Cache Valley Idaho $PM_{2.5}$ Nonattainment Area State Implementation Plan

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December 2012

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Acronyms, Abbreviations, and Symbols

ºF	degrees Fahrenheit
$\mu g/m^3$	micrograms per cubic meter
AQI	Air Quality Index
AQS	Air Quality System
asl	above sea level
BAM	beta attenuation monitor
CAA	Clean Air Act
CCV	closed crankcase ventilation
CFR	Code of Federal Regulations
CMAQ	community multiscale air quality model
CO	carbon monoxide
CVNAA	Cache Valley Nonattainment Area
DERP	Diesel Emission Reduction Program
DOC	diesel oxidation catalyst
DSL	deep stable layers
EPA	United States Environmental Protection Agency
FDMS	Filter Dynamic Measurement System
FEM	federal equivalent method
FR	Federal Register
FRM	federal reference method
IDAPA	Idaho Administrative Procedures Act
IDEQ	Idaho Department of Environmental Quality
IMPROVE	Interagency Monitors of Protected Visual Environments
ITD	Idaho Transportation Department
km	kilometers
LRTP	Long Range Transportation Plan

MATS	Model Attainment Test Software
MOVES	motor vehicle emission simulator
MPO	Metropolitan Planning Organization
msl	mean sea level
MVEB	motor vehicle emissions budget
NAA	nonattainment area
NAAQS	National Ambient Air Quality Standards
NH_3	ammonia
NO_x	nitrogen oxides
PLSS	Public Land Survey System
$PM_{2.5}$	particulate matter under 2.5 microns in size
ppm	parts per million
RACM	reasonably available control methods
RACT	reasonably available control technology
RFP	reasonable further progress
RWC	residential wood combustion
SIP	State Implementation Plan
SO_2	sulfur dioxide
SPM	special purpose monitor
STN	Speciation Trends Network
TCM	transportation control measure
TEOM	tapered element oscillating microbalance
TIP	Transportation Improvement Program
tpd	tons per day
TPY	tons per year
UDAQ	Utah Division of Air Quality
VOC	volatile organic compounds

VSCC	very sharp cut cyclone
WRF	weather research and forecasting
WRF-ARW	weather research and forecasting advanced research

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Executive Summary

Air pollution in the intermountain west is becoming an increasing problem because of two key factors. First, increasing populations in these areas increase the number of pollution emission sources such as vehicles. Secondly, air sheds in the intermountain west region consist of high altitude valleys confined by mountains often resulting in climatic wintertime air stagnation and inversions that limit the ability of air pollution to disperse. These two components increase the likelihood of the occurrence of significant air pollution exposures to population centers if left unmitigated.

A major component of air pollution in the intermountain west that may cause significant human health issues is the level of particulate matter within the affected air. More specifically, it is the *size* of the particulate matter that is directly linked to their potential for causing health problems. Fine particulate matter with a diameter less than or equal to 2.5 micrometers (1/30th the width of a human hair) is referred to as particulate matter 2.5 ($PM_{2.5}$). These small particles pose the greatest risk to human health because they can lodge deep into the lungs, and some particles may get into the bloodstream, affecting heart function. Because of this relationship, $PM_{2.5}$ exposure is linked to a variety of health problems including increased respiratory stress (irritation of airways, coughing, or difficulty breathing); decreased lung function; aggravated asthma; development of chronic bronchitis; irregular heartbeat; nonfatal heart attacks; and premature death in people with heart or lung disease.

In the intermountain west, the major direct (primary) sources of $PM_{2.5}$ are vehicle emissions, wood combustion, and ambient dust created from road maintenance and vehicular use. Secondary sources contribute to chemical reactions of gases in the atmosphere, which include sulfur dioxide, nitrogen oxides, volatile organic compounds, and ammonia. In addition to vehicle emissions, secondary emission sources also include agricultural emissions, commercial solvent use, nonroad mobile sources (planes, trains, construction equipment, all-terrain vehicles, and small engines), and commercial cooking emissions.

The Environmental Protection Agency (EPA) promulgated the current National Ambient Air Quality Standards (NAAQS) for $PM_{2.5}$ in 2006 to protect human health. These standards require that concentrations of $PM_{2.5}$ in the air not exceed 35 micrograms per cubic meter ($\mu g/m^3$) on a daily basis and 15 $\mu g/m^3$ on an annual basis. Within 12 months of the 2006 promulgation, states were required to submit a statewide finding that defined which areas of a state attained the standard, which areas did not attain the standard, and which areas were unclassifiable. Based on monitoring data, the Cache Valley, spanning Utah and Idaho, did not meet the 35 $\mu g/m^3$ standard and was designated a nonattainment area for the 24-hour $PM_{2.5}$ NAAQS in 2011. The major emission sources contributing to the nonattainment status designation in the Cache Valley include the following:

- Mobile dust emissions
- Vehicle emissions
- Woodstove emissions

The Clean Air Act (CAA) further requires states to submit an air quality improvement plan, known as a State Implementation Plan (SIP), to EPA for concurrence when an area has been designated nonattainment. The SIP must demonstrate that sufficient measures have been put into

place to return the area to attainment and to maintain that attainment into the future. Since the Logan, UT-ID (Cache Valley) nonattainment area spans two states and two EPA regions, both Utah and Idaho are required to develop a SIP. Utah, EPA Region 8 (Denver), and Idaho, EPA Region 10 (Seattle), have cooperated throughout this SIP development process. In addition, there has been extensive public involvement in the selection of reasonable control strategies to bring the Cache Valley into attainment.

This document contains the necessary evidence, analysis, and Idaho control strategies (in conjunction with the Utah SIP) to demonstrate that the area will attain the NAAQS by January 1, 2015. Key elements of the Idaho control strategies and contingency measures include the following:

- Reduce the amount of wintertime road sanding material.
- Implement residential woodstove combustion control ordinances by the cities and Franklin County to control burning during air quality alerts.
- Institute the Idaho Department of Environmental Quality's (IDEQ's) Air Quality Index program for the Idaho side of the Cache Valley as an education and information tool for the public.
- Provide incentives to replace outdated woodstoves with energy and emission efficient EPA-certified woodstoves.
- Continued application of Idaho's industrial air permitting program.
- Continued application of IDEQ's diesel emission reduction program.

1 Introduction

The Idaho Department of Environmental Quality (IDEQ) is required to submit a particulate matter $_{2.5}$ ($PM_{2.5}$) State Implementation Plan (SIP) for the Idaho side of the Cache Valley nonattainment area (CVNAA) to the United States Environmental Protection Agency (EPA). The purpose of the SIP is to show that the area will attain the 24-hour standard for airborne particulate matter less than or equal to 2.5 micrometers in aerodynamic diameter ($PM_{2.5}$) by the attainment date of January 1, 2015. This document includes all of the necessary components to demonstrate timely attainment within the Cache Valley airshed.

1.1 Background

In September 2006, EPA revised the National Ambient Air Quality Standards (NAAQS) for $PM_{2.5}$. While the annual standard remained unchanged at 15 micrograms per cubic meter ($\mu g/m^3$), the 24-hour standard was lowered from 65 $\mu g/m^3$ to 35 $\mu g/m^3$. Fine particles consist of a complex mixture of extremely small particles and liquid droplets. Exposure to fine particles has been linked to a variety of health effects and is known to cause or contribute to respiratory disease, asthma attacks, and heart conditions. An area in violation of the $PM_{2.5}$ standard (based on the most recent 3 years of federal reference method [FRM] monitoring data) is designated as a *nonattainment area* (NAA).

$PM_{2.5,}$ or fine particulate matter, is referred to as *primary* if it is directly emitted into the air as a solid or liquid particle and its chemical form is stable. $PM_{2.5}$ that is formed by chemical reactions of gases (termed precursors) in the atmosphere is referred to as *secondary* $PM_{2.5}$. These reactions form condensable matter that either forms new particles or condense onto other particles in the air.

This SIP addresses the $PM_{2.5}$ NAA, designated by EPA as the Logan, UT–ID NAA, and referred to here as Cache Valley or CVNAA (74 FR 58688). Straddling the border between Utah and Idaho, this NAA presents unique challenges with respect to topographical features and jurisdictional authority issues—an NAA that spans two states (Utah–Idaho) and two EPA regions (Region 8–Region 10).

Cache Valley experiences air stagnation events in the wintertime. During these periods, the stable layer above the ground is much deeper than a typical nocturnal inversion. Cold air is trapped in the basins, and the air mass stabilizes as high pressure aloft overtakes the region. Under such circumstances, a prolonged strong inversion layer (or layers) limits vertical mixing, trapping local pollutants in a thin layer against the valley floor. During episodes such as this, emissions increase above typical winter days because more home heating occurs due to the cold temperatures. The low sun angle, short length of the days during winter months, and strong likelihood of snow cover to reflect the solar radiation are all factors that limit daytime surface heating and aggravate the situation. As a result, some inversions may not break for many days.

The scenario described above leads to exceedances and violations of the 24-hour health standard for $PM_{2.5}$. In other parts of the year $PM_{2.5}$ concentrations are generally low, and even when averaged with the high peaks occurring during the winter, are well within the annual health standard for $PM_{2.5}$.

1.2 Nonattainment Area Description

The following subsections offer a brief glimpse of the CVNAA to orient the reader to the area. Descriptions are given for the area's climatology, topography, and meteorology. The legal descriptions provided for the CVNAA demonstrate the complexity of the airshed spanning two states and the need to cooperatively address the $PM_{2.5}$ air quality issues.

1.2.1 Nonattainment Area Location and Topography

The Cache Valley $PM_{2.5}$ NAA lies within Cache County, Utah, (northern Utah) and Franklin County, Idaho (southeastern Idaho) (Figure 1). The CVNAA encompasses a bowl-shaped, topographically isolated valley measuring approximately 37.3 miles north to south and 12.4 miles east to west. The Wellsville Mountains (with altitudes up to 9,900 feet above mean sea level [MSL]) lie to the west and on the east lie the Bear River Range (with altitudes up to 8,300 feet MSL); both are northern branches of the Wasatch Range. These mountain ranges are approximately 3,000 to 5,000 feet above the Cache Valley floor. The Wellsville Mountains, Bear River Range, and northern Wasatch Range converge in southern Cache County to form a topographical barrier between Cache Valley and other adjacent counties. As with the southern area of Cache Valley, the mountain ranges of the northern area of Cache Valley, bordering the eastern and western portions of Franklin County, meteorologically and topographically, isolate Franklin County from other counties. The inversions that produce the high concentrations of $PM_{2.5}$ in the CVNAA are only confined to areas below the elevated, mountainous terrain areas of both Cache and Franklin Counties.

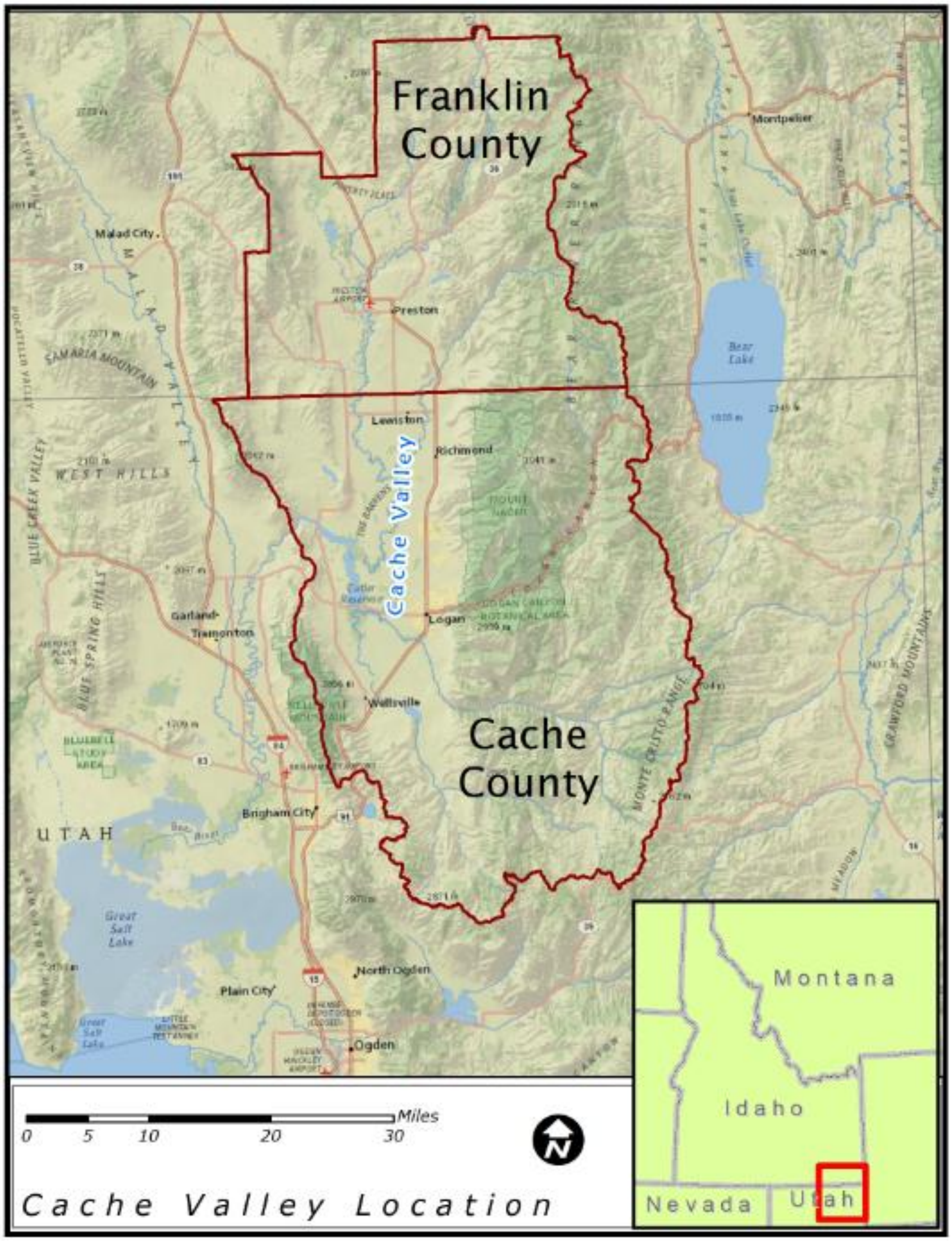

Figure 1. Location map showing the Cache Valley and the boundaries for Franklin County, Idaho, and Cache County, Utah.

1.2.1.1 Franklin County, Idaho, Legal Description

The Idaho portion of the CVNAA includes those areas of Franklin County bounded as follows (Figure 2):

> Begin in the bottom left corner (southwest) of the nonattainment area boundary, southwest corner of the Public Land Survey System (PLSS)-Boise Meridian, Township 16 South, Range 37 East, Section 25. The boundary then proceeds north to the northwest corner of Township 15 South, Range 37 East, Section 25; then the boundary proceeds west to the southeast corner of Township 15 South, Range 38 East, Section 19; then north to the Franklin County boundary at the northwest corner of Township 13 South, Range 38 East, Section 20. From this point the boundary proceeds east 3.5 sections along the northern border of the county boundary where it then turns south 2 sections, and then proceeds east 5 more sections, and then north 2 sections more. At this point, the boundary leaves the county boundary and proceeds east at the southeast corner of Township 13 South, Range 39 East, Section 14; then the boundary heads north 2 sections to northwest corner of Township 13 South, Range 39 East, Section 12; then the boundary proceeds east 2 sections to the northeast corner of Township 13 South, Range 40 East, Section 7. The boundary then proceeds south 2 sections to the northwest corner of Township 13 South, Range 40 East, Section 20; the boundary then proceeds east 6 sections to the northeast corner of Township 13 South, Range 41 East, Section 19. The boundary then proceeds south 20 sections to the southeast corner of Township 16 South, Range 41 East, Section 30. Finally, the boundary is completed as it proceeds west 20 sections along the southern Idaho state boundary to the southwest corner of the Township 16 South, Range 37 East, Section 25.

1.2.1.2 Cache County, Utah, Legal Description

The Utah portion of the CVNAA includes the following townships, or portions thereof located in Cache County (Figure 2), which forms the eastern boundary of the NAA, and then proceeds west to include all areas over to the western boundary of Cache County:

> Township 15 North Range 1 East
> Township 14 North Range 1 East
> Township 13 North Range 1 East
> Township 12 North Range 1 East
> Township 11 North Range 1 East
> Township 10 North Range 1 East
> Township 9 North Range 1 East (portion located in Cache County)

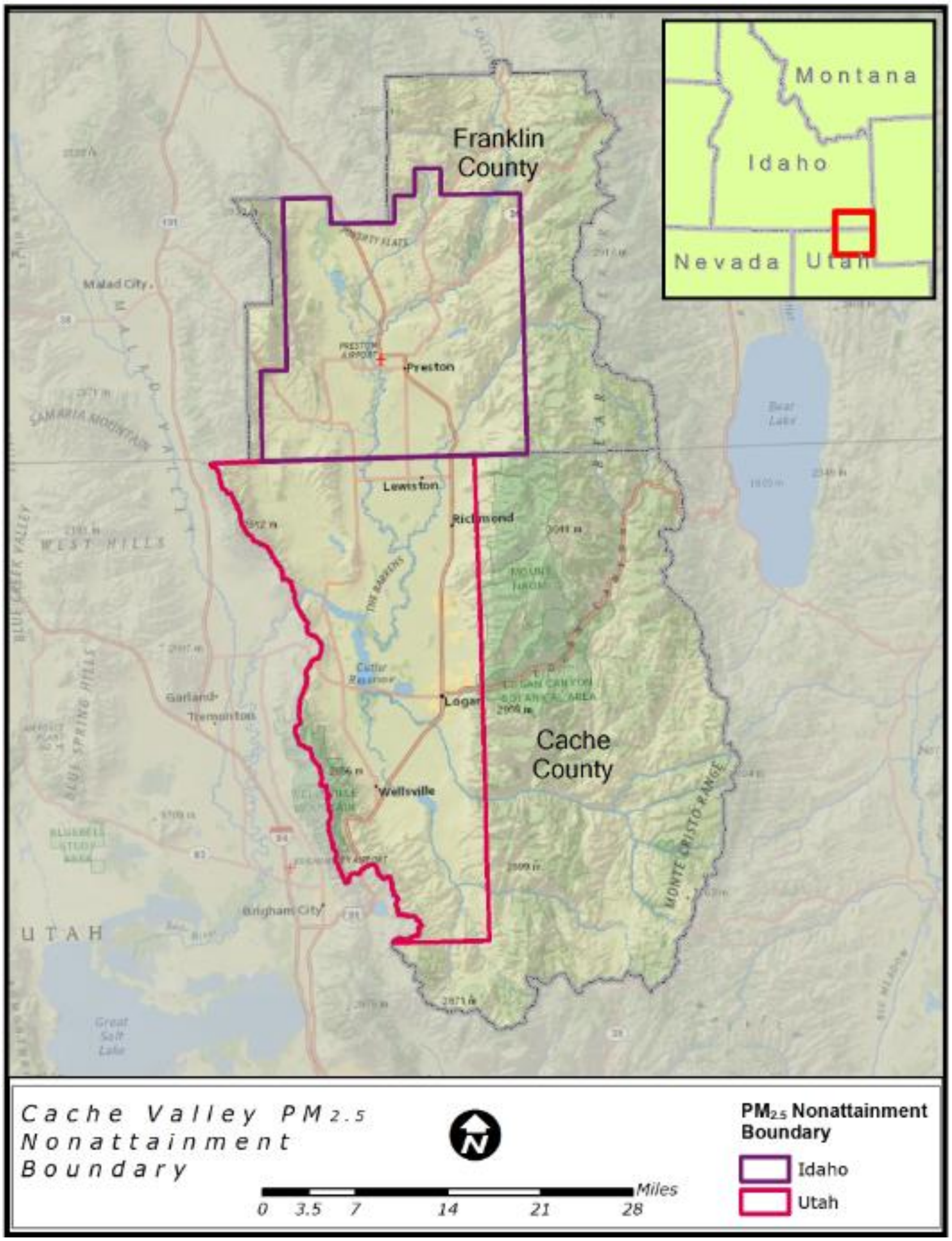

Figure 2. Cache Valley nonattainment area showing the nonattainment area boundary in Idaho and Utah.

1.2.2 Cache Valley Secondary Aerosol Precursors

The majority of ambient $PM_{2.5}$ collected during a typical cold-air pool episode of elevated concentration is secondary particulate matter, born of precursor emissions. The main precursor gases associated with fine particulate matter are discussed in EPA's "Clean Air Particulate Implementation Rule" (72 FR 20586). In accordance with the rule, this SIP specifically addresses emissions of sulfur dioxide (SO_2), nitrogen oxides (NO_x), volatile organic compounds (VOC), and ammonia (NH_3).

1.2.3 Climatology and Meteorology

The weather in Franklin County can be described as a mild northern climate. Summer temperatures average in the high sixties, with days that can exceed 100 degrees Fahrenheit (°F). These hot spells are usually short in duration, or the afternoons are punctuated by clouds and a brief rain shower. Winter temperatures average in the low twenties. Table 1 illustrates these temperature changes.

Table 1. Average weather in Franklin County, Idaho.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Average temp. (ºF)	21.3	26.4	36.6	45.0	53.5	61.9	69.4	68.2	58.6	46.9	33.6	23.3
High temp. (ºF)	30.3	36.6	47.7	57.9	67.5	78.0	87.1	86.1	76.1	62.5	44.6	32.8
Low temp (ºF)	12.2	16.2	25.5	32.1	39.5	45.8	51.6	50.3	41.1	31.3	22.6	13.8
Precipitation (inches)	1.4	1.3	1.5	1.4	2.1	1.2	0.9	1.0	1.3	1.6	1.2	1.3

Note: degrees Fahrenheit (°F).

The mountains surrounding the Cache Valley rise to 8,356 feet above sea level (asl) to the west and 9,900 feet asl to the east. The isolated valley floor ranges from 4,500 to 5,200 feet asl. The mountains trap pollutants in the valley when dispersion conditions are poor.

Excluding wind-blown dust events, wildland fires, and holiday-related fireworks, elevated $PM_{2.5}$ in southern Idaho and Utah occurs when stagnant cold-air pools develop during the winter season. The weather conditions that lead to the formation of cold-air pools in the Cache Valley are synoptic scale (> 600 miles) ridging, subsidence, light winds, snow cover (often), and cool to cold surface temperatures. These conditions occur during winter months, generally mid-November through early March. During a wintertime cold-air pool episode, dispersion is poor due to the very stable air mass, and concentrations of primary and secondary $PM_{2.5}$ elevate because the pollutants are trapped in the cold-air pool. Episodes may last from a few days to tens of days until meteorological conditions change to once again allow for good mixing.

A study of deep stable layers (DSL) in western air basins (Wolyn and McKee 1989) revealed that DSL can cause the stagnation of cold air in basins. In other words, only light winds occur at the surface, even if moderately strong winds aloft are present, and restriction of the growth of daytime convective boundary layers occurs. IDEQ analyzed DSL in the Treasure Valley in southwestern Idaho and found high correlation between DSL and particulate levels in the area. Salt Lake City was found to have a high frequency of DSL occurrence, averaging about 12 days per year in the period from 1959–1983 (Wolyn and McKee 1989). The Cache Valley is most likely under the same stagnation conditions as the Salt Lake City area during most of these periods.

