9.0 µg/m³, aside from Libby.

Figure 5 – Wildfire Smoke Contribution to PM_{2.5} Design Values 2021-2023

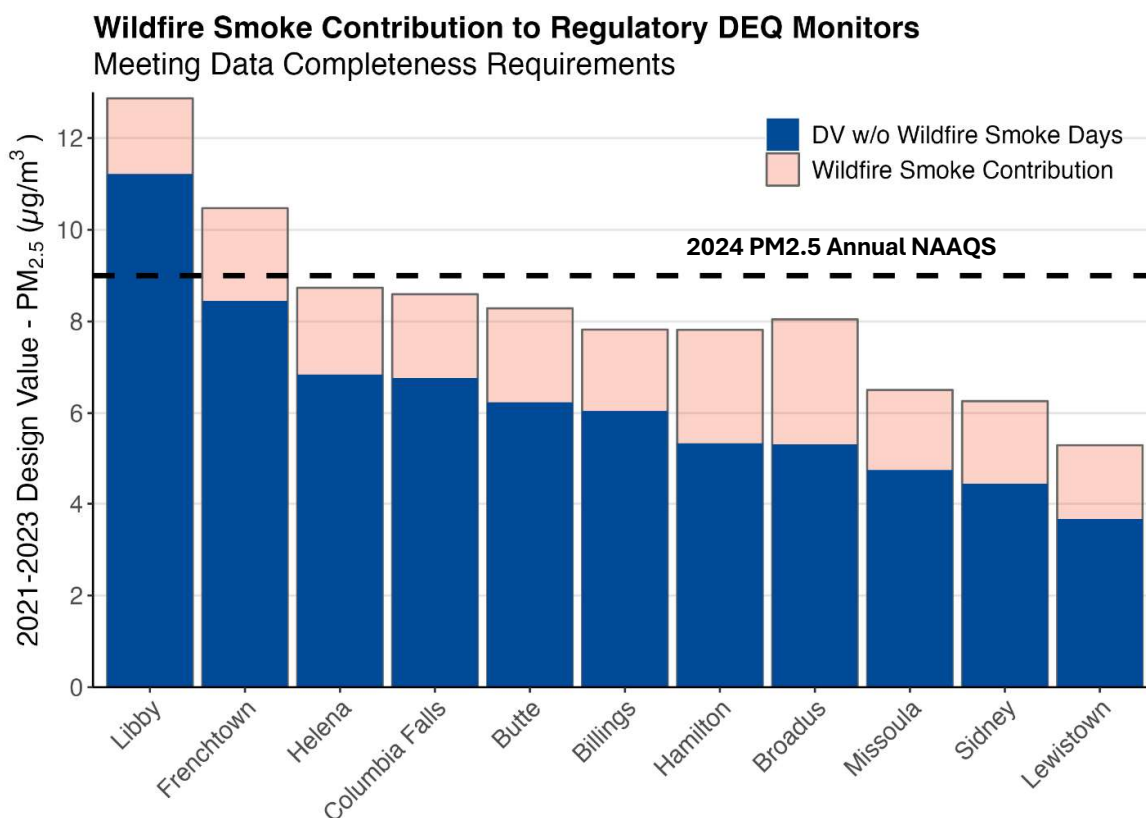
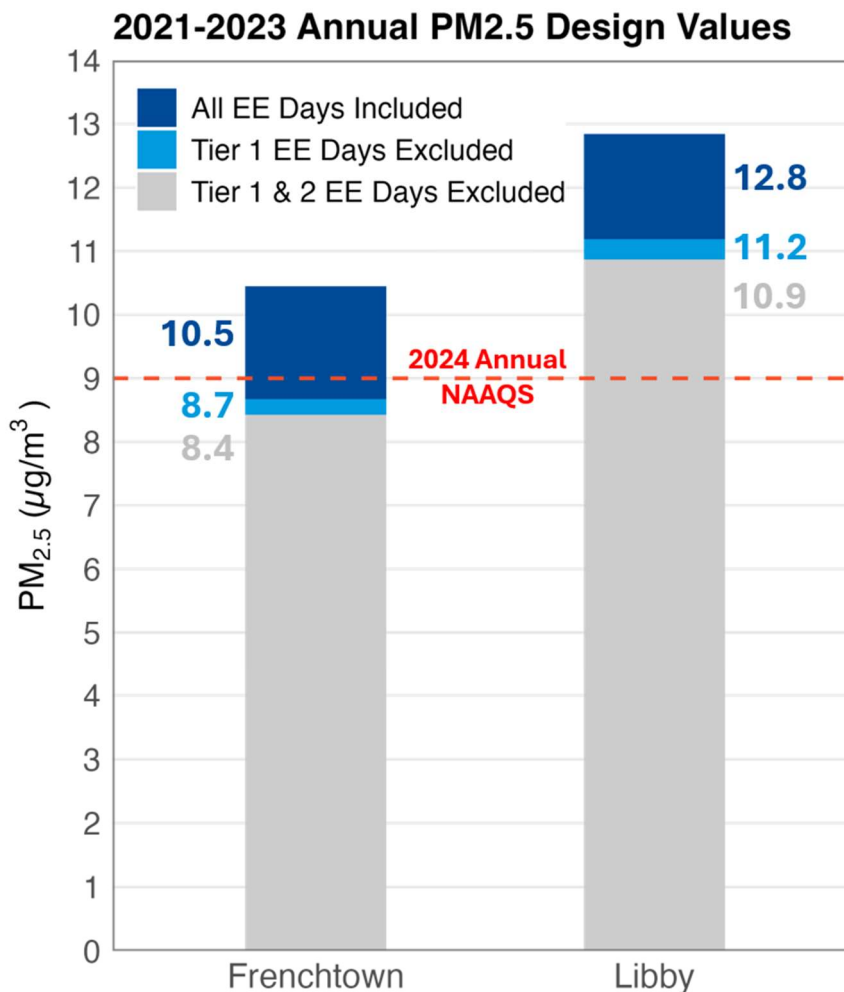


Figure 6 identifies the design values for the Frenchtown and Libby ambient monitors excluding only wildfire exceptional event days that were requested for exclusion (i.e., R-flagged data only, both Tier 1 and Tier 2 days)² in MT DEQ's 2021-2023 Exceptional Event Demonstration.

Figure 6 – Wildfire Exceptional Event Contribution to PM_{2.5} Design Values for Libby and Frenchtown Monitors 2021-2023



Frenchtown

The Frenchtown monitor was not originally sited for the purpose of representing outdoor ambient air quality in a regional airshed. The site, which has monitored PM_{2.5} continuously since November 2009, was originally a source-oriented SPM monitor. The site was selected specifically to evaluate potential air quality impacts from the nearby Smurfit-Stone Container

² See the following document for a discussion of exceptional events and tiering: US EPA. (2024). *PM_{2.5} Wildland Fire Exceptional Events Tiering Document*. Available at: [final-pm-fire-tiering-4-30-24.pdf](https://www.epa.gov/sites/default/files/2024-04/final-pm-fire-tiering-4-30-24.pdf) (epa.gov)

Mill. Smurfit-Stone produced liner-board and pulp wood products for nearly 53 years in Frenchtown beginning in 1957. Plant operations ceased in 2010, and the former mill site is currently being remediated through the Federal Superfund program. Even after Smurfit-Stone shutdown, the Frenchtown monitor remained situated on a narrow strip of land between Interstate 90 and a rail line; the location does not meet federal siting criteria³ for spacing from a roadway for a regional scale particulate monitor. The Frenchtown PM_{2.5} monitor is, however, in attainment status for the design value period of 2021-2023 with exceptional events removed, and set to attain the revised annual PM_{2.5} standard for the year 2024, without the need for exclusion of exceptional events.

³ 40 CFR Appendix E to Part 58—Probe and Monitoring Path Siting Criteria for Ambient Air Quality Monitoring

IV. Nonattainment Area

The only area in Montana to be designated “nonattainment” for the 2024 revised annual PM_{2.5} standard is the town of Libby. Libby is a small, rural community nestled in a mountain valley in the northwest corner of Montana. Libby is the county seat of Lincoln County – a large, rural county with a total area of 3,675 square miles and a population of 19,687, for a density of just over five people per square mile. The population of Libby proper is approximately 2,775, based on 2020 U.S. census data. There has been no significant rise or decline in population in the last four decades. The vast majority of Lincoln County consists of forested land owned by either the U.S. Forest Service or private timber companies.

