Northern Ada County Carbon Monoxide Limited Maintenance Plan Revision

State of Idaho

Department of Environmental Quality

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Prepared by
Idaho Department of Environmental Quality
Air Quality Division
1410 N. Hilton St.
Boise, ID 83706

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Abbreviations, Acronyms, and Symbols

µ	micro
AQS	air quality standard
ATR	automatic traffic recorder
AVRT	Alternative Vehicle and Fuels Technology
BPR	Bureau of Public Roads
CAA	Clean Air Act
CMAQ	Community Multiscale Air Quality
CO	carbon monoxide
COMPASS	Community Planning Association of Southwest Idaho
CY	calendar year
DEQ	Idaho Department of Environmental Quality
DMV	Department of Motor Vehicle
EPA	United States Environmental Protection Agency
FHWA	Federal Highway Administration
FRM	Federal Reference Method
g	gram
HMS	Hazard Mapping System
HPMS	Highway Performance Monitoring System
I/M	inspection and maintenance
ITD	Idaho Transportation Department
INL	Idaho National Laboratory
LMP	Limited Maintenance Plan
m^3	cubic meters
mb	millibar
MOVES	Motor Vehicle Emissions Simulator
mph	miles per hour
MSA	Metropolitan Statistical Area
MVEB	motor vehicle emissions budget
NAAQS	National Ambient Air Quality Standards
NEI	National Emissions Inventory
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NO_X	nitrogen oxides
PM_{10}	particulate matter with diameter less than or equal to 10 microns
$PM_{2.5}$	particulate matter with diameter less than or equal to 2.5 microns

ppb	parts per billion
ppm	parts per million
SIP	state implementation plan
SO_2	sulfur dioxide
TAZ	transportation analysis zone
TDM	travel demand model
TPY	tons per year
VHT	vehicle hours traveled
VIN	vehicle identification number
VMT	vehicle miles traveled
VOC	volatile organic compounds

1 Introduction

Idaho DEQ is submitting a state implementation plan (SIP) revision to remove the Inspection and Maintenance (I/M) Program from the Northern Ada County Carbon Monoxide (CO) limited maintenance plan (LMP). The Clean Air Act (CAA) allows states to remove control measures initially included in a maintenance plan if the state demonstrates the removal of the control measures "would not interfere with any applicable requirement concerning attainment and reasonable further progress (as defined in section 7501 of this title), or any other applicable requirement of this chapter" (CAA § 110(l)). This demonstration shows that removal of the I/M program will not interfere with any applicable CAA requirement per CAA 110(l).

A 20-year maintenance period is required following the redesignation of a nonattainment area for a pollutant that has attained the National Ambient Air Quality Standard during which all contingency provisions included in the maintenance plan apply (CAA 175A). The requirement in section 175(A)(d) for contingency measures to include all control measures contained in the SIP prior to redesignation does not prevent the removal of contingency measures from the maintenance plan once the second 10-year maintenance plan period has expired. The Northern Ada County CO second 10-year limited maintenance period will end on December 27, 2022. Thus, section 175A(d) does not prevent the removal of the I/M program from the Northern Ada County CO LMP after this date. Idaho's SIP revision seeking such a removal must, however, still comply with the requirements of CAA sections 110(l) and 193, where applicable.

1.1 Background

The northern Ada County area was originally designated as nonattainment for the 1971 carbon monoxide (CO) National Ambient Air Quality Standard (NAAQS) on March 3, 1978 (43 FR 8962). Under CAA § 107(d)(1)(C), the northern Ada County area was designated nonattainment for CO by operation of law because the area had been designated as nonattainment before November 15, 1990.

The area was redesignated to attainment on December 27, 2002, when the United States Environmental Protection Agency (EPA) approved Idaho's *Northern Ada County Carbon Monoxide Redesignation Request and Limited Maintenance Plan* (LMP) on October 28, 2002 (*67 FR 65713*). EPA approved Idaho's *Northern Ada County Air Quality Maintenance Area Second 10-Year Carbon Monoxide Limited Maintenance Plan* on August 2, 2012 (*77 FR 45962*). The 20-year maintenance period for the northern Ada County CO limited maintenance area will end on December 27, 2022.

The second 10-year CO maintenance plan retained the three control measures from the initial northern Ada County maintenance plan:

1. Federal Motor Vehicle Emissions Control Program
2. Controls on Stationary Sources—New Source Review Program, including Prevention of Significant Deterioration Program

3. Ada County Vehicle Inspection and Maintenance (I/M) Program

The following CO contingency measures will be retained in the state implementation plan (SIP) and implemented if triggered:

1. Oxygenated Fuels Program—The Idaho Department of Environmental Quality (DEQ) will promulgate a rule through the Board of Environmental Quality requiring all gasoline fuels dispensed in the maintenance area to contain ethanol at a minimum of 10% by volume.
2. Alternative EPA-Approved Contingency Measure—DEQ understands EPA is reviewing the effectiveness of oxygenated fuels as a CO reduction measure and may provide guidance on more effective alternative contingency measures for CO reduction. If a more effective EPA-approved contingency measure become available, DEQ will negotiate and implement the alternative.

These contingency measures are triggered under the following circumstances: (1) immediately upon any exceedance of the CO NAAQS, based on quality assured data, recorded at any site within the maintenance area or (2) if quality assured monitoring data show nonoverlapping 8-hour average CO concentrations of 8.0 parts per million (ppm) on four or more days within a single winter season (November through March) within the maintenance area. If either of these two triggers are met, DEQ will implement one of the two contingency measures listed above.

1.2 Description of Limited Maintenance Area

Northern Ada County is part of the Treasure Valley in southwestern Idaho and is the most urbanized area of the state. This limited maintenance area is part of the large metropolitan statistical area (MSA) that includes Canyon, Boise, Gem, and Owyhee Counties (Figure 1). Even though the area has seen growth in the last 10 years, with population increasing by an average of 2.35% each year, the area still qualifies for a limited maintenance plan with the most recent CO design values being much less than 85% of the CO NAAQS.

1.3 Purpose of SIP Revision

DEQ is requesting EPA remove the following control measure and associated local ordinances from the Northern Ada County CO LMP:

1. Automotive Inspection and Maintenance Program (I/M program)
2. Motor Vehicle Emissions Control Ordinance, Air Quality Board (January 1, 2010)
3. Ada County, 1999 Motor Vehicle Emissions Control Ordinance (June 15, 1999) (Ordinance 6-1-3 Motor Vehicle Emissions Control) (Ord. 130, 8-28-1984; amd. Ord. 145, 2-18-1985; amd. Ord. 206, 8-10-1989; amd. Ord. 228, 11-29-1990, eff. 1-1-1991; amd. Ord. 374, 6-15-1999)
4. City of Boise, 1999 Motor Vehicle Emissions Control Ordinance (July 20, 1999), (1952 Code § 8-13-01)
5. City of Eagle, 1999 Motor Vehicle Emissions Control Ordinance (April 27, 1999), (Ord. 346, 4-27-1999)

6. Garden City, 1991 Motor Vehicle Emissions Control Ordinance (August 13, 1996), (1988 Code)
7. City of Meridian, 1999 Motor Vehicle Emissions Control Ordinance (June 1, 1999), (Ord. 814, 6-1-1999)

The Northern Ada County CO LMP is the only implementation plan that relied on the I/M program as a control strategy to demonstrate compliance with the NAAQS or other federal CAA requirements. This revision includes an analysis of air quality monitoring data, trends, and emission projections that demonstrates the removal of the I/M program from the Northern Ada County CO LMP will not interfere with any applicable requirement concerning attainment and reasonable further progress (as defined in CAA § 7501), or any other applicable requirement of CAA Chapter 85.

This SIP revision only addresses I/M Program incorporated into Idaho's SIP through the Northern Ada County CO Maintenance Plan and does not include or address the Canyon County or City of Kuna I/M Program.

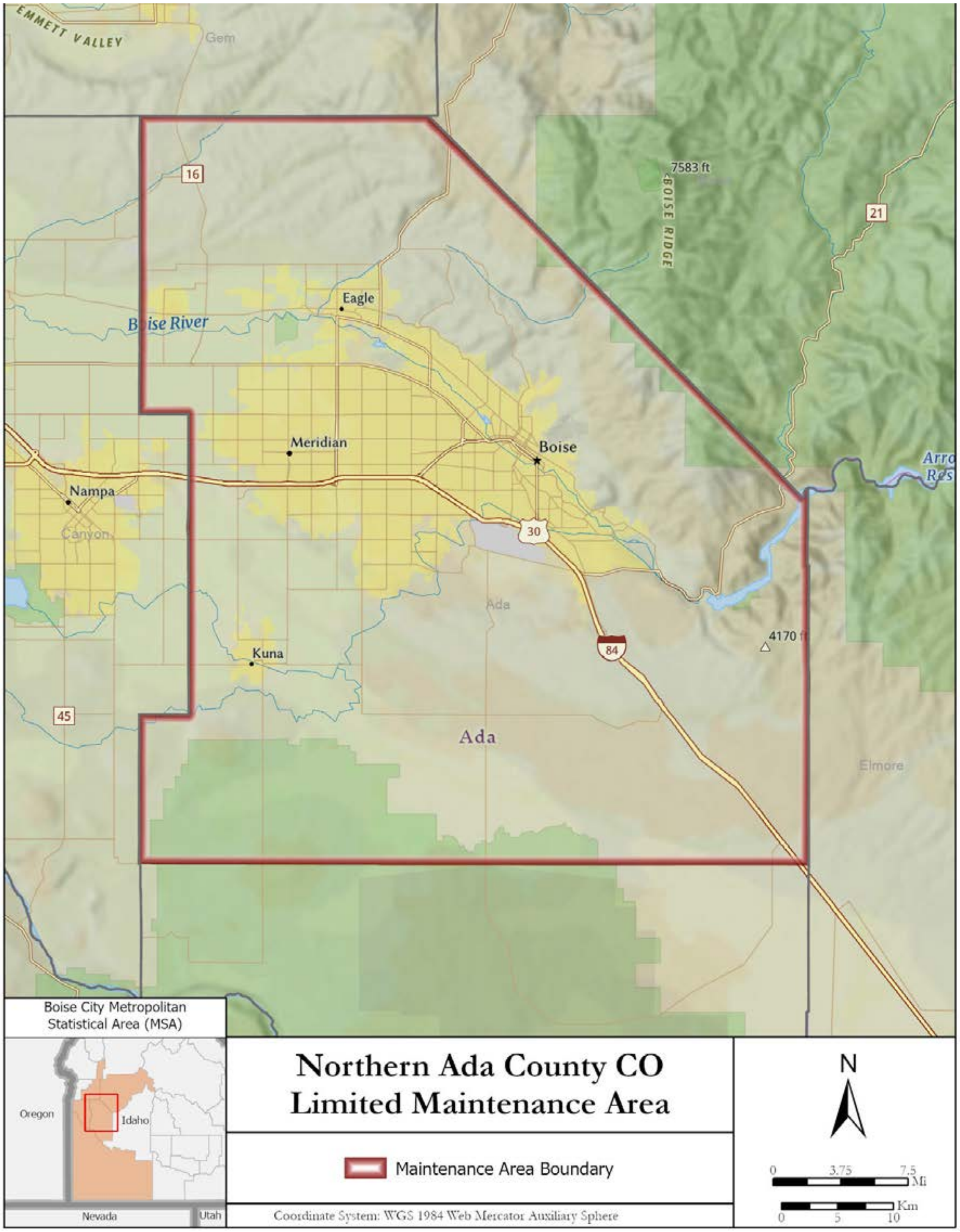

Figure 1. Northern Ada County CO limited maintenance area and surrounding MSA.

1.4 Public Comment

DEQ held a public comment period XXXX-XXXXX with a public hearing on XX/XX/XX.

2 Overview of the Vehicle I/M Program

Ada County and the cities of Meridian, Boise, and Eagle have operated the I/M program since 1984, covering all cities, except Kuna, and unincorporated parts of the county. This program is managed by the Air Quality Board and follows the requirements in the local ordinances listed section 1.3. The Air Quality Board implements the vehicle I/M program to comply with the Northern Ada County CO LMP.

The Air Quality Board has 42 emissions testing stations throughout northern Ada County. The I/M program requires emissions testing every other year for vehicles that meet local ordinances in section 1.3 and the following requirements:

1. The certificate of registration has "ADA COUNTY" entered upon it as the county of residence or would be required to have "ADA COUNTY" entered upon it as the county of residence pursuant to Idaho Code § 49-401B.
2. The gross vehicle weight equals or exceeds 1,500 pounds.
3. The model year is 1981 or newer.

The following vehicles are exempted from the I/M program:

1. Motorcycles as defined in Idaho Code § 40-114
2. Idaho Old Timers" as defined in Idaho Code § 49-406
3. Farm tractors as defined in Idaho Code § 49-107
4. Motor vehicles registered under the prorated registration provisions of Idaho Code § 49-437 for a period of less than 6 months
5. Idaho classic vehicles as defined in Idaho Code § 49-406A.
6. Motor vehicles for which an alternate fuel type has been established according to rules and regulations adopted by the board
7. Such other motor vehicles as may be exempted by rules and regulations adopted by the board

All vehicles 1984 and newer are subject to visual inspections of emissions control equipment in addition to the actual test. If the vehicle was originally manufactured with a catalytic converter or air injection system, those must be in place and operational. Gasoline-powered vehicles are tested by one of two methods, depending on the age of the vehicle:

1. Type 1—Two-Speed Idle (TSI) method (BAR 97 specification), gas-powered vehicles, model years 1981–1995.
2. Type 2—Second-generation On-Board Diagnostic (OBDII) system, model years 1996 and newer (SAE J1979 specification).

Diesel-powered vehicles are inspected by a snap acceleration test, which uses a smoke meter inserted at the exhaust pipe that reads the opacity of the exhaust when engine speed is quickly increased (SAE J1667 specification).

In 2020, 143,016 vehicles were tested through the I/M program (Figure 2). The program has had excellent compliance rates ranging from 96% to 99% since 2010 (Figure 3). When COVID occurred in early 2020, testing was stopped for 2 months before it was resumed. Even with temporary stoppage, the number of vehicles tested during this year was roughly the same as tested in previous years.

- Compliance rates reflect the percentage of vehicles due for testing that have either passed an emissions test or received a waiver or exemption.
- Failure rates reflect the percentage of tested vehicles that fail the initial test and are required to either obtain repairs and pass a retest or obtain a waiver due to hardship or repair costs (Figure 4). DEQ started tracking this metric in 2012.

The I/M program offers two forms of waivers: repair waivers and hardship waivers. The total waiver rate has been less than 1% since 2010.

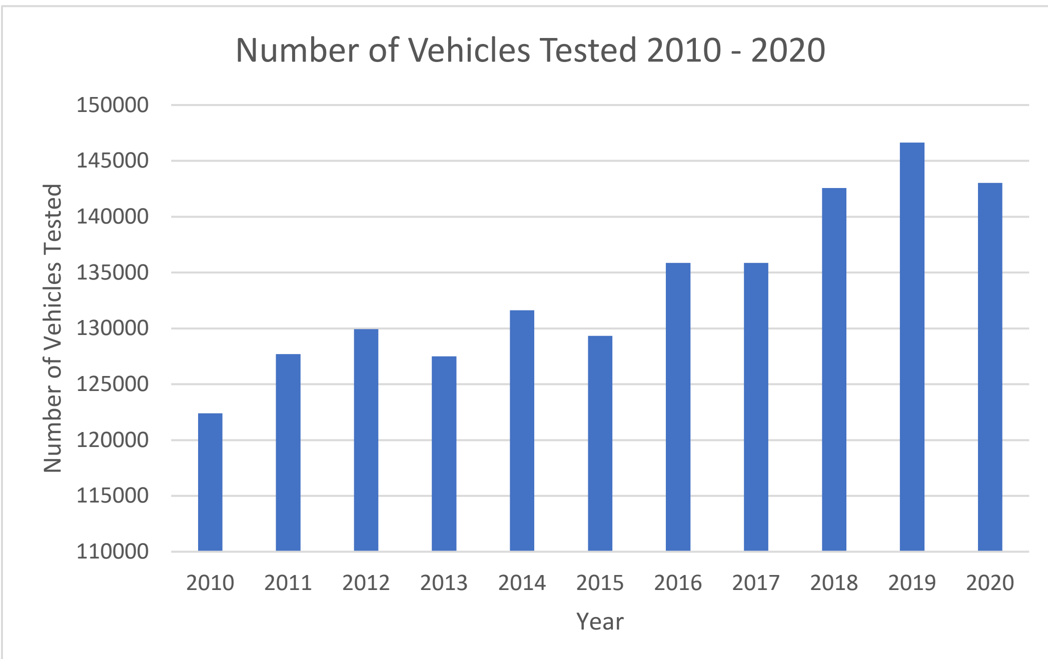

Figure 2. Number of vehicles tested in the I/M program from 2010 to 2020.

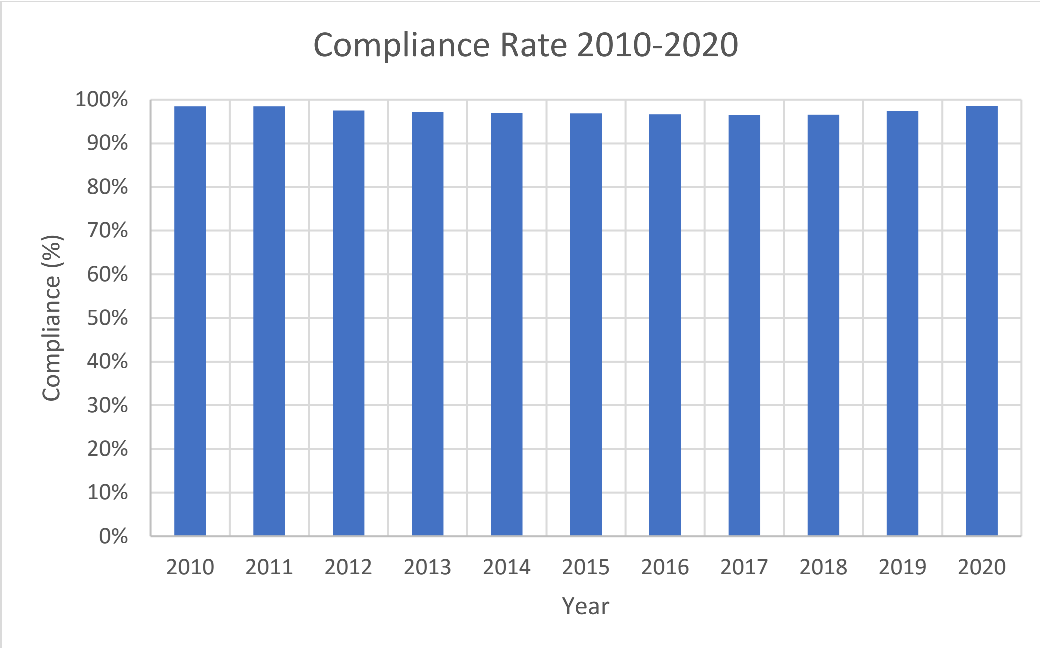

Figure 3. Compliance rates from 2010 to 2020 for the I/M program.