Figure 3, which is from a Utah State University inversion study (Martin 2006), provides an excellent example of correlation between the $PM_{2.5}$ concentration levels and the evolution of the stable layer over the Cache Valley. In Figure 3, blue represents cold air and red indicates warmer air. The solid yellow line represents the ambient $PM_{2.5}$ concentration as measured at the Logan monitoring site. The dotted green line represents the 1997 $PM_{2.5}$ NAAQS. From January 9 through January 17, 2004, the cold-air pool strengthened and deepened each day, eventually reaching a depth of about 5,500 feet asl on January 15 when the $PM_{2.5}$ concentrations peaked. The $PM_{2.5}$ concentration levels rose steadily as trapped pollutants accumulated from each day to the next.

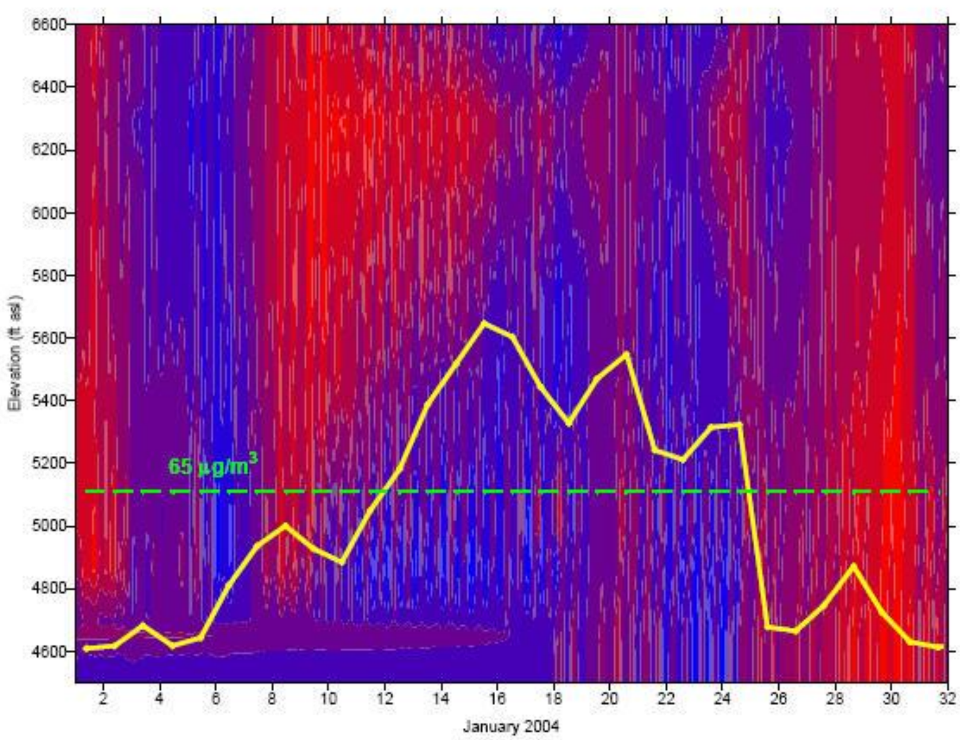

Figure 3. January 2004 temperature contour map with $PM_{2.5}$ concentration levels (yellow line) and 1997 $PM_{2.5}$ National Ambient Air Quality Standards (green line) (Martin 2006).

Under this type of stagnation condition, the pollutants may quickly build, especially in areas like the Cache Valley where airflow is greatly restricted by terrain. Figure 4, also taken from the Utah State University inversion study (Martin 2006), provides an example of inverted temperature profiles in the Cache Valley during the January 2004 extended stagnation episode. During the period from January 1 to January 17, 2004, as shown in the figure, a strong inversion about 1,500 feet thick persistently occupied the area. The record high $PM_{2.5}$ concentration of 132.7 $\mu g/m^3$ was observed at Logan on January 15, 2004. The right-slanted temperature profiles indicate strong temperature inversion from the ground to 6,300 feet asl during the night (the green dotted line represents the adiabatic lapse rate, typical of profiles that occur when temperature inversion is not present). The strong, deep, stable layer persisted through the entire period, even in the afternoon hours (noon and 3 p.m.) when the base of the inversion rose to an average 5,500 feet asl trapping pollutants below this elevation. The average 24-hour $PM_{2.5}$ concentration observed at a Franklin monitor, placed for the study, during this same period was

39.0 µg/m^3, with the highest 24-hour concentration of 82.6 µg/m^3 occurring on January 17, 2005. Thus, it appears that the low afternoon mixing height during stagnation episodes (at approximately 5,500 feet asl) is the controlling factor in accumulating pollutants from day to day.

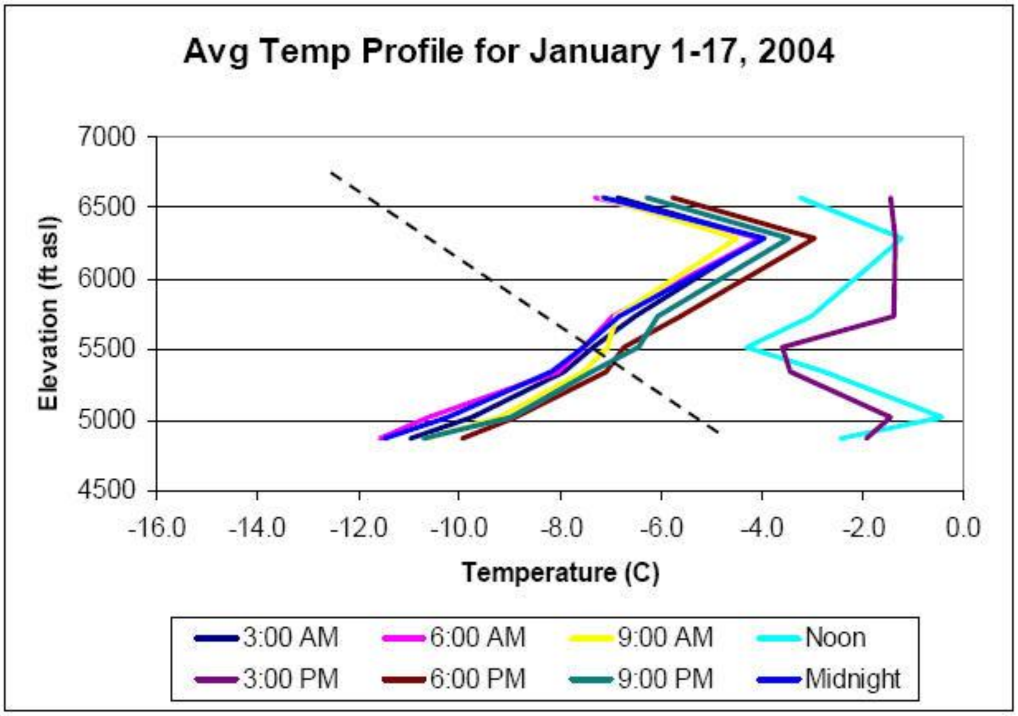

Figure 4. Average temperature profiles in Cache Valley during January 1–17, 2004 (Martin 2006).

2 Air Quality

The basis for determining the air quality of any area is accurate and adequate monitoring data. Data collected from an area's monitoring network are used to establish air quality trends, to determine if and when air quality standards are exceeded, and to aid in developing appropriate air quality control strategies when standards are exceeded. Likewise, because local meteorology plays an important role in the area's air quality, high-quality meteorological data are extremely important in conducting modeling studies and interpreting the results.

2.1 Monitoring Sites

$PM_{2.5}$ ambient air quality monitoring in the Cache Valley has been conducted since 2005 on the Idaho side of the CVNAA and 2000 on the Utah side of the CVNAA. The monitoring is conducted to characterize problems and support air quality improvement planning and analysis. Analysis of the Cache Valley shows that topographical features and wintertime meteorology limit the transport of pollutants into or out of the area. Pollutants emitted within the Cache

Valley (Idaho and Utah) remain trapped. The Cache Valley experiences inversions that build from day to day when strong high-pressure systems are present in the region. Table 2 details the air monitoring locations across the Cache Valley.

Table 2. Cache Valley air quality monitoring site locations.

State	Monitor	Address	EPA-AIRS	Parameters Monitored
Idaho	Franklin	East 4800 South Road	160410001	$PM_{2.5}$, AQI
Utah	Logan–L4	125 W. Center	490050004	$PM_{2.5}$, PM_{10}, O_3, NO_2, SO_2, AQI

Notes: United States Environmental Protection Agency (EPA); aerometric information retrieval system (AIRS); particulate matter (PM); Air Quality Index (AQI); ozone (O_3); nitrogen dioxide (NO_2); sulfur dioxide (SO_2)

The state and local air monitoring stations air quality data are collected from federal reference method (FRM) or federal equivalent method (FEM) monitors that are sited and operated in accordance with 40 CFR Part 58. These data are stored in the EPA Air Quality System (AQS). Procedures for using the data to determine whether a violation has occurred are codified in 40 CFR 50, Appendix N. Data collected at both monitoring sites are used for Air Quality Index (AQI) forecasting. Table 3 details the air quality monitors used in the Cache Valley and the measurement frequency.

Table 3. Specific Cache Valley air quality monitors and measurement frequency.

State	Monitor	Pollutant Monitored	Dates in Operation	Monitoring Frequency	Instrument
Idaho	Franklin	$PM_{2.5}$–FRM	2005–present	Every sixth day (1/6)	R&P Model 2025 Sequential with VSCC
Idaho	Franklin	$PM_{2.5}$–SPM	2010–present	Continuous	Met One beta gauge (BAM)
Utah	Logan	$PM_{2.5}$–FRM	2000–present	Daily	Manual gravimetric
Utah	Logan	$PM_{2.5}$–FEM	2004–present	Continuous	Instrumental TEOM FDMS

Notes: particulate matter (PM); federal reference method (FRM); very sharp cut cyclone (VSCC); special purpose monitor (SPM); beta attenuation monitor (BAM); federal equivalent method (FEM); tapered element oscillating microbalance (TEOM); Filter Dynamic Measurement System (FDMS).

2.1.1 Idaho Monitors

The following are brief descriptions of the $PM_{2.5}$ monitors used by IDEQ in the CVNAA. The Partisol Plus 2025 Sequential Ambient Particulate Sampler is an FRM, while the beta attenuation monitor (BAM) is listed as a special purpose monitor (SPM).

2.1.1.1 Partisol Plus 2025 Sampler

The Partisol Plus 2025 Sequential Ambient Particulate Sampler is an FRM sampler for $PM_{2.5}$. The unit measures $PM_{2.5}$ on 47-millimeter filter cassettes contained in removable magazine cartridges. The Partisol Plus 2025 is a performance-based stand-alone unit that meets EPA’s guidelines for manual air samplers.

2.1.1.2 Beta Attenuation Monitor-1020

The BAM 1020 automatically measures and records airborne particulate concentrations levels ($\mu g/m^3$) using the principle of beta ray attenuation. The BAM 1020 (properly equipped) can be an FEM, and data collected by the BAM 1020 are suitable for NAAQS compliance monitoring. The BAM 1020 is a continuous monitor, providing hourly-averaged data, which makes it useful for air quality forecasting, air quality index reporting, and NAAQS compliance determinations.

2.2 Air Quality Data

$PM_{2.5}$ standards are based on averaging air quality measurements both annually and on a 24-hour basis. The annual standard is designed to provide an appropriate level of protection from long-term exposures to $PM_{2.5}$. The annual standard for $PM_{2.5}$ is met whenever the 3-year average of the annual mean $PM_{2.5}$ concentrations for designated monitoring sites in an area is less than or equal to 15 $\mu g/m^3$. The 24-hour standard is designed to provide an appropriate level of protection from short-term exposures to $PM_{2.5}$. The 24-hour standard for $PM_{2.5}$ is met whenever the 3-year average of the annual 98th percentile of values at designated monitoring sites in an area is less than or equal to 35 $\mu g/m^3$. Sampling may not occur every day, so the number of days with measured values above the standard must be adjusted to account for days that were not sampled. The 98th percentile is the daily value out of a year of $PM_{2.5}$ monitoring data below which 98% of all daily values fall. IDEQ submits all air quality data to EPA, through the AQS.

The analysis of the $PM_{2.5}$ data for the monitoring sites across the valley shows violations of the 24-hour $PM_{2.5}$ NAAQS on both the Utah and the Idaho sides of the CVNAA. Both the Utah and Idaho sides of the CVNAA attain the annual $PM_{2.5}$ standard.

2.2.1 Idaho Summary

Figure 5 details the 98th percentile monitoring data for the Franklin County air quality monitor. The 2010 data should not be considered representative of the area; due to upgrades to the Franklin sewage lagoons, the area was without power for a considerable portion of the year. During 2010, none of the quarters for data collection met EPA criteria for data completeness. However, for the 24-hour standard, years with less than complete data are considered valid if the resulting 98th percentile for that year is greater than the standard.

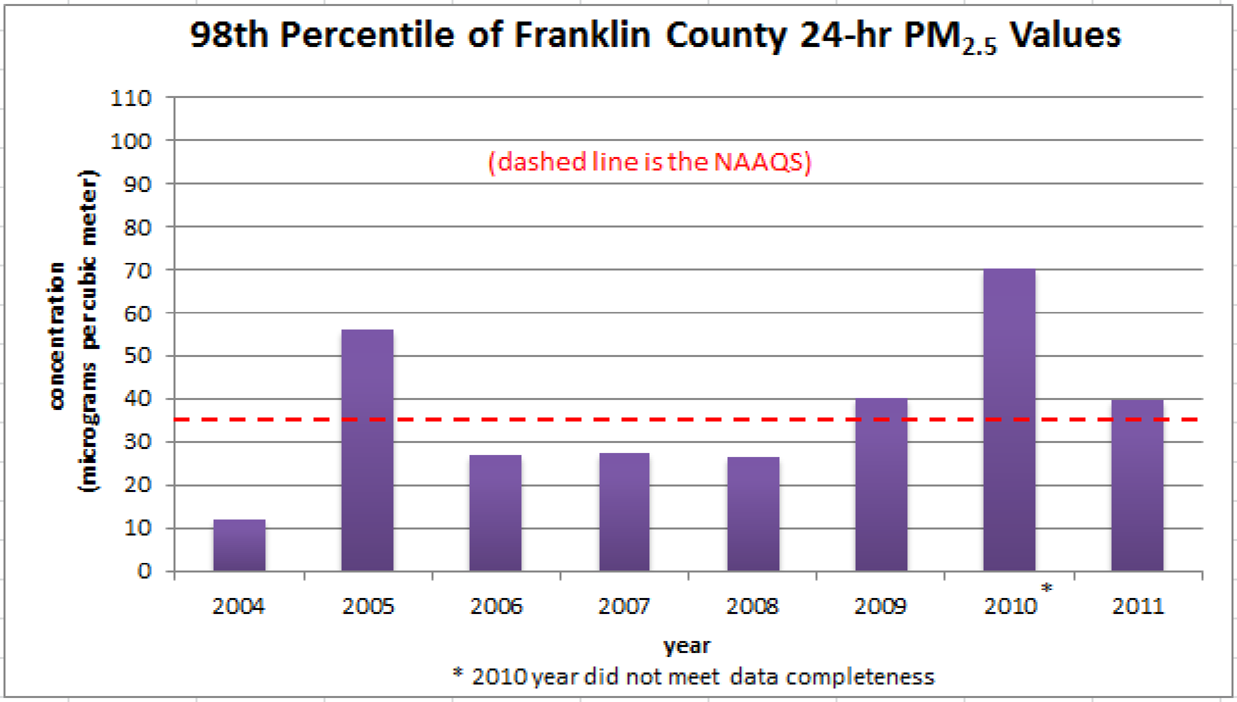

Figure 5. The 98th percentile of Franklin County 24-hour $PM_{2.5}$ values.

Figure 6 shows the annual average $PM_{2.5}$ monitoring data for the Franklin County air quality monitor. From 2004 through 2011, Franklin County has met the annual NAAQS.

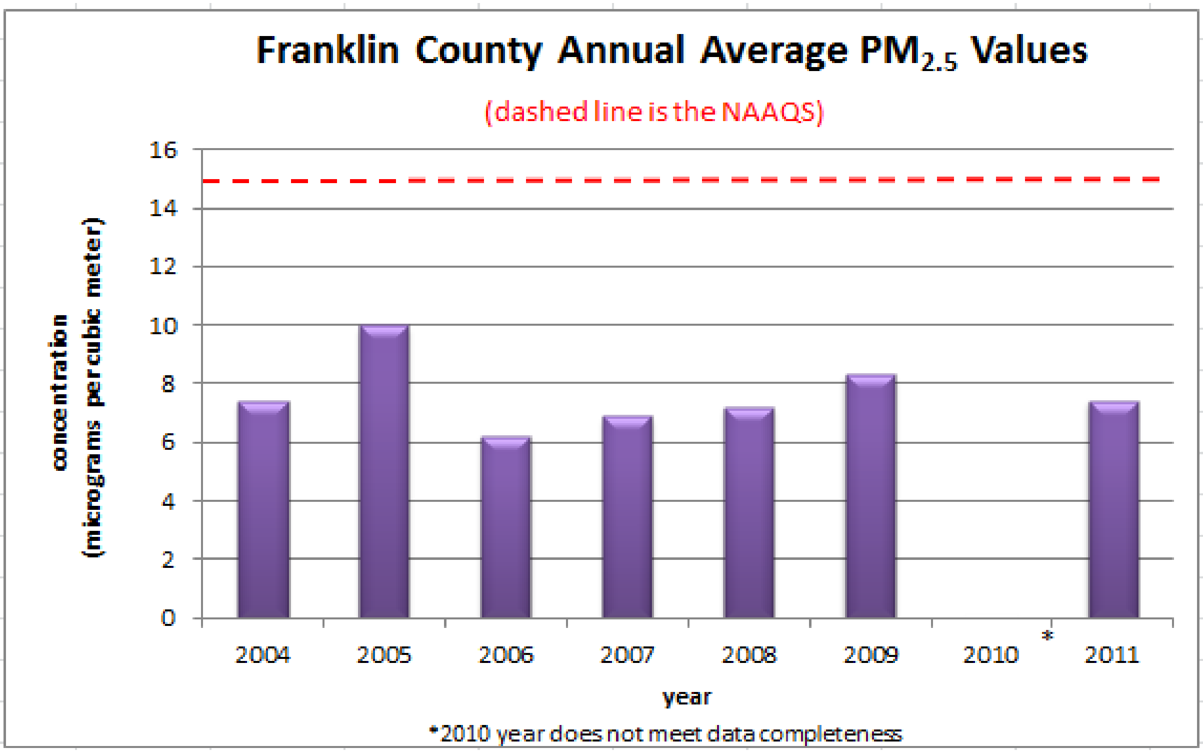

Figure 6. Franklin County annual average $PM_{2.5}$ values.

2.2.2 Utah Summary

Figure 7 details the 98th percentile monitoring data for the Cache County (Logan) air quality monitor, and Figure 8 presents the annual air quality data. From 2005 to 2011, the annual standard has been attained.

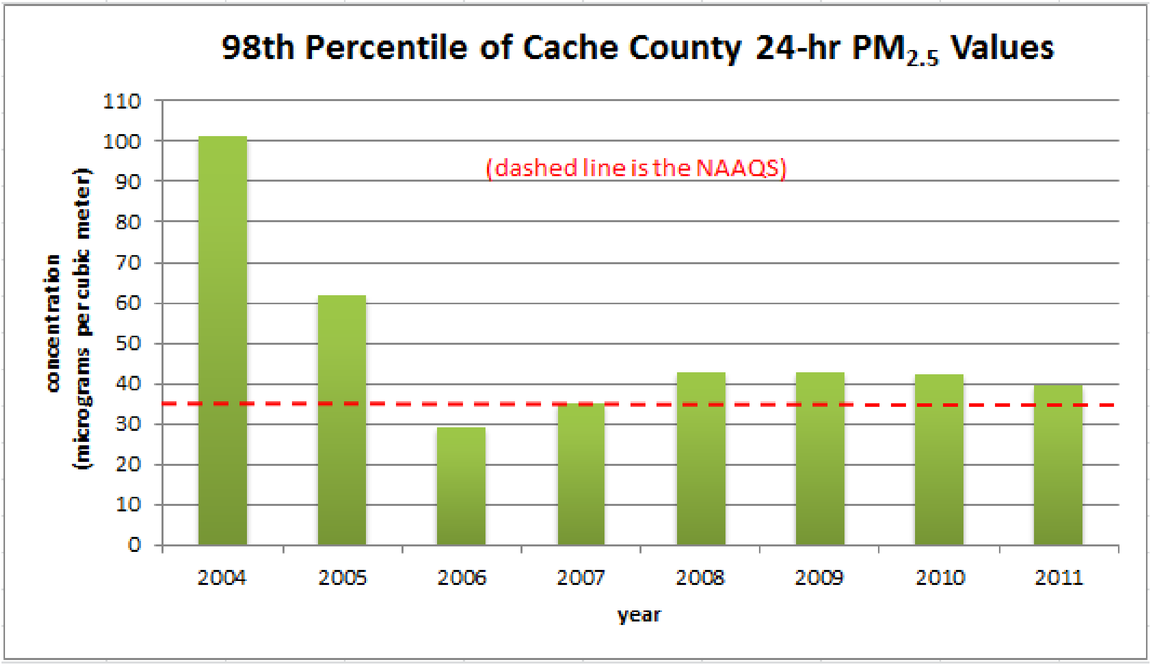

Figure 7. The 98th percentile of Cache County 24-hour $PM_{2.5}$ values.