The current regulatory ambient air monitor in Libby (a continuous Beta Attenuation Monitor, Libby-Courthouse Annex, AQS ID 30-053-0018) has continuously monitored PM_{2.5} and reported hourly data at the neighborhood scale since August 2011. Previous monitoring efforts at the site began as early as 1986. Episodic, filter-based, PM_{2.5} sampling (i.e., 24-hour samples collected every 3 days) was conducted from January 1999 through 2011 using different equipment and methods. National Chemical Speciation Network (CSN) PM_{2.5} supplemental monitoring was conducted at the site from 2002 through 2008.

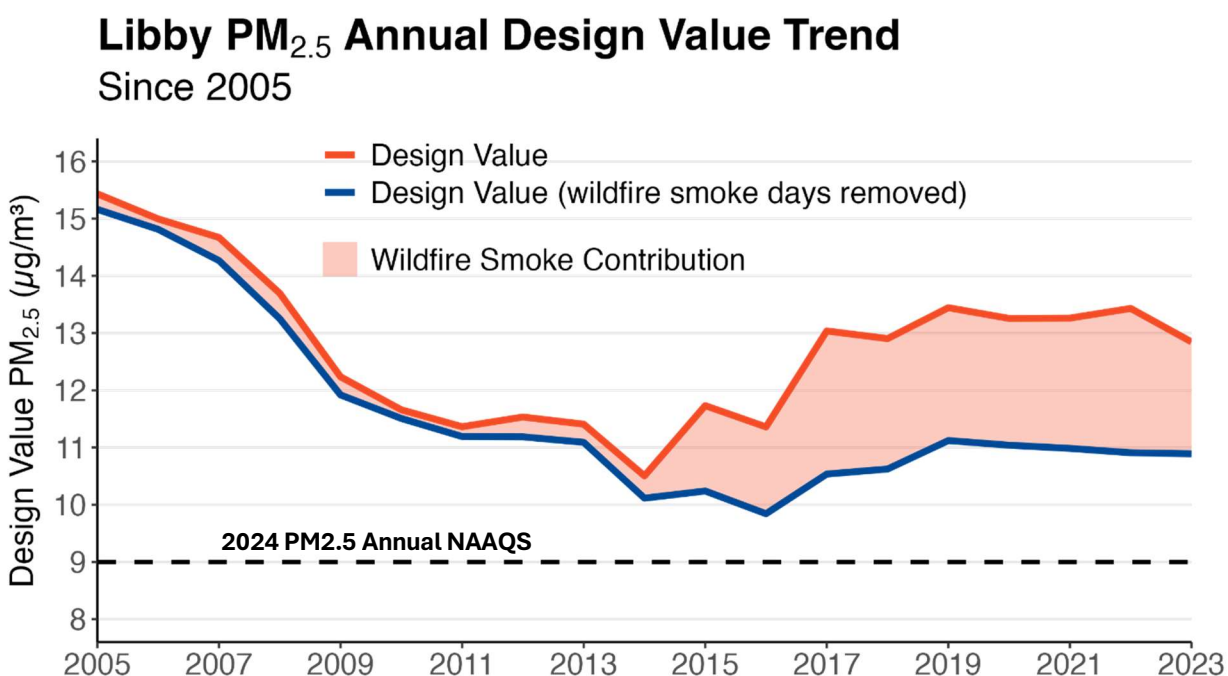
The town of Libby is considered an EJ disadvantaged community because it meets more than one burden threshold and the associated socioeconomic threshold per EPA’s CEJST screening tool. Libby is above the 90th percentile for the following EJ burden thresholds: expected population loss rate, projected flood risk, projected wildfire risk, energy cost, PM_{2.5} in the air, heart disease, low life expectancy, lack of indoor plumbing, proximity to superfund sites. It is also in the 82nd percentile for low-income communities. The area in and around Libby includes the Libby Asbestos and Libby Groundwater Federal Superfund sites that contribute to its classification as a disadvantaged community. These burdens and socioeconomic factors, including the fact that there is no natural gas pipeline routed to the community, have made it challenging for citizens to transition away from woodstove use for residential heating.

PM_{2.5} background concentrations in Libby are elevated compared to other locations in Lincoln County, and compared to other locations in the state, due to pervasive residential woodstove use, and because the valley’s restricted airshed limits atmospheric mixing, often trapping pollutants at the surface in a stagnant boundary layer. Surrounding topographic and geographic features create favorable conditions for local cold air drainage into the valley bottom. Cold air pooling creates frequent vertical temperature inversions that concentrate and confine pollutants to stable air layers at populated elevations. Despite these challenges, PM concentrations in this area have steadily dropped over the last few decades due to factors such as woodstove changeout programs, limitations/restrictions on open burning, and improved efficiency of vehicles over time. However, the revised 2024 annual PM_{2.5} NAAQS limit of 9.0 µg/m³ approaches background concentrations for Libby, and highlights the natural/environmental obstacles to good air quality the community contends with.

Five-Factor Analysis

Air Quality Data – Over the past nineteen years, measured PM_{2.5} concentrations (with exceptional events included) at the regulatory ambient air monitor in Libby have generally decreased, with 3-year design values ranging from 10.5 µg/m³ (2014) to 15.4 µg/m³ (2005). A moderately increasing (but also highly variable) trend in design values over the last decade is largely attributable to the growing impact of wildfires in the Western U.S. and Canada. As illustrated in Figure 7, PM_{2.5} contribution from wildfire smoke has intensified over the last two decades. When all monitor data flagged for wildfire exceptional events (those days with and without EPA concurrence) are removed, the design values since 2014 establish an average baseline of 10.5 µg/m³.

Figure 7 – Libby 3-Year Design Value Trend With and Without Wildfire Smoke Contribution⁴



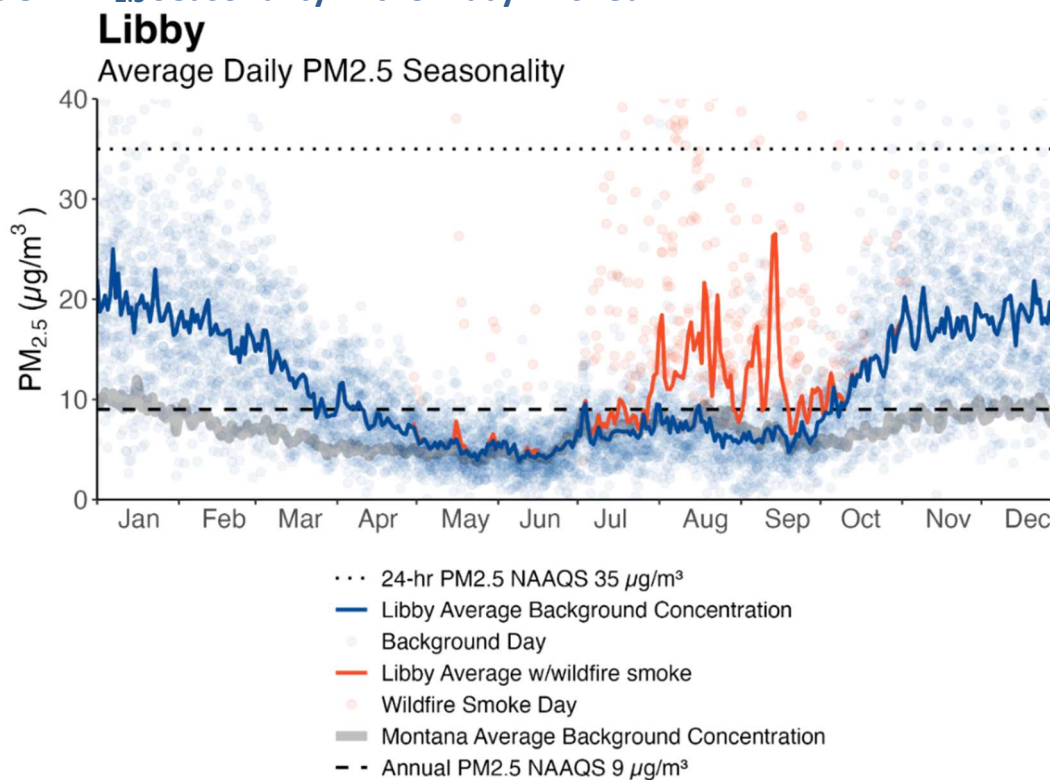
A review of historical daily average PM_{2.5} concentrations measured at the Libby monitor between 2005-2023 reveals a distinct seasonal pattern (Figure 8 below). From May to October, wildfire emissions have caused historical average daily concentrations, in some cases, to exceed 25 µg/m³, yet with wildfire exceptional event days excluded, background average

⁴ Design values are presented as the final year of the 3-year design value period (i.e., the 2005 design value in this figure represents data for 2003-2005), so data beginning with 2003 are represented. From 2003 to August 2011, the Libby regulatory monitor (30-053-0018) data comes from 24-hour filter samples that were collected every 3 days. Continuous, regulatory, 1-hour sampling began in August 2011. The years of 2003 and 2011 only have 2 and 3 complete data quarters, respectively, though sampling was conducted in portions of all 4 quarters.

concentrations are generally between 4 and 7 $\mu\text{g}/\text{m}^3$, owing to optimal atmospheric ventilation in the summer months. Late July to mid-September is typically peak wildfire smoke season in Libby, however, the record-breaking Canadian wildfire season of 2023 caused measurable impacts at the Libby monitor in May 2023, which can also be seen in Figure 8.