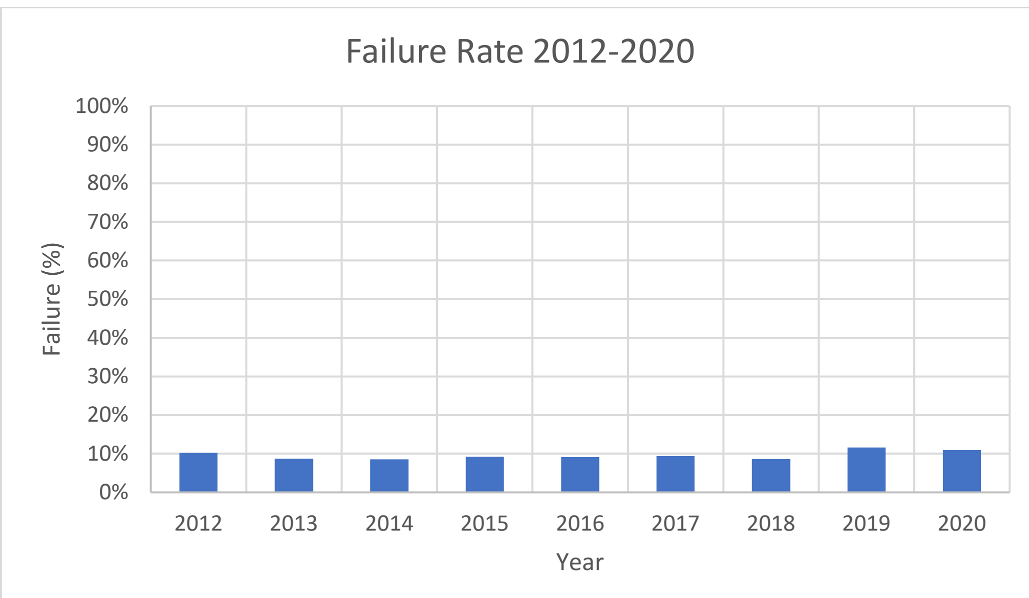

Figure 4. Failure rate results recorded through the I/M program from 2012 to 2020.

DEQ has estimated the reductions in emissions attributed to the I/M program since 2008. The emission reductions are estimated using the latest version of the EPA-approved motor vehicle emissions model. The motor vehicle emissions model has been continuously improved and updated over the years, which provided for a somewhat discontinuous dataset. Appendix A provides the list of models used for each calendar year. Each year, the I/M program has seen a decreasing CO emissions reductions attributable to the I/M program as well as ozone and particulate matter with diameter less than or equal to 2.5 microns ($PM_{2.5}$) precursors (nitrogen oxides [NO_X]and volatile organic compounds [VOCs]) (Figure 5).

Air quality has improved significantly in Ada County since the initial nonattainment designation, and the area is currently designated attainment or attainment/unclassifiable for all NAAQS. Older cars are continuously being replaced with newer, cleaner models, which are built with more stringent emissions controls and higher fuel-efficiencies. This fleet turnover has led to the I/M program achieving fewer emissions reductions each year and becoming less and less effective at improving air quality (Figure 5).

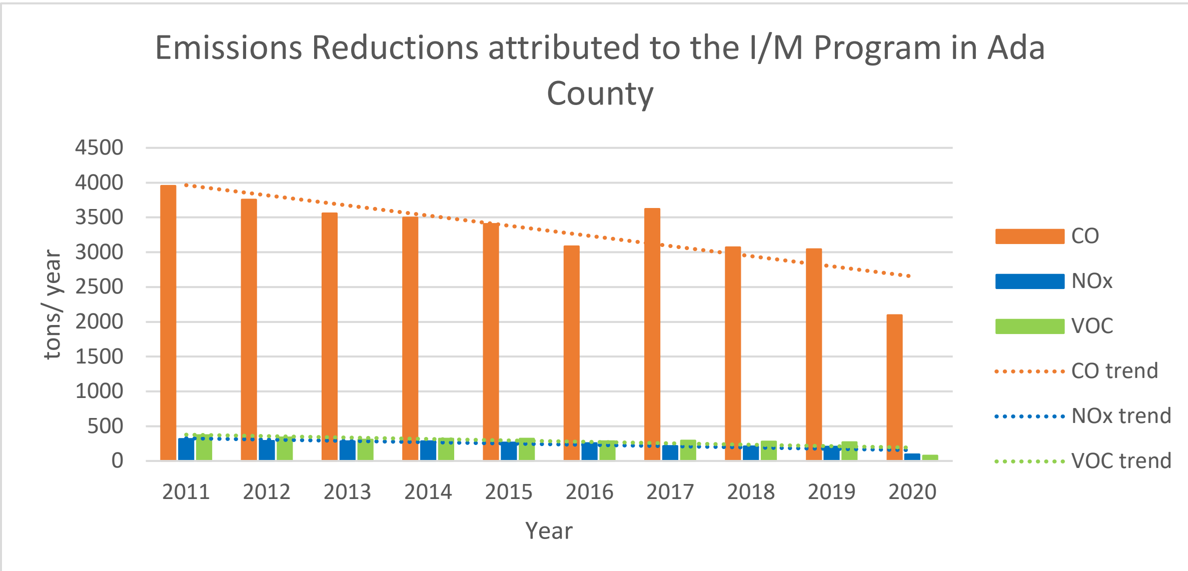

Figure 5. Emissions reductions in CO, VOCs, and NO_X from 2008 to 2020 due to the I/M program.

Because of the COVID-19 pandemic in 2020, cities and other areas across the country saw a decrease in VMT and therefore vehicle emissions, as more people stayed home. Unlike other areas of the country, Ada County did not see a decrease in VMT in 2020 due to COVID (Figure 6). VMT continued to increase overall in 2020 and is projected to continue growing in future years.

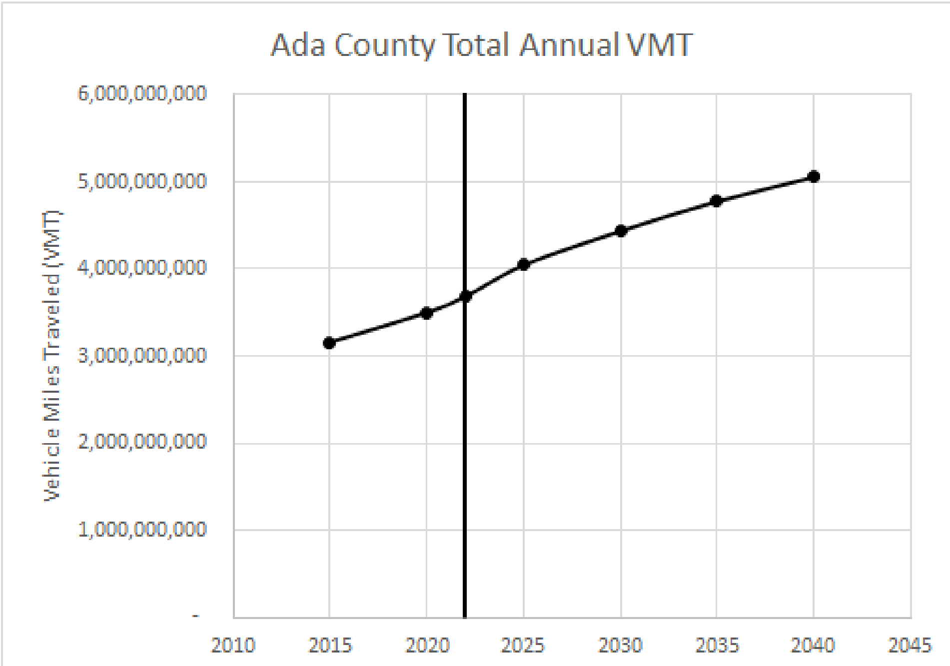

Figure 6. Ada County total annual VMT for 2015, 2020, 2022, 2025, 2030, 2035, and 2040. VMT is from COMPASS Travel Demand Model output for each year.

3 Current NAAQS Compliance and Air Quality Trends

The CAA 110(l) requires that each revision to an implementation plan not interfere with any applicable requirements of the CAA. EPA interprets section 110(l) as applying to all NAAQS that are in effect, including those for which SIP submissions have not been made, therefore DEQ is presenting analysis on all criteria pollutants.

CO monitoring in Ada County began in 1977. Violations of the health-based standard for CO occurred every winter from 1977 until 1986. No violations of the CO NAAQS have occurred since 1986. DEQ also monitors ozone, sulfur dioxide (SO_2), nitrogen dioxide (NO_2), $PM_{2.5}$, and PM_{10} in Ada County as well as the Treasure Valley as a whole. Table 1 lists the current primary NAAQS.

Table 1. Primary NAAQS.

Pollutant	Averaging Period	NAAQS	Form
CO	1-hour	35 ppm	Not to be exceeded more than once per year
	8-hour	9 ppm	
Lead	Rolling 3-month average	0.15 micrograms per cubic meter (µg/m3)	Not to be exceeded
NO_2	1-hour	100 parts per billion (ppb)	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	Yearly	53 ppb	Annual mean
Ozone	8-hours	0.070 ppm	Annual 4th-highest daily maximum 8-hour concentration, averaged over 3 years
$PM_{2.5}$	24-hours	35 $\mu g/m^3$	98th percentile averaged over 3 years
	Annual	12 $\mu g/m^3$	Annual mean, averaged over 3 years
PM_{10}	24-hours	150 $\mu g/m^3$	Not to be exceeded more than once on average over 3 years
SO_2	1-hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years

3.1 Carbon Monoxide

Until December 31, 2021, there were two CO monitors for NAAQS compliance in Ada County. The Boise Eastman monitor was located in the urban core of the city of Boise. The Meridian St. Luke’s site is centrally located for the greater MSA. The Boise Eastman CO monitor was discontinued, after obtaining approval from EPA on December 31, 2021. The Meridian St. Luke’s CO monitor will remain as the CO monitor to ensure NAAQS compliance for the maintenance area and the MSA as a whole. The level of the 1971 8-hour NAAQS for carbon monoxide is 9 parts per million (ppm) over an 8-hour period and 35 ppm over a 1-hour period, not to be exceeded more than once per year. The CO design value for both standards is calculated based on 2 years (8 quarters) and is the higher of each year's annual second maximum, non-overlapping 8-hour average. The design value listed for each area is the highest among monitors with valid design values. Table 2 list the 2017–2021 1-hour design values, and Table 3 lists the 2017-2021 8-hr design values for CO. Table 2 and Table 3 verify that area still meets the requirements for a LMP (EPA 1995). Figure 7 and Figure 8 show the 1-hour and 8-hour design values for the MSA have been well below the NAAQS since 2016 when taking the highest second maximum between the two monitors.

Table 2. 2017–2021 carbon monoxide 1-hour design values (ppm).

Site Name	AQS ID	MSA	2nd Highest 1-Hour Average					Meets LMP Requirement?[a]
			2016-2017	2017-2018	2018-2019	2019-2020	2020-2021	
Meridian St. Luke's	160010010	Boise City–Nampa	1.4	1.0	1.0	1.09	1.0	Yes
Boise Eastman	160010014	Boise City–Nampa	15.9	15.9	4.6	2.5	2.5	Yes

a. To qualify for a LMP, the design value must be below 85% of the NAAQS, 29.75 for the 1-hour.

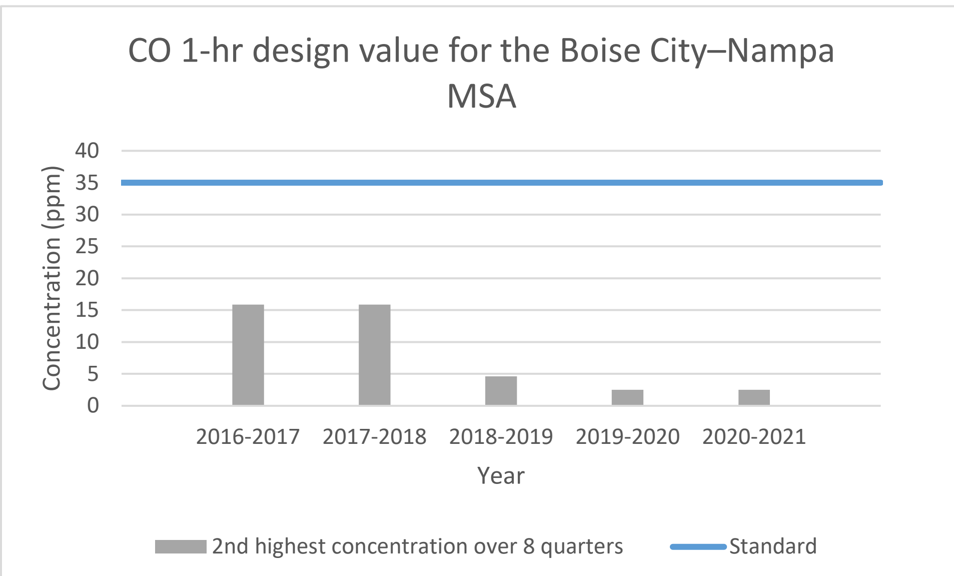

Figure 7 CO 1-hour design concentrations from 2017 to 2021 for the Treasure Valley MSA

Table 3. 2017–2021 carbon monoxide 8-hour design values (ppm).

Site Name	AQS ID	MSA	2nd Highest 8-Hour Average					Meets LMP Requirement?[a]
			2016-2017	2017-2018	2018-2019	2019-2020	2020-2021	
Meridian St. Luke's	160010010	Boise City–Nampa	4.1	4.1	1.6	0.9	0.9	Yes
Boise Eastman	160010014	Boise City–Nampa	0.9	0.7	1.6	1.5	1.5	Yes

a. To qualify for a LMP, the design value must be below 85% of the NAAQS, 7.65 for the 8-hour.

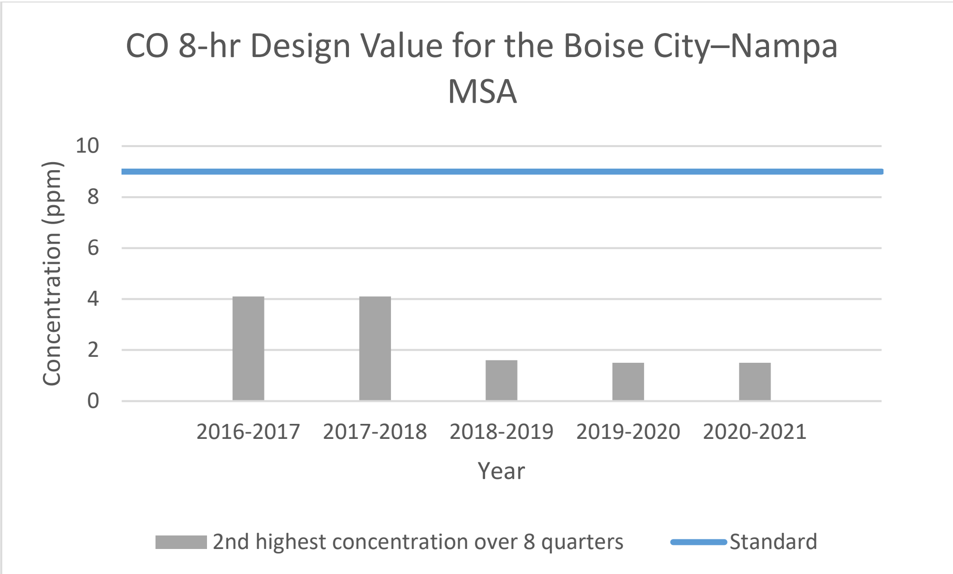

Figure 8. CO 8-hour design values from 2017 to 2021 for the MSA.

3.2 Ozone

DEQ has been monitoring ozone in Ada County since 2001. There are two ozone monitors in Ada County: the Boise White Pine Elementary site monitors peak ozone in Ada County and the Meridian St Luke's site represents the larger MSA. Table 4 presents the most recent 3-year ozone design values for 2019-2021. Figure 9 presents the rolling 3-year design values for 2017–2021 for both ozone monitors. The design values have been below the NAAQS for both monitors since 2019.

Table 4. 2021 ozone design value (ppm).

Site Name	AQS ID	MSA	4th-Highest Daily Maximum 8-Hour Average			3-Year Design Value
			2019	2020	2021	
Meridian St. Luke's	160010010	Boise City–Nampa	0.057	0.063	0.075	0.065
Boise White Pine Elementary	160010017	Boise City–Nampa	0.052	0.065	0.074	0.063

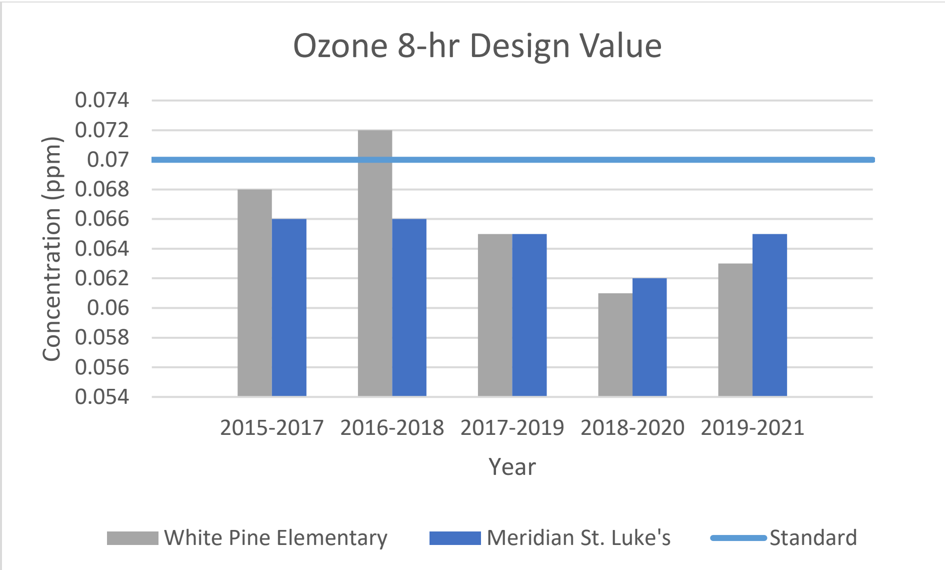

Figure 9. Ozone 8-hour design values from 2017 to 2021.

3.3 Particulate Matter 10

DEQ has been monitoring for PM_{10} in Ada County since 1986 and currently operates two monitors in the Treasure Valley: the Boise Fire Station in Boise and Nampa Fire Station in Canyon County. Table 5 presents the 2019–2021 design values. Both monitors are below the NAAQS for 2019–2021 (Table 5). The Boise Fire Station monitor has had zero exceedances of the NAAQS since 2017 when exceptional events are removed and has been in compliance with the NAAQS through this period even with exceptional events included. The Nampa Fire Station monitor has not violated the NAAQS for PM_{10} based on the most recent design value and is not in danger of exceeding based on the 3-year design values since 2017. Figure 10 and Figure 11 show the first highest and 2nd highest concentrations over the 3 design value years.

Table 5. 2021 PM_{10} design value

Site Name	AQS ID	MSA or County	# of Exceedances			3-Year Design Value[b]
			2019	2020	2021	
Boise Fire Station #5	160010009	Boise City–Nampa	0.0	0.0	0.0	0.0
Nampa Fire Station	160270002	Boise City–Nampa	0.0 [a]	0.0	0.0	0.0

a. Does not meet data completeness criteria
b. Design value is the 3-year average of estimated exceedances.

Table 6. 2019–2021 PM_{10} maximum daily concentrations.