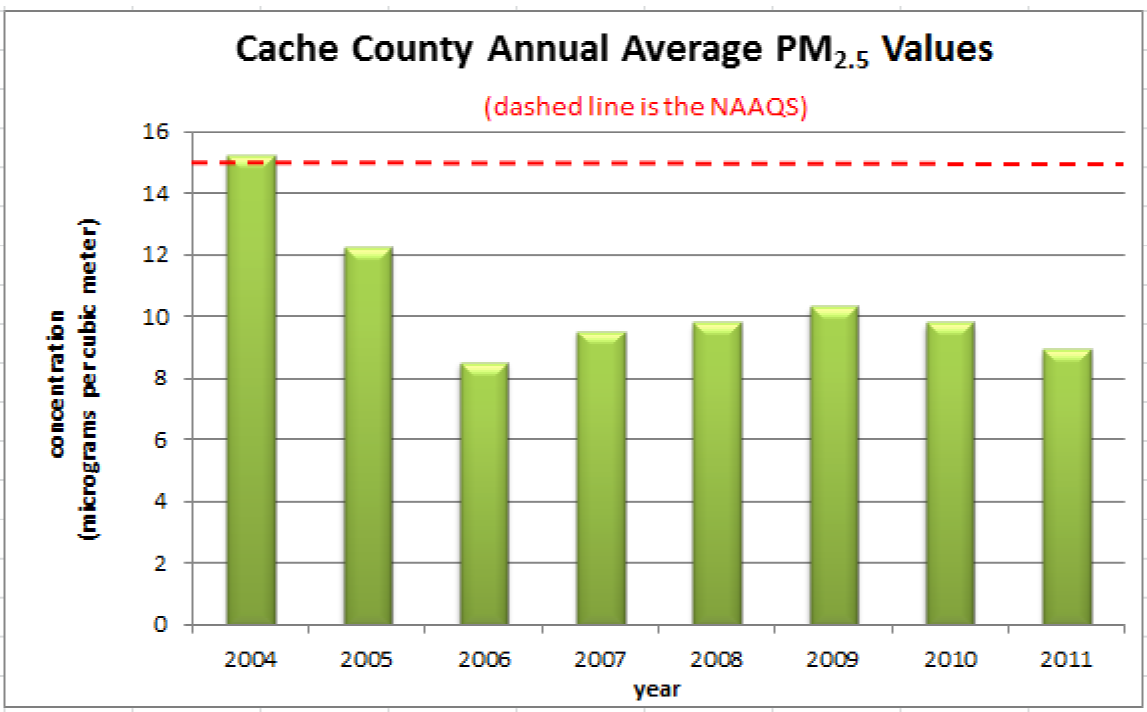

Figure 8. Cache County annual average $PM_{2.5}$ values.

2.3 Meteorological Data during High $PM_{2.5}$ Events Summary

Elevated 24-hour $PM_{2.5}$ concentrations in the Cache Valley have been observed during the wintertime, typically from November through February, throughout the airshed. Analysis of the $PM_{2.5}$ air quality data suggests local meteorological conditions often played a significant role during these episodes by providing adverse dispersion conditions or favoring the formation of secondary aerosols. During these periods, the stable layer above the ground is much deeper than a typical nocturnal inversion. Cold air is trapped in the basins, and the air mass stabilizes as high pressure aloft overtakes the region. Under such circumstances, a prolonged strong inversion layer (or layers) limits vertical mixing, trapping local pollutants in a thin layer against the valley floor. The low sun angle, short length of the days during winter months, and strong likelihood of snow cover to reflect the solar radiation are all factors that limit daytime surface heating and aggravate the situation. As a result, some inversions may not break for many days. For additional information pertaining to the meteorological conditions, see Section 1.2.3 Climatology and Meteorology.

Figure 9 through Figure 14 illustrate the seasonal nature of the air quality issues in the Cache Valley. These figures also show that, with very few exceptions, the concentrations measured in Franklin County are lower than those measured in Cache County.

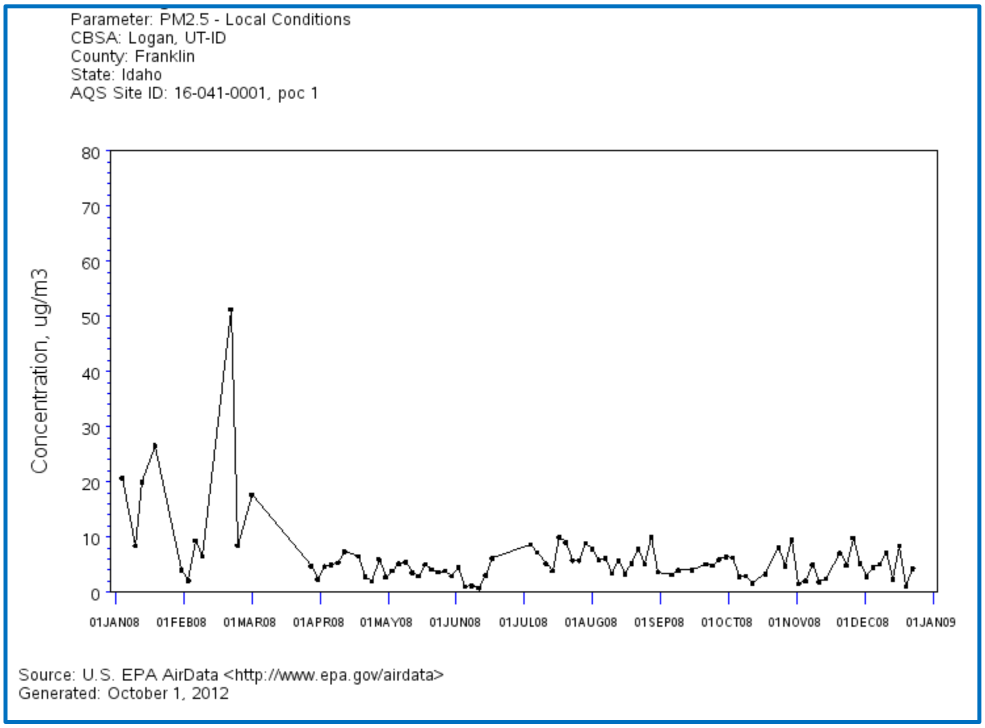

Figure 9. Franklin County daily mean $PM_{2.5}$ concentrations from January 1, 2008 to December 31, 2008.

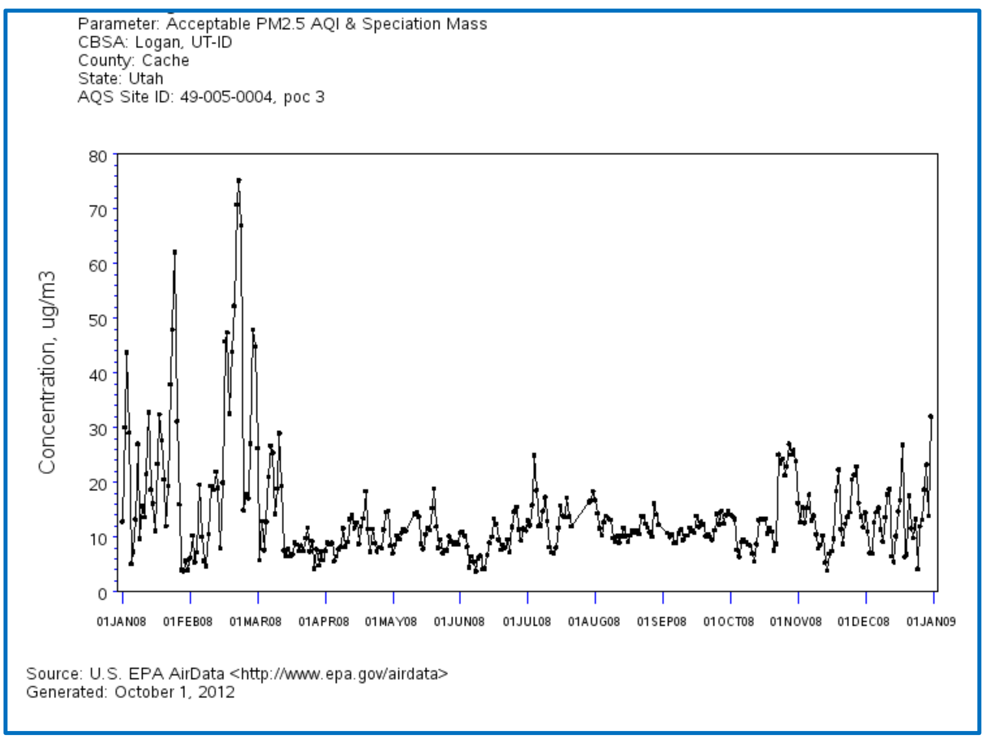

Figure 10. Cache County daily mean $PM_{2.5}$ concentrations from January 1, 2008 to December 31, 2008.

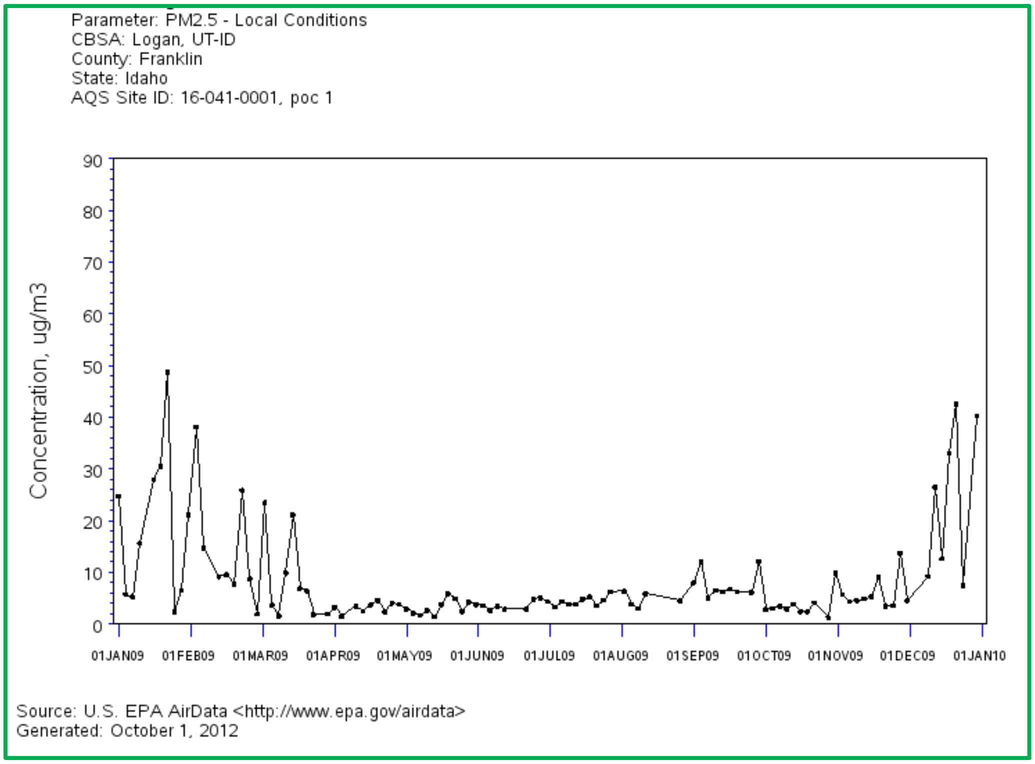

Figure 11. Franklin County daily mean $PM_{2.5}$ concentrations from January 1, 2009 to December 31, 2009.

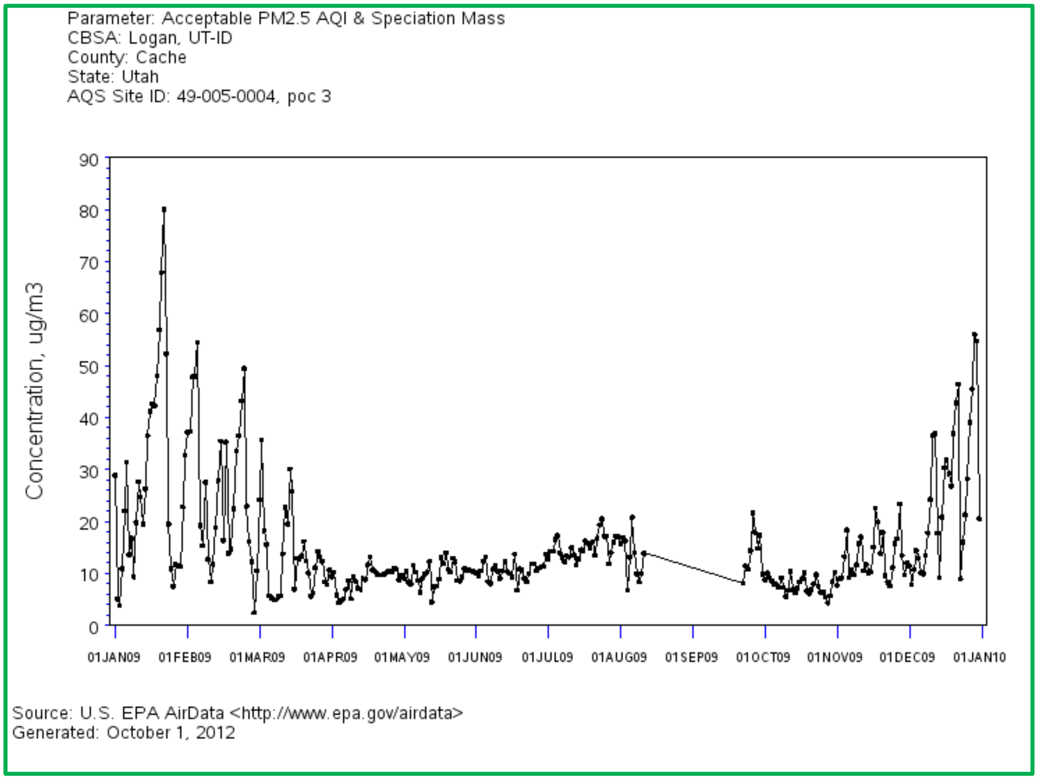

Figure 12. Cache County daily mean $PM_{2.5}$ concentrations from January 1, 2009 to December 31, 2009.

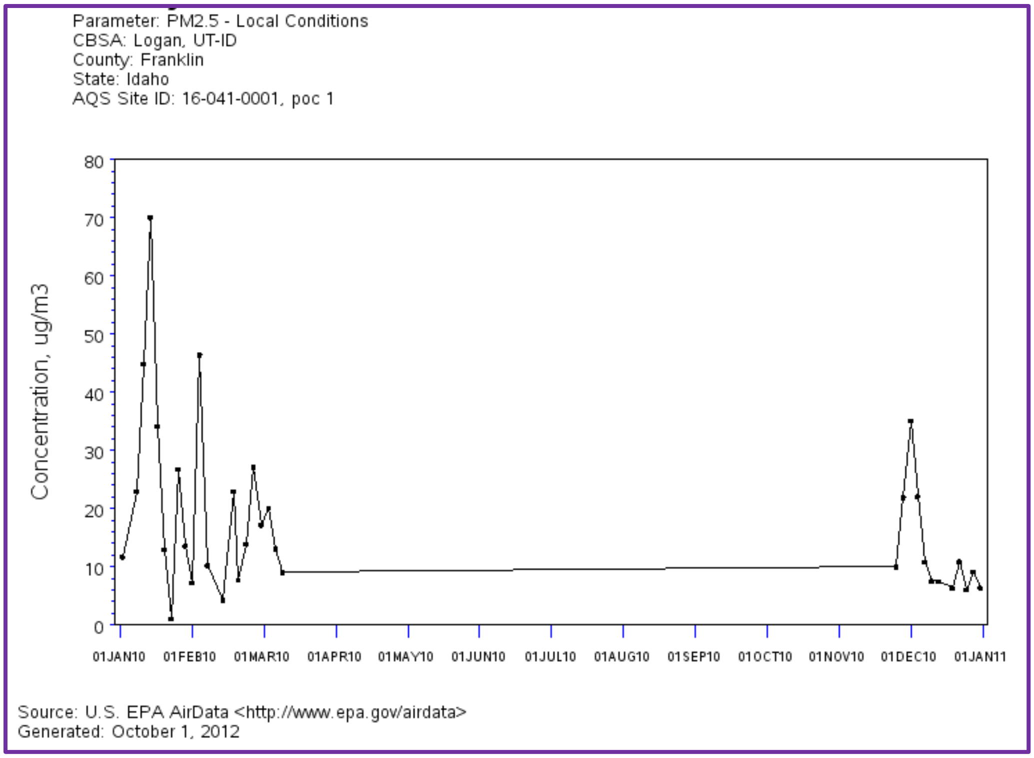

Figure 13. Franklin County daily mean $PM_{2.5}$ concentrations from January 1, 2010 to December 31, 2010.

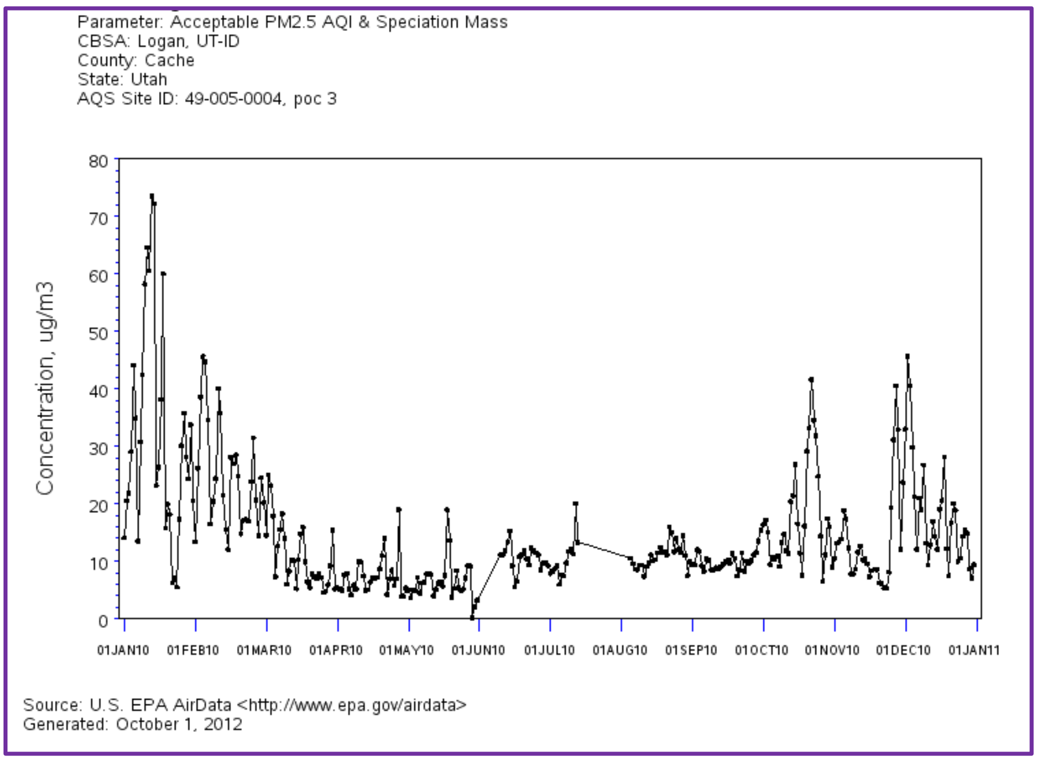

Figure 14. Cache County daily mean $PM_{2.5}$ concentrations from January 1, 2010 to December 31, 2010.

2.4 Correlation between Utah and Idaho Monitors

Figure 15 shows the correlation between the Logan, Utah, and the Franklin, Idaho, monitors. These monitors are used to forecast the AQI for both sides of the Cache Valley. The correlation coefficient, R^2, of 0.9002 shows good correlation between the two continuous monitors during the winter months.

The data in Figure 16 show that both of the real-time monitors over-predict the actual $PM_{2.5}$ concentrations in the Cache Valley. This over-prediction is more significant during warm weather (summer months) than during the cold weather (winter months).

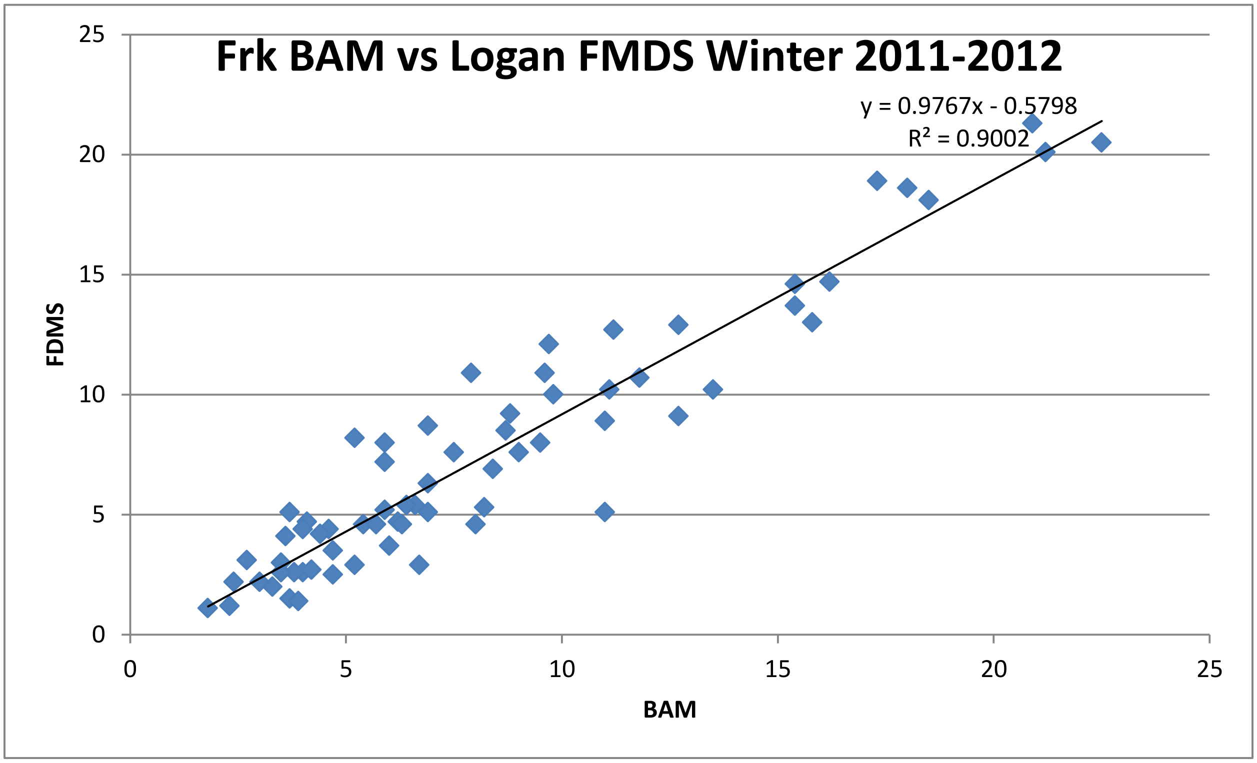

Figure 15. Correlation between the Franklin beta attenuation monitor and the Logan Filter Dynamic Measurement System monitor for winter 2011–2012.