While impacts from wildfire smoke can be severe at times, background (i.e., every day) $\text{PM}_{2.5}$ concentrations can also be quite high in Libby. A seasonal shift is observed beginning in October of every year. $\text{PM}_{2.5}$ concentrations typically increase steadily into November and remain elevated until March or early April when they return to typical warm season background values of $\sim 4\text{--}7\ \mu\text{g}/\text{m}^3$. During the winter months, peak average daily $\text{PM}_{2.5}$ concentrations often exceed $20\ \mu\text{g}/\text{m}^3$. As will be discussed in detail below, seasonal temperature variability plays a major role in dictating local meteorology. The rate and source of $\text{PM}_{2.5}$ emissions also coincide with the transition into and out of winter. Most notably, the primary source of $\text{PM}_{2.5}$ in Libby is woodstove smoke which increases annually as the demand for residential heat rises with the onset of fall and winter. The beginning of the observed seasonal rise in $\text{PM}_{2.5}$ concentration also coincides with the beginning of fall open burning season (September 1 to November 30 annually) in MT, and trails off with the end of spring open burning season (March 1 annually).

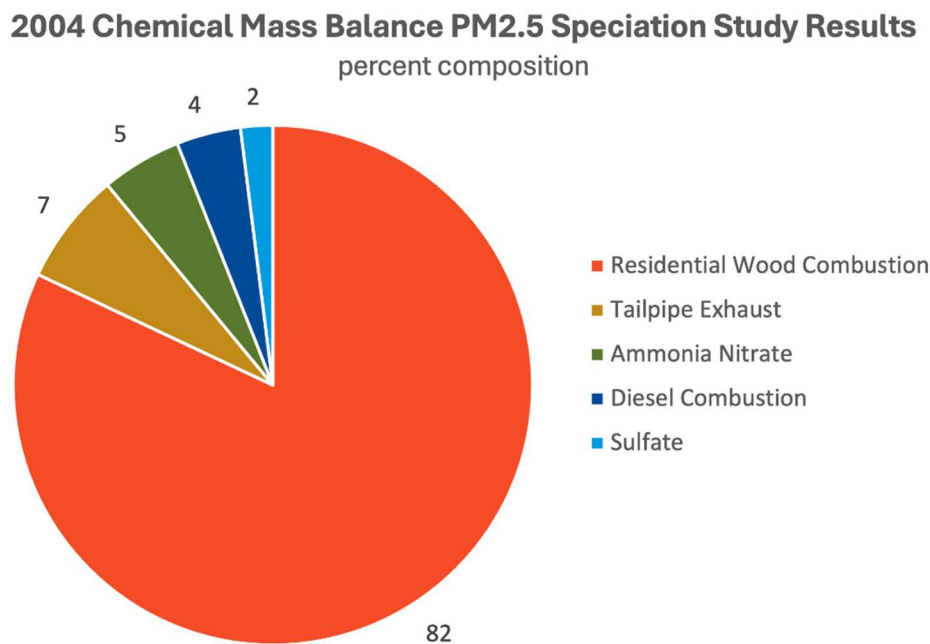
Figure 8 – $\text{PM}_{2.5}$ Seasonality in the Libby Airshed⁵



⁵ Utilizes all available continuous monitoring data (24-hr bulk averages of 1-hour sampling) from the Libby monitor (AQS ID 30-053-0018) dating back to November 2005; hourly continuous sampling at Libby operated under a non-regulatory status from November 2005 to August 2011.

Emissions related data – MT DEQ investigated the composition of PM_{2.5} during a previous chemical mass balance (CMB) study. The CMB study was a 4-month wintertime study conducted from November 11, 2003, through February 27, 2004, to cover a period of peak air quality concern in Libby. Additional analyses, including polar organic compounds and polycyclic aromatic hydrocarbon (PAH) analyses, and carbon 14 (14C) analyses were conducted as part of the CMB study to provide chemical fingerprinting to trace the emission sources. The CMB study identified the following emission sources as contributing to the area’s PM_{2.5}: residential wood combustion (82%), tailpipe exhaust (7%), ammonia nitrate (5%), diesel combustion (4%), and sulfate (2%; see also Figure 9). Since this study was conducted twenty years ago, we know that tailpipe and exhaust emissions have decreased, to some extent, due to the advancements in motor vehicle technology. When compared to more current pollutant speciation data, the majority of PM_{2.5} emissions in Libby still stem from residential wood smoke due to the town's propensity for atmospheric inversions and poor ventilation.

Figure 9 – Speciated PM_{2.5} 2003/2004 CMB Study Results



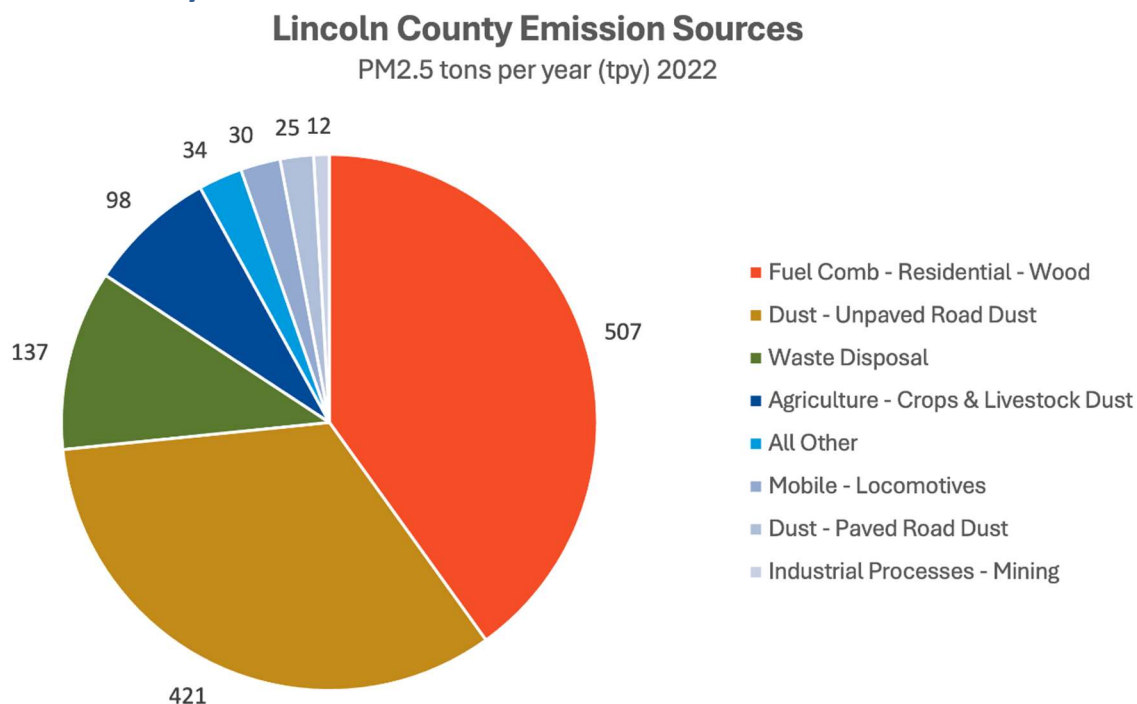
Recently, state agencies and the EPA have developed a national-scale emissions inventory that includes aggregated county-level emissions data representative of the year 2022.⁶ The 2022v1 Emissions Modeling Platform (EMP) contains the most up-to-date, quality-assured emissions inventory data available for the Libby area; that data is shown below in Figure 10. Unlike the Libby CMB study that precisely identified the percent composition of PM_{2.5} within the local airshed, the EMP quantifies PM_{2.5} emissions by source across all of Lincoln County. Therefore, differences in the relative proportion of emission sources between the earlier CMB results and

⁶ 2022v1 Emissions Modeling Platform | US EPA

the more recent EMP dataset do not necessarily reflect a change in the emission sources most impactful to Libby. However, the EMP does establish a modern baseline of county-wide emissions that, in the absence of a more recent CMB speciation study, provides an estimation of the most concerning regional PM_{2.5} sources.