Site Name	AQS ID	MSA	Max Daily Concentration		
			2019	2020	2021
Boise Fire Station #5	160010009	Boise City–Nampa	64	150	103
Nampa Fire	160270002	Boise City–	90	153	126

Site Name	AQS ID	MSA	Max Daily Concentration		
			2019	2020	2021
Station		Nampa			

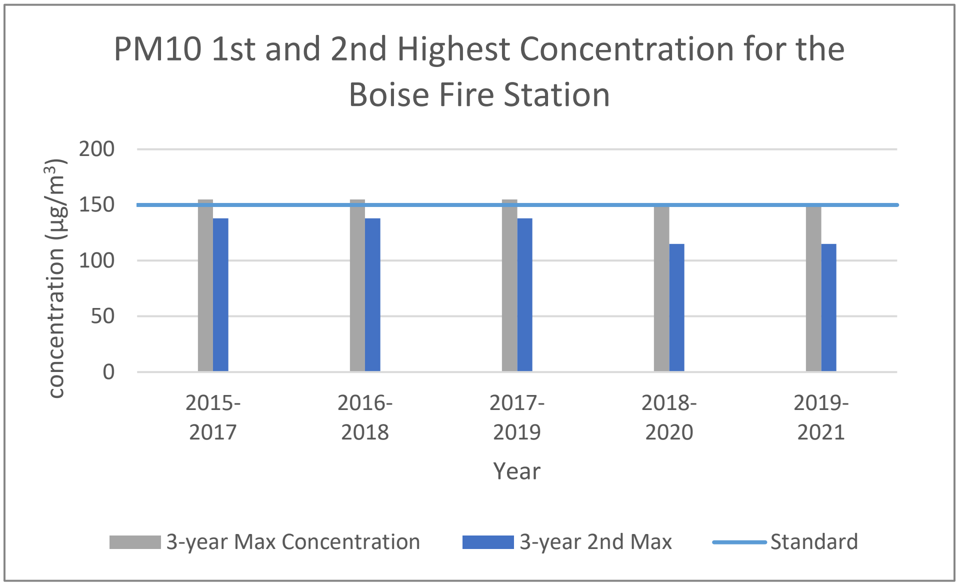

Figure 10. Boise Fire Station 1st and 2nd highest 24-hour PM_{10} concentrations for design value years 2017–2021.

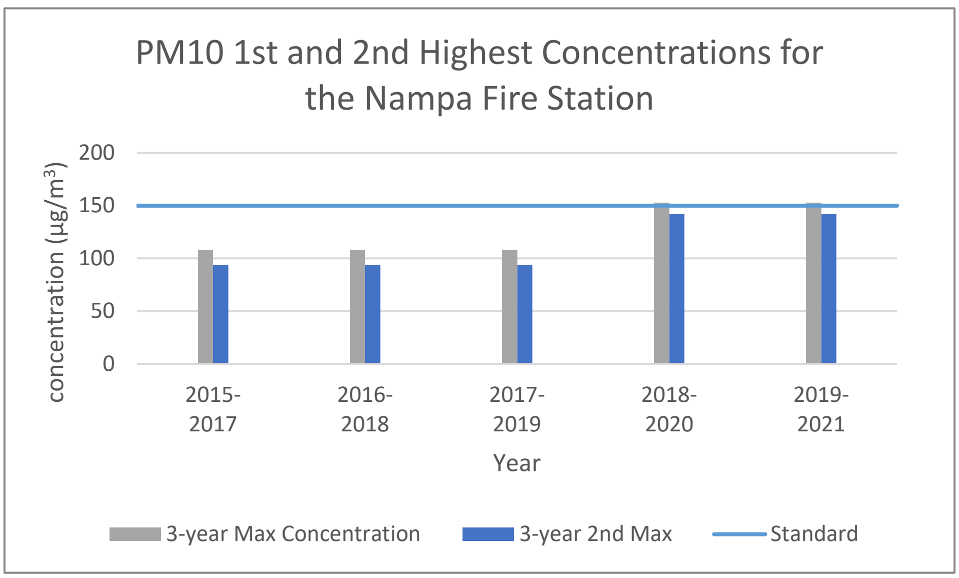

Figure 11. Nampa Fire Station 1st and 2nd highest 24-hour PM10 concentrations for design value years 2017–2021.

3.4 Particulate Matter 2.5

DEQ has been monitoring for $PM_{2.5}$ in Ada County since 1998 and currently operates two monitors in the MSA: the Meridian St. Luke's site is located in the nonattainment area and

Nampa Fire Station is in Canyon County. Table 7 and Table 8 show the current design values for both monitoring sites. Figure 12 Figure 13 show the design values are below the 24-hour $PM_{2.5}$ NAAQS at the Meridian St. Luke's monitor. The design values for Meridian St. Luke's monitor is well below the annual standard for $PM_{2.5}$ for the last 5 years (Figure 13).

Table 7. 2021 $PM_{2.5}$ 24-hour design values (µg/m³).

Site Name	AQS ID	MSA or County	98th-Percentile 24-Hour Concentration			3-Year Design Value
			2019	2020	2021	
Meridian St. Luke's	160010010	Boise City–Nampa	15	37	37	30
Nampa Fire Station	160270002	Boise City–Nampa	25	49	31[a]	35[a]

a. Does not meet data completeness criteria.

Table 8. 2021 $PM_{2.5}$ annual design values (µg/m³).

Site Name	AQS ID	MSA or County	Annual Weighted Mean Concentration			3-year Design Value
			2019	2020	2021	
Meridian St. Luke's	160010010	Boise City–Nampa	5.2	7.6	9.2	7.3
Nampa Fire Station	160270002	Boise City–Nampa	6.9	10.6	9.3[a]	8.9[a]

a. Does not meet data completeness criteria.

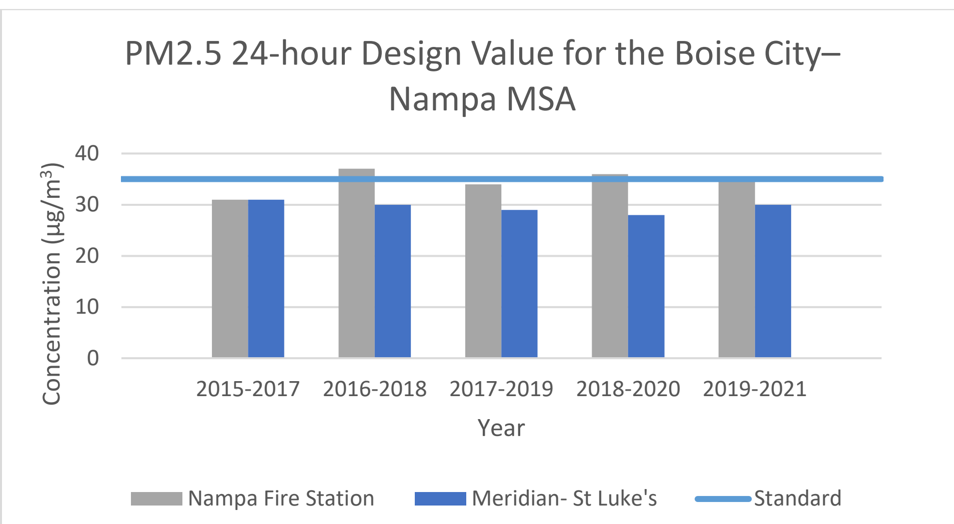

Figure 12. Meridian St. Luke's and Nampa Fire Station 24-hour $PM_{2.5}$ design values 2017–2021.

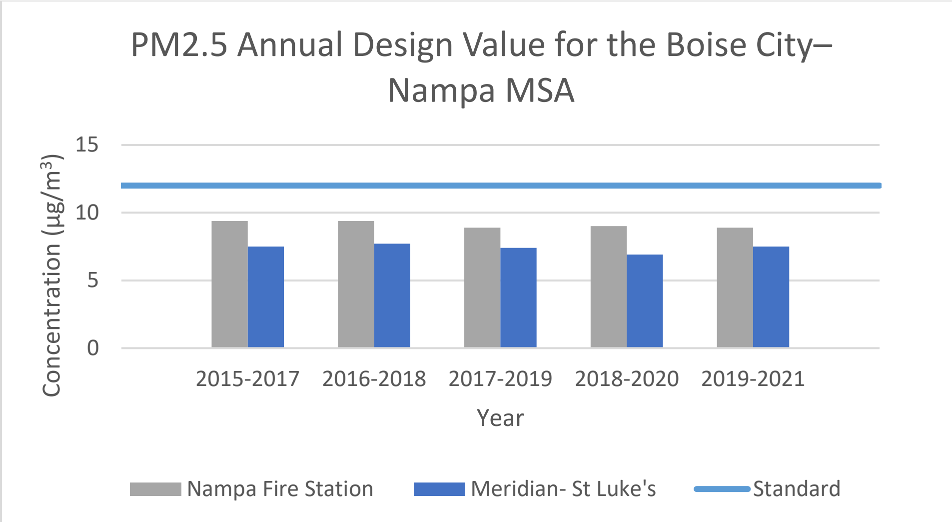

Figure 13. Meridian St. Luke's and Nampa Fire Station annual $PM_{2.5}$ design values 2017–2021.

3.5 Nitrogen Dioxide

DEQ has monitored for NO_2 in Ada County, since 2009 and year-round since 2019. DEQ operates one NO_2 monitor in Ada County. The NO_2 monitor was located at the Meridian Near Road site from 2012 through 2017 when it was shut down with EPA approval. DEQ relocated the NO_2 monitor to the Meridian St. Luke's site in the 4th quarter of 2018 and started collecting data in 2nd quarter of 2019. Table 9 and Table 10 show the current NO_2 design values. NO_2 concentrations have been well below the NAAQS from 2017 to 2021 (Figure 13 and Figure 14Figure 14).

Table 9. 2021 nitrogen dioxide 1-hour design value (ppb).

Site Name	AQS ID	MSA	98th Percentile—Highest Daily Maximum 1-Hour Average			3-Year Design Value
			2019	2020	2021	
Meridian St. Luke's	160010010	Boise City–Nampa	40.8[a]	43.1	45.1	43[b]

a. Due to computer malfunction on site, the official EPA air quality system start date was 04/01/2019. This number is based on three quarters.
b. Insufficient years to determine a 3-year design value.

Table 10. 2021 nitrogen dioxide annual design value (ppb)[a].

Site Name	AQS ID	MSA	2019	2020	2021
Meridian St. Luke's	160010010	Boise City–Nampa	9.03[a]	9.59	9.84

a. Design value is based on 1-year annual average
b. Due to computer malfunction on site, the official EPA air quality system start date was 04/01/2019. This number is based on three quarters.

Figure 14. Meridian sites 1-hour NO_2 design values 2017–2021.

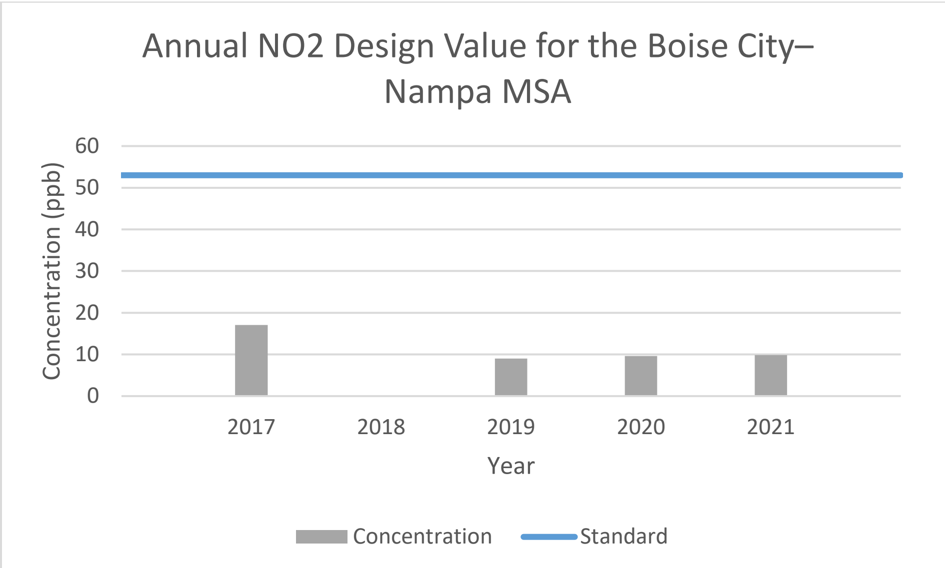

Figure 15. Meridian sites annual NO_2 design values 2017–2021.

3.6 Sulfur Dioxide

DEQ has monitored for SO_2 in Ada County since 2009 at the Meridian St. Luke's site. Table 11 shows the current 1-hour SO_2 design value. SO_2 has been consistently lower than 10% of the NAAQS from 2017 to 2021 (Figure 16).

Table 11. 2021 sulfur dioxide design value (ppb).

Site Name	AQS ID	MSA or County	99th Percentile–Highest Daily Maximum 1-Hour Average			3-Year Design Value
			2021	2020	2019	
Meridian St. Luke's	160010010	Boise City–Nampa	2	2	3	2

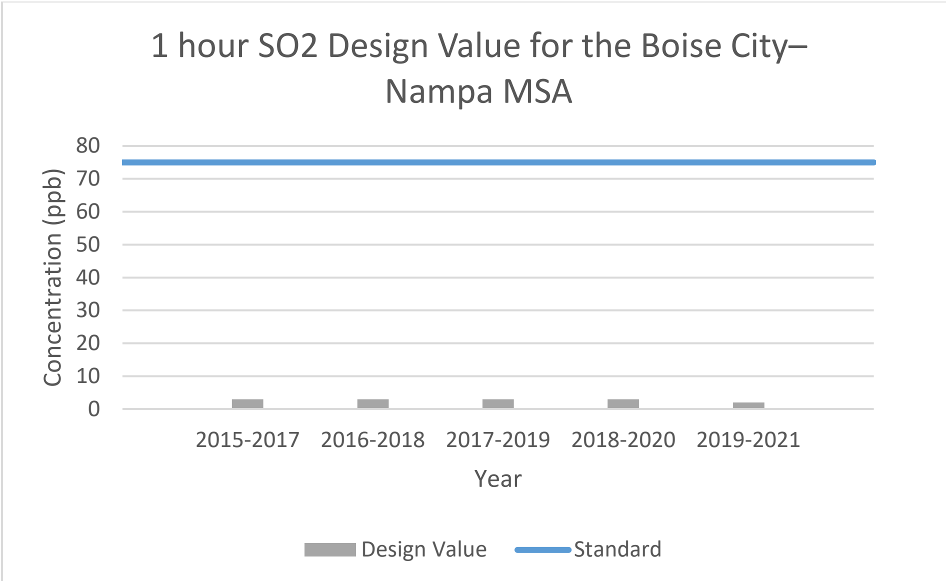

Figure 16. Meridian-St. Luke's 1-hour SO_2 design values 2017–2021.

4 Emission Inventory Summary

4.1 Carbon Monoxide

Figure 17 shows the sources of CO emissions in Ada County using 2017 National Emissions Inventory (NEI) data (EPA 2017). The onroad category consists of vehicles that are driven on roadways, such as passenger cars, trucks, and heavy-duty diesel trucks. The vast majority of onroad vehicles in Idaho use gasoline, making up 86.3% of the total onroad vehicle miles travelled (VMT)with diesel (12.8%) and other fuels (0.9%) making up the rest. Onroad gasoline-powered motor vehicles are the main source of CO emissions, accounting for 48% of the total annual CO emissions. The next largest source category is nonroad, which includes off-road mobile sources that use gasoline, diesel, and other fuels, such as construction equipment, lawn and garden equipment, and aircraft ground support equipment. Wildfires, another source of CO emissions, are included in the "Other" category as well as other smaller sources.

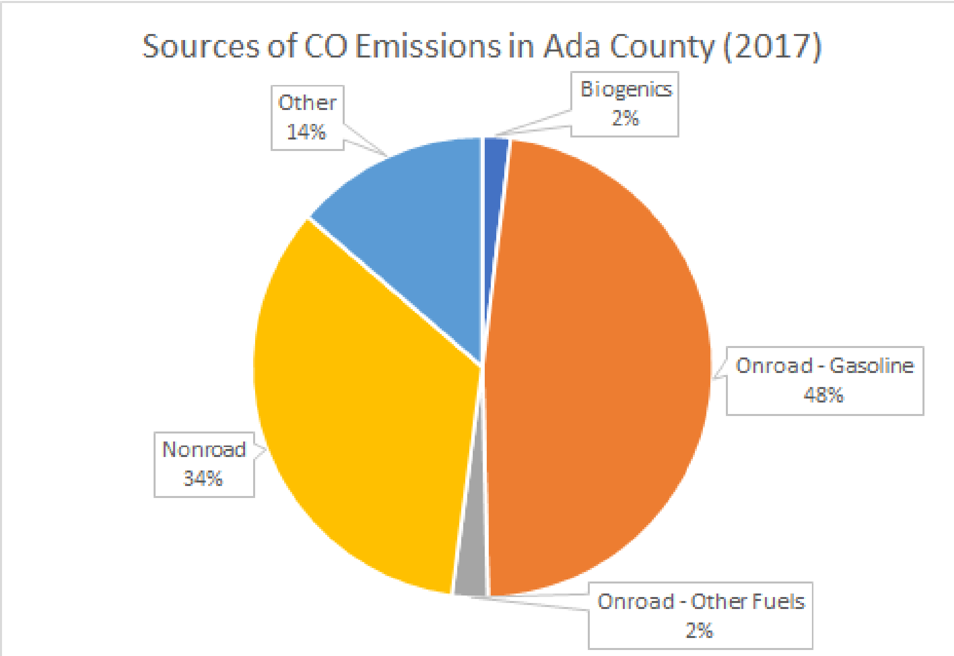

Figure 17. Sources of CO emissions in Ada County from the 2017 NEI.

4.2 Nitrogen Oxides

Figure 18 shows the sources of NO_X emissions in Ada County, using 2017 NEI data. Onroad gasoline-powered motor vehicles are the main source of NO_X emissions, accounting for 34% of the total annual NO_X emissions with total onroad motor vehicle emissions accounting for just over half of the countywide emissions. The “other” category consists of emissions mostly from residential, industrial and commercial fuel combustion, solvent use, gas stations and wildfires.

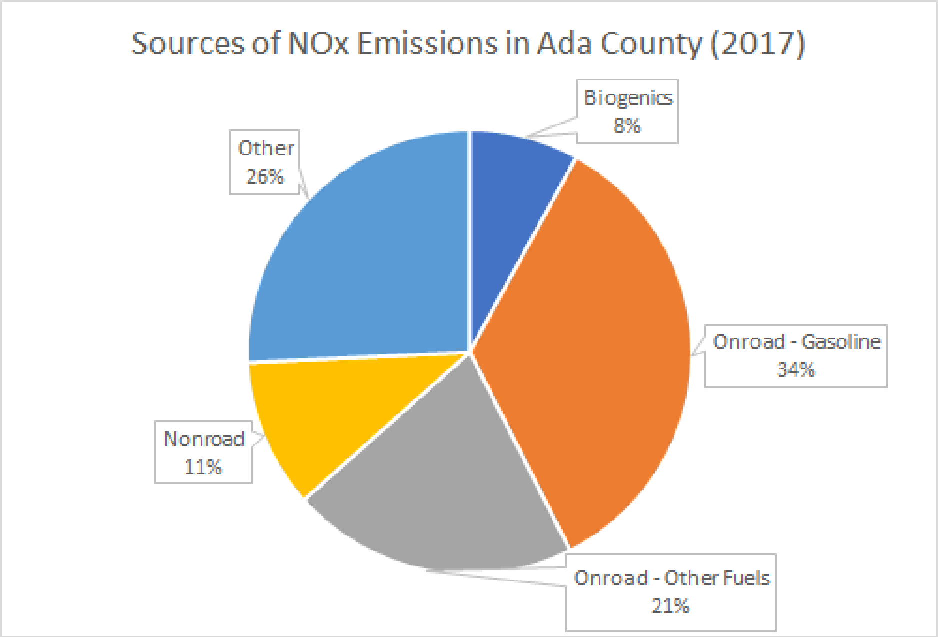

Figure 18. Sources of NO_X emissions in Ada County from the 2017 NEI.