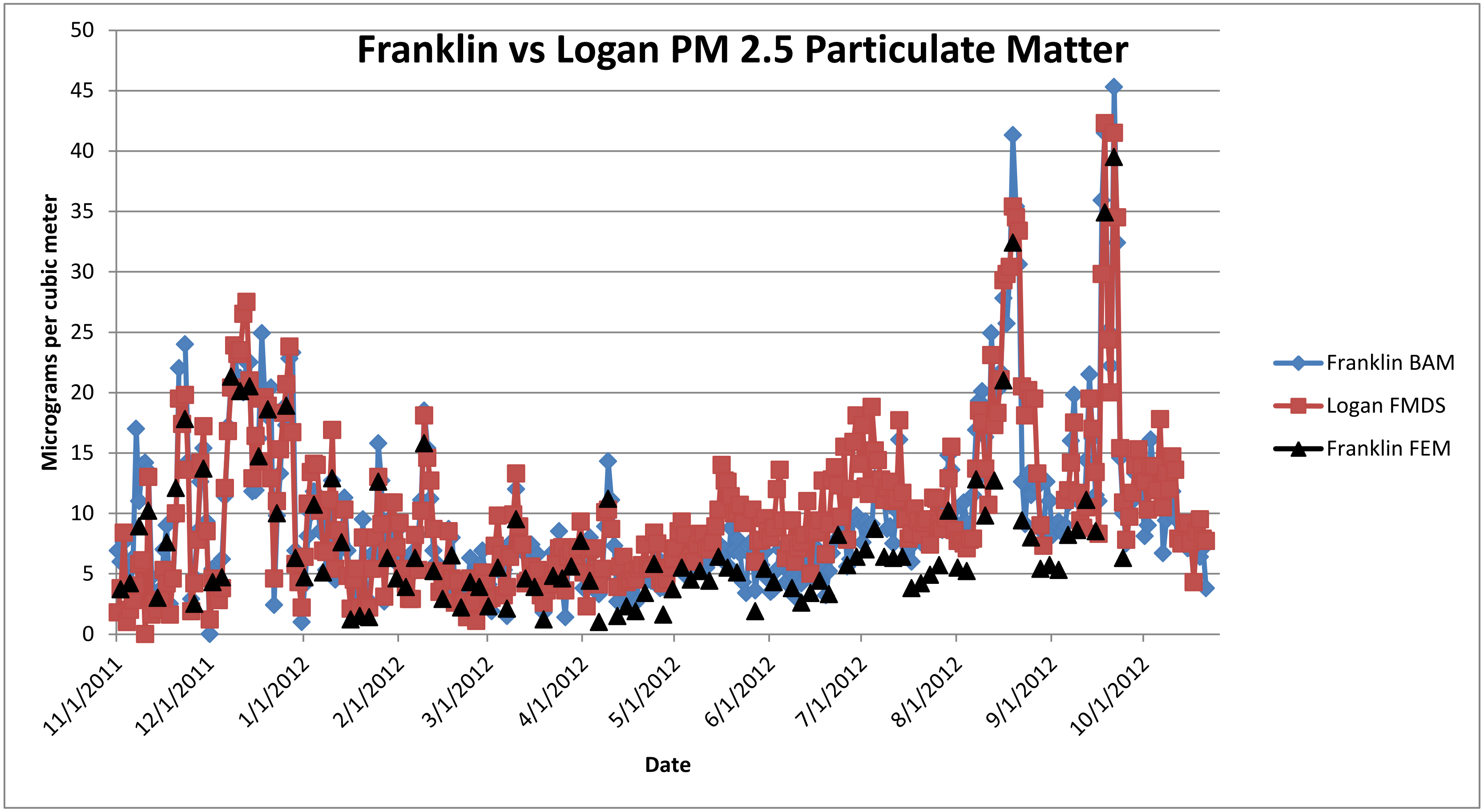

Figure 16. Franklin versus Logan $PM_{2.5}$ concentrations.

2.5 Special Studies

To understand the contributions of various types of emissions sources and secondary aerosol formation to the total $PM_{2.5}$ concentrations in the Cache Valley, the following special studies have been conducted:

- $PM_{2.5}$ saturation studies–Utah State University
- Speciated monitoring data—Utah Division of Air Quality (UDAQ)

2.5.1 $PM_{2.5}$ Saturation Studies

Utah State University conducted a study of the homogeneity of PM_{10} in Cache Valley in 2002-2003 and a study of the homogeneity of $PM_{2.5}$ in 2003–2004 (Appendix A). In addition to the permanent UDAQ air quality monitoring site in Logan, 17 sites measuring $PM_{2.5}$ concentrations were established in Cache Valley. Measurements of $PM_{2.5}$ concentrations were made every 6 days from November 2003 to February 2004. Several temperature inversions developed during the course of the study with $PM_{2.5}$ concentrations in Logan ranging from 3 $\mu g/m^3$ to 128 $\mu g/m^3$. In general, the study found that $PM_{2.5}$ concentrations were homogenous throughout the Cache Valley.

On days with $PM_{2.5}$ concentrations < 65 $\mu g/m^3$, mean $PM_{2.5}$ concentrations at 11 of the 17 sites had values within 20% of the mean $PM_{2.5}$ concentration for the entire valley. $PM_{2.5}$ concentrations were generally most homogenous throughout Cache Valley on days when $PM_{2.5}$ concentrations were > 65 $\mu g/m^3$. On these high $PM_{2.5}$ days (> 65 $\mu g/m^3$), mean $PM_{2.5}$ concentrations at only two sites were statistically different from the mean $PM_{2.5}$ concentration for all of Cache Valley. The study concluded that $PM_{2.5}$ concentrations in Cache Valley were homogenous, within a 95% confidence interval, during the winter 2003–2004.

2.5.2 Fine Particle Pollution Composition—Speciated Monitoring Data

UDAQ operates three $PM_{2.5}$ speciation sites. The Hawthorne site in Salt Lake County is one of 54 Speciation Trends Network (STN) sites operated nationwide on an every-third-day sampling schedule. Sites at Bountiful/Viewmont in Davis County and Lindon in Utah County are state and local air monitoring station $PM_{2.5}$ speciation sites that operate on an every-sixth-day sampling schedule. Samples are collected for particulate mass, elemental analysis, identification of major cations and anions, and concentrations of elemental and organic carbon as well as crustal material present in $PM_{2.5}$. Carbon sampling and analysis changed in 2007 to match the interagency monitoring of protected visual environments (IMPROVE) method using a modified IMPROVE sampler at all sites.

Data from the STN show the importance of volatile secondary particulates during the colder months. Speciation monitoring during the winter high-pollution episodes produced similar results in $PM_{2.5}$ composition each year. The results of the speciation studies lead to the conclusion that the exceedances of the $PM_{2.5}$ NAAQS are a result of the increased portion of the secondary $PM_{2.5}$ that was chemically formed in the air and not emitted directly into the troposphere. While none of the speciation sites were in the Cache Valley, data from these sites were used by UDAQ in their overall model validation process. Figure 17 and Figure 18 show the contribution of the identified compounds from the speciation sampler during a winter atmospheric inversion period (Figure 17) and during a clear winter period (Figure 18) at the Hawthorne (HW) site.

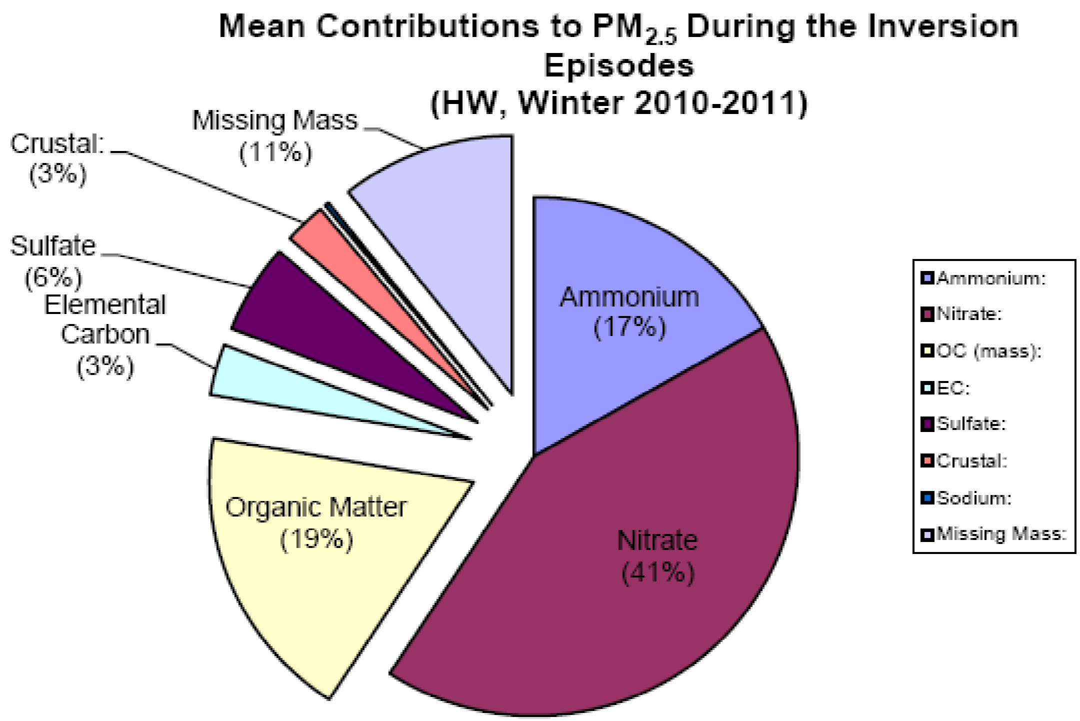

Figure 17. Composite wintertime $PM_{2.5}$ speciation profile during an inversion period.

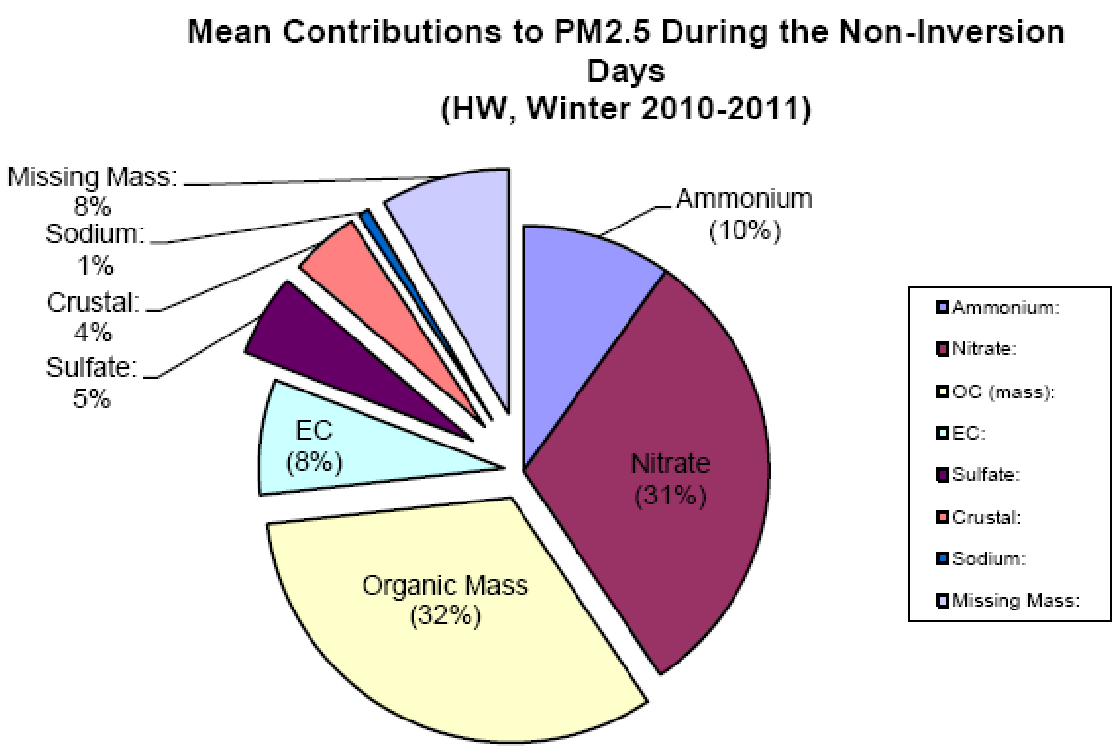

Figure 18. Composite wintertime $PM_{2.5}$ speciation profile during a clear period.

2.6 Design Value Determination—24-Hour Standard

Design values are the metrics that are compared to the NAAQS to determine compliance. For the 24-hour standard, the design value is the 3-year average of annual 98th percentile, 24-hour average values. The 24-hour $PM_{2.5}$ NAAQS is met when the design value is less than or equal to 35 $\mu g/m^3$. Years with less than complete data, like 2010, are considered valid if the resulting 98th percentile for that year is greater than the standard. The 3-year average, 24-hour $PM_{2.5}$ design values for the Franklin County monitor and Cache County monitor are shown in Figure 19 and Figure 20, respectively.

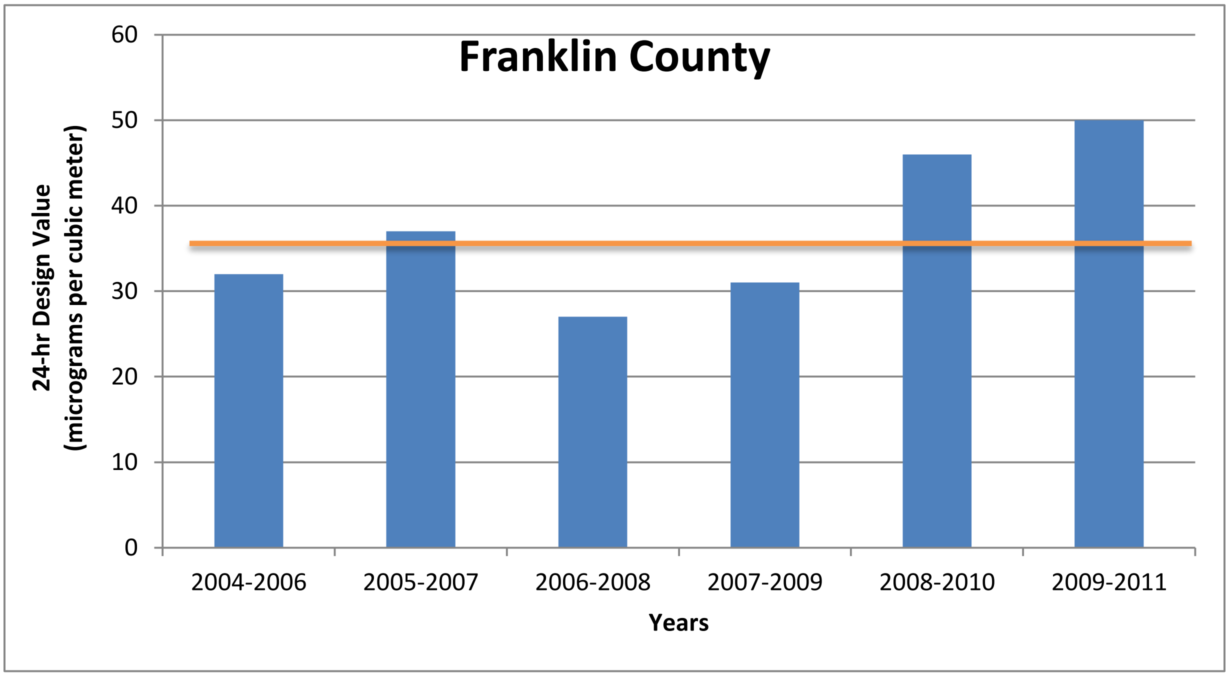

Figure 19. Franklin County running 24-hour $PM_{2.5}$ design values.

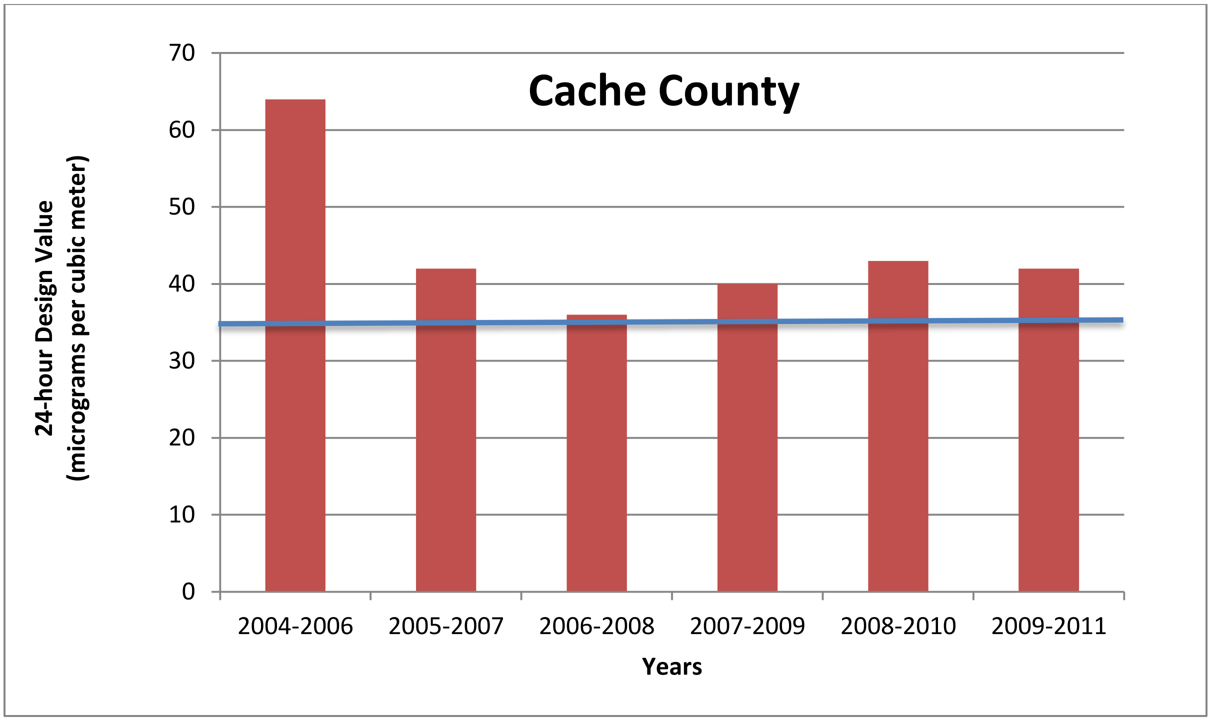

Figure 20. Cache County running 24-hour $PM_{2.5}$ design values.

EPA recommends an average of three such 3-year averages that straddle the baseline inventory be used to calculate the monitored baseline value. The year 2008 is represented by the baseline inventory. Therefore, the 3-year average of 98th percentile values collected from 2006–2008 would be averaged together with the 3-year averages from 2007–2009 and 2008–2010 to arrive at the site-specific monitored baseline design value.

For this SIP, the baseline design value concentration for the Utah side of the CVNAA is 39.5 $\mu g/m^3$ and is 34.7 $\mu g/m^3$ for the Idaho side of the CVNAA. The SIP demonstrations will be based on the Utah design value because it is the highest in the NAA.

3 Emissions Inventory

A detailed emissions inventory using the best information available was prepared for the Cache Valley airshed to assess direct $PM_{2.5}$ emissions as well as emissions of precursors to secondary $PM_{2.5}$ formation. The inventory addresses industrial (or point) sources, on-road mobile sources (cars, trucks, and buses), nonroad mobile sources (planes, trains, boats, off-road vehicles, construction equipment, agricultural equipment, generators, lawn care equipment, and other assorted equipment), and area sources (sources of emissions not captured in the previous categories). Emissions inventory information pertinent to Franklin County is summarized in this section. Additional details concerning the technical analysis, including links to UDAQ documents, for this SIP can be found in Appendix B.

The modeling analysis used to support this SIP considers a regional domain that encompasses three distinct airsheds belonging to three distinct $PM_{2.5}$ NAAs; CVNAA, central Wasatch Front (Salt Lake City, Utah, NAA), and the southern Wasatch Front (Provo, Utah, NAA).

The inventories developed for each of these three areas illustrate many similarities but also a few notable differences. All three areas are more or less dominated by a combination of on-road mobile and area sources. However, emissions from large point sources are nonexistent in the Cache Valley. These emissions sources are situated along the Wasatch Front, and primarily influence the Salt Lake City NAA. Conversely, most of the agricultural emissions are located in Cache Valley.

Various time horizons are significant to developing the emissions inventories for this SIP. The first is the emissions inventory base year. This year is selected to represent the time(s) when exceedances were measured and will serve as the basis for modeling and control strategy evaluation. The episodes studied as part of this SIP occurred in 2007, 2008, 2009, and 2010. Another important horizon is the attainment date.

3.1 Seasonal Adjustment

Prior to use in the air quality model, the emissions are preprocessed to account for seasonality because all attainment modeling reflects the winter stagnation episodes when secondary $PM_{2.5}$ formation dominates. These temporal adjustments also account for daily and weekly activity patterns that affect the generation of these emissions. To acknowledge the episodic and seasonal nature of Utah's elevated $PM_{2.5}$ concentrations, inventory information presented here, unless otherwise noted, reflects the temporal adjustments made prior to air quality modeling. These adjustments make more appropriate use of the inventories for such purposes as correlating measured $PM_{2.5}$ concentrations, evaluating control strategies, establishing budgets for transportation conformity, and tracking rates of progress.

3.2 2008 Baseline Emissions Inventory

The basis for this SIP was the 2008 triannual National Emissions Inventory (NEI). This inventory represented, at the time it was selected for use, the most recent comprehensive inventory compiled by both Idaho and Utah. In addition to the large major point sources that are required to report emissions every year, the triannual inventories consider emissions from many more, smaller point sources. These inventories were collected in accordance with state and federal rules that ensure proper methods and comprehensive quality assurance. Thus, to develop other inventories for each of the years discussed in section 3, the 2008 inventory was either back-cast and adjusted for certain episodic conditions, or forecast to represent more typical conditions.

3.2.1 On-Road Mobile Emissions Inventory

Idaho's 2008 NEI included on-road mobile emissions estimated using EPA's MOBILE6.2 and paved road dust emissions using an estimation method recommended by the AP-42 Air Pollutant Emission Factors (EPA 1996). Since the completion of that inventory, EPA released the Motor Vehicle Emission Simulator (MOVES) model and required that the model be used for SIPs and conformity analyses by March 2012. As a result, IDEQ developed new on-road emissions estimates for NO_x, VOCs, and exhaust, brake wear, and tire wear direct particulate emissions, using the MOVES2010a model for Franklin County and the other 10 Idaho counties within or partly within the UDAQ's photochemical modeling domain. This effort was conducted independently of the UDAQ MOVES modeling effort, using detailed traffic information from the Idaho Transportation Department (ITD) automatic traffic recorders, and detailed Idaho weather conditions for each Idaho county. Nevertheless, the on-road emission estimates for Idaho counties were in close agreement with those UDAQ developed for Utah counties, when adjusted for population. The MOVES modeling is described in Appendix C.

In addition to the revised vehicle emissions, EPA released an improved estimation procedure for paved road dust emissions in January 2011. This procedure provides the capability of more explicitly modeling wintertime episodic road dust emissions that reflect more realistic road dust levels following winter storms when sand is applied and the dust suppression effects of precipitation (EPA 2011). Since these enhancements are critical to obtaining realistic road dust estimates during winter episodes, consistent with UDAQ emission estimation methods, IDEQ developed new paved road dust estimates for Franklin County and the other Idaho counties in the photochemical modeling domain, using the January 2011 EPA methodology. Paved road dust emissions calculations are described fully in Appendix C.

3.2.2 Emissions Inventory Results Summary

Figure 21 through Figure 25 illustrate the emissions contributions from source categories representing the majority of emissions of primary $PM_{2.5}$ and precursor gases. The same scale was used for the precursor gases to provide perspective on their relative contributions. Because primary $PM_{2.5}$ concentrations do not depend on atmospheric chemistry, the emissions rate scale differs to better show detail. This information was used to determine which pollutants and source categories should be the focus of control efforts. For this SIP, Idaho considered both the absolute and relative amount of pollutants contributed by Idaho sources. See Appendix C for details regarding Figure 24.