Based on the EMP results, the largest source of PM_{2.5} emissions in Lincoln County in 2022 was residential wood combustion (507 tons per year (tpy)), which corroborates with the earlier CMB study results. The next greatest contributing source of PM_{2.5} emissions was dust from unpaved roads, though it's likely that most of the 421 tpy of dust reported for Lincoln County would've been generated on rural unpaved roads outside Libby city limits. Highlighting this likelihood is the fact that the 2003/2004 CMB study did not find unpaved road dust as being a significant contributor to PM pollution in Libby at all. Of course, during the study's November to February timeline, unpaved road dust may have been seasonally less abundant due to roads being damp or snow/ice-covered. Even so, on paved roads, sand was used in tandem with snow-clearing operations during the CMB study and found to be a negligible⁷ source of PM_{2.5}, despite being a significant contributor to Libby's PM₁₀ Nonattainment Area (NAA) inventory.⁸

Figure 10 – County-Level Emissions Based on the 2022v1 EMP Results



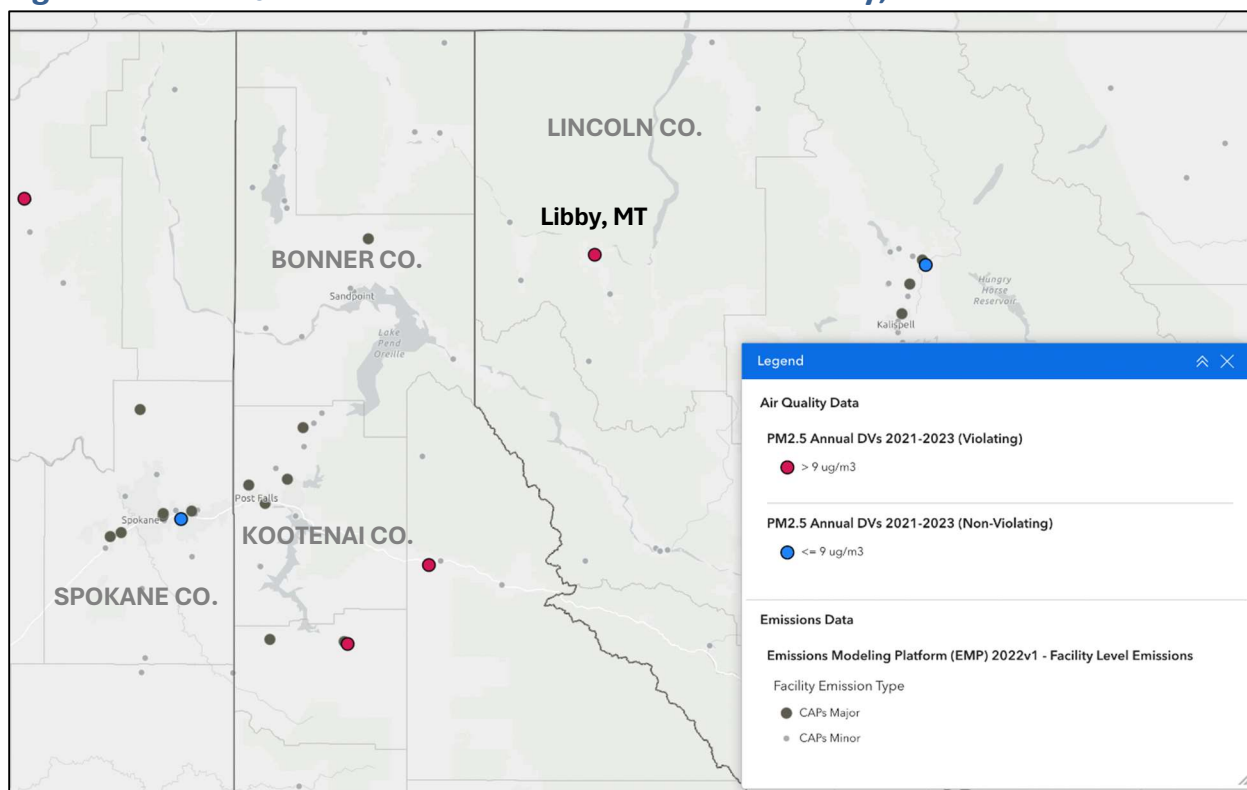
⁷ Ward, T. J., Rinehart, L. R., & Lange, T. (2006). The 2003/2004 Libby, Montana PM_{2.5} source apportionment research study. *Aerosol Science and Technology*, 40(3), 166-177.

⁸ 75 FR 55713

Industrial facility emissions are not included in the county-level EMP inventory because they are reported separately in the National Emissions Inventory. In many parts of the U.S., industrial point-source pollution contributes significantly to PM_{2.5} concentrations measured at a monitor; this is not true for Libby. Within Lincoln County, there are no major industrial emitters, a label that applies to any facility that emits 100 tpy or more of any criteria air pollutant (CAP)⁹, or 25 tpy or more of any combination of hazardous air pollutants (HAPs)¹⁰.

There are a handful of major facilities located across state lines in Idaho's Bonner and Kootenai Counties, as well as Washington's Spokane County, that have the potential to affect Libby if the emissions are high enough, and meteorological conditions are just right (Figure 11, gray dots). However, due to the relatively low potential to emit from these sources, the overland transport distances involved, and the isolated nature of Libby's airshed, MT DEQ does not believe these facilities significantly contribute to Libby's design value for the PM_{2.5} annual standard.

Figure 11 – PM_{2.5} Monitors and Point Sources Near Libby, MT¹¹



One way to estimate the relative impact potential of a source at a monitor is to perform a Q/d analysis where Q is emissions as tpy and d is distance in kilometers. As emissions are

⁹ 42 USC §7602

¹⁰ 42 USC §7412

¹¹ Map provided by EPA's PM_{2.5} Designations Mapping Tool. Available at: [PM2.5 Designations Mapping Tool, US EPA, OAR, OAQPS](#)

transported downwind, they disperse into the atmosphere and become less concentrated. Thus, either low emissions and/or greater distances result in lower Q/d values. Table 2 identifies all facilities in Lincoln (MT), Bonner (ID), Kootenai (ID), and Spokane (WA) Counties ranked from highest to lowest Q/d for direct PM_{2.5} emissions. Only facilities with the top ten Q/d values are listed. Similarly, Table 3 enumerates facilities in these same counties ranked by Q/d for combined oxides of nitrogen (NO_x) and sulfur dioxide (SO₂) emissions; NO_x and SO₂ are considered precursor emissions to secondary PM_{2.5} formation.