4.3 Volatile Organic Compounds

Figure 19 shows the sources of VOC emissions in Ada County using 2017 NEI data. Onroad motor vehicles account for 19% of VOC emissions in Ada County. Most of the VOC emissions (53%) are from the "other" source category which is dominated by emissions from solvent use, gas stations and wildfires

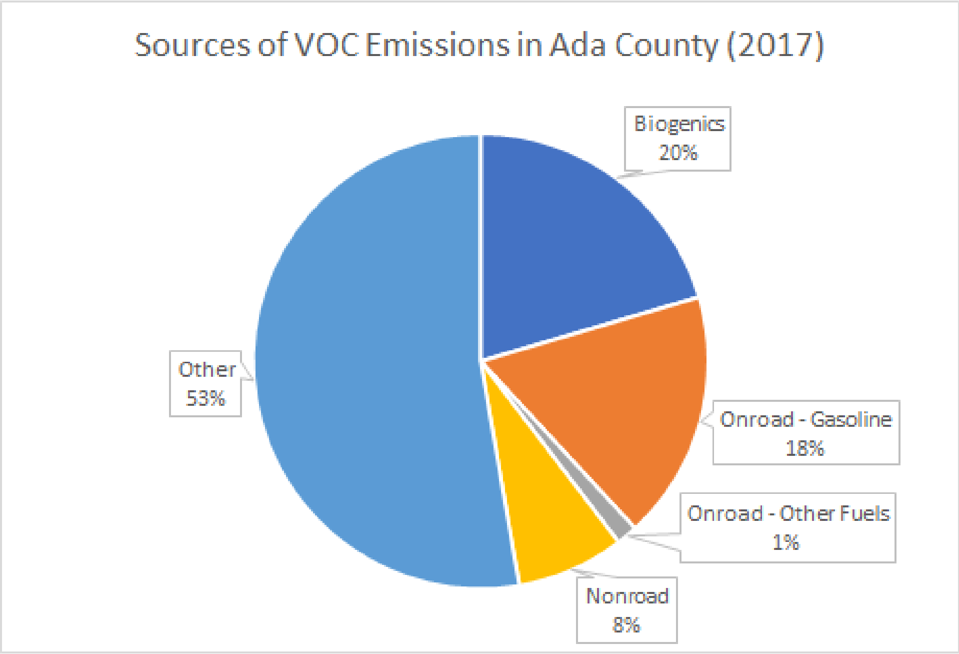

Figure 19. Sources of VOC emissions in Ada County from the 2017 NEI.

4.4 Particulate Matter 10

Figure 20 shows the sources of PM_{10} emissions in Ada County using 2017 NEI data. Onroad motor vehicles (primary exhaust, brakewear, and tirewear) contribute just 2% of total annual primary PM_{10} emissions. Road dust from both paved and unpaved roads account for 58% of the total annual PM_{10} emissions. The "Other" source category includes construction dust, agriculture (crops and livestock), industrial fuel combustion and other smaller sources.

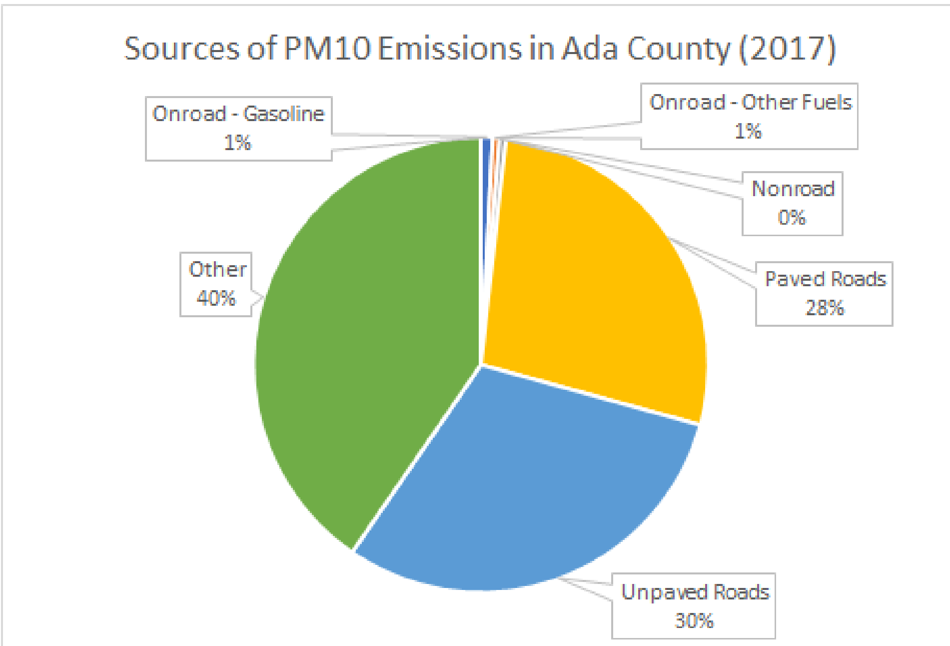

Figure 20. Sources of PM_{10} emissions in Ada County from the 2017 NEI.

4.5 Particulate Matter 2.5

Figure 21 shows the sources of $PM_{2.5}$ emissions in Ada County using 2017 NEI data. Most of the $PM_{2.5}$ emissions (63%) are from sources other than mobile sources. Onroad motor vehicles contribute just 4% of the total annual primary $PM_{2.5}$ emissions. The "Other" source category includes emissions from industrial fuel combustion, construction dust, agriculture, residential wood combustion, commercial cooking, and wildfires.

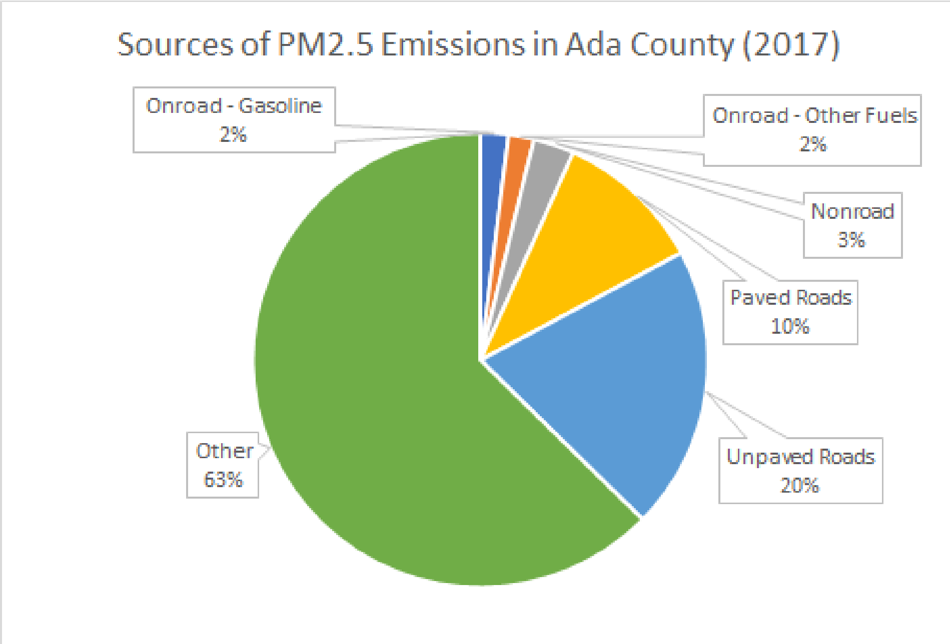

Figure 21. Sources of $PM_{2.5}$ emissions in Ada County from the 2017 NEI.

4.6 Sulfur Dioxide

Figure 22 shows the sources of SO_2 emissions in Ada County using 2017 NEI data. Onroad motor vehicles contribute 11% of the total annual SO_2 emissions. Most of the SO_2 emissions (88%) are from sources other than onroad and nonroad mobile sources. The Other" source category includes emissions mostly from waste disposal, aircrafts, industrial fuel combustion and wildfires.

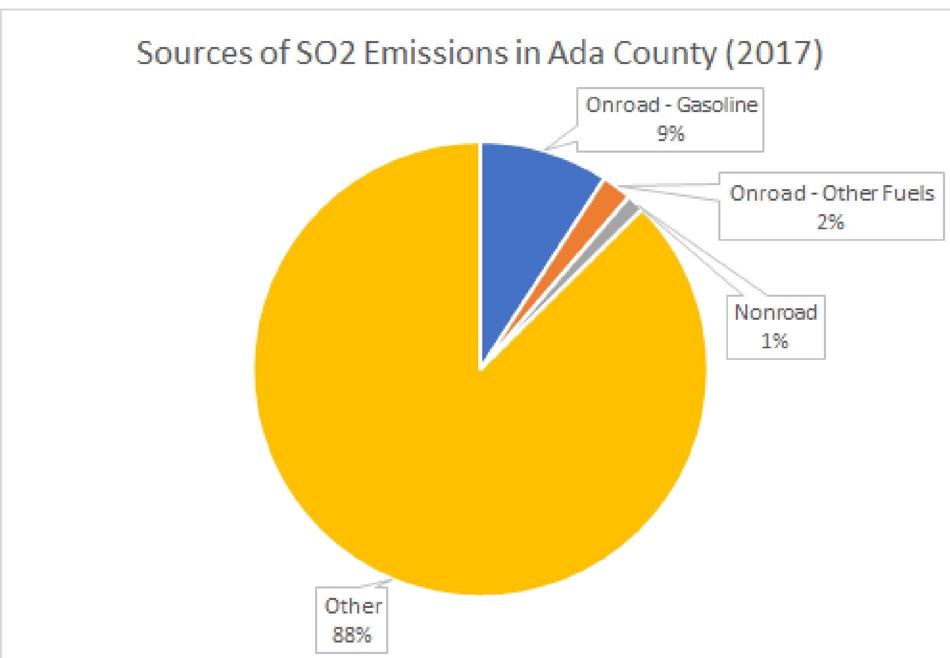

Figure 22. Sources of SO_2 emissions in Ada County from the 2017 NEI.

5 Demonstration of Continued Attainment

This section evaluates the impacts of removing the I/M program from the Northern Ada County CO LMP to ensure that the removal will not interfere with attaining the NAAQS. The criteria pollutants of interest for this revision are CO, NO_2, and ozone. MOVES does not estimate emission reductions of SO_2, lead, or direct $PM_{2.5}$ and PM_{10} due to an I/M program. Since onroad vehicles are not a significant source of lead emissions and lead is not a precursor for particulate matter and ozone, DEQ does not address lead in this document. DEQ evaluated the following for this demonstration:

- Onroad vehicle emissions trends
- Previous Treasure Valley ozone modeling
- Winter PM2.5 concentrations

5.1 Onroad Vehicle Emissions Trends

5.1.1 Modeling Methods

DEQ analyzed the trends in emissions reductions due to the I/M program into the future using a state-of-the-art motor vehicle emissions model, MOVES (Motor Vehicle Emissions Simulator). MOVES is provided and maintained by EPA for modeling vehicle emissions for SIPs and for transportation conformity analyses. For this analysis, the latest version, MOVES3, was used.

DEQ performed MOVES model runs with and without I/M program effects and examined seasonal and monthly trends in onroad vehicle emissions through 2040. The MOVES inputs are largely based on SIP-quality inputs developed for EPA's 2020 NEI using primarily local data and travel demand model (TDM) output provided by Community Planning Association of Southwest Idaho (COMPASS) (Table 12).

The source-related input files take SIP-quality NEI 2020 inputs for all years other than 2015, which uses NEI 2014 inputs. Between the NEI 2017 and the NEI 2020, the Idaho Transportation Department (ITD) started modernizing its vehicle registration database, resulting in more accurate source-related input files for the latest NEI. One major change from 2017 to 2020 is that vehicles that are removed from the Idaho fleet before the expiration of their registration are now immediately removed from the database rather than remaining in the database until the registration expired. Because of this fleet modernization, there is a noticeable decrease in emissions between 2015 and 2020, as seen in the figures in the following sections.

Table 12. Sources of MOVES3 inputs for I/M evaluation.

MOVES Input	Source for Input Data	Input Group
Source Type Age Distribution, Source Type Year	Source Type Age Distribution: Take NEI 2014 inputs (for 2015) and NEI 2020 inputs (for all other years) and assume the same fleet turnover rate in the future Source Type Year: Take NEI 2014 inputs (for 2015) and NEI 2020 inputs and adjust them to account for growth through 2022, 2025, 2030, 2035, and 2040	Source-related
HPMS Vehicle Type Year, Month VMT Fraction, Day VMT Fraction, Hour VMT Fraction, Road Type Distribution	TDM output from COMPASS for all runs 2015 through 2040 Idaho 2020 ATR dataset and 2020 HPMS dataset used in NEI 2020 development	VMT-related
Average Speed Distribution	TDM output from COMPASS for all runs 2015 through 2040 Idaho 2020 ATR dataset and 2020 HPMS dataset used in NEI 2020 development	VHT-related
I/M Coverage	I/M Program parameters (AQB and Applus, Inc. for Ada and Canyon Counties, respectively)	I/M-related
Fuel Use Fraction, Fuel Formulation, Fuel Supply	MOVES Default Fuels Inputs (used MOVES3 defaults for all runs)	Fuel-related
Zone Month Hour	Local CY2020 meteorology data from MesoWest hosted by Univ. of Utah for the Boise Airport (Ada County). 2015 used local CY2015 met data from the same source.	Met-related
Alternative Vehicle and Fuels Technology (AVFT)	Take the NEI 2020 inputs and assume the same turnover rate in the future (used NEI 2014 for 2015)	Fuel-related but used the source data as surrogate

Notes: National Emissions Inventory (NEI); Highway Performance Monitoring System (HPMS); vehicle miles traveled (VMT); Travel Demand Model (TDM); automatic traffic recorder (ATR); vehicle hours traveled (VHT); Community Planning Association of Southwest Idaho (COMPASS); Motor Vehicle Emissions Simulator (MOVES); calendar year (CY)

5.1.2 Reduction in Onroad Emissions attributed to the I/M Program

Through 2040, the I/M program accounts for an 11%–12% reduction in total annual onroad CO emissions, a 2%–3% reduction in total annual onroad NO_X emissions, and a 5% reduction in total annual onroad VOC emissions. Even without the I/M program in place, Ada County will still see emissions continue to decrease in the future from continuing fleet turnover and more stringent motor vehicle emission standards. Without the I/M program, Ada County will reach the estimated emissions levels that would be attained with the I/M program at a delay of about 1 to up to 8 years (Table 13). For example, the CO emissions level expected to be reached in 2025 with the I/M program in place will instead be reached in 2029 without the I/M program.

Table 13. Years Ada County will hit modeled onroad CO, NO_X, and VOC emissions levels based on whether the I/M program is active or not.

Pollutant	I/M Program	No I/M Program
CO	2025	2029
	2030	2034
	2035	2041
NO_X	2025	2026
	2030	2031
	2035	2039
VOC	2025	2027
	2030	2034
	2035	2043

For this analysis, DEQ analyzed onroad CO and NO_X emissions reductions for summer (June through August), winter (December through February), and ozone season (April through September). VOC emissions were analyzed for the summer and ozone season. These seasons were selected because this is when emissions from motor vehicles are likely to have the highest concentrations. In the winter, multiday air stagnation events are common in Ada County and result in elevated concentrations for all pollutants. Ozone season was selected because NO_X and VOC are precursors to ozone.

5.1.3 Onroad CO Emission Reductions due to I/M Program

Figure 23 shows the onroad CO emissions over three seasons (ozone season, summer, and winter) with and without the I/M program for selected years from 2015 to 2040. Year 2022 is included to mark the end of the current I/M program. CO emissions will continue to decrease into the future, and the emissions reductions attributable to the I/M program will also decline.

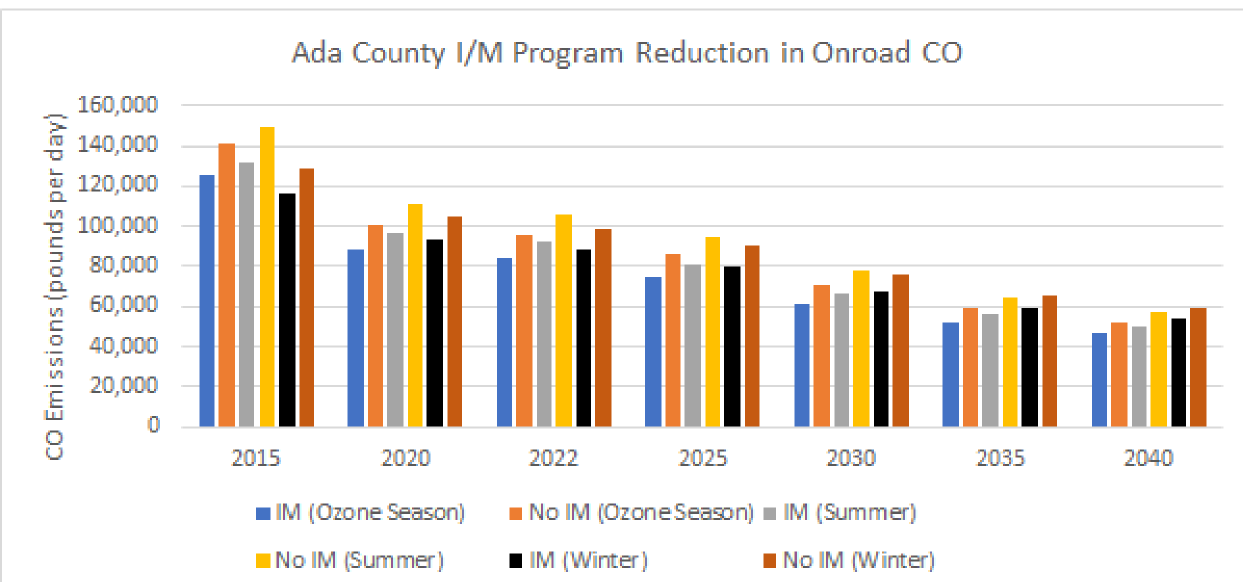

Figure 23. Onroad CO emissions (in pounds per average day over the season of interest) both with and without the I/M program from 2015 to 2040.

5.1.3.1 *Summer Season CO*

The long-term reduction in summertime (June, July, and August) onroad CO emissions in Ada County and the additional emissions reductions attributed to the I/M program are shown in Figure 24. Without the I/M program, summer CO emissions are projected to decrease by 62% between 2015 and 2040 and 46% between 2022 and 2040. This continued decline in onroad emissions without the I/M program is due to stricter federal vehicle emissions standards and continuing fleet turnover.