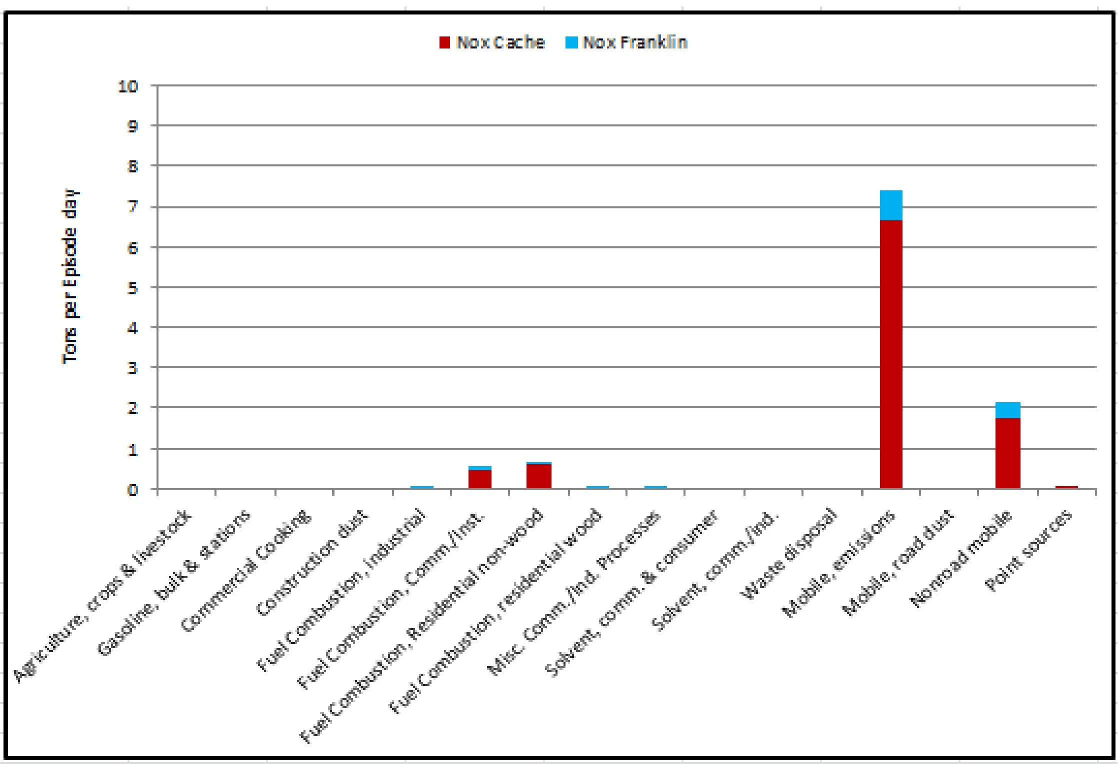

Figure 21. Nitrogen oxide emission totals sorted by source type and county.

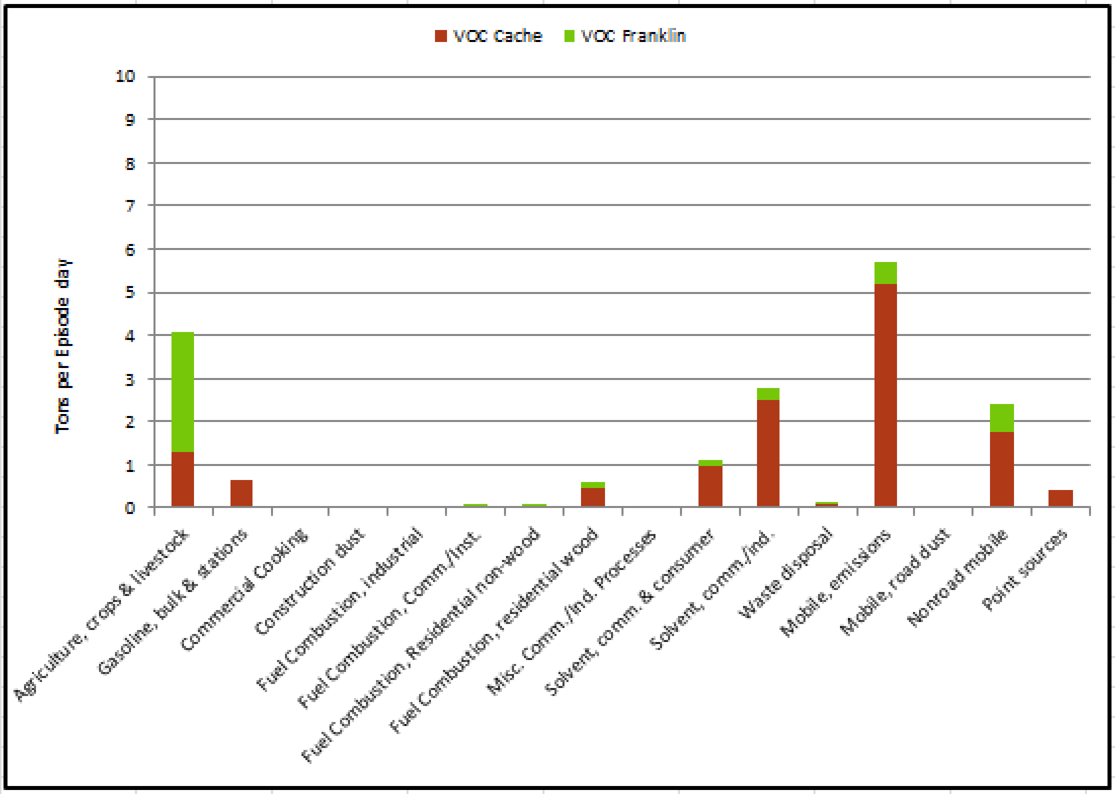

Figure 22. Volatile organic compound emission totals sorted by source type and county.

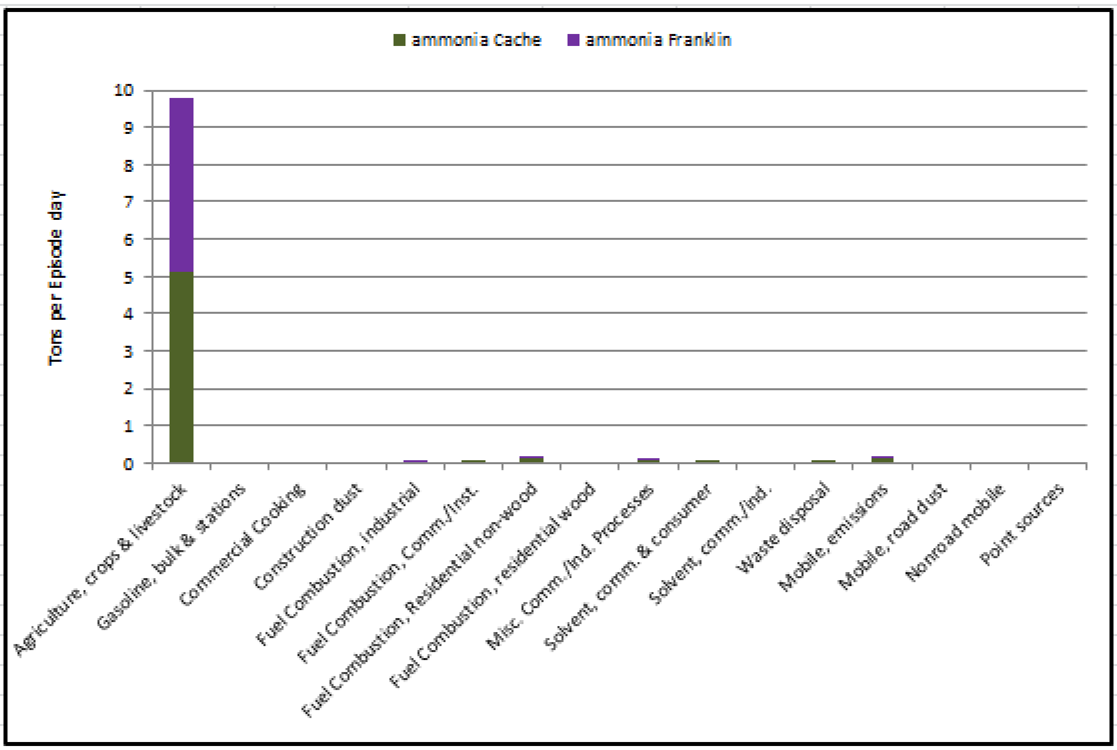

Figure 23. Ammonia emission totals sorted by source type and county.

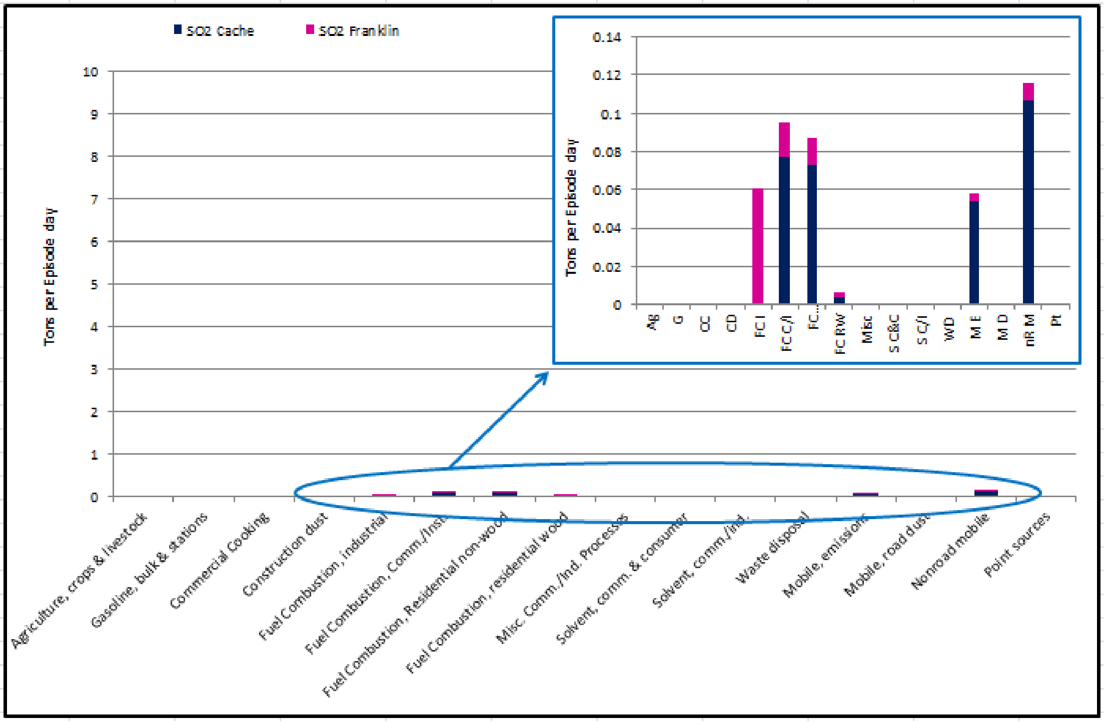

Figure 24. Sulfur dioxide emission totals sorted by source type and county.

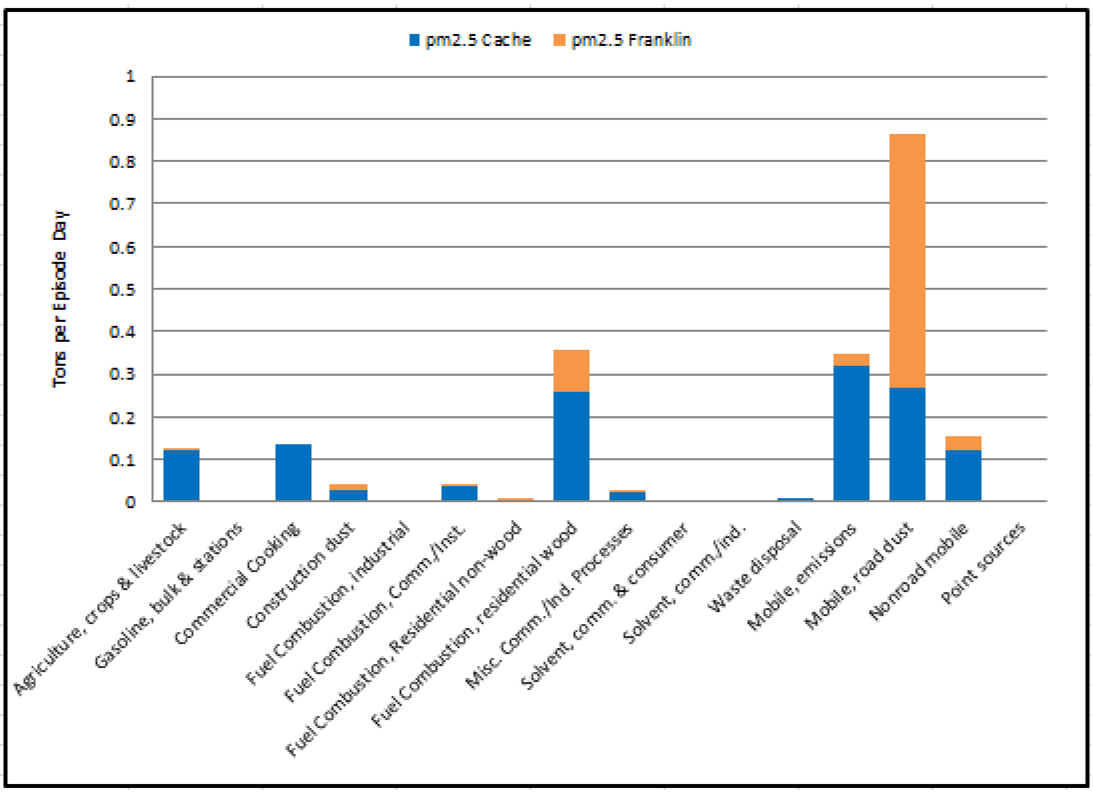

Figure 25. $PM_{2.5}$ emission totals sorted by source type and county.

3.2.3 Primary $PM_{2.5}$ Emissions

Figure 26 represents the relative $PM_{2.5}$ emissions contributions for the entire CVNAA; the emissions presented here are for all source types emitting primary $PM_{2.5}$ and include both Cache County, Utah, and Franklin County, Idaho. The three top contributors to $PM_{2.5}$ across the CVNAA were mobile dust (38%) mainly from road sanding, mobile emissions (24%) from tailpipe emissions, and residential wood combustion (18%).

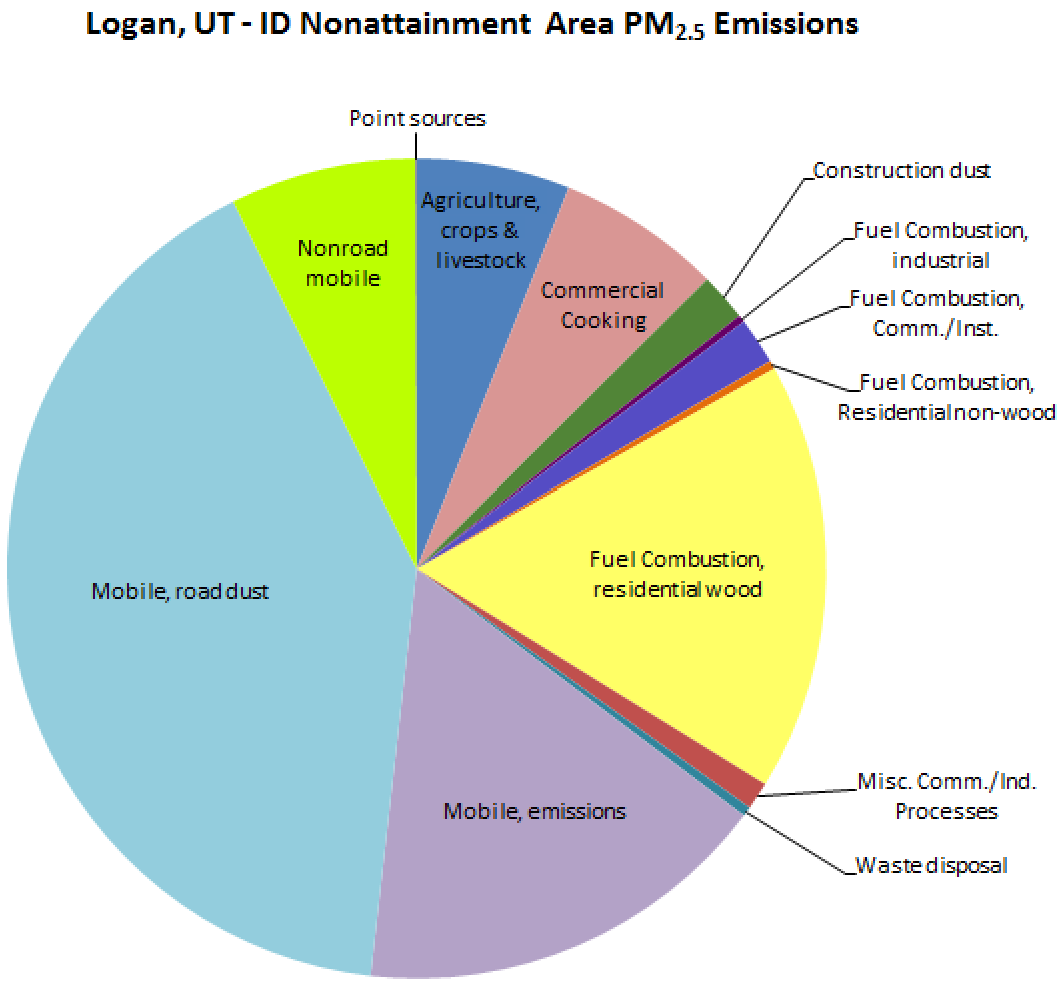

Figure 26. $PM_{2.5}$ emissions from all source types (area, point, and mobile) for the entire nonattainment area including Utah and Idaho emissions.

On the Utah side of the CVNAA (Figure 27), the same source categories were the top $PM_{2.5}$ contributors—mobile emissions (34%), residential wood combustion (RWC) (21%), and mobile dust (20%). Figure 28 depicts the same three top source categories but at much different percentages. In rural Idaho, mobile dust from road sanding accounts for 70% of all directly emitted $PM_{2.5}$, while residential wood combustion accounts for 14%, and mobile emissions account for only 6%.

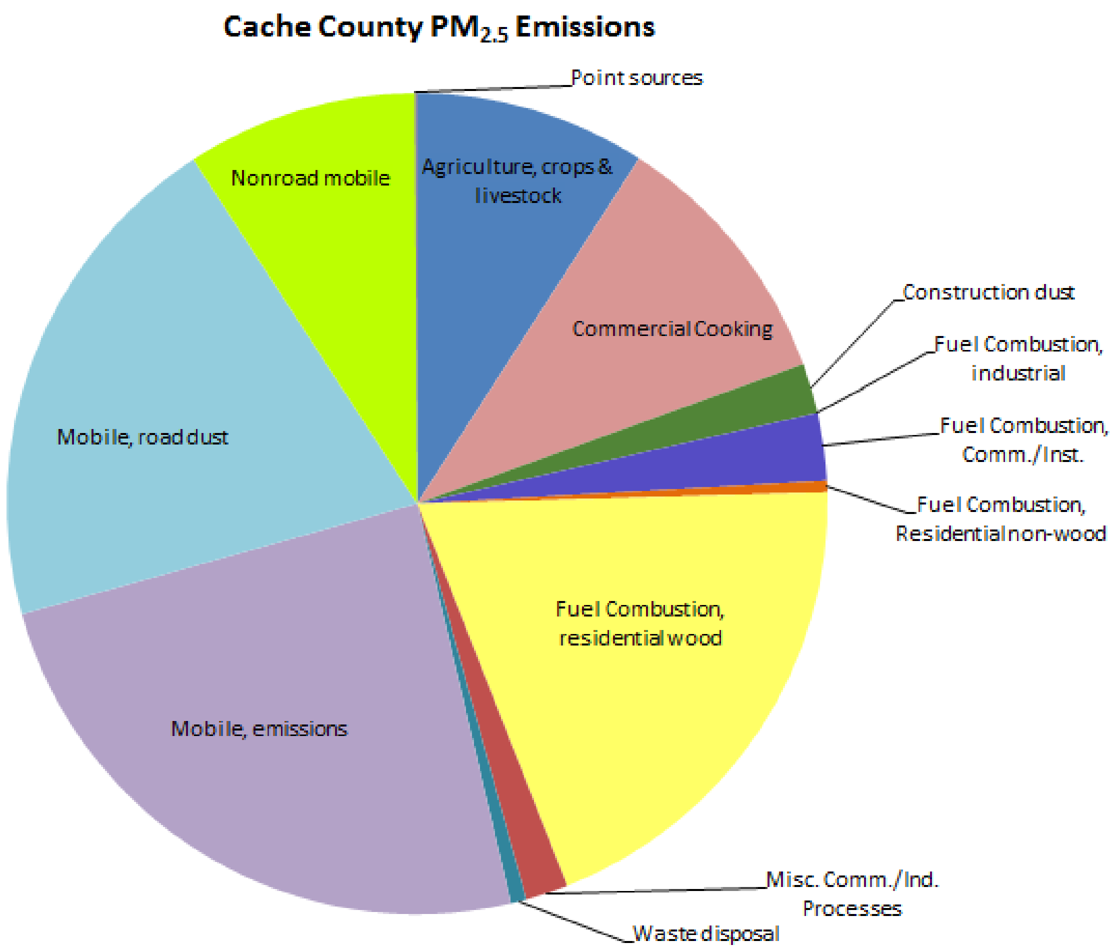

Figure 27. $PM_{2.5}$ emissions from all source types (area, point, and mobile) for the Utah side of the nonattainment area (Cache County).