Table 2 – PM_{2.5} Point Sources Near Libby, MT

EIS Facility ID	State-County	Facility Name	NAICS Description	Pollutant	Distance (km)	Distance (mi)	2022 Emissions (tons)	Q/d (tons/km)
7321511	ID-Kootenai	PLUMMER FOREST PRODUCTS, INC. - POST FALLS	Reconstituted Wood Product Manufacturing	PM25-PRI	126	79	84.70	0.67
6299311	WA-Spokane	Inland Empire Paper	Paper Mills	PM25-PRI	150	93	50.94	0.34
14495011	MT-Lincoln	SCHNACKENBERG & NELSON FUNERAL HOME	Funeral Homes and Funeral Services	PM25-PRI	0	0	0.14	0.33
6439011	WA-Spokane	Kaiser Trentwood	Aluminum Sheet, Plate, and Foil Manufacturing	PM25-PRI	146	91	33.66	0.23
9763911	ID-Kootenai	IDAHO FOREST GROUP LLC - CHILCO	Sawmills	PM25-PRI	107	66	15.15	0.14
15472711	ID-Kootenai	AVISTA CORP	Fossil Fuel Electric Power Generation	PM25-PRI	117	73	11.57	0.10
9763211	ID-Kootenai	Coeur D'Alene Air Term	Airport Operations	PM25-PRI	116	72	9.04	0.08
946211	ID-Bonner	GAS TRANSMISSION NORTHWEST, LLC - COMPRESSOR STATION 04, SAMUELS	Pipeline Transportation of Natural Gas	PM25-PRI	69	43	4.72	0.07
9770511	ID-Bonner	IDAHO FOREST GROUP LLC - RILEY CREEK-LACLEDE	Sawmills	PM25-PRI	93	58	4.63	0.05
6647111	WA-Spokane	Waste To Energy	Solid Waste Combustors and Incinerators	PM25-PRI	168	105	6.90	0.04

Table 3 – PM_{2.5} Precursor Emission (NO_x+SO₂) Point Sources Near Libby, MT

EIS Facility ID	State-County	Facility Name	NAICS Description	Pollutant	Distance (km)	Distance (mi)	2022 Emissions (tons)	Q/d (tons/km)
946211	ID-Bonner	GAS TRANSMISSION NORTHWEST, LLC - COMPRESSOR STATION 04, SAMUELS	Pipeline Transportation of Natural Gas	NOx+SO2	69	43	232.37	3.37
6647111	WA-Spokane	Waste To Energy	Solid Waste Combustors and Incinerators	NOx+SO2	168	105	327.53	1.95
8354611	ID-Kootenai	GAS TRANSMISSION NORTHWEST, LLC - COMPRESSOR STATION 05, ATHOL	Pipeline Transportation of Natural Gas	NOx+SO2	104	64	170.33	1.64
14472511	WA-Spokane	YARDLEY	Support Activities for Rail Transportation	NOx+SO2	155	96	149.02	0.96
9770511	ID-Bonner	IDAHO FOREST GROUP LLC - RILEY CREEK-LACLEDE	Sawmills	NOx+SO2	93	58	76.46	0.83
6439011	WA-Spokane	Kaiser Trentwood	Aluminum Sheet, Plate, and Foil Manufacturing	NOx+SO2	146	91	117.72	0.80
9029811	WA-Spokane	Spokane Intl	Airport Operations	NOx+SO2	172	107	121.20	0.71
6299311	WA-Spokane	Inland Empire Paper	Paper Mills	NOx+SO2	150	93	82.40	0.55
15472711	ID-Kootenai	AVISTA CORP	Fossil Fuel Electric Power Generation	NOx+SO2	117	73	57.55	0.49
7321511	ID-Kootenai	PLUMMER FOREST PRODUCTS, INC. - POST FALLS	Reconstituted Wood Product Manufacturing	NOx+SO2	126	79	61.68	0.49

For direct PM_{2.5} emissions, all facilities have a Q/d well under 1, and precursor emission totals (NO_x + SO₂) indicate that Q/d is under 4 for all facilities. Additionally, all facilities but one are ≥69 km away. For reference, Federal Land Manager (FLM) guidance presumes any facility with a Q/d ≤10 at a distance ≥50 km does not have an adverse impact on an area.¹² This guidance specifically relates to visibility impairment in Federal Class 1 parks and wilderness areas, but given that even the most significant direct emitter of PM_{2.5} is less than 7% of the FLM Q/d threshold, it's clear that facility emissions in Spokane, Kootenai, and Bonner Counties are unlikely to contribute significantly to PM_{2.5} concentrations measured at the Libby monitor.

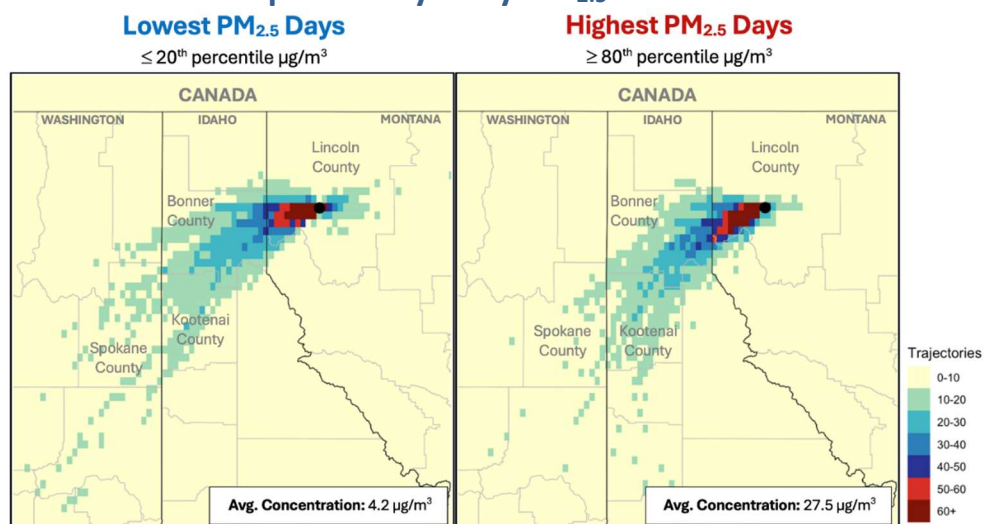
¹² U.S. Department of the Interior. (2010). *Federal Land Managers' Air Quality Related Values Work Group (FLAG) Phase 1 Report*. Available at: [FLAG Air Quality Phase 1 report.pdf](#)

Atmospheric transport analyses also suggest that Libby’s violation of the 2024 annual PM_{2.5} NAAQS is driven by local emissions rather than interstate transport. EPA’s Office of Air Quality Planning and Standards (OAQPS) HYSPLIT¹³ tool was used to create backward trajectories that represent atmospheric transport to the Libby monitor on every day of the 2021-2023 design value period. Two separate backward trajectories, one in the morning and one in the afternoon, were run for each day, for a duration of 24 hours. Initial inspection of the morning vs. afternoon transport patterns revealed no discernible difference, so trajectories were binned based on daily PM_{2.5} concentration for each trajectory. Figure 12 compares atmospheric transport on the lowest 20% of PM_{2.5} concentration days versus the highest 20% of PM_{2.5} concentration days. Two trajectories were run per day for the highest and lowest 20% of concentration days from 2021-2023; therefore, each concentration-binned dataset is comprised of 438 individual trajectories. Trajectory density was calculated for a 1/10th-degree grid and mapped over state and county boundaries.

This analysis demonstrates there is very little difference in atmospheric transport between days with low PM_{2.5} concentrations and those with high PM_{2.5} concentrations. The difference in PM_{2.5} concentrations was significant, 4.2 µg/m³ vs. 27.5 µg/m³, yet the transport pattern was the same. On both the highest and lowest PM_{2.5} days, average transport was dominated by southwesterly flow and intersected Spokane, Kootenai, and Bonner Counties where most of the industrial activity in this region is concentrated.

Since transport on the best air quality days (lowest PM_{2.5} concentrations) also passed over these industrial facilities during the 2021-2023 period, it can again be concluded that those facilities did not meaningfully contribute to elevated PM_{2.5} concentrations at the Libby monitor.