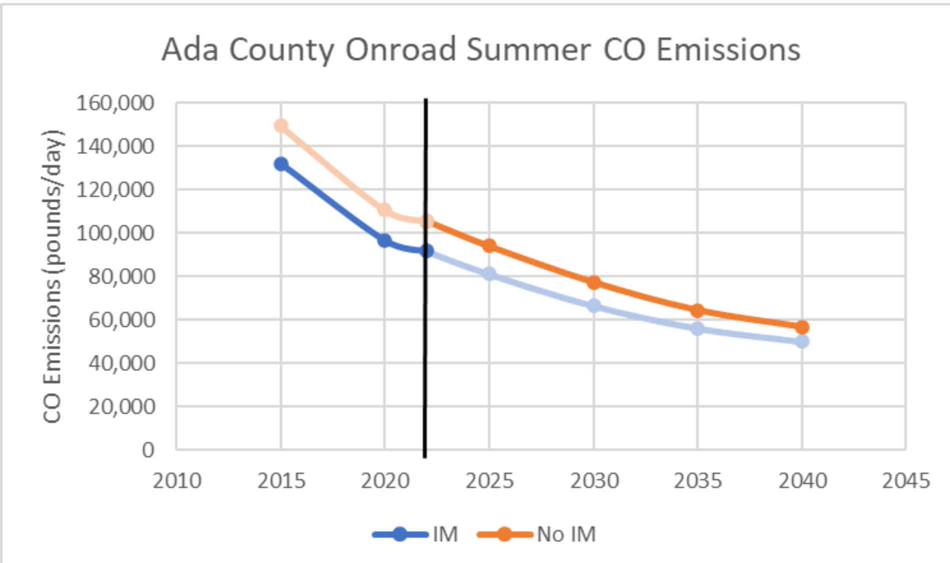

Figure 24. Ada County onroad summer CO emissions in pounds per average day from 2015 to 2040. The blue line indicates the emissions trend with the I/M program, and the orange line indicates the emissions trend without the I/M program. The vertical black line marks 2022, the projected final year of the I/M program. Prior to 2022, the orange line is faded to indicate that the I/M program is active, and after 2022, the blue line is faded to indicate the end of the I/M program.

5.1.3.2 *Winter Season CO*

The long-term reduction in wintertime (January, February, and December) onroad CO emissions in Ada County, and the additional emissions reductions attributed to the I/M program are shown in Figure 25. Without the I/M program, winter CO emissions are projected to decrease by 53% between 2015 and 2040 and 40% between 2022 and 2040. This continued decline in onroad emissions without the I/M program is due to stricter federal vehicle emissions standards and continuing fleet turnover.

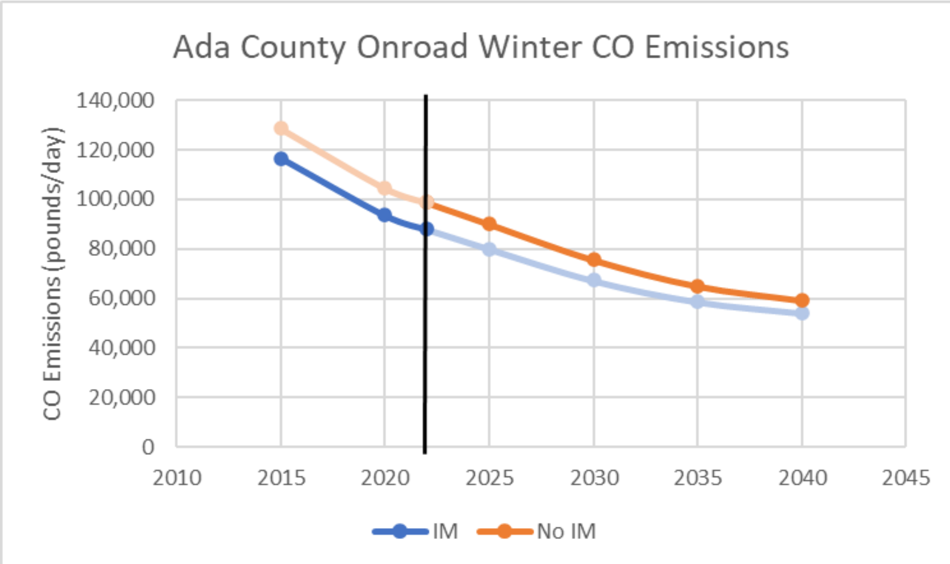

Figure 25. Ada County onroad winter CO emissions in pounds per average day from 2015 to 2040. The blue line indicates the emissions trend with the I/M program, and the orange line indicates the emissions trend without the I/M program. The vertical black line marks 2022, the projected final year of the I/M program. Prior to 2022, the orange line is faded to indicate that the I/M program is active, and after 2022, the blue line is faded to indicate the end of the I/M program.

5.1.3.3 CO in Ozone Season

The long-term reduction in ozone season (April through September) onroad CO emissions in Ada County and the additional emissions reductions attributed to the I/M program are shown in Figure 26. Without the I/M program, CO emissions over ozone season are projected to decrease by 63% between 2015 and 2040 and 45% between 2022 and 2040. This continued decline in onroad emissions without the I/M program is due to stricter federal vehicle emissions standards and continuing fleet turnover.

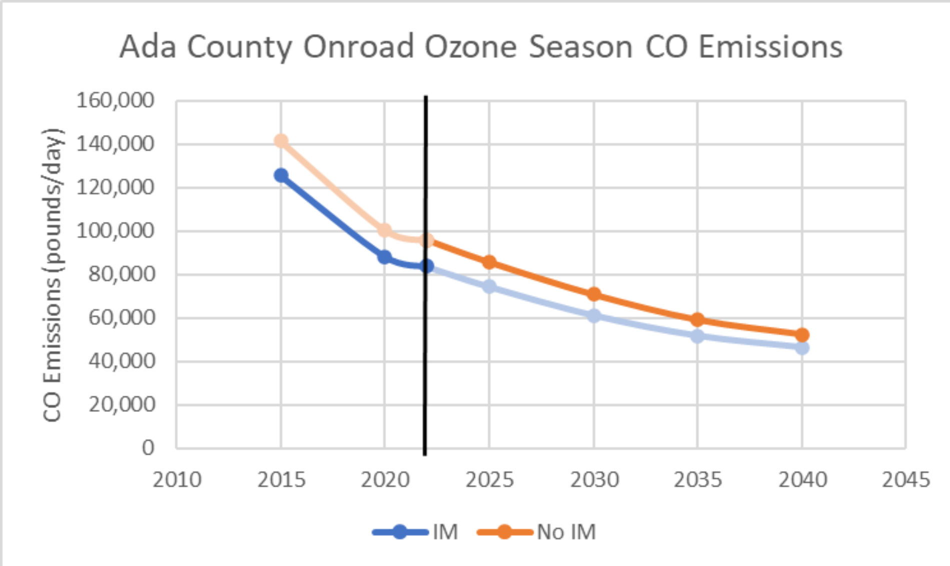

Figure 26. Ada County onroad ozone season CO emissions in pounds per average day from 2015 to 2040. The blue line indicates the emissions trend with the I/M program, and the orange line indicates the emissions trend without the I/M program. The vertical black line marks 2022, the projected final year of the I/M program. Prior to 2022, the orange line is faded to indicate that the I/M program is active, and after 2022, the blue line is faded to indicate the end of the I/M program.

5.1.4 Onroad NO_X Emission Reductions due to I/M Program

Figure 27 shows the onroad NO_X emissions over three seasons (ozone season, summer, and winter) with and without the I/M program from 2015 to 2040. Year 2022 is included to mark the end of the current I/M program. NO_X emissions will continue to decrease into the future, and the emissions reductions attributable to the I/M program will also decline.

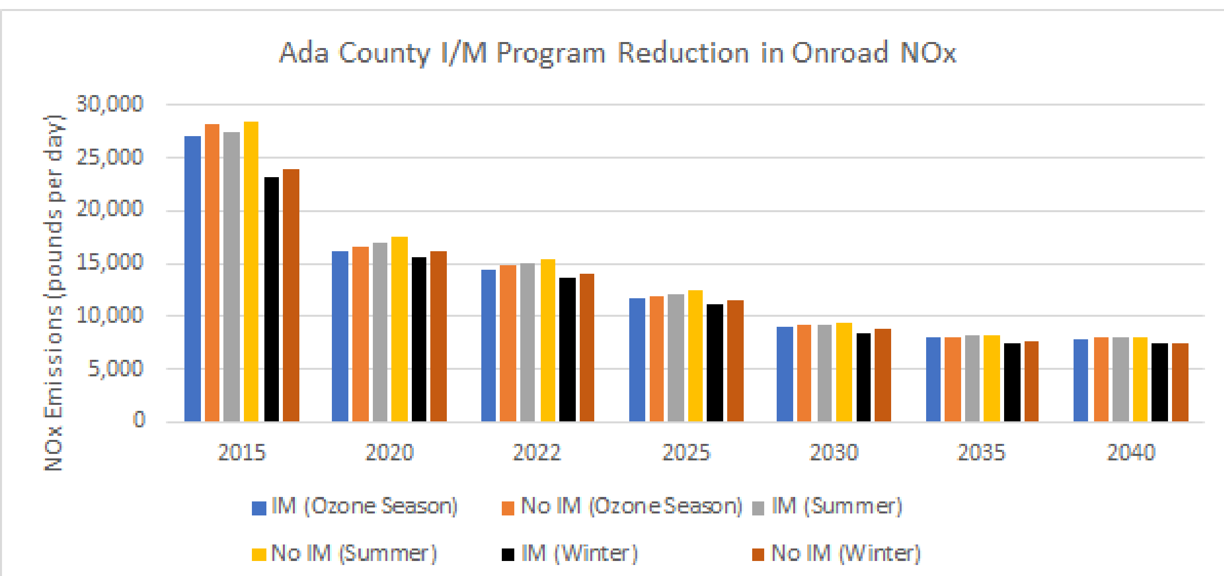

Figure 27. Onroad NO_X emissions (in pounds per average day over the season of interest) both with and without the I/M program in Ada County from 2015 to 2040.

5.1.4.1 Summer Season NO_X

The long-term reduction in summertime (June, July, and August) onroad NO_X emissions in Ada County, and the additional emissions reductions attributed to the I/M program are shown in Figure 28. Without the I/M program, summer NO_X emissions are projected to decrease by 72% between 2015 and 2040 and 48% between 2022 and 2040. This continued decline in onroad emissions without the I/M program is due to stricter federal vehicle emissions standards and continuing fleet turnover.

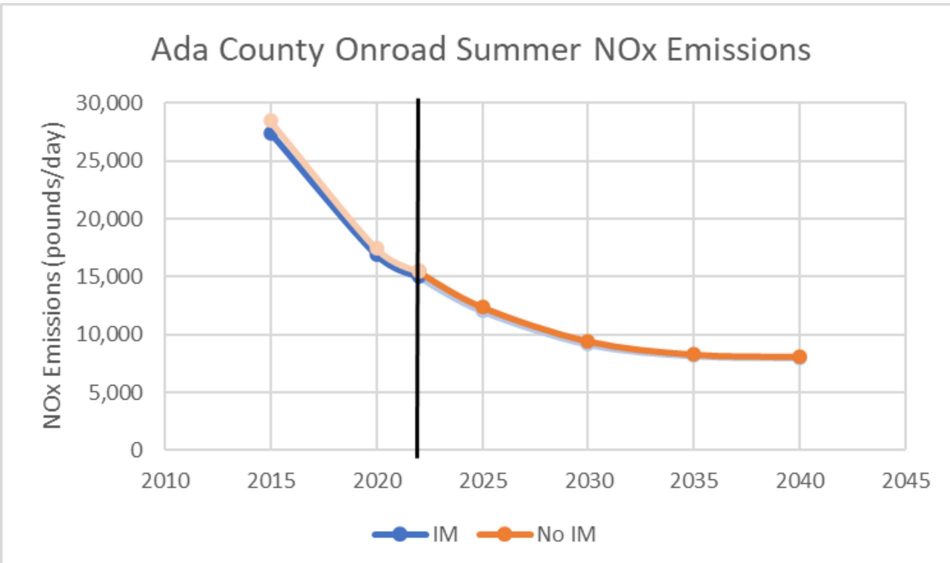

Figure 28. Ada County onroad summer NO_X emissions in pounds per average day from 2015 to 2040. The blue line indicates the emissions trend with the I/M program, and the orange line indicates the emissions trend without the I/M program. The vertical black line marks 2022, the projected final year of the I/M program. Prior to 2022, the orange line is faded to indicate that the I/M program is active, and after 2022, the blue line is faded to indicate the end of the I/M program.

5.1.4.2 Winter Season NO_X

DEQ also analyzed wintertime NO_X due to stagnant air conditions that occur regularly in Ada County. The long-term reduction in wintertime (January, February, and December) onroad NO_X emissions in Ada County, and the additional emissions reductions attributed to the I/M program are shown in Figure 29. Without the I/M program, winter NO_X emissions are projected to decrease by 69% between 2015 and 2040 and 47% between 2022 and 2040. This continued decline in onroad emissions without the I/M program is due to stricter federal vehicle emissions standards and continuing fleet turnover.

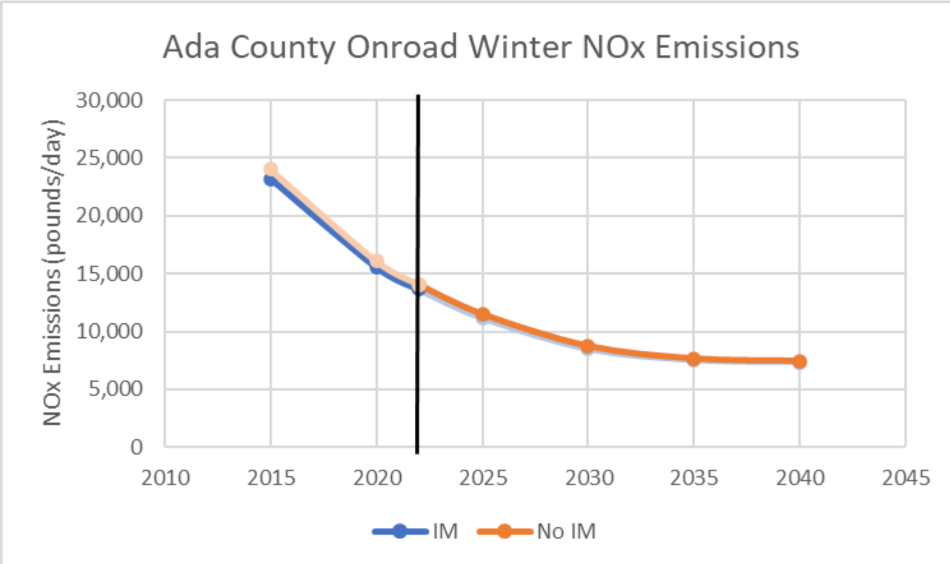

Figure 29. Ada County onroad winter NO_X emissions in pounds per average day from 2015 to 2040. The blue line indicates the emissions trend with the I/M program, and the orange line indicates the emissions trend without the I/M program. The vertical black line marks 2022, the projected final year of the I/M program. Prior to 2022, the orange line is faded to indicate that the I/M program is active, and after 2022, the blue line is faded to indicate the end of the I/M program.

5.1.4.3 NO_X in Ozone Season

The long-term reduction in ozone season (April through September) onroad NO_X emissions in Ada County, and the additional emissions reductions attributed to the I/M program are shown in Figure 30. Without the I/M program, NO_X emissions over ozone season are projected to decrease by 72% between 2015 and 2040 and 46% between 2022 and 2040. This continued decline in onroad emissions without the I/M program is due to stricter vehicle emissions standards and continuing fleet turnover.

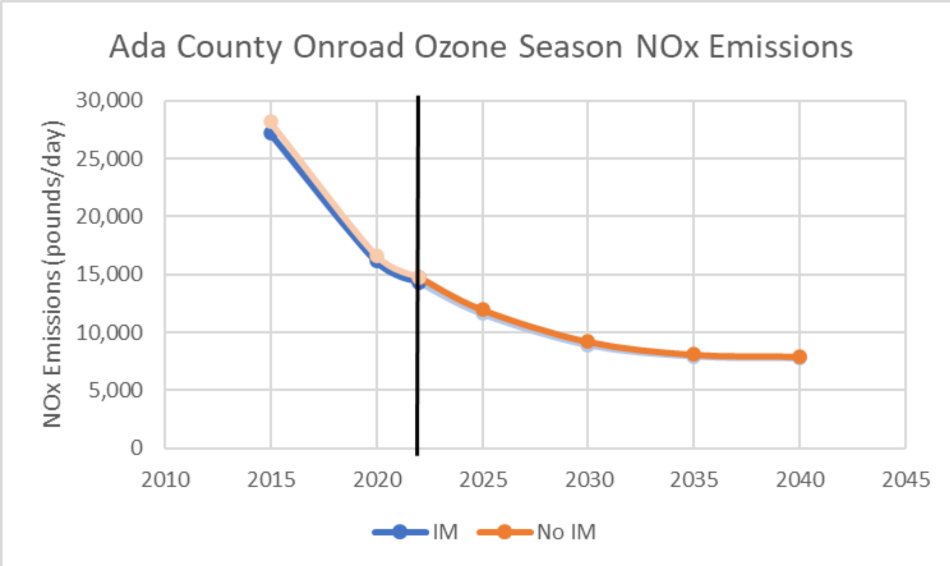

Figure 30. Ada County onroad ozone season CO emissions in tons per average day from 2015 to 2040. The blue line indicates the emissions trend with the I/M program, and the orange line indicates the emissions trend without the I/M program. The vertical black line marks 2022, the projected final year of the I/M program. Prior to 2022, the orange line is faded to indicate that the I/M program is active, and after 2022, the blue line is faded to indicate the end of the I/M program.

5.1.5 Onroad VOC Emission Reductions due to I/M Program

Figure 31 shows the onroad VOC emissions over two seasons (ozone season and summer) with and without the I/M program from 2015 to 2040. Year 2022 is included to mark the end of the current I/M program. VOC emissions will continue to decrease into the future, and the emissions reductions attributable to the I/M program will also decline.

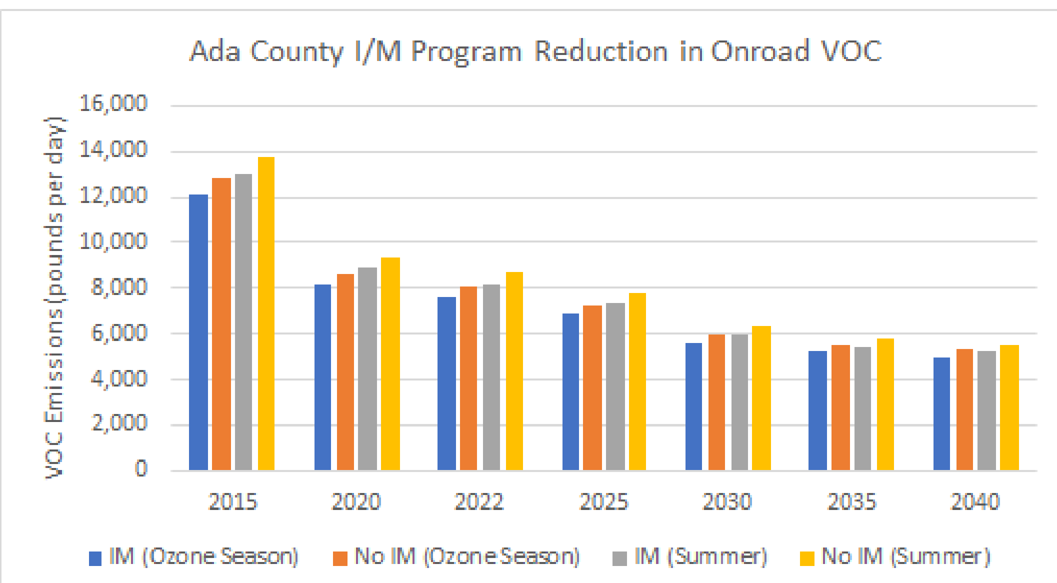

Figure 31. Onroad VOC emissions (in pounds per average day over the season of interest) both with and without the I/M program in Ada County from 2015 to 2040.