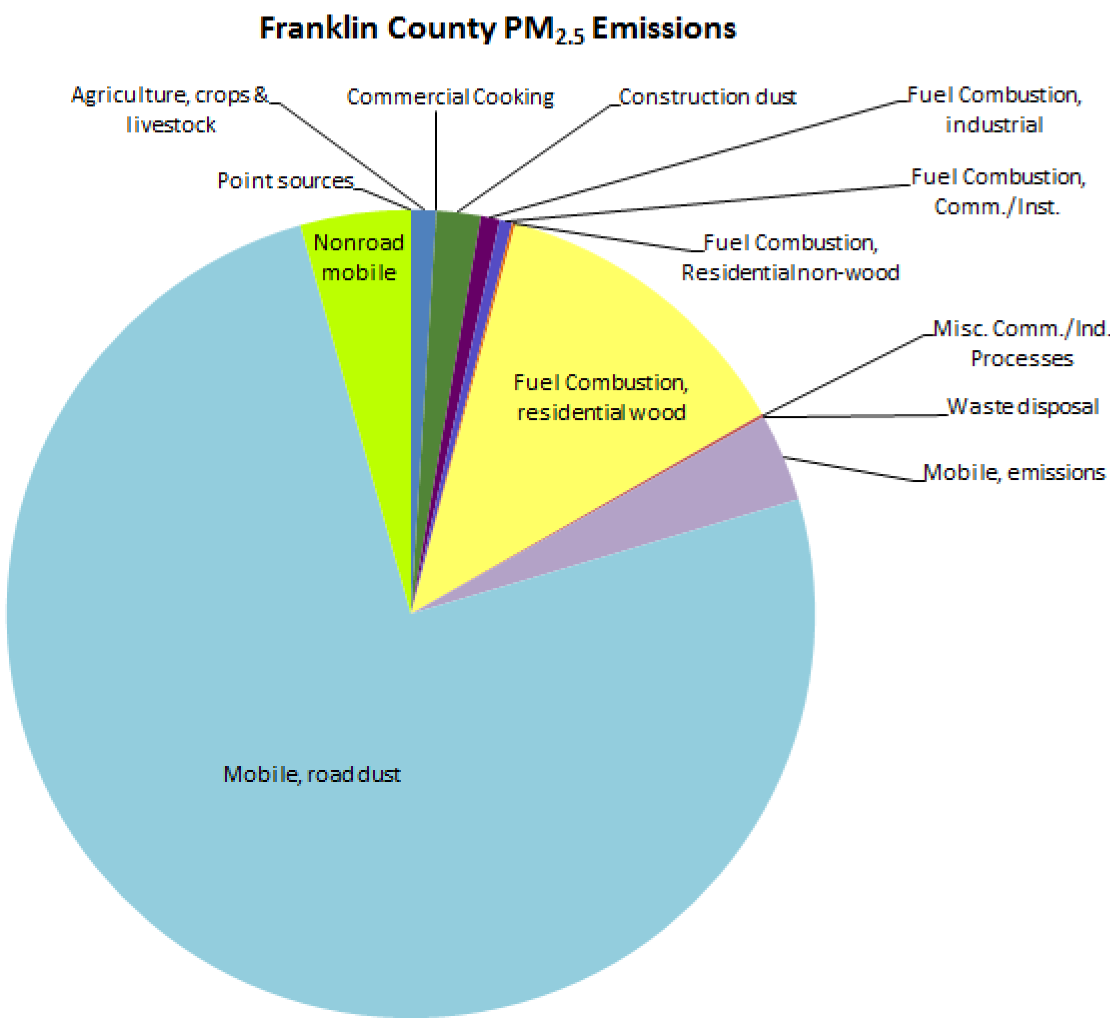

Figure 28. $PM_{2.5}$ emissions from all source types (area, point, and mobile) for the Idaho side of the nonattainment area (Franklin County).

3.3 Attainment Year Inventory

Table 4 lists total daily winter emissions (for both Utah and Idaho) for the 2008 base year as well as the 2014 attainment year. The attainment year totals include projections concerning growth in population, vehicle miles traveled, and the economy. The totals also include the effects of emissions control strategies that are either already promulgated or were required as part of the Utah SIP. More detailed inventory information are found in Appendix B.

Table 4. Cache Valley emissions inventory, tons per day, for the 2008 base year and 2014 attainment year for $PM_{2.5}$, NO_x, VOC, NH_3, and SO_2; emissions shown are for Utah and Idaho.

	NA-Area	Source Category	PM2_5	NOX	VOC	NH3	SO2
2008	Logan, UT-ID						
Sum of Emissions (tpd)		Area Sources	0.46	1.95	6.13	11.61	0.34
		Mobile Sources	0.46	8.25	6.43	0.13	0.09
		NonRoad	0.07	0.73	1.29	0.00	0.07
		Point Sources	0.00	0.02	0.41	0.00	0.00
	Total		0.99	10.95	14.26	11.75	0.50
2014	Logan, UT-ID						
Sum of Emissions (tpd)		Area Sources	0.41	1.77	4.74	10.03	0.27
		Mobile Sources	0.33	5.42	4.35	0.12	0.04
		NonRoad	0.11	1.01	1.88	0.00	0.05
		Point Sources	0.00	0.04	0.34	0.00	0.00
	Total		0.85	8.24	11.31	10.15	0.36

Notes: particulate matter 2.5 ($PM_{2.5}$); nitrogen oxides (NO_x); volatile organic compounds (VOC); ammonia (NH_3); sulfur dioxide (SO_2); tons per day (tpd).

Emissions reductions due to woodstove change-outs and changes in road sanding practices reduce the 2014 Cache Valley emissions further as shown in blue in Table 5. Franklin County $PM_{2.5}$ emissions are reduced 68% and VOC emissions are reduced 1.5%. Emissions of primary $PM_{2.5}$ will be reduced 71% from the 2008 base year through the 2014 attainment year. This moves Franklin county emissions from 21% of the entire CVNAA primary $PM_{2.5}$ inventory in 2008 to 7% of the inventory in 2014.

Table 5. Franklin County emissions summary.

Franklin County Emissions Summary (tons per episode day)					
Pollutant	**$PM_{2.5}$**	**NO_X**	**VOC**	**NH_3**	**SO_2***
2008 baseline emissions**	0.21	1.54	1.97	6.25	0.08
2014 Utah model without Idaho control measures**	0.19	1.15	2.16	5.54	0.08
2014 with Idaho control measures	0.06	1.15	2.10	5.54	0.08

Notes: particulate matter 2.5 ($PM_{2.5}$); nitrogen oxides (NO_x); volatile organic compounds (VOC); ammonia (NH_3); sulfur dioxide (SO_2)
*Corrected values—see Appendix C
**From Utah's Technical Support Document for the $PM_{2.5}$ Attainment SIPs

The residential woodstove ordinances *shut off* additional emissions sources when the AQI reaches, or is forecasted to reach, 75. The estimated maximum reductions are as shown in Table 6. However, these emissions reductions, while having a proven track record in Idaho, are more difficult to quantify specifically. For this reason, IDEQ did not include reductions due to the woodstove ordinances in Table 5. Documentation for these estimated reductions are found in Appendix C.

Table 6. Emissions reductions due to burn cessation ordinances.

Emissions Sources Affected by Burn Cessation Ordinances					
Source	**PM2.5**	**N0x**	**VOC**	**NH3**	**SO2**
fireplace: general	0.016	0.002	0.013	0.000	0.000
woodstove: fireplace inserts, non-EPA certified	0.029	0.003	0.050	0.000	0.000
woodstove: freestanding, non-EPA certified	0.035	0.003	0.063	0.000	0.000
Furnace: indoor, wood fired, non-EPA certified	0.005	0.000	0.002	0.000	0.000
Hydronic heater, outdoor	0.001	0.000	0.000	0.000	0.000
Firelog	0.004	0.001	0.005	0.000	0.000
waste disposal, open-burning	0.000	0.000	0.005	0.000	0.000
subtotal	**0.090**	**0.009**	**0.138**	**0.000**	**0.000**
less emissions reductions due to woodstove change-outs	0.030	0.000	0.060	0.000	0.000
total	0.060	0.009	0.078	0.000	0.000

Notes: particulate matter 2.5 ($PM_{2.5}$); nitrogen oxides (NO_x); volatile organic compounds (VOC); ammonia (NH_3); sulfur dioxide (SO_2); United States Environmental Protection Agency.

4 Attainment Demonstration

UDAQ led the efforts with respect to developing the technical components for the Cache Valley SIP attainment demonstration because they were dealing with two additional NAAs, Salt Lake City, Utah, and Provo, Utah, located along the Wasatch Front, and because 90% of the Cache Valley population resides in Utah. The Wasatch Front can generally be described as the population centers at the foot of the Wasatch Range from Brigham City to Santaquin. The attainment demonstration is summarized in this section, with excerpts from UDAQ technical support document included for continuity. Details concerning the SIP technical analysis, including links to UDAQ documents, are found in Appendix D. All modeling was performed by the UDAQ staff, with technical guidance from modeling experts around the country. A technical review group, including EPA Regions 8 and 10 and IDEQ technical staff, provided updates as the work progressed and provided peer review throughout the process.

4.1 Photochemical Model Selection

Photochemical models are relied upon by federal and state regulatory agencies to support their planning efforts. Models assist policymakers in deciding which control programs are most effective in improving air quality and meeting specific goals and objectives. The air quality analyses for this SIP were conducted with the Community Multiscale Air Quality (CMAQ) model version 4.7.1, with emissions and meteorology inputs generated using the SMOKE (Sparse Matrix Operator Kernel Emissions) processor and Weather Research and Forecasting (WRF) model, respectively. CMAQ was selected because it is the open source atmospheric chemistry model co-sponsored by EPA and the National Oceanic and Atmospheric Administration.

4.2 Domain/Grid Resolution

UDAQ selected a high-resolution 4-kilometer (km) modeling domain to cover all of northern Utah and portions of Idaho, Wyoming, and Nevada (Figure 29). This 97 x 79 horizontal grid cell domain was selected to ensure that all of the 23 major emissions sources that have the potential to impact three $PM_{2.5}$ NAAs, largely located in Utah, were included. The vertical resolution in the CMAQ model consists of 17 layers extending up to 15 km, with higher resolution in the boundary layer. The UDAQ modeling domain includes 11 Idaho counties or portions of counties to ensure that all Idaho emissions that could possibly contribute to the Cache Valley and other Utah NAAs would be included.

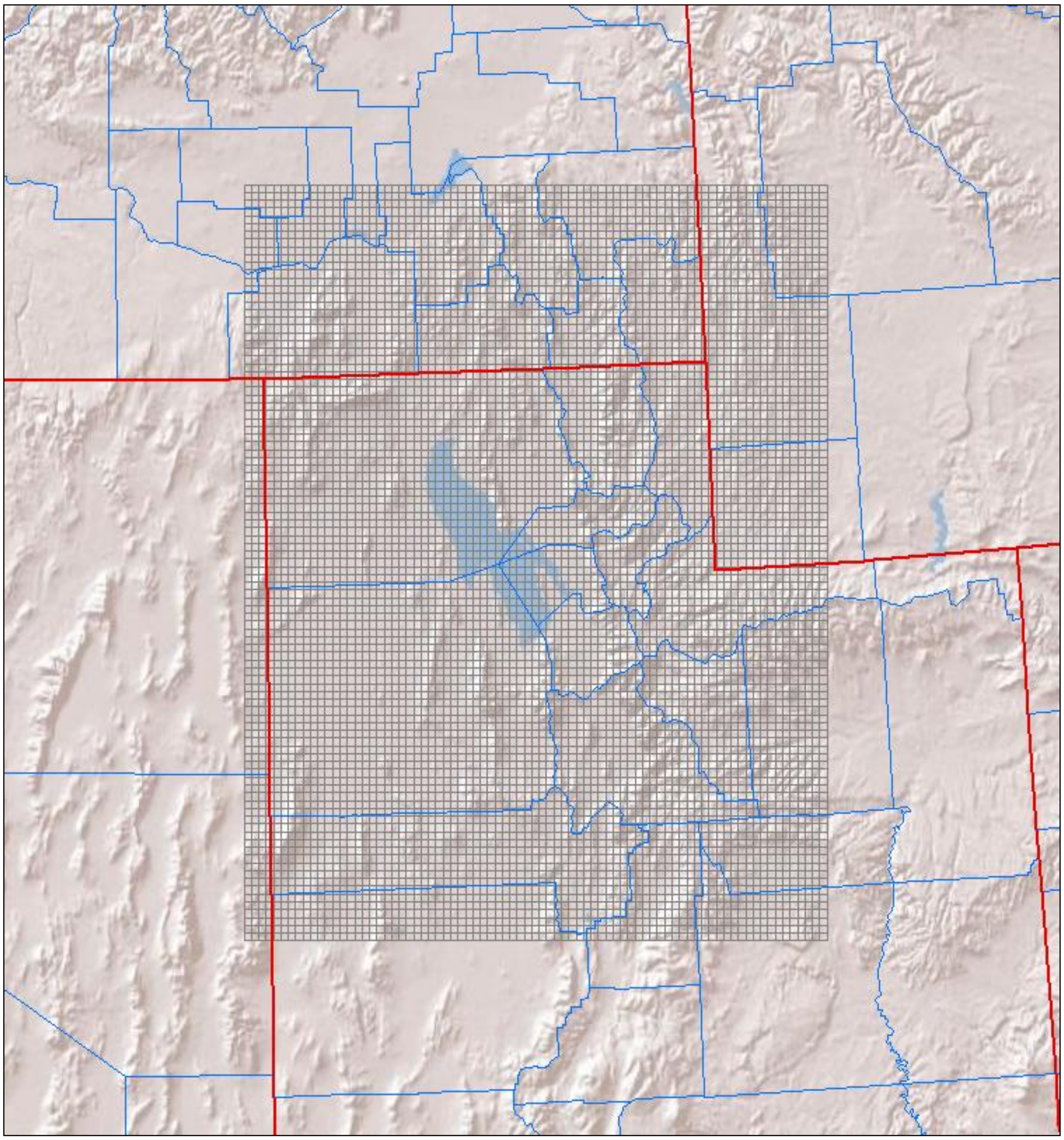

Figure 29. Cache Valley photochemical modeling domain.

4.3 Episode Selection

While the general meteorological characteristics are identical between the Wasatch Front and Cache Valley, there are important differences related to topography. The Cache Valley is a closed basin with no significant outlets. The Cache Valley topographical features lead to faster forming, more intense, and more persistent cold-air pools relative to the Wasatch Front. The episodes chosen for the modeling were selected so that observed elevated $PM_{2.5}$ concentrations occur simultaneously along the Wasatch Front and in Cache Valley.

Each of the selected episodes features a similar pattern that includes a deep trough over the eastern United States with a building and eastward moving ridge over the western United States. The episodes typically begin as the ridge builds eastward and near surface winds weaken; rapid stabilization occurs due to warm advection and subsidence dominates. As the ridge centers over Utah and southeast Idaho and subsidence peaks, the atmosphere becomes extremely stable and a subsidence inversion descends towards the surface. During this time, weak insolation, light winds, and cold temperature promote development of a persistent cold-air pool. Not until the ridge moves eastward or breaks down from north to south is there enough mixing in the atmosphere to completely erode the persistent cold-air pool. While each episode has its unique characteristics, the commanding similarity between each episode is stability and stagnation that traps locally produced emissions and allows secondary $PM_{2.5}$ formation and concentration buildup.

Episodes selected for the model evaluation and attainment demonstration, described more fully in the UDAQ technical support document in Appendix D, are listed below. Episode 4 is the most complete modeling period, including multiple stagnation periods with high $PM_{2.5}$ concentrations, and was therefore used by UDAQ for the final attainment demonstration.

- Episode 1: January 11–20, 2007
- Episode 2: February 14–19, 2008
- Episode 3: January 13–23, 2009
- Episode 4: December 8, 2009–January 22, 2010

4.4 Meteorological Inputs

Meteorological inputs were derived using the WRF, Advanced Research WRF (ARW) model version 3.2. Model performance of WRF was assessed using actual observations at sites maintained by the Utah Air Monitoring Center.

The most significant issue with meteorological performance is the existence of a warm bias in surface temperatures. WRF does a good job replicating the light wind speeds (< 5 miles per hour) and is able to simulate the diurnal wind flows common to the NAAs. Although, WRF has reasonable ability to replicate the vertical temperature structure of the boundary layer (temperature inversion), it is difficult for WRF to reproduce the inversion when the inversion is shallow and strong.

4.5 Photochemical Model Performance Evaluation

The model performance evaluation focused on the magnitude, spatial pattern, and temporal variation of modeled and measured concentrations. This evaluation was intended to assess whether, and to what degree, confidence in the model is warranted and to assess whether model improvements were necessary. CMAQ model performance was compared to observed air quality data. $PM_{2.5}$ speciation performance was assessed using the three STNs located along the Wasatch Front (Hawthorne, Bountiful, and Lindon).

Figure 30 shows the time series of the modeled versus measured Logan 24-hour $PM_{2.5}$ concentrations for the December 13, 2009–January 15, 2010, modeling period (Episode 4).

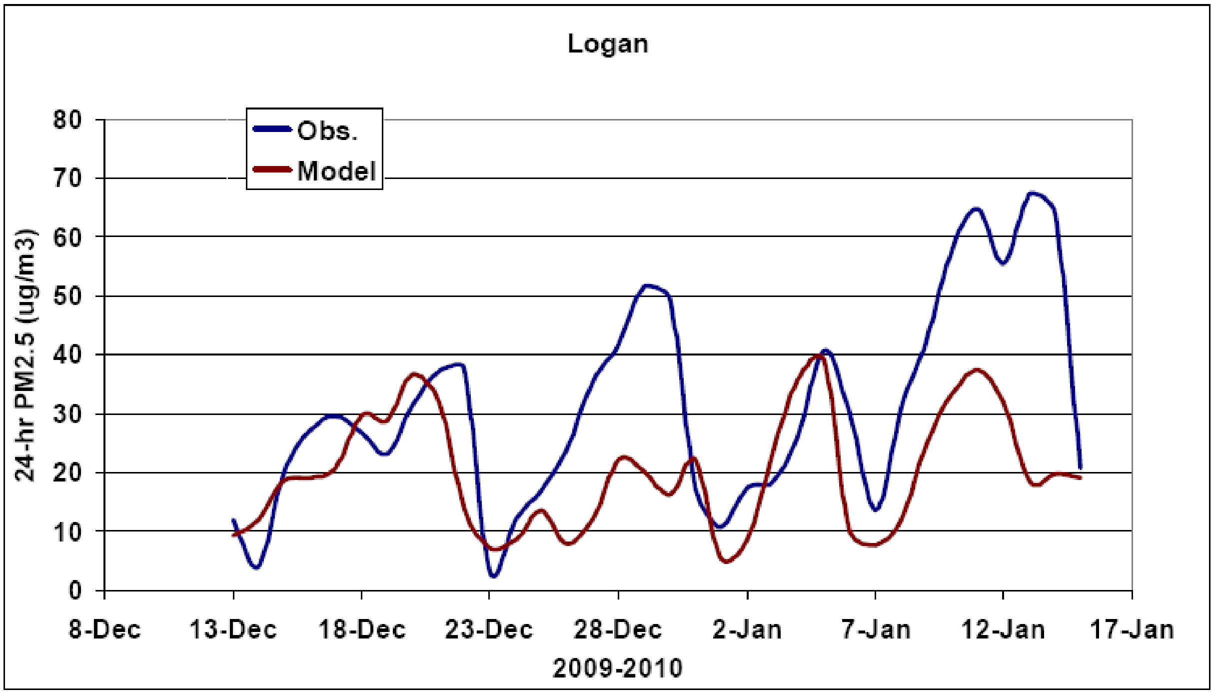

Figure 30. Twenty-four-hour $PM_{2.5}$ time series (Logan). Observed $PM_{2.5}$ (blue line), modeled with vertical advection activated (red line).

The model does a reasonably good job of capturing the multiday increases in $PM_{2.5}$ concentrations, although not always at the same magnitude as the measurements. The model performance is not a critical problem as long as the speciation characteristics are captured reasonably well, since evaluating the effect of control measures on future $PM_{2.5}$ levels is accomplished on a relative basis so that the influence of model inaccuracies is minimized. In their performance evaluation, UDAQ found that the model achieved a mean fractional bias of -16% and a mean fractional error of 26% for the Logan monitor in Cache Valley, both within the performance goals generally accepted for SIP modeling (Boylan and Russell 2006).

There is no regularly operated speciation measurement site in the Logan CVNAA, and while there is very little speciation information available in Cache Valley for the simulation period, past studies have shown that ammonium nitrate contributes 60%–80% of the $PM_{2.5}$ during inversion episodes (Martin 2006). Figure 31 shows the simulated speciation at the Logan monitor site. Ammonium (20%) and nitrate (60%), which together comprise ammonium nitrate secondary aerosol, make up a higher percentage of the simulated $PM_{2.5}$ at Logan when compared to sites along the Wasatch Front. In addition to the ammonium nitrate secondary aerosol, organic and elemental carbon from sources such as RWC and diesel emissions contribute 11% of the modeled $PM_{2.5}$. Finally, geologic and trace metal species from road dust, fugitive dust, and combustion sources comprise less than 10% of the $PM_{2.5}$, in close agreement with measurements.

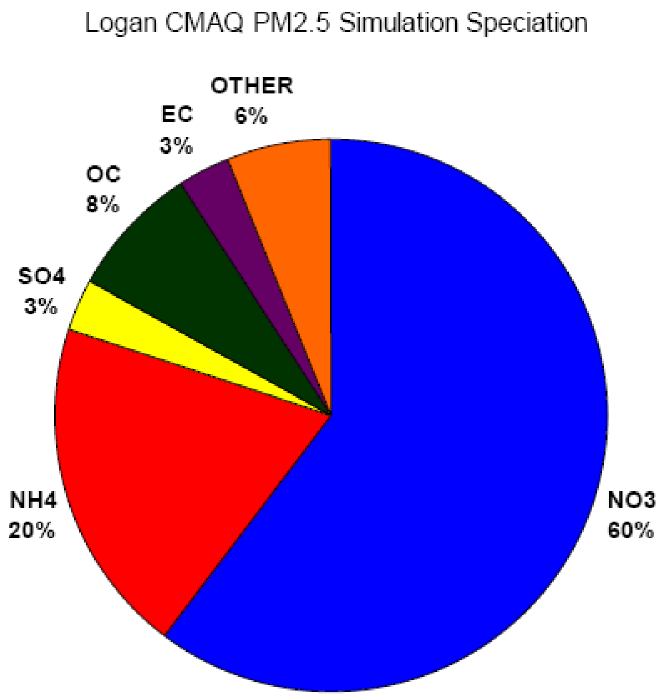

Figure 31. Composition of model-simulated average 24-hour $PM_{2.5}$ concentrations averaged over days when a modeled day had 24-hour concentrations >25 micrograms per cubic meter at the Logan monitor.

4.6 Model Performance Summary

Model performance for 24-hour $PM_{2.5}$ for the entire domain, Wasatch Front and Cache Valley, is good and generally meets model performance goals accepted by EPA for SIP modeling. The model performance was summarized by UDAQ as follows:

- Good replication exists of the episodic build up and clear out of $PM_{2.5}$. Often the model will clear out the simulated $PM_{2.5}$ a day too early at the end of an episode. This clear out time period is difficult to model.
- Good agreement exists in the magnitude of $PM_{2.5}$, as the model can consistently produce high concentrations of $PM_{2.5}$ that coincide with observed high concentrations.
- Spatial patterns of modeled 24-hour $PM_{2.5}$ show, for the most part, that the $PM_{2.5}$ is being confined in the valley basins, which is consistent with actual observations.
- Speciation and composition of the modeled $PM_{2.5}$ matches the observed speciation quite well. Modeled and observed nitrates are between 40% and 50% of the $PM_{2.5}$. Ammonium is between 15% and 20% for both modeled and observed $PM_{2.5}$.

Consistent with EPA guidance, the model has been used in a relative sense to project future year values.

4.7 Additional Model Sensitivity Tests of Nitrogen Oxides and Volatile Organic Compounds Chemistry

CMAQ sensitivity simulations were conducted by UDAQ to test the changes in $PM_{2.5}$ secondary nitrate concentrations resulting from changes in the emissions of NO_x and VOCs. The sensitivity simulations were performed on the 2008 inventory and the 2019 inventory that had incorporated emission reduction control strategies.