Figure 12 – HYSPLIT Transport Analysis by PM_{2.5} Concentration

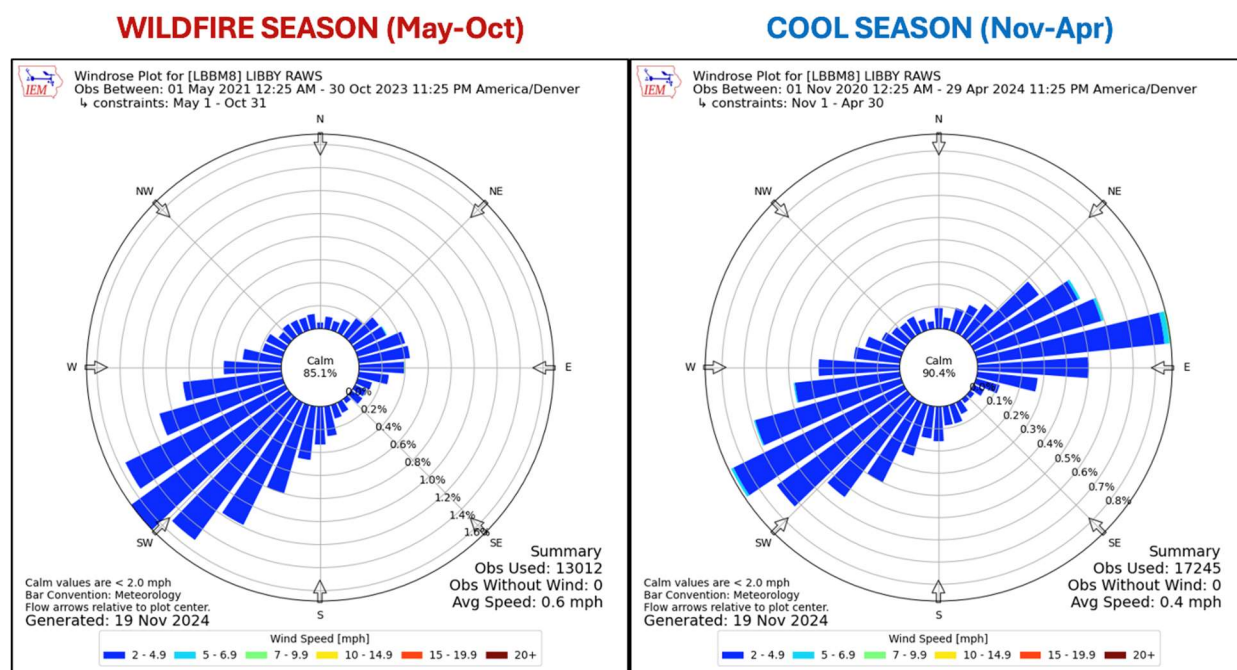


¹³ NOAA’s HYSPLIT (formerly Hybrid Single Particle Lagrangian Integrated Transport) model. Accessible at: <https://www.arl.noaa.gov/hysplit/>

Meteorology - Libby has a continental climate with warm summers and cold winters. Year-round Libby experiences very little wind because of its protected location surrounded by steep mountainous topography. In the winter months, between 2021 and 2023, winds were calm in Libby over 90% of the time. Colder air is denser and heavier than warmer air and it pools in the Libby Valley bottom, creating layers of stable air known as temperature inversions. As a result, smoke from residential heating by woodstoves and, PM_{2.5} from other sources, often become trapped in Libby for consecutive days, and even weeks, at a time. The combination of suppressed winter atmospheric ventilation and increased PM_{2.5} contributions from woodstove smoke often creates poor seasonal air quality conditions in the Libby Valley.

Like the HYSPLIT transport results discussed above, seasonal wind data from the U.S. Forest Service Remote Automated Weather Station (RAWS, National Weather Service ID: LBBM8), 2021-2023 reveals little variability across the year (Figure 13). During wildfire season, typically May through October annually, prevailing wind direction in Libby was southwesterly, and rarely, if ever, reached five miles per hour. Even during the warmest months of the year, winds were calm 85% of the time. Cool season (November through April) winds were still largely southwesterly, but east- to northeasterly winds were slightly more prevalent. Given that calm winds were measured 90% of the time during the cooler season, and wind speeds never reached seven miles per hour, a seasonal difference in winds is not significant.

Figure 13 – Libby, MT 2021-2023 Seasonal Wind Patterns¹⁴



¹⁴ Data and figures provided by Iowa State University's Iowa Environmental Mesonet (IEM). Accessible at: https://mesonet.agron.iastate.edu/sites/locate.php?network=MT_DCP

The seasonal covariance between mixing height and PM_{2.5} concentrations at Libby is significant, which underscores how local airshed meteorology dominantly influences particulate emissions compared to regional meteorology, as shown in Figure 14 below. Mixing height is defined as the “thickness” of the air above ground level that is mixed by buoyant turbulence caused by solar heating of the surface of the earth. As the ground absorbs solar radiation, air near the surface warms, causing it to become less dense relative to the cooler air above it. The warmer, less dense air rises, while cool dense air sinks to replace it, and in turn, the cooler air also begins to warm creating convective motion of air. Throughout the day, surface and atmospheric heat builds, and the buoyant mixing process gradually elevates the mixing height to its peak level in the mid-afternoon. When the sun begins to set, and surface heating decreases, atmospheric mixing also shuts down, resulting in a very stable (laminar) boundary layer with mixing heights often only a few hundred feet above ground level.

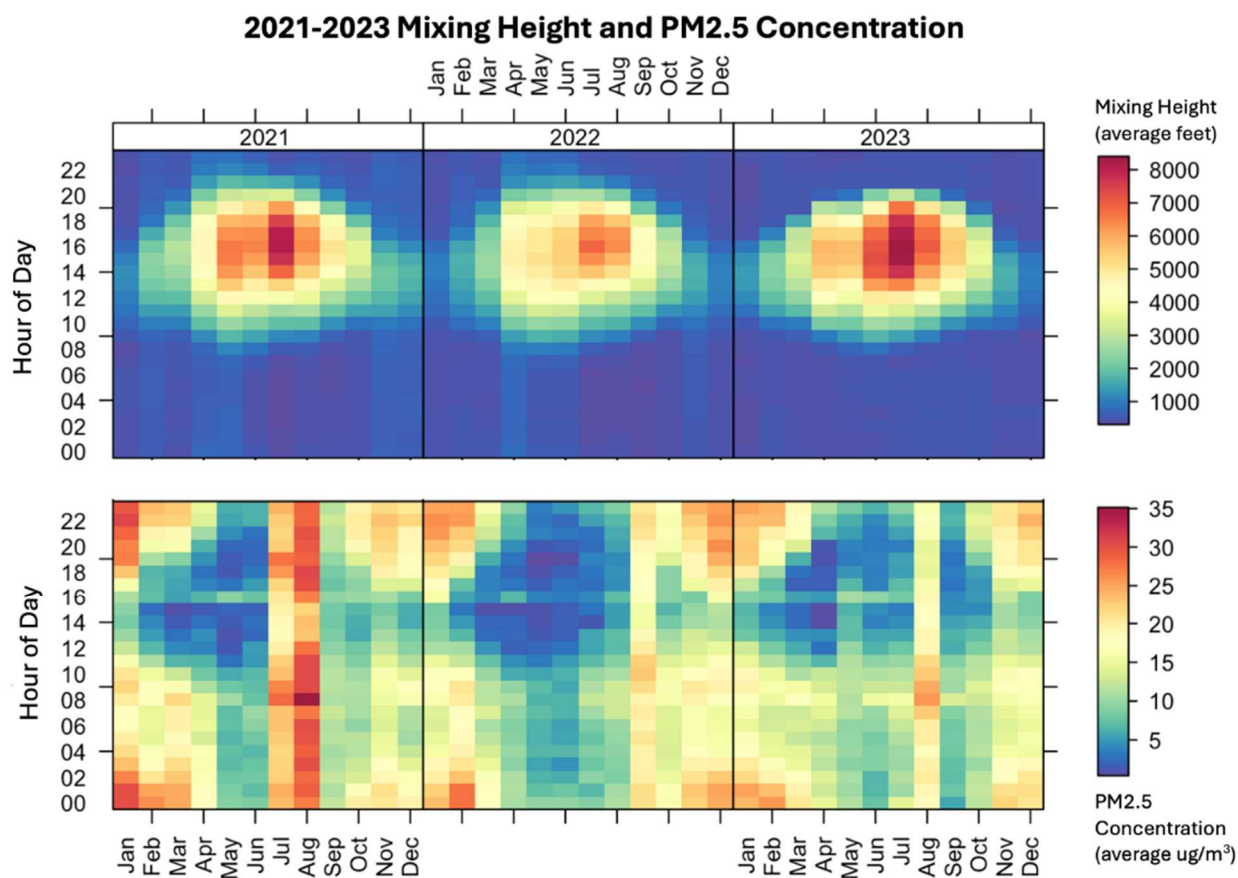
This diurnal mixing pattern is critically important for dispersing ambient pollutants in complex terrain such as that surrounding Libby. When mixing heights are low at night, particulates emitted at the surface (e.g., residential wood smoke) into the boundary layer remain trapped until mixing heights rise again and convective turnover in the atmosphere allows pollutants to disperse and be transported away from their sources. In Libby, however, mixing heights only consistently reach heights above the surrounding terrain seasonally between the months of May and October. While nighttime mixing heights are relatively consistent across the year, daytime mixing heights exhibit extreme seasonal variability.