5.1.5.1 Summer Season VOC

The long-term reduction in summertime (June, July, and August) onroad VOC emissions in Ada County, and the additional emissions reductions attributed to the I/M program are shown in Figure 32. Without the I/M program, summer VOC emissions are projected to decrease by 60% between 2015 and 2040 and 36% between 2022-2040. This continued decline in onroad emissions without the I/M program is due to stricter federal vehicle emissions standards and continuing fleet turnover.

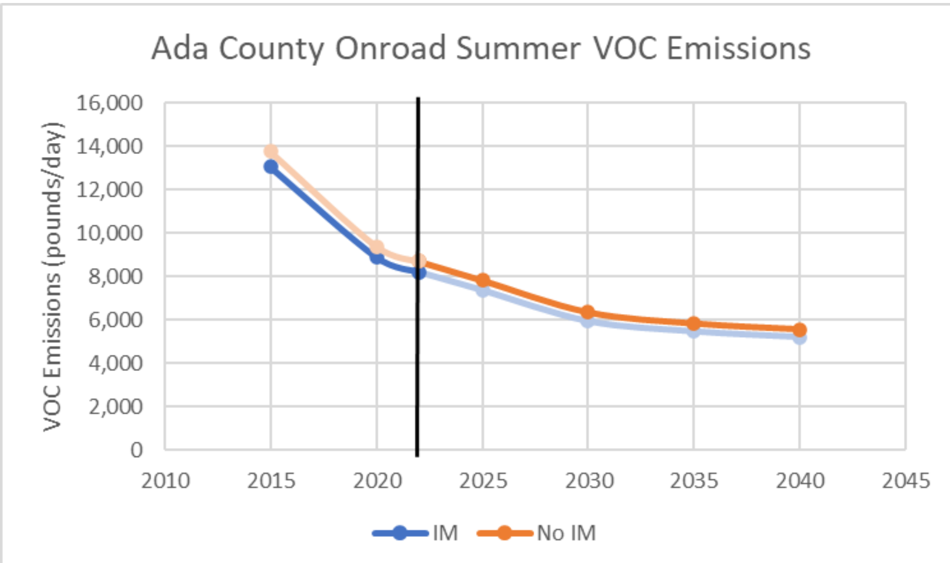

Figure 32. Ada County onroad summer VOC emissions in pounds per average day from 2015 to 2040. The blue line indicates the emissions trend with the I/M program, and the orange line indicates the emissions trend without the I/M program. The vertical black line marks 2022, the projected final year of the I/M program. Prior to 2022, the orange line is faded to indicate that the I/M program is active, and after 2022, the blue line is faded to indicate the end of the I/M program.

5.1.5.2 VOC in Ozone Season

The long-term reduction in ozone season (April through September) onroad VOC emissions in Ada County, and the additional emissions reductions attributed to the I/M program are shown in Figure 33. Without the I/M program, VOC emissions over ozone season are projected to decrease by 59% between 2015 and 2040 34% between 2022 and 2040. This continued decline in onroad emissions without the I/M program is due to stricter federal vehicle emissions standards and continuing fleet turnover.

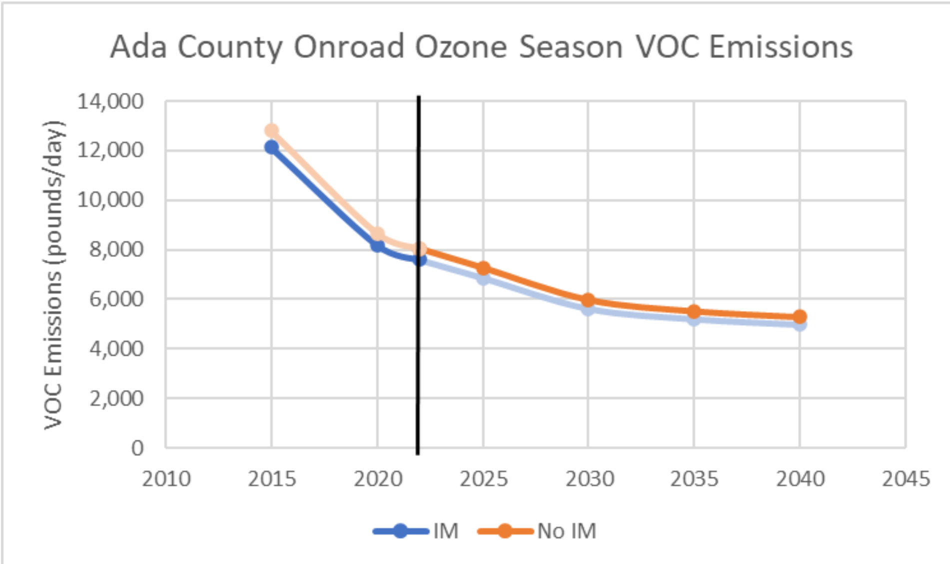

Figure 33. Ada County onroad ozone season VOC emissions in tons per average day from 2015 to 2040. The blue line indicates the emissions trend with the I/M program, and the orange line indicates the emissions trend without the I/M program. The vertical black line marks 2022, the projected final year of the I/M program. Prior to 2022, the orange line is faded to indicate that the I/M program is active, and after 2022, the blue line is faded to indicate the end of the I/M program

5.1.6 Reduction in Onroad $PM_{2.5}$ Emissions

The long-term reduction in wintertime (January, February, and December) onroad $PM_{2.5}$ emissions in Ada County is shown in Figure 34. Winter $PM_{2.5}$ emissions are projected to decrease by 45% between 2015 and 2040 and 17% between 2022 and 2040. This continued decline in onroad emissions is due to stricter federal vehicle emissions standards and continuing fleet turnover. The MOVES model does not credit the I/M program with any onroad $PM_{2.5}$ emissions reductions. The slight increase in onroad winter $PM_{2.5}$ emissions starting in 2040 is due to projected increases in vehicle population and VMT (due to population growth) finally beginning to outweigh the benefits from stricter federal vehicle standards currently on the books.

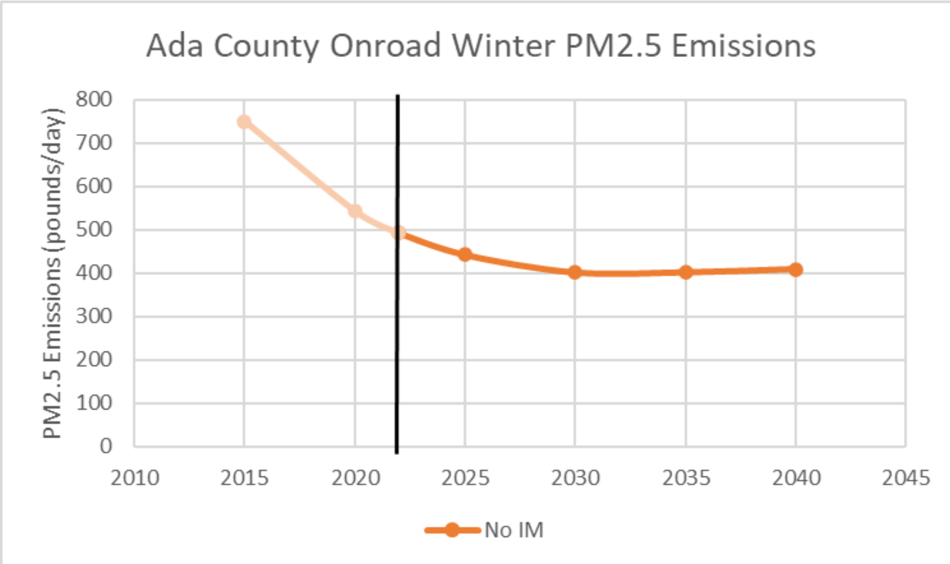

Figure 34. Ada County onroad winter $PM_{2.5}$ emissions in pounds per average day from 2015 to 2040. The orange line indicates the emissions trend without the I/M program, as MOVES does not credit the I/M program with any reductions in $PM_{2.5}$ emissions. The vertical black line marks 2022, the projected final year of the I/M program. Prior to 2022, the orange line is faded to indicate that the I/M program is active.

5.2 Analysis of Previous Treasure Valley Ozone Modeling

Ozone is a secondary pollutant produced primarily by chemical reactions of its precursors: NO_X and VOCs. NO_X and VOCs emitted from mobile sources can interact with emissions from other various natural and anthropogenic sources, influencing ozone concentrations. Due to the complexity of the chemistry of ozone with other pollutants, predictions of changes in their concentrations under various control scenarios is only possible if all relevant trace species are simulated in the same framework, including reactive radicals such as hydroxide, photochemical processes, and cloud and secondary aerosol processes. This predication can only be achieved using a comprehensive chemical transport model that can account for all important atmospheric chemistry in the target area. In 2018, DEQ performed a study to simulate the impacts of the I/M programs in Ada and Canyon Counties on ozone concentrations using a comprehensive modeling system established in the 2017 *Crop Residue Burning Ozone State Implementation Plan Revision Amendment* (DEQ 2017).

5.2.1 Modeling Platform

The modeling platform used for this study consisted of several complex components, including the Weather Research and Forecasting model, Meteorology-Chemistry Interface Processor, Sparse Matrix Operator Kernel Emissions Modeling System, and Community Multiscale Air Quality (CMAQ) Modeling System. Modeling was derived from the AIRPACT-5 air quality forecasting modeling platform run once daily by Washington State University through the Northwest International Air Quality Environmental Science and Technology Consortium.

The transport of VOCs and NO_X and their reaction products from sources in other states and other Idaho counties may also affect ozone concentrations in the Treasure Valley. To account for the effect of regional pollution transport, the domain of the photochemical simulations (Figure 35) covers the entire Pacific Northwest, including all of Idaho, Oregon, and Washington, portions of California, Montana, Nevada, Utah, Wyoming, and portions of the Canadian provinces of Alberta, British Columbia, and Saskatchewan. Boundary conditions for the photochemical simulations were provided by the results of a global chemical transport model, the Model for Ozone And Related chemical Tracers. The episode selected for the study was July 8 to September 26, 2013, which covers a period of highest ozone concentrations. This time selection allows investigation into the impacts of the I/M program on ozone concentrations across the important ozone season.

The modeling platform for ozone simulation in the 2013 episode passed a comprehensive performance evaluation, which was documented in DEQ (2017). The performance for ozone simulations in the 2013 episode was evaluated using observational data at all ozone monitoring sites in the domain and a subset focusing on those in Idaho ingested into the EPA's the Atmospheric Model Evaluation Tool program. The model evaluation showed that model performance was very good—much better than most of the photochemical studies over the United States or Canada documented in 69 peer-reviewed articles compiled by Simon et al. (2012). The good performance of the photochemical modeling system indicates that it is adequate for studying the impacts of I/M programs on ozone concentrations.

5.2.2 Modeling Methods

Several modeling runs were performed in the 2018 study. Two modeling runs using the 2013 platform were necessary to determine the impact of the I/M program on ozone concentrations in the Treasure Valley:

1. Full I/M Programs—This scenario is considered the base run as it attempts to replicate actual conditions and includes mobile emissions based on the actual I/M programs in place in Ada and Canyon Counties in 2013.
2. No I/M Programs—In this scenario, only the mobile emissions were modified to reflect estimated emissions from MOVES2014a (the most recent version of MOVES at the time) if there were no I/M programs in Ada or Canyon Counties in 2013.

The difference between the results of these two runs provides a conservative estimate of the impact of the Ada County I/M program in the Treasure Valley on the period of highest ozone concentrations in 2013 since it also includes the impacts of the Canyon County I/M Program, which is not included in Idaho's SIP and not addressed in this SIP revision.

5.2.3 Results

The study performed in 2018 was designed to look at the I/M programs in both Ada and Canyon Counties in the Treasure Valley. However, this SIP is only concerned with the Ada County program as the Canyon County program is based on Idaho state law and is not related to the Ada County program under review in this SIP. The results combine the impacts of both programs and provide a conservative estimate of the impacts from the Ada County program alone. Figure 35 and Figure 36 show the reductions in the 4th-highest daily maximum 8-hour average ozone concentrations due to the I/M programs in both Ada and Canyon Counties as simulated by CMAQ across the modeling domain and Canyon and Ada Counties, respectively. This metric is important when evaluating compliance with the ozone NAAQS, which is based on the monitored 3-year average of this value. The I/M programs of both Ada and Canyon Counties reduce the 4th-highest daily maximum 8-hour average ozone concentration by up to 0.47 ppb or less than 1%. Figure 37 shows the modeled 4th-highest daily maximum 8-hour average ozone concentrations, with the Ada and Canyon Counties I/M programs, in the region for reference.

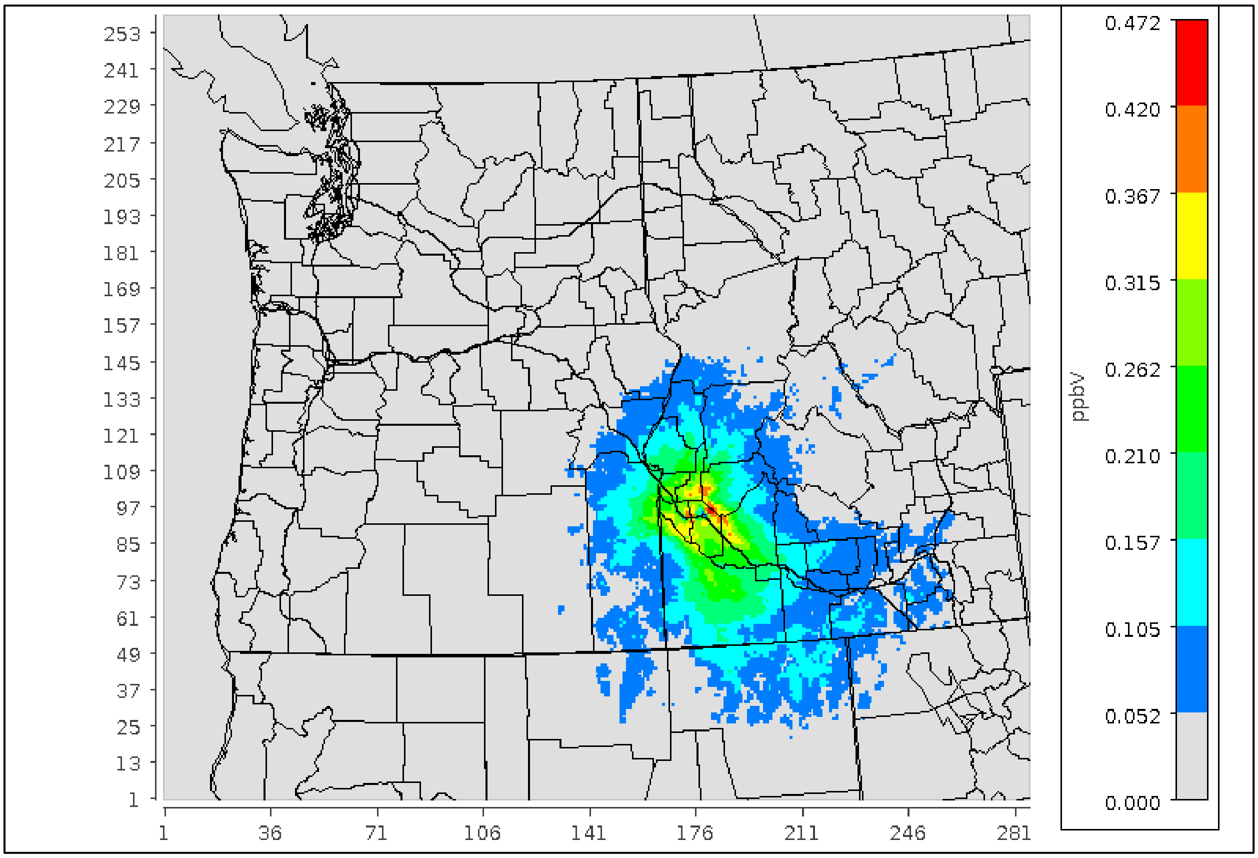

Figure 35. CMAQ-simulated reductions of the 4th-highest daily maximum 8-hour average ozone concentrations resulting from emission changes of vehicles in the Ada and Canyon Counties I/M programs across the full modeling domain from July 8 to September 26, 2013.

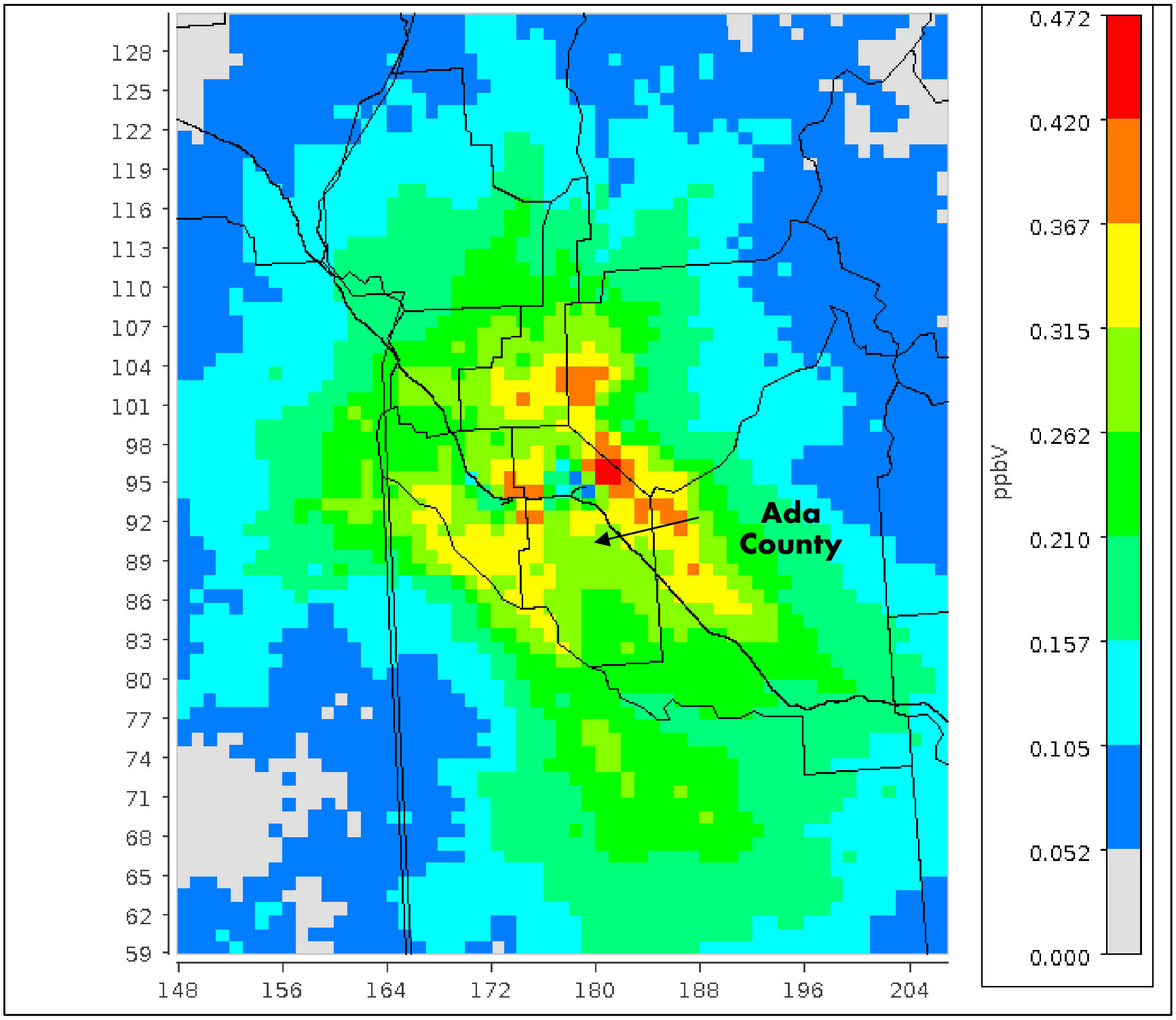

Figure 36. CMAQ-simulated reductions of the 4th-highest daily maximum 8-hour average ozone concentrations resulting from emission changes of vehicles in the Ada and Canyon Counties I/M programs in the Treasure Valley from July 8 to September 26, 2013.