At Logan, where the inventory is smaller than that of the Wasatch Front airshed, reductions in both NO_x and VOCs lead to the benefit of reducing particulate nitrate. This reduction is the expected behavior for more rural areas such as Cache Valley, contrary to the more populated areas of the Wasatch Front where a NO_x decrease can actually cause nitrate aerosol to increase, a result found by UDAQ in sensitivity modeling of the Wasatch Front.

4.8 Modeled Attainment Test

UDAQ used the Model Attainment Test Software (MATS) for the modeled attainment test at grid cells near monitors. MATS was designed to perform two basic analyses of future year modeling.

1. Interpolate the species fractions of the particulate matter mass from the STN monitors to the FRM monitors. The model also calculates the relative response factor for grid cells near each monitor and uses these to calculate a future year design value for these cells.

2. Perform an unmonitored area analysis on grid cells in areas of the domain that are far from monitors. This analysis is done by adjusting the modeled values in grid cells with the observed values from monitors in the domain. The adjustment is based on an inverse distance weighting so that monitored data nearest to a grid cell exerts the most influence in the adjustment. The capability to perform an analysis of an unmonitored area for daily average $PM_{2.5}$ is not currently implemented in MATS.

MATS results for future year modeling at the Logan monitor site are presented in Figure 32. The future year design value is presented for 2014, the attainment year, along with the MATS future year design values for modeling simulation that include control strategies. For comparison purposes, the monitored design value is also presented for the base year, 2008.

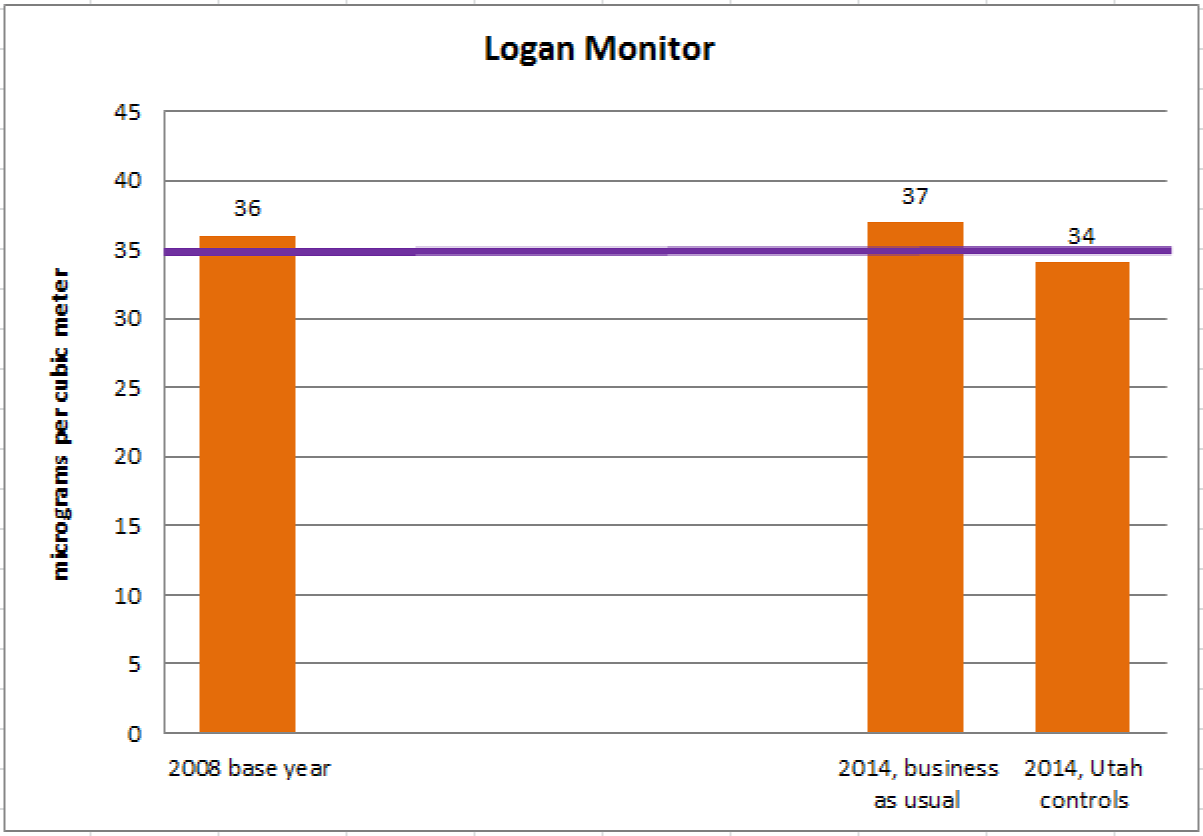

Figure 32. Model results for the Cache Valley nonattainment area, Logan monitor.

4.9 Unmonitored Areas

While many areas within the CVNAA do not have permanent air quality monitors, Idaho does not believe any of those areas will have higher concentrations than the two existing monitor sites in Logan and Franklin. The bases for this conclusion are threefold:

1. Monitoring data—Monitoring data are provided in section 2 of this document. The highest values occur almost exclusively at the Logan monitor site, and there is a clear gradient decreasing from the Logan area toward the northern end of the valley.
2. Special study—Utah State University's study of the Cache Valley included a network of monitors located throughout the valley (Martin 2006). Data from those monitors indicated that highest concentrations are expected in Logan, and again the gradient decreases from south to north on the highest days. When concentration levels drop somewhat, there are more areas with concentrations similar to those in Logan, but none expected to be significantly greater.
3. Understanding of model behavior—Because there are no large stationary sources, emissions inputs in the model will be based largely on the density of the population and location of roads. The majority of both population and roads are located in Logan and that is where the largest modeled concentrations, particularly in cases of stagnation, are expected to be found. Since only 10% of the Cache Valley population resides in Franklin

County, Idaho, any concentration hotspot that is in an unmonitored area is very unlikely to occur in Idaho.

4.10 Attainment Date

As shown in the modeled attainment test, the emissions reductions achievable in 2014 allow for a demonstration that the CVNAA can attain the 24-hour $PM_{2.5}$ NAAQS. Therefore, this SIP identifies an attainment date of January 1, 2015. This timeframe will allow for the consideration of monitoring data and inventory data collected during calendar year 2014 in making an assessment of whether the area has attained the standard in accordance with CAA Section 172 (a)(2)(C).

5 Control Strategies

The overall strategy for improving air quality throughout the CVNAA consists of many different components across the multistate NAA. Collectively, these components will be responsible for reducing $PM_{2.5}$ emissions in the CVNAA and allow Utah and Idaho to demonstrate attainment with the NAAQS by January 1, 2015. Both sides of the CVNAA (Utah and Idaho) dealt separately with various control measures, due to both jurisdictional authority and differences in the emissions inventory. Details concerning the control measures used on the Utah side of the Cache Valley can be found in the $PM_{2.5}$ SIP and technical support document (Appendix B) developed by UDAQ.

5.1 Control Strategy Consideration

In accordance with 40 CFR 51.1002, this SIP must address emissions of $PM_{2.5}$ precursors (SO_2, NO_x, VOC, and NH_3) in addition to direct emissions of $PM_{2.5}$.

5.1.1 Sulfur Dioxide

Idaho has addressed SO_2 as a $PM_{2.5}$ precursor. SO_2 emissions make up a very small portion of the overall inventory. Ammonium nitrate formation is the predominant process that leads to high $PM_{2.5}$ concentrations in the Cache Valley during winter inversions. For these reasons, Idaho did not consider NAA specific controls for SO_2.

5.1.2 Nitrogen Oxides

Emissions of NO_x mainly due to combustion for heating and mobile sources, contribute to the $PM_{2.5}$ problem in the Cache Valley through the formation of ammonium nitrate secondary aerosol. Additional controls for home heating of natural gas or distillate oil was deemed prohibitively expensive for very little reduction in overall emissions. Idaho's relative contribution to emissions from mobile sources is 10%. An inspection and maintenance program would be expected to reduce NO_x emissions by 4.6% based on UDAQ MOVES modeling, with an estimated cost of $20,000 per ton (see Appendix C). Idaho determined this cost was not reasonable in light of federal vehicle regulations that are expected to provide ongoing emissions reductions.

5.1.3 Volatile Organic Compounds

Utah's modeling team determined that VOCs do play a role in secondary $PM_{2.5}$ formation in the Cache Valley. However, VOC emissions are a small portion of the Franklin County inventory and, therefore, were not considered reasonable to control. Some of the Utah VOC controls have an airshed-wide effect because many Franklin County residents obtain goods and services in Utah. IDEQ MOVES modeling results predict VOC emissions reductions from on-road mobile sources of 37%, from 0.61 to 0.39 tons per day, by January 1, 2015 (see Section 5.5.2).

5.1.4 Ammonia

Most of the secondary particulate matter collected during cold-air pool conditions is ammonium nitrate. Studies performed at Utah State University have shown NH_3 to be in abundance in the Cache Valley and that the limiting reagent in the formation of ammonium nitrate is nitric acid (HNO_3). Sensitivity runs with the model indicate that significant reductions in the NH_3 inventories have little to no effect on predicted $PM_{2.5}$ concentrations. Therefore, NH_3 reductions are not beneficial in reducing $PM_{2.5}$ concentrations, and NH_3 will not be considered as a $PM_{2.5}$ attainment plan precursor.

5.1.5 Direct $PM_{2.5}$ Emissions

Idaho focused primarily on direct $PM_{2.5}$ emissions for control efforts and, in particular, focused on the two sources (mobile source road dust and woodstoves) that make up 84% of those emissions. EPA guidance document, *Implementation Guidance for the 2006 24-Hour Fine Particle ($PM_{2.5}$) National Ambient Air Quality Standards (NAAQS)* (Implementation Guidance) (EPA 2012), recommends that states place emphasis on reducing direct $PM_{2.5}$ emissions because published literature has indicated there are higher estimated health benefits per ton of reduction when compared with emissions of precursor gases.

The following sections discuss control measures developed specifically for the Idaho side of the CVNAA as well as measures already in place that play a part in reducing $PM_{2.5}$ emissions.

5.2 Reasonably Available Control Measures

The following subsections detail the reasonably available control measures (RACM), see Appendix E.

5.2.1 Road Sanding

Within the Idaho side of the CVNAA, 70.5% of the directly emitted $PM_{2.5}$ is due to mobile dust, which is primarily from reentrained dust on paved roads. Franklin County Road and Bridge and ITD have entered into road sanding agreements as part of the SIP. The Franklin Road and Bridge agreement reduces the amount of sand used on paved roads by applying brine, when conditions are appropriate, and by using a salt/sand mixture where antiskid treatment is required. ITD has moved to applying a straight solution of sodium chloride, thereby eliminating the amount of sanding material. Franklin County Road and Bridge has used a 10-to-1 ratio of sand to salt in past years; however, for this SIP they have agreed to use a 4-to-1 sand-to-salt ratio mix when antiskid treatment is required. In addition, brine will be applied when temperatures are above

22 ^{o}F, a measure which further reduces the amount of sand required by approximately 50%. Table 7 shows the expected episode daily emissions reductions. The road sanding agreements are found in Appendix E.

Table 7. Road sanding emission reductions.

Scenario	Weekday Emissions Uncontrolled Scenario (tpd)	Controlled Weekday Emissions (tpd)	Emission Reductions (tpd)
Assumed control scenario	—	4-to-1 sand-to-salt mixture for antiskid application; with brine	—
2008 base year	0.45	NA	NA
2014	0.47	0.37	0.10
2019	0.52	0.41	0.11
Notes: tons per day (tpd); not applicable (NA)			

5.2.2 Residential Wood Combustion Ordinances

RWC ordinances have been adopted within Franklin County and all six Idaho cities that lie within the Idaho side of the Cache Valley (Franklin, Preston, Weston, Dayton, Clifton, and Oxford). Key elements in the current RWC ordinances include issuing a mandatory burn ban when $PM_{2.5}$ is at, or is forecasted to reach 75 on the AQI. (This corresponds directly to a $PM_{2.5}$ concentration of 25.4 µg/m^3 and lines up directly with the RWC ordinances that are applicable within Cache County, Utah). All of the cities and the unincorporated Franklin County have existing ordinances prohibiting both open burning and the use of a RWC device when an air quality alert is issued, as noted above. The ordinances also prohibit installing non EPA-certified devices. Appendix E contains copies of all of the RWC ordinances.

5.2.3 Air Quality Index Program

IDEQ operates an AQI program to support the public information and regulatory components of the $PM_{2.5}$ SIP. Through this program, IDEQ provides information on the measured and forecasted ambient air pollution levels for $PM_{2.5}$ in Franklin County, Idaho. UDAQ also operates a similar program on the Utah side of the CVNAA.

Information on open burning bans and indoor wood burning bans is provided via several formats. These formats may include, but are not limited to, IDEQ’s website, recorded messages available 24-hours per day, and e-mail to people who wish to be on a daily forecast list or an *alert* list.

5.2.4 Woodstove Change Outs

IDEQ has operated two woodstove change-out programs on the Idaho side of the CVNAA (2006 and 2011) changing out a total of 152 uncertified RWC devices. In addition, during the intervening years, two uncertified stoves were replaced by certified stoves in accordance with

Idaho's Alternative Energy Device tax deduction, which allows Idaho citizens to deduct all, or most, of the cost to acquire and install a certified woodstove.

Table 8 lists the emissions reductions due to these woodstove change outs. Supporting documentation is found in Appendix C In addition to reductions in particulate matter, the woodstove change-out program has also led to the reduction in air toxics, such as formaldehyde, acrolein, and benzo(a)pyrene, which are generated as byproducts of combustion.

Table 8. Emissions reductions due to the woodstove change outs.

Emissions avoided due to wood stove change-outs in Tons/yr						
Pollutant	2006 uncert WS to cert WS or gas	2006 uncert WS to pellet	2009 uncert WS to cert WS or gas	2011 uncert WS to cert WS or gas	2011 uncert WS to pellet	Total
CO	18.87	3.03	0.45	14.88	4.71	**41.94**
SO2	0.02	0	0	0.01	0	**0.03**
NOx	0.2	0	0	0.13	0.01	**0.34**
VOC	4.76	0.73	0.13	4.04	1.13	**10.79**
PM2.5-PRI	2.6	0.39	0.06	2.12	0.61	**5.78**
PM10-PRI	2.6	0.39	0.06	2.12	0.61	**5.78**

Notes: woodstove (WS); carbon monoxide (CO); sulfur dioxide (SO_2); nitrogen oxides (NO_x); volatile organic compounds (VOC); particulate matter ($PM_{2.5,\ 10}$); primary (PRI).

5.3 Contingency Measures

CAA Section 172(c)(9) requires that any NAA implementation plan must contain contingency measures to be undertaken if the area fails to make reasonable further progress (RFP), or to attain the NAAQS by the applicable attainment date (CVNAA, January 1, 2015). These required contingency measures are required to take effect without further action by the state or EPA. The CAA does not specify the number of contingency measures to be adopted or the magnitude of the emission reductions to be achieved. However, the preamble of the 2007 $PM_{2.5}$ Implementation Rule (72 FR 20586) states:

> One basis EPA recommends for determining the level of reductions associated with contingency measures is the amount of actual PM2.5 emissions reductions required by the control strategy for the SIP to attain the standards. The contingency measures are to be implemented in the event that the area does not meet RFP, or attain the standards by the attainment date, and should represent a portion of the actual emissions reductions necessary to bring about attainment in area. Therefore, the emissions reductions anticipated by the contingency measures should be equal to approximately 1 years' worth of emissions reductions necessary to achieve RFP for the area. (72 FR 20586, page 20643)

The EPA (2012) Implementation Guidance clarifies that this concept does not hinge on whether a given area is required to develop an RFP plan. Rather,

> The basic concept is that an area's set of contingency measures should provide for an amount of emission reductions that would achieve "one year's worth" of air quality improvement proportional to the overall amount of air quality improvement to be achieved by the area's attainment plan; or alternatively, an amount

> of emissions reductions (for all pollutants subject to the plan) that would achieve one year's worth of emission reductions proportional to the overall amount of emission reductions needed to show attainment.

Following the example provided in the Implementation Guidance and using data from the Logan monitor because it consistently measures the highest concentrations in the CVNAA, yields:

> The CVNAA was designated in December 2009 with a 2006–2008 design value of 36 $\mu g/m^3$. To demonstrate attainment, the CVNAA must reduce its air quality concentration from 36 $\mu g/m^3$ in 2008 to 35 $\mu g/m^3$ in 2014, equal to a rate of change of 0.2 μg/year. Utah's control measures are expected to reach a design value of 34 $\mu g/m^3$ by the attainment date.

The only Idaho emissions reductions included in the UDAQ attainment demonstration are those due to federal vehicle standards that are imbedded in the MOVES model. Idaho's controls, with reductions as shown in Table 5, provide additional emission reductions that are not relied on by UDAQ for attainment and are not included in their demonstration. Further, UDAQ has included 3 contingency measures in their SIP; lowering the trigger for woodstove burn bans, offsets for new stationary sources and transportation control measures. The RACM for Franklin County has, therefore, met the contingency measure obligation as stated in the preamble to the Implementation Rule:

> The key is that the statute requires that contingency measures provide for additional emission reductions that are not relied on for RFP or attainment and that are not included in the demonstration.

Idaho recognizes, however, that the real world does not always behave according to models. If Cache Valley has a violation in the future, the event will be evaluated, and the filters will be chemically analyzed to target further controls. This step will allow the root cause of the violation to be determined so that the appropriate additional measures can be implemented. With this in mind, Idaho can and will make a number of adjustments to ensure air quality continues to improve in the CVNAA.

5.3.1 Forecasting

Forecasting when burn bans are called can be adjusted based on experience gained year to year. This experience allows IDEQ forecasters to use meteorological information related to the expected strength and duration of a developing air stagnation combined with knowledge of the rate of particulate matter buildup in the airshed to determine when to call a burn ban.

5.3.2 Road Sanding

If data indicate a significant amount of crustal matter is contributing to elevated values in Franklin County, IDEQ will work with Franklin County and ITD to further adjust sanding rates or road sweeping.

5.3.3 Certified Woodstoves

If experience indicates that solely banning the use of uncertified woodstoves is not sufficient to ensure attainment and maintenance of the NAAQS, IDEQ will work with the local governments to add a trigger for burn cessation to include certified woodstoves.

5.3.4 Revised Woodstove New Source Performance Standard

EPA is expected to revise the “Standards of Performance for New Residential Wood Heaters” (40 CFR 60 Subpart AAA) in the near future.

5.3.5 Air Pollution Emergency Rule (Open Burning Ban)

In addition to the open burning ban that is enacted with the RWC ordinance (AQI 75), additional mandatory burn bans can be implemented by IDEQ at the *stage one* and *caution* level. The stage one levels for $PM_{2.5}$ are set at 50 µg/m^3 for the 24-hour average and 80 µg/m^3 for the 1-hour average as defined in the “Rules for the Control of Air Pollution in Idaho” (IDAPA 58.01.01.550-562).

5.3.6 Agricultural Sources

Agricultural operations occasionally contribute to the ambient $PM_{2.5}$ levels in many rural areas and in some urban areas. Typically, all agricultural operations are generically classified as soil preparation, soil maintenance, and crop harvesting operations. Reasonable available control measures for agricultural sources include using best management practices and land conservation practices under the Food Security Act of 1985, which was reauthorized in 1996, 2002, 2008, and 2012. Appendix C contains the reauthorized 2012 farm bill as it pertains to conservation.

In addition, Idaho’s crop residue burning program controls impacts from this activity so that NAAQS are attained and maintained. While this activity does not generally occur in winter months, the rules regarding when this activity can be allowed (burning cannot occur if concentrations are forecasted to reach 75% of the NAAQS or when dispersion characteristics are unfavorable) will allow this activity to occur in the CVNAA without causing or contributing to a violation, or interfering with maintenance, of the NAAQS.

5.3.7 Idaho Permitting Program

The industrial air permitting rules are found in IDAPA 58.01.01.200-500. The permitting program requires permits for constructing and operating new or modified major stationary sources within the CVNAA. New and modifying sources must demonstrate that they will not cause or interfere with maintenance of a NAAQS. Modeling must be in compliance with 40 CFR 51, Appendix W, “Guideline on Air Quality Models.” The Tier II operating permit program allows IDEQ to develop permits for existing sources that must be controlled to attain or maintain compliance with the NAAQS.

5.3.8 Tier 2 Federal Motor Vehicle Emission Requirements

The federal motor vehicle emission program went into effect on April 10, 2000 (65 FR 6698) and was phased in between 2004 and 2008. Tier 2 introduced more stringent numerical emission limits compared to the previous program (Tier 1). The program also required refiners to reduce gasoline sulfur levels nationwide, which was fully implemented in 2007. The sulfur levels need to be reduced so that Tier 2 vehicles could run correctly and maintain their effectiveness. The EPA estimated that the Tier 2 program will reduce nitrogen oxide emissions by at least 2,220,000 tons per year nationwide in 2020. Tier 2 has also contributed in reducing VOC and direct particulate matter emissions from light-duty vehicles.

In addition to the benefits from Tier 2 in the current emissions inventories, the emission projections for this SIP from 2014 through 2019 (and beyond) continue to reflect significant reductions in both VOC and NO_x as older vehicles are replaced with Tier 2 vehicles. This trend may be seen in the inventory projections for on-road mobile sources despite the growth in vehicles and vehicle miles traveled that are factored into the same projections.

Additional on-road mobile source emissions improvement stemmed from federal regulations for heavy-duty diesel vehicles. EPA's Clean Air Highway Diesel Rule, which aimed at reducing pollution from heavy-duty diesel highway vehicles, was finalized in January 2001. Under the rule, beginning in 2007 (with a phase-in through 2010) heavy-duty diesel highway vehicle emissions were required to be reduced by as much 90% with a goal of complete fleet replacement by 2030. To enable the updated emission reduction technologies necessitated by the rule, beginning in 2006 (with a phase-in through 2009) refiners were required to begin producing cleaner-burning ultra-low sulfur diesel fuel. Specifically, the rule required a 97% reduction in sulfur content from 500 parts per million (ppm) to 15 ppm. The overall nationwide effect of the rule is estimated to be equivalent to removing the pollution from over 90% of trucks and buses when the fleet turnover is completed in 2030. All federal vehicle emission reduction programs are incorporated into the MOVES model used to develop on-road emission inventories.

5.3.9 Diesel Emission Reduction Program—School Bus Retrofits

IDEQ's diesel emission reduction program (DERP) has been working to reduce emissions from school bus fleets. DERP has chosen to employ closed crankcase ventilation (CCV) units and diesel oxidation catalysts (DOC) to school buses located in Franklin County and the Idaho portion of the CVNAA. The CVV units are diesel emission reduction technologies that target and filter the combustion gases that escape past the piston rings in legacy engines. DOCs are technologies that target and break down the exhaust gases as they pass through the exhaust system towards the tailpipe.