Figure 14 (below) demonstrates the relationship between mixing height and PM_{2.5} concentrations, highlighting the significance and interplay of both diurnal and seasonal factors. The top pane represents mixing height in feet above ground level (AGL), and the bottom pane represents average PM_{2.5} concentrations in $\mu\text{g}/\text{m}^3$. The mixing height and concentration data are mapped as a grid, such that the x-axis represents both the months and the years of 2021-2023, and the y-axis for each variable represents the hour of the day (hours 00-24).

During the winter months, mixing heights remain below ~1,000-2,000 feet across all hours of the day in Libby, but as winter transitions into spring and summer, peak average mixing height increases to over 7,000 feet around 4pm (hour 16) daily. The average PM_{2.5} concentration (bottom pane) exhibits an inverse relationship to mixing height. When the mixing height is high, PM_{2.5} is low, and vice versa. From November through March of each year, nighttime PM_{2.5} concentrations often averaged more than 20 $\mu\text{g}/\text{m}^3$. Not only is the meteorology during this time of year the *least* favorable for dispersing (diluting) pollution, but it's also the time of year when residential wood combustion is at its highest. The combination of these factors creates an air quality problem unique to this small rural mountain valley community.

The only inconsistencies in the inverse relationship noted above occurred primarily in July-August 2021, September 2022, and August 2023. In each case, these were the months of peak wildfire smoke transport to the Libby Valley.

Figure 14 – Libby Airshed Mixing Height and PM_{2.5} Diurnal Trends^{15,16}



Geography - In Montana, there are two major air basins, in a general sense. The eastern two-thirds of the state is characterized by semi-arid rolling prairies with little vertical relief. In contrast, the physical geography of the western side of the state, where Libby is located, is dominated by deep mountainous valleys punctuated by steep mountainous terrain that greatly affects the transport and concentrations of ambient PM_{2.5}, as described above.

Topography – The mountains around Libby have a history of influencing the fate of transport emissions and PM_{2.5} concentrations, causing local air stagnation episodes. The Libby Valley floor sits at an elevation of 2,069 feet along the Kootenai River, which represents a low point in the state of Montana. Surrounded by smaller valleys to the west, south, and east, Libby’s airshed is confined by mountain features in all directions. Most notably, the Cabinet Mountain Range is located just a few miles southwest of Libby and reaches an elevation of 8,738’ at Snowshoe Peak (13 miles southwest). Additionally, the Purcell Mountains to the north rise to 6,000 feet,

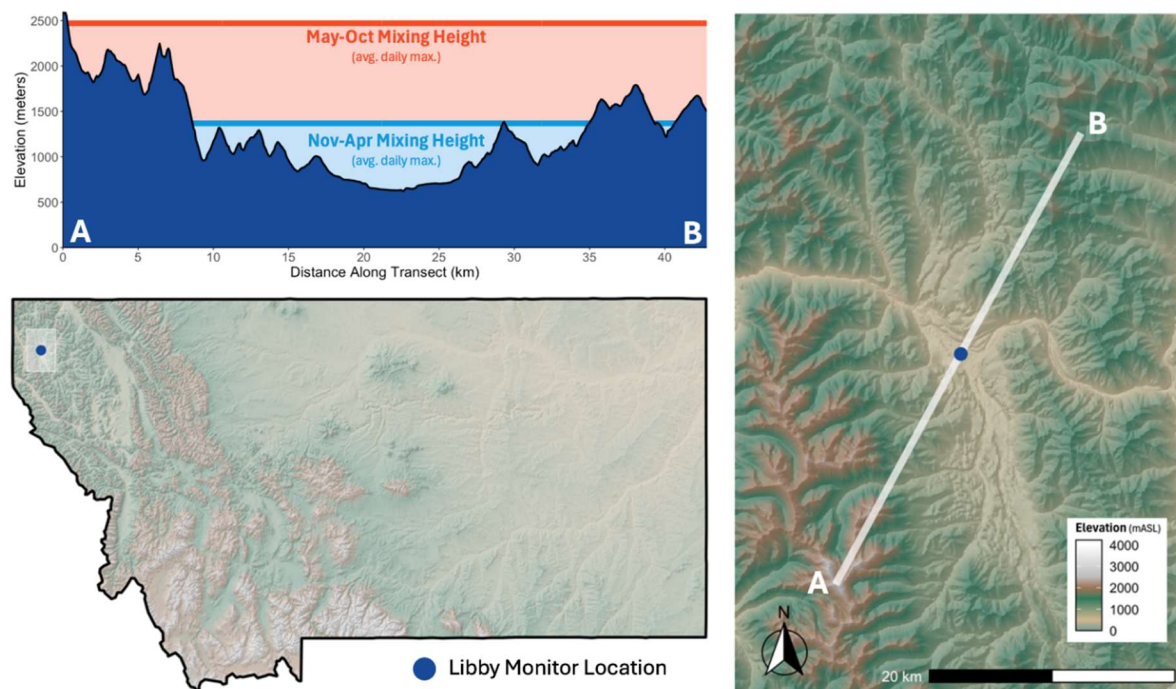
¹⁵ Mixing height data provided by the National Blend of Models (NBM) archived data. Data represents modeled mixing height at point LBBM8 (USFS Libby RAWs). Data available at: <https://noaa-nbm-grib2-pds.s3.amazonaws.com/index.html>

¹⁶ PM_{2.5} data accessed via EPA’s Air Quality System (AQS).

and the Salish Mountains to the east extend to 6,000 feet. These steep valley walls limit and channel air flows. During predominant calm wind conditions, temperature inversions easily develop, trapping cold air and pollution at the valley floor. This confined airshed limits PM_{2.5} dispersion because it's susceptible to diurnal inversions and poor ventilation under high-pressure atmospheric ridge patterns. Given these unique topographic characteristics, pollution in the Libby area can more easily accumulate, leading to extended periods of elevated PM_{2.5}.

Figure 15 provides a comparison of average daily maximum mixing heights along a cross-section of the Libby Valley. This example demonstrates how dramatically the Libby airshed physically shrinks during the cold season. From November through April 2021-2023, the average daily maximum mixing height in Libby was only 2,420 feet AGL (738 mAGL), but during the months of May to October, the average daily maximum mixing height increased to 6,035 feet AGL (1,839 mAGL).¹⁷ The figure below necessarily simplifies mixing height as a straight horizontal line. In reality, mixing height is a complex metric that contours a 3-dimensional landscape. This simplified example is provided to illustrate the strength of the seasonal effect on mixing heights and the degree to which surrounding terrain can confine air and pollutants within the Libby Valley.

Figure 15 – Mixing Heights, Topography and Geography of Libby, MT



¹⁷ Libby sits at an elevation of 2,070 ft AGL or 631 mAGL

Figure 16 depicts what MT DEQ considers the Libby Valley “major impact area” (red), which includes the valley floor up to 3,000 feet of elevation. 3,000 feet elevation is a significant margin because pollution under that threshold can become more easily trapped on the valley floor, especially in wintertime due to inversions. In fact, the November-April seasonal average mixing height is nearly identical to the 3,000 feet isoline, sitting at 3,084 feet of elevation (1,014 feet AGL). Times of the year when poor dispersion is anticipated, like shoulder seasons and winter, MT DEQ places restrictions on open burning below 2,500 feet elevation in the Libby area to limit accumulation of PM_{2.5} emissions in the boundary layer. The areas surrounding Libby above 3,000 ft (the portion in Figure 16 not highlighted) have much better atmospheric mixing and are in turn less prone to inversions, and experience much less impact from woodstove smoke and other emissions. Emissions injected at higher heights will also remain above the stable boundary layer, not ever reaching the populated valley bottom.