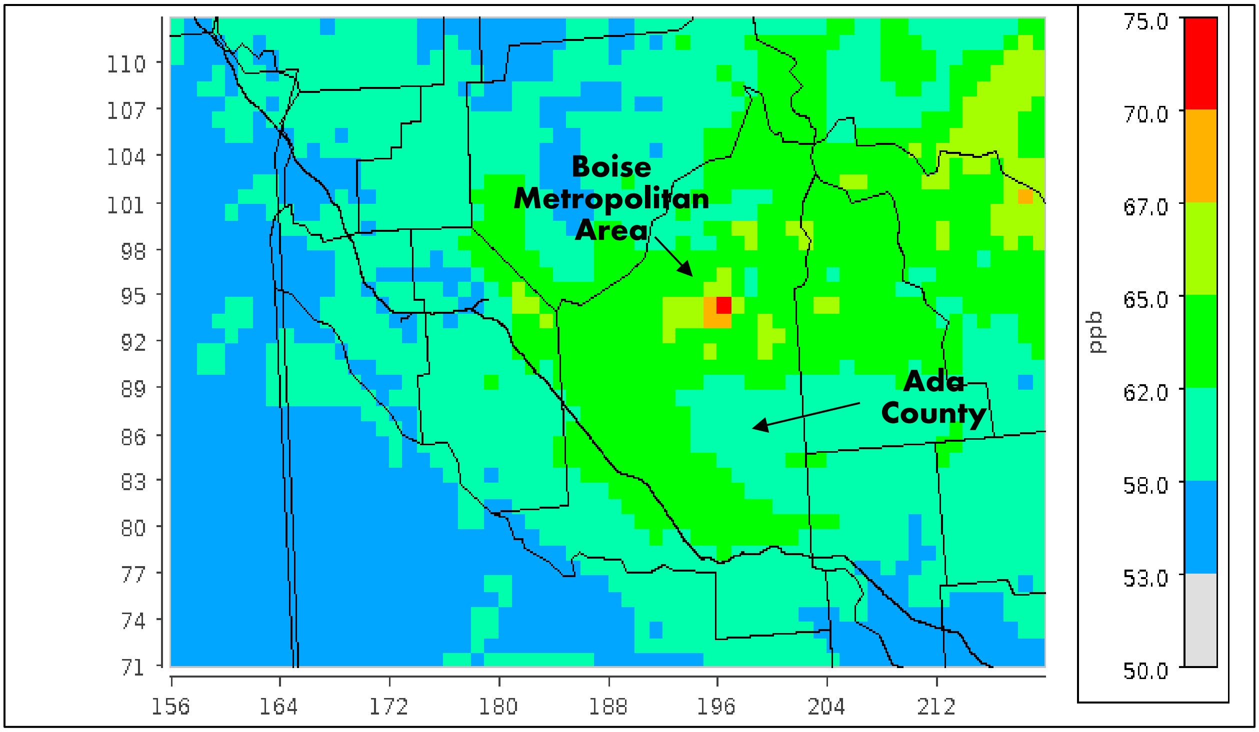

Figure 37. CMAQ-modeled 4th-highest daily maximum 8-hour average ozone concentrations in southwestern Idaho from July 8 to September 26, 2013 (with I/M Program).

5.2.4 Summary

Ozone formation is highly complex, and changes in VOC and NO_X emissions can have confounding effects on ambient ozone concentrations. A previous study evaluating ozone formation in the Treasure Valley by the Desert Research Institute in 2007 determined that rural parts of the Treasure Valley are generally NO_X-limited as it relates to ozone formation (Kavouras et. al, 2008). This determination means that reductions in NO_X emissions are most effective at reducing ozone concentrations in these areas due to the abundance of VOC from natural sources. As seen in the figures above, the areas of highest ozone reductions in Ada County occur mainly to the north and east of Boise along the Ada County border with Boise and Elmore Counties. These areas are rural in nature and located along the Boise Front range of mountains, downwind of the urban areas due to the prevailing afternoon winds in the Treasure Valley. This area is exactly where the highest reductions would be expected and provides confidence in the modeling results.

In contrast, urban areas are generally VOC-limited due to an abundance of NO_X sources. In these areas, reducing VOC and NO_X at the same time has less straightforward effects on ozone concentrations. Reductions in NO_X emissions alone can sometimes result in increases in ozone concentrations due to reduced titration of ozone by NO_X while reductions in VOC emissions alone may reduce ozone concentrations but not necessarily at the same magnitude. As shown in the figures above, ozone reductions in the more urban areas of Ada County are estimated to be much less than in the rural areas with values approaching 0 ppb in and around Boise, where most of the population and the two ozone monitors are located.

This modeling study estimated the reduction in peak ozone concentrations in the Treasure Valley due to the emission reductions attributable to the Ada and Canyon Counties I/M programs in 2013 to be no more than 0.47 ppb. This is a conservative estimate of the impacts from the Ada County I/M program alone, both in the present and into the future. For reference, the annual estimated emission reductions attributable to the two I/M programs in 2013 were 428 tons of NO_X and 475 tons of VOC, approximately triple the 2020 emission reductions of 156 tons of NO_X and 124 tons of VOC.

The 2019-2021 ozone design values for the two monitors in Ada County are both 62 ppb (with exceptional events excluded), well below the NAAQS of 70 ppb. Based on this modeling study, removing the Ada County I/M program is expected to increase ozone concentrations by no more than 0.47 ppb and likely less given that the emission reductions of ozone precursors attributable to the I/M programs in 2020 are about one-third of the values reflected in the study, and this includes the Canyon County I/M program that is not included in this SIP revision. Removal of the I/M program in Ada County is not expected to cause or contribute to any violation of the ozone NAAQS.

5.3 Particulate Matter

Particulate matter describes the mixture of solid particles and liquid droplets found in the air, including dust, dirt, soot, and smoke. Particulate matter is regulated based on the size of the particles. There are two NAAQS for PM: PM_{10} and $PM_{2.5}$. PM_{10} are particles up to 10 micrometers in diameter. $PM_{2.5}$, also called fine particulates, are particles with a diameter less than 2.5 micrometers, or about 30 times smaller than a human hair. $PM_{2.5}$ are a subset of PM_{10}. Northern Ada County is currently in attainment with all particulate matter NAAQS; a PM_{10} maintenance plan is in place through 2023 due to violations of the PM_{10} NAAQS in the 1980s.

Particulate matter pollution can be emitted directly into the air from a source (direct emissions) or can form in the air due to a variety of complex chemical reactions involving precursor emissions (secondary formation). Motor vehicle exhaust is not a major source of direct particulate matter emissions. Most motor vehicle-related particulate matter emissions are due to road dust, which the I/M program does not impact. The I/M program also has no measurable impact on exhaust emissions of direct particulate matter (Table 14). NO_X and VOC emissions from motor vehicles can contribute to secondary formation of particulate matter under specific conditions.

Table 14. Annual onroad motor vehicle direct particulate matter emissions in Ada County with and without the impacts of the I/M program. The I/M program has no impact on these emissions as determined by EPA's MOVES model.

Source	2020 $PM_{2.5}$ Emissions with I/M Program (tons)	2020 $PM_{2.5}$ Emissions without I/M Program (tons)	2020 PM_{10} Emissions with I/M Program (tons)	2020 PM_{10} Emissions without I/M Program (tons)
Vehicle Exhaust	72.48	72.48	79.75	79.75
Brake and Tire Wear	22.78	22.78	173.88	173.88
Road Dust	493.27	493.27	8,653.88	8,653.88

5.3.1 Wintertime Particulate Matter Trends

Previous studies have shown that secondary formation of nitrate particles (ammonium nitrate) can constitute a significant portion of the total $PM_{2.5}$ and PM_{10} concentrations during winter stagnation events (Kavouras et. al, 2010; Mwaniki et. al, 2013). During these events, pollutants can become trapped in the valley beneath a temperature inversion layer, and chemical reactions involving NO_X can create ammonium nitrate. Reactions involving VOCs can form secondary organic aerosols. A review of recent wintertime particulate matter concentrations in Ada County shows there have been no exceedances of the 24-hour $PM_{2.5}$ NAAQS in more than 4 years and no exceedances of the PM_{10} NAAQS since 2015 (Table 15).

Table 15. Winter season (December, January, and February) particulate matter monitoring data since 2015 for the Meridian $PM_{2.5}$ monitor and the Boise Fire Station PM_{10} monitor.

Winter Period (Dec-Feb)	Maximum 24-Hour Average $PM_{2.5}$ Concentration (µg/m^3)	Number of Exceedances of the 24-Hour $PM_{2.5}$ NAAQS (35 µg/m^3)	Maximum 24-Hour Average PM_{10} Concentration (µg/m^3)	Number of Exceedances of the 24-Hour PM_{10} NAAQS (150 µg/m^3)
2015–2016	26.0	0	37	0
2016–2017	41.6	3	57	0
2017–2018	50.1	4	45	0
2018–2019	25.9	0	30	0
2019–2020	18.9	0	33	0
2020–2021	30	0	45	0

These low wintertime particulate matter concentrations follow a multiyear trend of falling NO_X and VOC emissions in Ada County led by motor vehicles as detailed in section 0. Even with the removal of the I/M program, these emissions, along with emissions of direct PM, are projected to continue to fall well into the future. The most recent design values for $PM_{2.5}$ for the monitor located in Ada County are below both the annual NAAQS (7.3 µg/m^3 of 12 µg/m^3) and the 24-hour NAAQS (30 µg/m^3 of 35 µg/m^3). These very low concentrations combined with continued significant decreases in onroad mobile emissions of direct particulate matter and precursor pollutants provide high confidence that removing the I/M program in Ada County will not cause or contribute to an exceedance of any particulate matter NAAQS.

5.3.2 2013 Ada County PM_{10} Second 10-Year Maintenance Plan

Northern Ada County remains a PM_{10} maintenance area through 2023 due to violations of the PM_{10} NAAQS in the 1980s. DEQ performed a modeling analysis in 2012 as a part of the 2013 Northern Ada County PM_{10} Maintenance Plan update to demonstrate continued compliance with the PM_{10} NAAQS (DEQ 2012). Based on projected emission inventories for 2015 and 2023, this modeling analysis demonstrated that northern Ada County would remain in compliance with the PM_{10} NAAQS through at least 2050, including during winter stagnation events. The maintenance plan did not include the I/M program as a control measure; however, the projected emission inventories used in the modeling analysis did include the effects of the I/M program.

The analysis performed used linear roll-forward modeling with a conservative treatment of secondary formation of particulate matter (keeping the secondary formation of particulate matter the same as 2013 even though precursor emissions are projected to decline significantly in the future years). This relatively simple modeling technique estimates concentrations based on changes in emissions and relies heavily on projections of future emissions. A comparison of the projected inventories used in the 2012 modeling and the actual inventory from the 2017 EPA NEI shows that emissions have fallen more rapidly than anticipated. Emissions of NO_X in Ada County, the pollutant of primary concern for secondary formation of particulate matter, have fallen more quickly than those considered in the modeling analysis (Table 16). Even when the NO_X emissions changes due to the removal of the I/M program are considered, the projected emissions from onroad mobile sources remain lower than the projections from 2012 (Table 17). The SIP modeling analysis remains valid and is likely a conservative estimate of future PM_{10} concentrations in Ada County, particularly during winter stagnation events as suggested in the SIP, even with removal of the I/M program. By 2025, NOx emissions are projected to be almost half of what actual emissions were in 2017. This suggests that the estimated future PM10 emissions are likely even less than projected here, making the impact of I/M program on those emissions even lower.

Table 16. Annual NO_X emissions in Ada County by source category as projected in the 2013 Northern Ada County PM_{10} Maintenance Plan SIP update compared to actual emissions as determined by the 2017 EPA NEI.

Source Category	2015 Projected Emissions (tons) (PM_{10} SIP)	2017 Actual Emissions (tons) (2017 NEI)	2023 Projected Emissions (tons) (PM_{10} SIP)
Point	356	111	391
Area	900	1,415	952
Onroad Mobile	5,857	4,454	4,306
Nonroad Mobile	1,980	1,373	1,355
Biogenic	202	641	202
Total	**9,294**	**7,994**	**7,207**

Table 17. Annual NO_X emissions in Ada County from onroad motor vehicles as projected by the 2013 Northern Ada County PM_{10} Maintenance Plan SIP update compared to actual emissions as determined by the 2017 EPA NEI and projected emissions from this document.

2015 Projected Emissions (PM_{10} SIP)	2017 Actual Emissions (2017 NEI)	2020 Actual Emissions (2020 NEI Submittal)	2023 Projected Emissions (PM_{10} SIP)	2025 Projected Emissions (No I/M Program)
5,857	4,454	2,932	4,306	2,164

6 Transportation Conformity

The transportation conformity rule and the general conformity rule (set forth in the Code of Federal Regulations (CFR) at 40 CFR parts 51 and 93) apply to nonattainment areas and maintenance areas covered by an approved maintenance plan. Under either conformity rule, an acceptable method of demonstrating that a Federal action conforms to the applicable SIP is to demonstrate that expected emissions from the planned action are consistent with the emissions budget for the area. While the EPA's LMP option does not exempt an area from the need to affirm conformity, it explains that the area may demonstrate conformity without conforming to an emissions budget. The Northern Ada County qualified for a limited maintenance plan (LMP) and is therefore not required to have a motor vehicles emissions budget. In addition, the 20 year maintenance period for the carbon monoxide limited maintenance area will end on December 27, 2022, and the area will no longer be subject to transportation conformity requirements for carbon monoxide. COMPASS is the metropolitan planning organization (MPO) for the Northern Ada County area and is currently conducting the conformity demonstration that addresses the transportation conformity requirements for the area, potentially concluding before this request is approved.

The northern Ada County PM_{10} maintenance area modeled PM_{10} concentrations are a conservative estimate of future PM_{10} concentrations in Ada County, even with the removal of the I/M program. In addition, the northern Ada County PM_{10} maintenance area transportation conformity requirements will end in 2023. Table 18 shows the motor vehicle emissions budget (MVEB) in tons per day for PM_{10}, NO_X, and VOC.

Table 19, which includes the MVEB in tons per year compared to onroad emissions projected by MOVES3 and road dust emissions, shows that removing the I/M program will not impact the area before the end of 2023. DEQ determined the emissions projections and motor vehicle emissions budgets do not need to be updated.

Table 18. PM_{10}, NOx, and VOC MVEB (tons per day) from the PM_{10} maintenance plan (2013). The MVEB includes PM_{10} road dust emissions.

Year	PM_{10}	NO_X	VOC
2008	31.0	29.5	12.6
2015	42.9	29.5	12.6
2023	60.1	34.2	17.2

Table 19. MVEB (tons per year) from the PM_{10} maintenance plan (2013) compared to MOVES3 onroad and road dust emissions assuming an active I/M program in 2015 and no I/M program in 2022 and 2025.

Year	MVEB (TPY)			MOVES3 Onroad Emissions (TPY)		
	PM_{10}	NO_X	VOC	PM_{10}	NO_X	VOC
2008	11,315	10,768	4,599	—	—	—
2015	15,659	10,768	4,599	8,080	4,688	2,052
2022	—	—	—	9,586	2,670	1,427
2023	21,937	12,483	6,278	—	—	—
2025	—	—	—	9,840	2,164	1,300

7 Conclusion

The I/M program was an important control strategy to comply with and maintain the CO NAAQS in northern Ada County in the past. CO concentrations in Ada County have dropped dramatically since the 1970s due initially to the I/M program and subsequently to federal vehicle emissions standards. MOVES modeling has shown that onroad vehicle emissions have been steadily decreasing since 2015 and are projected to continue decreasing through 2040. The emission reductions from onroad motor vehicles and reductions attributed to the I/M program have been decreasing as older cars are replaced with newer more efficient cars and are expected to continue decreasing after 2022. The benefits of fleet turnover and stronger federal vehicle emission standards have led to the I/M program achieving smaller emission reductions over time.

The northern Ada County area is not in danger of exceeding the NAAQS for PM_{10}, $PM_{2.5}$, NO_X, SO_2, ozone, or CO based on the 2019–2021 3-year design values (section 0). The last exceedance of the NAAQS for CO in northern Ada County was in January 1991. But no violations (more than one exceedance of the standard in a single year) have been recorded since 1986. In addition, the areas surrounding northern Ada County do not exceed the NAAQS based on the 2019–2021 design values for the pollutants mentioned above when exceptional events are removed.

The ongoing reductions from fleet turnover and federal vehicle emissions standards are going to outweigh emission reductions from the I/M program. After the I/M program is removed, the vehicle emissions will continue to decrease in the northern Ada County area. This analysis shows that removing the I/M program will not significantly impact northern Ada County's ability to comply with the NAAQS and will not interfere with attainment and maintenance of the NAAQS or any other CAA requirement.

In conclusion, DEQ has demonstrated that removing the I/M program meets all CAA requirements and requests that EPA remove the following control measure and associated local ordinances from the Northern Ada County CO LMP:

- Automotive Inspection and Maintenance Program, 1991 Motor Vehicle Control Ordinances
    - Ada County, 1999 Motor Vehicle Emissions Control Ordinance (June 15, 1999)
    - City of Boise, 1999 Motor Vehicle Emissions Control Ordinance (July 20, 1999)
    - City of Eagle, 1999 Motor Vehicle Emissions Control Ordinance (April 27, 1999)
    - Garden City, 1991 Motor Vehicle Emissions Control Ordinance (August 13, 1996)
    - City of Meridian, 1999 Motor Vehicle Emissions Control Ordinance (June 1, 1999)

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Appendix A. Motor Vehicle Emissions Model used for Emissions Reductions Years.

Table A-1. Mobile emissions model used to estimate emissions for each corresponding year of data.

Calendar Year	Model
2008	MOBILE 6
2010	MOVES 2010a
2011	MOVES 2010a
2012	MOVES 2010b
2013	MOVES 2010b
2014	MOVES 2014
2015	MOVES 2014a
2016	MOVES 2014a
2017	MOVES 2014b
2018	MOVES 2014b
2019	MOVES 2014b
2020	MOVES 3

Appendix B. Development of the 2020 Idaho Onroad MOVES Mobile Source Inventory

1 Introduction

The onroad mobile source inventory completed for the 2020 National Emissions Inventory (NEI) involved US Environmental Protection Agency (EPA)-developed MOtor Vehicle Emission Simulator (MOVES) modeling to determine emissions estimates for each county in Idaho. The most recent MOVES version, MOVES3.0.2, was used in this project.

The Idaho Department of Environmental Quality (DEQ) gathered data from multiple sources, processed them, and prepared the input database for all 44 counties in a format required by MOVES. In the following sections, the data sources and the methods used to process them are described in detail. The procedure used to post-process the MOVES output is discussed. Finally, the procedures used to perform quality control checks and quality assurance review of the process and results are summarized.