To date, DERP has retrofitted 8 school buses at the Westside School District in Dayton, Idaho, with DOCs. The lifetime emission reductions assumed from these technologies are estimated at $PM_{2.5}$—520 pounds, hydrocarbons—2,300 pounds, and carbon monoxide—9,780 pounds. Emission reductions are estimated using the diesel emissions quantifier, which uses the MOVES model. Through DERP, the Preston, Idaho, school district plans to retrofit 11 school buses with CCV and DOC technologies; the lifetime emission reductions are estimated to be $PM_{2.5}$— 860 pounds, hydrocarbons—2,100 pounds, and carbon monoxide—11,480 pounds. Efforts will continue with Preston to install the emission reduction technologies.

In addition to school buses, DERP is actively recruiting additional diesel engines in sectors beyond the school bus industry with legacy engines that meet the qualifications of emission reduction technologies within Franklin County and the Idaho portion of the CVNAA.

5.3.10 Transportation Control Measures

There are no required transportation control measures (TCMs) for the Idaho side of the CVNAA. The CAA requires that TCMs are included as contingency measures in SIPs, addressing ozone and carbon monoxide. TCMs include a wide variety of measures used to reduce motor vehicle emissions primarily by reducing the total amount of vehicle miles traveled in an area.

5.3.10.1 Commuter Bus Service

The Preston/Logan Commuter Bus Service is operated jointly by the Pocatello Regional Transit (Idaho) and the Cache Valley Transit District (Utah). This bus service operates Monday through Friday, 6:00 a.m. to 6:30 p.m. There is an estimated 1,700 commuters daily who travel from the Idaho to the Utah sides of the Cache Valley. This bus service has been in operation since 2006.

5.3.10.2 Park-n-Ride Lots

Park-n-ride lots serve multiple travel needs, providing an appropriate parking area to leave a car and make connections to public transit services, intercity bus services, or carpool and vanpool partners. In addition, these lots serve as *feeder* locations for people in rural areas not served by public transit, who could be transported by family or friends to meet available bus services or human service agency-provided transportation. The need for alternative mobility choices helps to mitigate the EPA NAA issue for the Logan-Preston corridor. Currently, there are two park-n-ride lots in Franklin County, one near Weston and the other near Franklin.

5.3.11 Other Measures

Due to the continual changes in the mixture of the $PM_{2.5}$ sources and evolving technologies to understand and control $PM_{2.5}$ emissions and precursor gases, other measures may become viable in the future. IDEQ will continue to evaluate the need for additional measures and will consider future additions to the previously listed control measures if it becomes necessary.

5.4 Reasonably Available Control Technology

CAA Section 172 (c)(1) requires SIPs for NAAs to implement RACM, including reasonably available control technology (RACT), for existing major stationary sources. EPA defines RACT as the lowest emissions limitations that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility. RACT is an emissions limit rather than a control technology and is determined on a case-by-case basis. On the Idaho side of the CVNAA, there are no major stationary sources; therefore RACT has not been implemented.

5.5 Transportation Conformity

The CAA requires that federal actions conform and are consistent with the approved SIP. Conformity addresses pollutant emissions through the process of reviewing plans, projects, and programs that are funded and/or approved by the federal government prior to implementation. The conformity process ensures that state and local entities plan and discuss programs that conform to the SIP.

5.5.1 Motor Vehicle Emissions Budget Requirements

The $PM_{2.5}$ SIP must identify not-to-be-exceeded limits on $PM_{2.5}$, NO_x, and VOC emissions from on-road mobile sources. The budgets outlined in this section apply specifically to the Idaho side of the CVNAA. Additional budgets exist for the Utah side of the CVNAA.

CAA § 176 requires any activity that is federally supported or permitted to conform to approved air quality SIPs. To help guide the transportation process, CAA § 108 (e) compelled the EPA Administrator and the Secretary of Transportation to develop a "continuous transportation-air quality planning" process and guidance on developing and implementing transportation and other measures necessary to demonstrate and maintain attainment of NAAQS. This effort led to the *conformity* rules found in 40 CFR 93.100-129. 40 CFR 93.102 (b)(2)(iii) of the regulation identifies NO_x and VOC as the two $PM_{2.5}$ precursor pollutants that must also have an motor vehicle emission budget (MVEB) if deemed significant. SO_2 is an insignificant contributor to the secondary aerosol formation in the CVNAA and is not included. Although NH_3 contributes to secondary aerosol formation, the region is *ammonia rich,* so the very small mobile source NH_3 emissions are also not considered in MVEBs.

The MVEB is developed following the transportation conformity rule under 40 CFR Section 93.118 (as adopted by IDAPA 58.01.01.563-574). The intent of the conformity rules is to synchronize the air quality planning process with transportation plans developed by metropolitan planning organizations (MPOs) and other transportation organizations to ensure air quality standards are met. Simply put, transportation plans must *conform* to air quality plans and show that transportation projects using federal funds or deemed to be *regionally significant* in air quality nonattainment and maintenance areas do not contribute to a degradation of air quality.

On the Idaho side of the CVNAA, the area is both rural and small enough in population that it does not warrant the formation of an MPO. The Federal-Aid Highway Act of 1962 required the formation of an MPO for any urbanized area with a population greater than 50,000. Federal funding for transportation projects and programs are channeled through this planning process. On the Idaho side of the CVNAA, ITD is responsible for developing the long-range transportation plan (LRTP) that incorporates all the new transportation projects anticipated within the 20-year planning horizon. ITD is also responsible for developing the transportation improvement program (TIP) that incorporates all the transportation projects that have identified funding sources and are scheduled to be built within 3–5 years. The Utah side of the CVNAA is covered by the Cache Valley MPO.

To reconcile long-range transportation plans and TIPs with air quality implementation plans, the conformity rules require these plans be consistent with the MVEB, which is part of the air quality SIP. The CVNAA is unique in that the airshed covers two states and EPA regions (Utah—Region 8 and Idaho—Region 10). Following EPA guidance to show adequacy of the MVEBs, both Utah and Idaho combined their respective MVEB (transportation emissions) along with both area and point source emissions as part of the attainment modeling demonstration (EPA 2012). The modeling demonstration used wintertime episodes from 2007, 2008, 2009, 2010 and included the future years 2014 and 2019. Following the modeling demonstration, each state will then use separate MVEBs as established in each state's SIP as allowed in 40 CFR 93.124(c).

When establishing a MVEB, the conformity rule, 40 CFR 93.102(b)(2)(iv)and(v), requires the state to make a finding on whether NO_x, SO_2, VOC, or reentrained road dust from transportation are significantly contributing to $PM_{2.5}$ nonattainment. On the Utah side of the CVNAA, they have determined that reentrained road dust is not an issue. However on the Idaho side of the CVNAA, it has been determined that reentrained road dust is an issue because of road sanding practices. SO_2 from Idaho is a very small contributor to the nonattainment issue. As discussed in section 5.1.1 and depicted in Figure 24, SO_2 from transportation on the Idaho side of the CVNAA is not significantly contributing to nonattainment. Therefore, Idaho is making the determination to not include SO_2 emissions in the MVEB. Idaho will include NO_x, VOC, and reentrained road dust in the MVEB.

The Utah side of the CVNAA will continue to use the Cache Valley MPO for future conformity determinations. Since the Idaho side of the CVNAA does not have an established MPO, the entire Franklin County will be considered a *rural donut area* for conformity purposes. Rural donut areas are geographic areas outside a metropolitan planning area boundary but inside the boundary of a nonattainment or maintenance area that contains any part of a metropolitan area as described in 40 CFR 93.101.

5.5.2 Motor Vehicle Emission Budget

The MVEB is comprised of on-road mobile sources including fugitive dust from paved and unpaved roads and vehicle emissions (exhaust, tire, and brake wear). EPA's MOVES model was used to develop vehicle emissions estimates for the MVEB. The MVEB becomes applicable when the EPA determines that the budget is adequate for transportation conformity purposes. In accordance with the conformity rule, the emissions budget acts as a ceiling on emissions in the year for which it is defined or until a SIP revision modifies the budget.

The MVEB is developed as part of the SIP to place a ceiling or cap on emissions from transportation projects. The conformity process compares projected emissions from the TIPs and LRTPs with the budgeted emissions set out in the SIP MVEB. The emissions budgets included as part of this SIP are shown in Table 9. The conformity rule will require the emission projections from future TIPs and LRTPs be less than or equal to the budget levels. The conformity process ensures that transportation projects will not cause or contribute to NAAQS violations.

Table 9. Motor vehicle emission budget for the Idaho side of the Cache Valley nonattainment area.

Year	County	NO_x (ton/day)	VOC (ton/day)	Total $PM_{2.5}$ (ton/day)
2008	Franklin	0.879	0.612	0.496
2014	Franklin	0.501	0.386	0.429
2019	Franklin	0.360	0.263	0.429

Notes: nitrogen oxides (NO_x); volatile organic compounds (VOC); particulate matter 2.5 ($PM_{2.5}$)

5.5.3 Adequacy Determination

Before the MVEB can be used for conformity purposes, it must demonstrate *adequacy*. For EPA to determine the MVEB is adequate, the conformity rule requires that MVEB emissions must be considered with all other emissions sources and be consistent with the applicable SIP. Modeling must demonstrate that all emission sources combined (point, area, and mobile sources) will not cause or contribute to a violation of the $PM_{2.5}$ NAAQS. As discussed above, a modeling demonstration was performed by UDAQ that included point, area, and mobile sources from both

Idaho and Utah, showing attainment and maintenance of the NAAQS by 2014. This information is available in Appendix B.

6 Administrative Requirements

Table 10 provides a crosswalk between the regulatory requirements in 40 CFR 51 this SIP must address and how Idaho has met the requirements.

Table 10. Crosswalk between the regulatory requirements and how the requirement is met within this State Implementation Plan.

Regulatory Requirement (paraphrased)	How Idaho Met Requirement
§ 51.102 Public hearings. States must provide notice, provide the opportunity to submit written comments, and allow the public the opportunity to request a public hearing.	Public participation in the development of this plan is discussed in section 6.2. IDEQ will provide a 30-day public comment period with a public hearing. Complete documentation of the public comment process will be included with the submittal of this plan to EPA.
§ 51.103 Submission of plans, preliminary review of plans.	Idaho will submit plan in accordance to letter from Region 10 dated April 26, 2011.
§ 51.110 Attainment and maintenance of national standards. Each plan providing for the attainment of a primary or secondary standard must specify the projected attainment date.	Idaho's 2006 $PM_{2.5}$ Infrastructure SIP was submitted to EPA June 25, 2010, and updated August 8, 2011. The attainment date is January 1, 2015
§ 51.111 Description of control measures. Each plan must set forth an enforceable control strategy.	The control strategy for Franklin County is discussed in section 5. In addition, the State of Utah has submitted a plan to EPA Region 8 that contains enforceable control measures for Cache County.
§ 51.112 Demonstration of adequacy. Each plan must demonstrate that the measures, rules, and regulations contained in it are adequate to provide for the timely attainment and maintenance of the national standard that it implements.	The adequacy of control measures for Franklin County is discussed in sections 4 and 5. In addition, the State of Utah has submitted a plan to EPA Region 8 demonstrating the adequacy of control measures for Cache County.

§ 51.114 Emissions data and projections. Each plan must contain a detailed inventory of emissions from point and area sources and a summary of emission levels projected to result from application of the new control strategy.	The emissions inventory is discussed in section 3 and the emissions projections are discussed in section 4.
§ 51.115 Air quality data and projections. Each plan must contain a summary of data showing existing air quality and a summary of air quality concentrations expected to result from application of the control strategy.	Existing air quality data is discussed in section 2 and expected air quality concentrations are discussed in section 4.
§ 51.116 Data availability. The State must retain all detailed data and calculations used in the preparation of each plan or each plan revision, and make them available for public inspection and submit them to the Administrator at his request.	IDEQ maintains documents and data in a central record management system. SIP related documents are retained for 35 years after the date of redesignation.
§ 51.213 Transportation control measures. (a) The plan must contain procedures for obtaining and maintaining data on actual emissions reductions achieved as a result of implementing transportation control measures.	TCM does not apply in Franklin County, see section 5.3.10.
§ 51.230 Requirements for all plans. Each plan must show that the State has legal authority to carry out the plan, including authority to (a) Adopt emission standards and limitations. (b) Enforce applicable laws, regulations, and standards, and seek injunctive relief. (c) Abate pollutant emissions on an emergency basis. (d) Prevent construction, modification, or operation of a facility which results or may result in emissions of any air pollutant at any location which will prevent the attainment or maintenance of a national standard. (e) Obtain information necessary to determine whether air pollution sources are in compliance with applicable laws. (f) Require owners or operators of stationary sources to install, maintain, and use emission monitoring devices and to make periodic reports to the State on the nature and amounts of emissions from such stationary sources.	Idaho's 2006 $PM_{2.5}$ Infrastructure SIP was submitted to EPA June 25, 2010, and updated August 8, 2011.

§ 51.231 Identification of legal authority. The provisions of law or regulation which the State determines provide the authorities required under this section must be specifically identified, and copies of such laws or regulations be submitted with the plan. These must be legal authorities available to the State at the time of submission of the plan.	Idaho's 2006 $PM_{2.5}$ Infrastructure SIP was submitted to EPA June 25, 2010, and updated August 8, 2011. Local ordinances and the road sanding agreements are included in Appendix E.
§ 51.232 Assignment of legal authority to local agencies. The State may authorize a local agency to carry out a plan, or portion thereof, if the local agency has the legal authority necessary to implement the plan or portion of it.	Affected governments in Franklin County have the authority to implement the local ordinances included in this plan.
§ 51.280 Resources. Each plan must include a description of the resources available to the State and local agencies at the date of submission of the plan and of any additional resources needed to carry out the plan.	Idaho's 2006 $PM_{2.5}$ Infrastructure SIP was submitted to EPA June 25, 2010, and updated August 8, 2011. No additional resources are necessary to implement this plan.
§ 51.281 Copies of rules and regulations. Emission limitations and other measures necessary for attainment and maintenance of any national standard must be adopted as rules and submitted with the plan.	Local ordinances are included in Appendix E.
$PM_{2.5}$ Specific Requirements (paraphrased)	**How Idaho Met Requirement**
§ 51.1002 Submittal of State implementation plan. (a) For any area designated by EPA as nonattainment, the State must submit a State implementation plan satisfying the requirements of section 172 of the Act to EPA no later than 3 years from the date of designation. (b) The State must submit a plan consistent with the requirements of section 110(a)(2) of the Act unless the State already has fulfilled this obligation for the purposes of implementing the $PM_{2.5}$ NAAQS. (c) Pollutants contributing to fine particle concentrations. The State implementation plan must identify and evaluate sources of $PM_{2.5}$ direct emissions and $PM_{2.5}$ precursors. After January 1, 2011, States must establish such limits taking into consideration the condensable fraction of direct $PM_{2.5}$ emissions. (1) The State must address sulfur dioxide as a $PM_{2.5}$ attainment plan precursor and evaluate sources of SO_2 emissions in the State for control measures. (2) The State must address NO_X as a $PM_{2.5}$ attainment plan precursor and evaluate sources of NO_X emissions in the	This plan meets this requirement. Idaho's 2006 $PM_{2.5}$ Infrastructure SIP was submitted to EPA June 25, 2010, and updated August 8, 2011. In addition to the requirements addressed by Idaho's Infrastructure SIP, this plan specifically identifies and evaluates sources of direct $PM_{2.5}$ emissions and $PM_{2.5}$ precursors in sections 3, 4, and 5.

State for control measures, unless the State and EPA provide an appropriate technical demonstration for a specific area showing that NO_X emissions from sources in the State do not significantly contribute to $PM_{2.5}$ concentrations in the nonattainment area. (3) The State is not required to address VOC as a PM2.5attainment plan precursor and evaluate sources of VOC emissions in the State for control measures, unless the State provides an appropriate technical demonstration for a specific area showing that VOC emissions from sources in the State significantly contribute to $PM_{2.5}$ concentrations in the nonattainment area. (4) The State is not required to address ammonia as a $PM_{2.5}$ attainment plan precursor and evaluate sources of ammonia emissions from sources in the State for control measures.	
§ 51.1004 Attainment dates. Consistent with section 172(a)(2)(A) of the Act, the attainment date for an area designated nonattainment for the $PM_{2.5}$ NAAQS will be the date by which attainment can be achieved as expeditiously as practicable, but no more than five years from the date of designation.	The attainment date is January 1, 2015.
§ 51.1007 Attainment demonstration and modeling requirements. (a) For any area designated as nonattainment for the $PM_{2.5}$ NAAQS, the State must submit an attainment demonstration showing that the area will attain the annual and 24-hour standards as expeditiously as practicable. The attainment demonstration and supporting air quality modeling should be consistent with EPA's $PM_{2.5}$ modeling guidance. (b) The State implementation plan must provide for implementation of all control measures needed for attainment as expeditiously as practicable.	The attainment demonstration can be found in section 4 and the control measures are listed in section 5.
§ 51.1008 Emission inventory requirements for the $PM_{2.5}$ NAAQS. (a) For purposes of meeting the emission inventory requirements of section 172(c)(3) of the Act for nonattainment areas, the State shall submit to EPA Statewide emission inventories for direct $PM_{2.5}$ emissions and emissions of $PM_{2.5}$ precursors. (b) For inventories required for submission under paragraph (a) of this section, a baseline emission inventory is required for the attainment.	The emissions inventory is discussed in section 3.

§ 51.1009 Reasonable further progress (RFP) requirements. If the State submits to EPA an attainment demonstration and State implementation plan for an area which demonstrates that it will attain the PM NAAQS within five years of the date of designation, the State is not required to submit a separate RFP plan.	RFP does not apply because this plan demonstrates attainment within 5 years of designation.
§ 51.1010 Requirements for reasonably available control technology (RACT) and reasonably available control measures (RACM). The State shall submit with the attainment demonstration a SIP revision demonstrating that it has adopted all reasonably available control measures necessary to demonstrate attainment as expeditiously as practicable. The SIP revision shall contain the list of the potential measures considered by the State, and information and analysis sufficient to support the State's judgment that it has adopted all RACM, including RACT. The State must consider the cumulative impact of implementing the available measures. Potential measures that are reasonably available considering technical and economic feasibility must be adopted as RACM if, considered collectively, they would advance the attainment date by one year or more.	RACT and RACM are discussed in section 5.
§ 51.1012 Requirement for contingency measures. Consistent with section 172(c)(9) of the Act, the State must submit in each attainment plan specific contingency measures to be undertaken if the area fails to make reasonable further progress, or fails to attain the $PM_{2.5}$ NAAQS by its attainment date. The contingency measures must take effect without significant further action by the State or EPA.	Franklin County's contingency measure obligation is addressed in section 5.

6.1 Consultation and Public Notification Procedures

CAA Section 110(a)(2)(M) requires that SIPs provide for public consultation and participation by affected local political subdivisions. The public participation effort by IDEQ and UDAQ on developing the CVNAA SIP has been extensive. Work commenced on this project in December 2009. While developing the SIP's technical portions (dispersion modeling, emissions inventory, and attainment and maintenance demonstrations), regular meetings were held with UDAQ, IDEQ, EPA Regions 8 and 10, MPO, and ITD. These meetings provided a cooperative atmosphere where the various $PM_{2.5}$ and jurisdictional issues could be addressed. Agreement was made as each critical component was established, including developing the emissions inventory and supporting document, resolving modeling issues, and evaluating control measures.

In addition to the technical committee listed above, IDEQ has worked and consulted with the cities of Preston, Franklin, Weston, Dayton, Clifton, and Oxford as well as Franklin County, and ITD on issues related to air quality issue within the CVNAA, modification to existing ordinances, and a RWC ordinance. The tight working relationship between all parties and mutual interests in air quality in and around the Cache Valley has provided for a cooperative partnership in addressing the complex airshed issues.

IDEQ also established a Cache Valley Airshed Advisory Group (see Appendix F). The group's purpose is to serve as stakeholders for the community at large, provide IDEQ input and feedback during the SIP development phase, and help IDEQ identify and establish effective control measures for the Idaho side of the CVNAA.

6.2 Continued Air Monitoring and Verification of Attainment

IDEQ is responsible for monitoring $PM_{2.5}$ levels on the Idaho side of the CVNAA. IDEQ commits to complying with the continued air monitoring requirement of CAA Title III, Section 319. The $PM_{2.5}$ site is operated in compliance with EPA monitoring guidelines set forth in 40 CFR 58, "Ambient Air Quality Surveillance," and 40 CFR 58, Appendices A–D.

On an annual basis, IDEQ will analyze the 3 most recent consecutive years of ambient $PM_{2.5}$ monitored data to verify continued attainment of the NAAQS for $PM_{2.5}$ in accordance with 40 CFR 50. In keeping with the requirements of CAA Title III, Section 319 (as defined in 40 CFR 58.26), IDEQ will continue to submit to EPA by July 1 of each year an annual report on $PM_{2.5}$ data collected during the previous calendar year. These data, along with the data contained in the annual reports for the previous 2 years, will provide all the information needed to determine whether the Cache Valley attains the $PM_{2.5}$ NAAQS.

6.3 Permitting Program Role

IDAPA 58.01.01, "Rules for the Control of Air Pollution in Idaho," contains various permitting rules. The stationary source air permitting rules are found in IDAPA 58.01.01.200–500. The permitting program requires permits for constructing and operating new, or modifying existing, stationary sources within the NAA. Section 204 applies specifically to major sources in NAAs. Additionally, there are statewide SIP-approved rules that apply to the SIP NAA such as those dealing with fugitive dust (IDAPA 58.01.01.650–651) and open burning (IDAPA 58.01.01.600–624).

6.4 Review Commitment and Plan Update

IDEQ commits to provide a revision to this plan if required in accordance with CAA Section 110(a)(2)(H). *The Environmental Protection and Health Act*, Idaho Code § 39-105, and the *Rules for the Control of Air Pollution in Idaho*, IDAPA 58.01.01, promulgated thereunder, provide the authority to the state to revise SIPs and to satisfy CAA requirements. The monitoring data will be analyzed to verify continued attainment with the NAAQS, and the plan will be reviewed if significant an upward trend in design values occurs. Finally, if any of the underlying EPA assumptions are modified, such as the motor vehicle emissions or a large increase in industrial or fugitive dust emissions, the SIP will be reviewed to determine if any revision is necessary.

7 Conclusions

This SIP demonstrates that the CVNAA (Logan, Utah—Franklin, Idaho) will achieve attainment with the 24-hour $PM_{2.5}$ NAAQS by January 1, 2015. The states of Utah and Idaho have worked cooperatively with each other, with EPA, and with citizens to develop control strategies in keeping with the inventories on both sides of the CVNAA.

The State of Idaho will continue to monitor $PM_{2.5}$ concentrations in Franklin County. If exceedances occur, IDEQ will determine the cause(s) and adjust the appropriate control measures to ensure prompt corrective action is taken.

This CVNAA SIP fulfills the requirements of the CAA as they pertain to State Implementation Plans. IDEQ requests that EPA approve this attainment plan in accordance with CAA Section 110.

8 References

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