Figure 16 – Libby Valley Highlighted to 3,000 Feet of Elevation

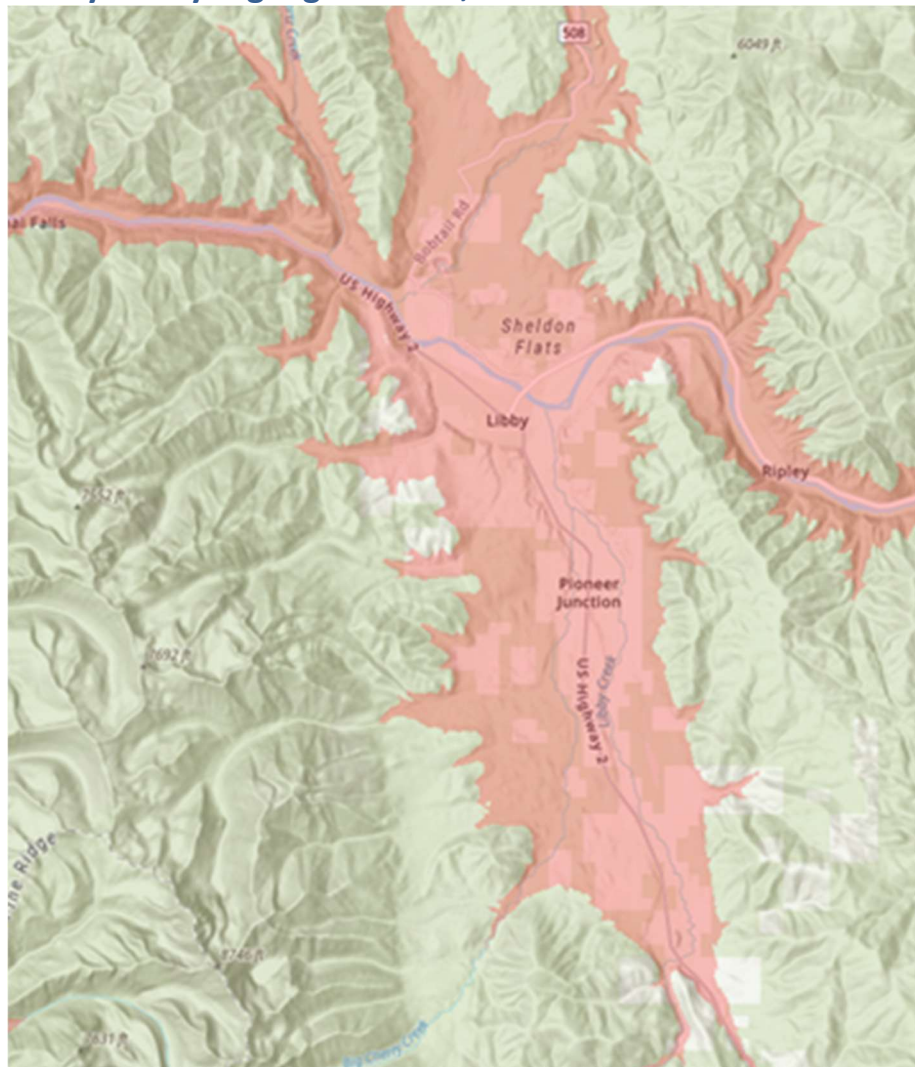


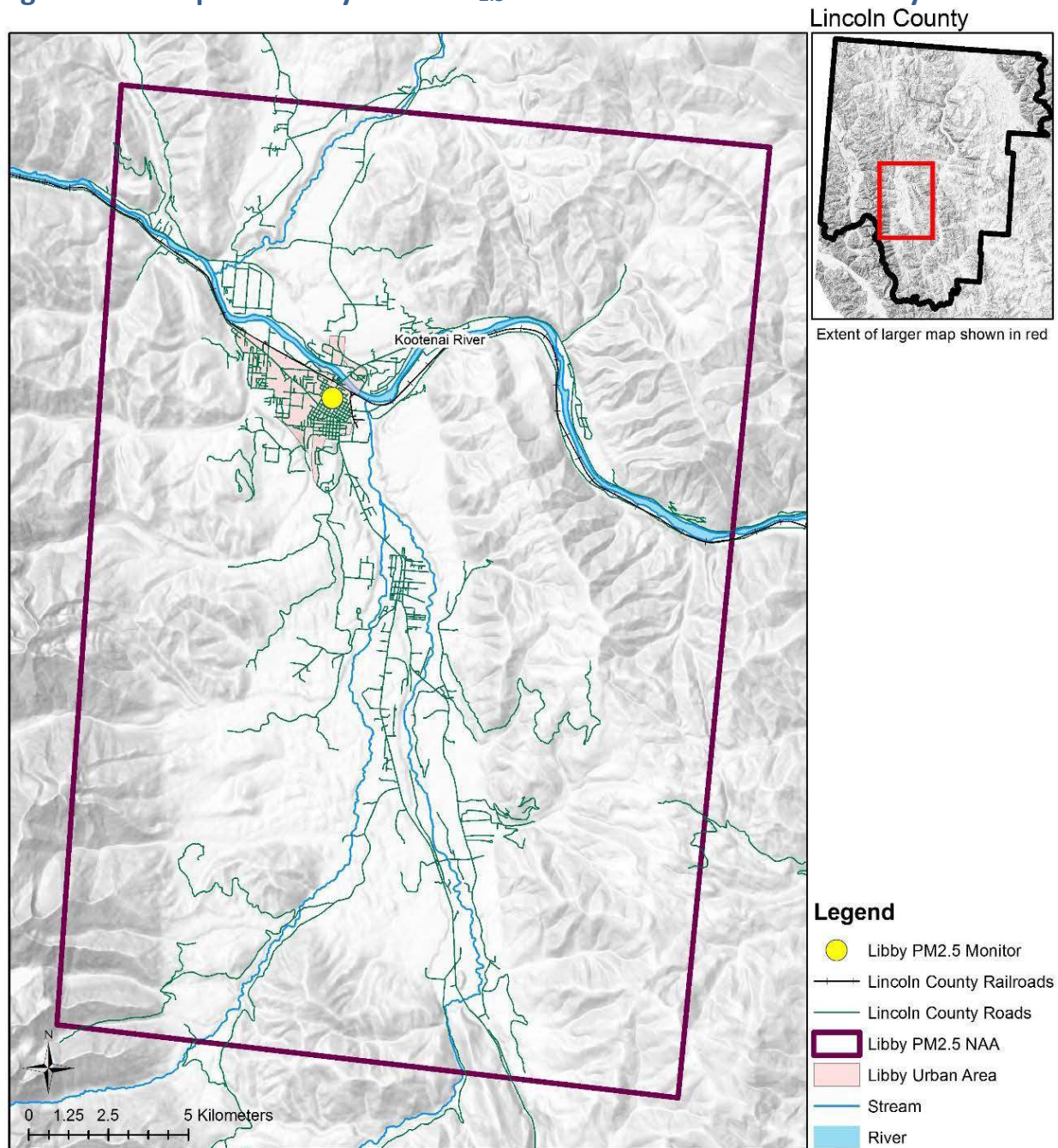
Figure 16 provides an important comparison to the previous/historical Libby PM_{2.5} nonattainment area boundary (Figure 17). The primary impact zone defined in this document (i.e., the area under 3,000 feet elevation that is prone to elevated PM_{2.5} concentrations) is contained nearly perfectly within the previous Libby nonattainment boundary.

As the impacted area identified through the current, independent, five-factor analysis process aligns with the extent of the previous Libby nonattainment area, MT DEQ proposes utilizing the earlier established boundaries to define the new nonattainment area for the 2024 revised PM_{2.5} annual NAAQS.

Boundaries – Figure 17 (below) shows the proposed nonattainment area boundary which encompasses the commercial and residential neighborhoods of Libby, including nearby communities that extend along the valley floor, and much of the neighboring mountainsides. MT DEQ proposes to adopt this boundary that has historical precedent and properly represents the impacted area. The Libby PM_{2.5} nonattainment area boundary MT DEQ proposes, based on the evidence provided, is rectangularly shaped and based on the Universal Transverse Mercator (UTM) system. The coordinate corners of this nonattainment polygon are:

- 600,000mE, 5,370,000mN;
- 620,000mE, 5370,000mN;
- 620,000mE, 5340,000mN; and
- 600,000mE, 5,340,000mN.

Figure 17 – Proposed Libby 2024 PM_{2.5} Nonattainment Area Boundary



V. Conclusion

Through the continued implementation of a robust PM_{2.5} ambient air quality monitoring network, and the five-factor analysis process with supporting evidence provided in this document, the State of Montana has determined that an initial designation of “attainment” is appropriate for the following nine counties: Silver Bow, Flathead, Missoula, Ravalli, Lewis and Clark, Custer, Richland, Yellowstone, and Fergus. The only area to be designated “nonattainment” in the state is the Libby Valley, which resides within Lincoln County. The remaining forty-six Montana counties should initially be designated as “unclassifiable” for the 2024 revised annual PM_{2.5} NAAQS.