2 Methods: Development of the MOVES3.0.2 Input Database

MOVES3.0.2 was developed to work in conjunction with MariaDB database management software, a community-developed, commercially-supported fork of the MySQL relational database management system (MariaDB 2013). To operate the MOVES3.0.2 model at the county level, development of an input database is necessary. DEQ prepared the input database at a higher level of detail using primarily local data at the county-level than is required by EPA for the NEI. This method allows DEQ to be prepared for and consistent with any potential state implementation plan (SIP) actions needing an onroad inventory required by EPA. DEQ also provided this database to Idaho Metropolitan Planning Organizations to use in their required transportation conformity determinations. This section discusses the data sources, assumptions, and calculations involved in developing the MOVES input databases for the 2020 NEI project.

Based on similarity of geographic features, vehicle travel patterns, and data sources, DEQ grouped all 44 Idaho counties into three groups: North Idaho, South Idaho, and the Treasure Valley. North Idaho exhibits slightly different traffic patterns than South Idaho due to the 1-hour time zone difference and a different nonwork pattern, probably related to greater recreational travel in North Idaho. Ada and Canyon Counties are more urban than other counties in the south but are separated primarily because their traffic patterns are determined by the Community Planning Association of Southwest Idaho (COMPASS) Travel Demand Model (TDM), a source not currently available for the other counties.

The required MOVES inputs, grouped by common data source, are shown in Table B-1. For example, "VMT-Related" inputs such as road type distribution and monthly, daily, and hourly traffic profiles require detailed information from Idaho Transportation Department (ITD) traffic counts and vehicle miles traveled (VMT) statistics to characterize the VMT within the modeling domain, while the "Source-Related" inputs are derived primarily from the statewide vehicle registration database.

Table B-1. MOVES input files and groups.

Group	MOVES INPUTS	Note
VMT-Related	HPMSVTypeYear	Annual VMT
	RoadTypeDistribution	VMT distribution by roadway type
	MonthVMTFraction	VMT distribution by month
	DayVMTFraction	VMT distribution by weekday/weekend
	HourVMTFraction	VMT distribution by hour
Source-Related	SourceTypeYear	Vehicle population
	AgeDistribution	Vehicle population distribution by age
	AVFT (Alternative Vehicle Fuels and Technologies)	Fraction of VMT by fuel/technologies (vehicle information was used as surrogate)
VHT-Related	AverageSpeedDistribution	VHT distribution by hourly average speed
Fuel-Related	FuelSupply	
	FuelFormulation	
	FuelUsageFraction	For vehicles that can use different fuel types
Meteorology	ZoneMonthHour	Hourly temperature and relative humidity by month
I/M Program	IMCoverage	

County-level input files were prepared for each category, using a combination of (primarily) local data and selected MOVES national defaults in those cases where local data are not available or are suspected to be less reliable. This section discusses creating each input. The input files are listed after each section heading for clarification. For reference, MOVES road types and source types (vehicles) used in the process are defined in Table B-2 and Table B-3, respectively.

Table B-2. MOVES road type descriptions.

MOVES Road Type	
Road Type ID	**Road Description**
1	Off-Network
2	Rural Restricted Access
3	Rural Unrestricted Access
4	Urban Restricted Access
5	Urban Unrestricted Access

Table B-3. MOVES source type descriptions.

MOVES Source Type	Description
11	Motorcycle
21	Passenger Car
31	Passenger Truck
32	Light Commercial Truck
41	Other Buses
42	Transit Bus
43	School Bus
51	Refuse Truck
52	Single Unit Short-haul Truck
53	Single Unit Long-haul Truck
54	Motor Home
61	Combination Short-haul Truck

3 Vehicle Miles Traveled Related Inputs

VMT-related inputs describe the distance traveled on different roadway types by the various source types (vehicles). VMT-related inputs include total annual VMT and VMT distribution with respect to monthly, daily, and hourly variation and road type. VMT-related inputs were developed from data provided by COMPASS (2021) and ITD (2021a, 2021b, 2021c, 2021d) including TDM output for Ada and Canyon Counties, Highway Performance Monitoring System (HPMS) statewide annual VMT data, the Idaho roadway link-level annual average daily traffic dataset, and the automatic traffic recorder (ATR) dataset. Complete data for all ATR sites in Idaho from 2020 (used only 2020 data to capture the pandemic effect) were obtained from ITD and screened to obtain complete datasets so that monthly, weekend/weekday, and hourly profiles were not biased by missing data. ATRs used in the analysis were aggregated to the North Idaho, South Idaho, and Treasure Valley county groups (Figure B-1) to ensure adequate statistics while still capturing regional differences in traffic patterns. This aggregation was necessary because for most counties, there are not enough ATRs for all roadway types to provide stable county-level profiles. For the Ada and Canyon Counties, the TDM output provided by COMPASS was used to provide the daily traffic volumes. In some cases, the MOVES default dataset was used as supplemental data source.

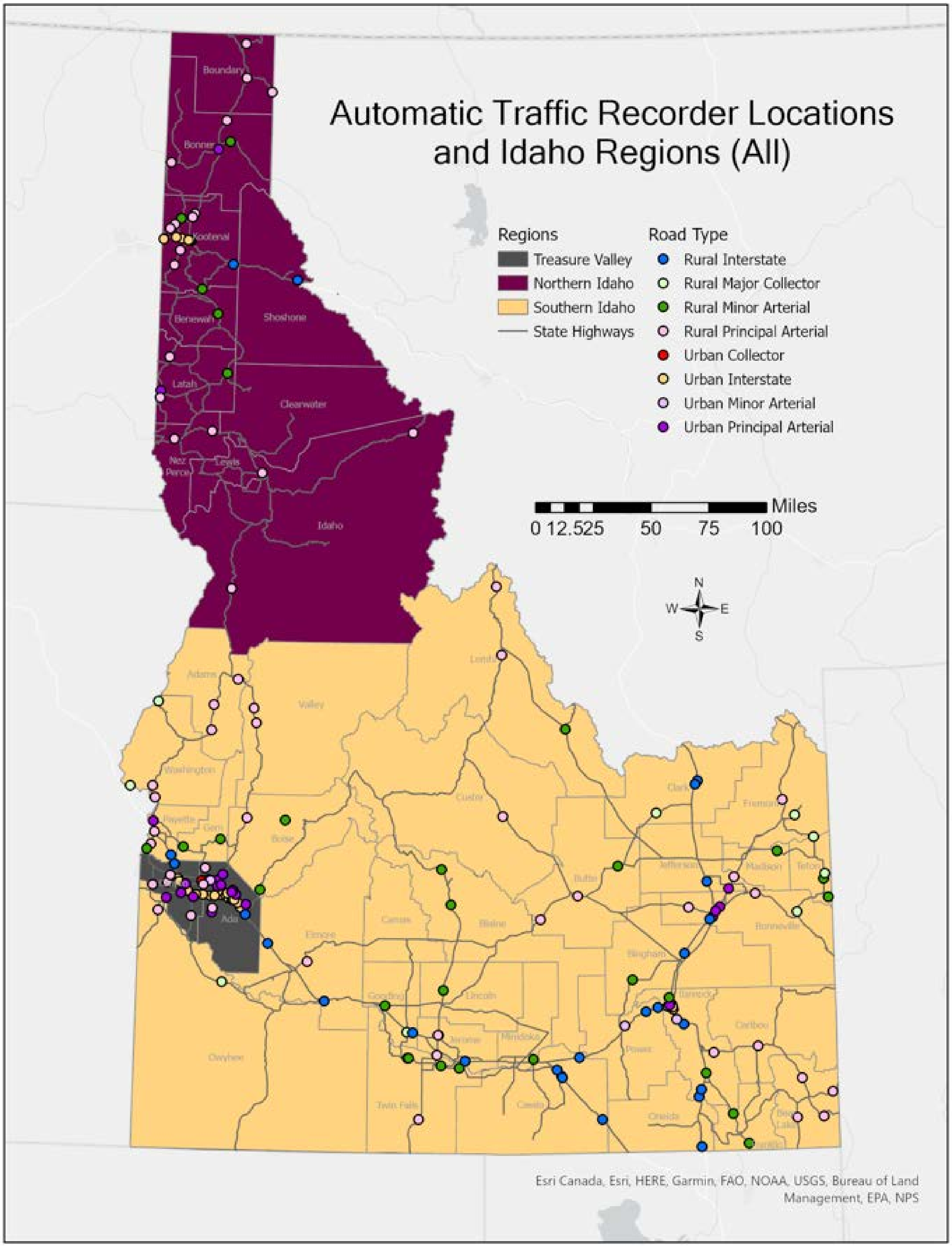

Figure B-1. ATR sites by county group.

3.1 Annual VMT

HPMSVTypeYear(HPMSVtypeID, yearID, HPMSBaseYearVMT)

Annual VMT represents the yearly total VMT for each of the counties in the domain.

3.1.1 Treasure Valley County Group (Ada and Canyon Counties)

ATR data for Ada and Canyon Counties were aggregated and used to generate a weekday/weekend ratio that was then applied to COMPASS TDM annual average weekday VMT output to estimate annual VMT by Federal Highway Administration (FHWA) roadway type.

The HPMS-based annual VMT by FHWA roadway type was also generated by using HPMS statewide dataset, ITD link level dataset, and MOVES default data.

A comparison of annual VMT attributed to local roads in the TDM output to the HPMS local road VMT indicated the TDM-based annual VMT underestimated travel on local roads. This underestimation is a known problem typically encountered when using TDM-based VMT because TDM uses a geographic unit called transportation analysis zone (TAZ) as building block and local roads in TAZ are not well represented. To compensate for this, DEQ scaled up TDM local road VMT until the total TDM-based VMT matched the HPMS-based annual VMT.

After the local VMT adjustment, annual VMT by FHWA roadway type was further allocated into annual VMT by HPMS vehicle type on each road type using the vehicle type information available in the ITD ATR dataset. Finally, MOVES defaults are used to split the light duty truck ATR counts to allocate light duty truck VMT to passenger truck and light duty commercial truck by roadway type; to split the bus ATR counts to allocate bus VMT to other buses, transit bus, and school bus by roadway type; and to split the heavy duty truck ATR counts to allocate heavy duty truck VMT to the single unit/combination and the long- and short-haul categories by roadway type.

3.2 Monthly, Daily, Hourly, and Roadway Type VMT Distribution

MonthVMTFraction(sourceTypeID, monthID, monthVMTFraction)
DayVMTFraction(sourceTypeID, monthID, roadTypeID, dayID, dayVMTFraction)
HourVMTFraction(sourceTypeID, roadTypeID, dayID, hourID, hourVMTFraction)
RoadTypeDistribution(sourceTypeID, roadTypeID, roadTypeVMTFraction)

Temporal distribution information derived from the ATR dataset was used to split the source type annual VMT into monthly, day of week, and hourly VMT profiles. The road type distribution describes the fraction of fleet miles driven on the each of the four MOVES roadway types (rural restricted, rural unrestricted, urban restricted, and urban unrestricted) within the modeling domain.

Temporal profiles and road type distribution were derived from ATR data and annual VMT by FHWA roadway type. ATR data contain vehicle type information and speed for individual vehicles or hourly vehicle counts for each length bin. A crosswalk from length bins to MOVES vehicle types and from FHWA roadway type to MOVES roadway types were developed. For each

ATR site, only data for a complete year were processed to ensure profiles were not biased by incomplete data. Hourly, weekday/weekend, and monthly statistics were calculated for each vehicle type for each ATR site with a complete dataset. Finally, ATR sites were grouped based on MOVES roadway types, and each site was weighted equally in constructing the final temporal profiles and road type distribution. This process was completed separately for each county group.

4 Source-Related Inputs

This group of inputs includes source type population, age distribution, and Alternative Vehicle Fuels and Technology (AVFT) (technically, AVFT is fuel related but DEQ used source information as a surrogate to develop the input). Source type-related inputs characterize the vehicles in the modeling domain and are compiled using a variety of data sources (Table B-3). The fleet mix, or source type population, and the age distributions are key components of onroad mobile source emissions modeling. The majority of vehicles are well characterized by the Department of Motor Vehicle (DMV) registration database provided by ITD (2021e). The database is screened to ensure that only vehicles with current registrations are included, and vehicle types and ages are obtained from the Vehicle Identification Number (VIN) to avoid data entry errors that may occur in other manually entered fields. ITD is undergoing a modernization of this dataset that will eventually result in a more accurate portrayal of the actual Idaho fleet. One major change from 2017 to 2020 is that vehicles that were removed from the Idaho fleet before the expiration of their registration are immediately removed from the database rather than remaining until the registration expired. Since some vehicles are not VIN decoded in the ITD dataset, DEQ looked for VIN decoded data used in NEI 2017 first. After that, DEQ manually decoded the VINs not shown in the NEI 2017 dataset based on the vehicle make, model, body type, and a free online VIN decoder (https://driving-tests.org/vin-decoder/) to correct any vehicle type miscategorization in the registration database.

Table B-3. Data sources for source-related MOVES inputs.

MOVES Source Type	Source-Related Input Data Source
Motorcycle	ITD–DMV registration database with VIN decoded information, VIN-decoded data used in NEI 2017, manually decoded data
Passenger Car	ITD–DMV registration database with VIN decoded information, VIN-decoded data used in NEI 2017, manually decoded data
Passenger Truck	ITD–DMV registration database with VIN decoded information, VIN-decoded data used in NEI 2017, manually decoded data
Light Commercial Truck	ITD–DMV registration database with VIN decoded information, VIN-decoded data used in NEI 2017, manually decoded data
Other Buses	ITD/INL/Other local companies—Bus Fleet Databases
Transit Bus	ITD/INL/Other local companies—Bus Fleet Databases
School Bus	Idaho Department of Education
Refuse Truck	Data from various refuse truck operators
Single Unit Short-haul Truck	MOVES default database, annual local VMT
Single Unit Long-haul Truck	MOVES default database, annual local VMT

MOVES Source Type	Source-Related Input Data Source
Motorhome	ITD–DMV registration database with VIN decoded information, VIN-decoded data used in NEI 2017, manually decoded data
Combination Short-haul Truck	MOVES default database, annual local VMT
Combination Long-haul Truck	MOVES default database, annual local VMT

4.1 Source Type Population

SourceTypeYear(yearID, sourceTypeID, sourceTypePopulation)

The source type population input file describes the types and numbers of vehicles that make up the fleet. The sources of data were used to develop the source type population inputs as shown in Table B-3.

Direct population data were obtained for refuse trucks from service providers. School bus data were obtained from the Idaho Department of Education. The Idaho statewide bus fleet database from ITD combined with the Idaho National Laboratory (INL) and other local companies' bus fleet databases were used to determine vehicle population for transit and other buses. For motorcycle, passenger car, passenger truck, light commercial truck, and motorhome source types, VIN-decoded registration data were used to determine vehicle populations.

For all other heavy duty truck source types, many of the vehicles are registered in other states so local registration data are not complete, and the heavy duty truck populations are derived from MOVES national defaults. For single and combination trucks, a factor was used to estimate the county-level source type populations using local activity data, MOVES national default activity data, and MOVES national default source type populations as shown in Equation B-1.

$$Population_{Local}^{SourceType} = VMT_{Local}^{SourceType}\left(\frac{Population_{NatlDefault}^{SourceType}}{VMT_{NatlDefault}^{SourceType}}\right)$$

Equation B-1. Estimate vehicle population for source types without local data available.

4.2 Age Distribution

AgeDistribution(sourceTypeID, yearID, ageID, ageFraction)

Age distributions characterize the age profile of each vehicle source type. Age distributions were developed for each county using VIN-decoded vehicle registration data; refuse truck data from service providers; transit and other bus fleet data from ITD, INL, and other local companies; school bus fleet data from the Idaho Department of Education; and MOVES defaults for heavy duty vehicle source types.

4.3 Alternative Vehicle Fuels and Technology

AVFT(sourceTypeID, modelYearID, fuelTypeID, engTechID, fuelEngFraction)

AVFT input files in MOVES allow the user to assign source type activity by model year to vehicles with different fuel and/or engine technologies. All counties were modeled using a custom AVFT input file derived from the same sources used for source population and age distribution. National default data were used as supplement where no local data were available.

5 Vehicle Hours Traveled-Related Inputs

VHT-related inputs characterize the time and average speeds that vehicles spend traveling on specific road types.

5.1 Average Speed

AverageSpeedDistribution(sourceTypeID, YearID, AgeID, AgeFraction)

The average speed distribution allocates the VHT for each source type (vehicle type) to 16 speed bins ranging from 0 to >=72.5 miles per hour (mph) (Table B-4). The average speed includes start/stop and turning events and congestion on busy roadways; as a result, the average speeds are typically lower than the free flow speed and the speed limit.

Table B-4. MOVES speed bin descriptions.

avgSpeedBinID	avgBinSpeed	avgSpeedBinDesc
1	2.5	speed < 2.5 mph
2	5	2.5 mph <= speed < 7.5 mph
3	10	7.5 mph <= speed < 12.5 mph
4	15	12.5 mph <= speed < 17.5 mph
5	20	17.5 mph <= speed <22.5 mph
6	25	22.5 mph <= speed < 27.5 mph
7	30	27.5 mph <= speed < 32.5 mph
8	35	32.5 mph <= speed < 37.5 mph
9	40	37.5 mph <= speed < 42.5 mph
10	45	42.5 mph <= speed < 47.5 mph
11	50	47.5 mph <= speed < 52.5 mph
12	55	52.5 mph <= speed < 57.5 mph
13	60	57.5 mph <= speed < 62.5 mph
14	65	62.5 mph <= speed < 67.5 mph
15	70	67.5 mph <= speed < 72.5 mph
16	75	72.5 mph <= speed

5.1.1 Treasure Valley County Group (Ada and Canyon Counties)

Average speed distributions were developed for all four MOVES road types using TDM outputs developed by COMPASS for the Treasure Valley and detailed ATR data in conjunction with a volume-capacity relationship developed by the Bureau of Public Roads called the BPR curve, or in this case, an updated or "modified BPR curve." The BPR curve relates the capacity of a given roadway to the volume of traffic traveling that roadway at any given time. The modified BPR curve was also used in the TDM model, and the same BPR coefficients (Equation B-2) were used in the TDM model and the average speed distribution calculations reported here.

$$s = \frac{s_f}{1 + a(v/c)^b}$$

Equation B-2. BPR method.

Where,

s = predicted average speed
s_f = free-flow speed
ν= volume
c = practical capacity
a = coefficient a
b = coefficient b.

Volume (ν) was calculated for each hour by multiplying weekday/weekend traffic counts for each link by hourly temporal profile fractions from ATR analysis. Practical capacity (c) and free-flow speed (s_f) for each link were directly obtained from TDM output.

6 Fuel-Related Inputs

6.1 Fuel Supply

FuelSupply(fuelRegionID,fuelYearID,monthGroupID,fuelFormulationID,marketShare,marketShareCV)

MOVES national default fuel supply information was judged to be reasonable, and alternative local data is not available. The national default fuel supply information was used for all source types.

6.2 Fuel Formulation

FuelFormulation(fuelFormulationID,fuelSubtypeID,RVP,sulfurLevel,ETOHVolume,MTBEVolume,ETBEVolume,TAMEVolume,aromaticContent,olefinContent,benzeneContent,e200,e300,volToWtPercentOxy,BioDieselEsterVolume,CetaneIndex,PAHContent,T50,T90)

MOVES national default fuel formulation information was judged to be reasonable, and alternative local data is not available. The national default fuel formulation information was used for all source types.

6.3 Fuel Usage Fraction

FuelUsageFraction(countyID,fuelYearID,modelYearGroupID,sourceBinFuelTypeID,fuelSupplyFuelTypeID,usageFraction)

MOVES national default fuel usage fractions were judged to be reasonable, and alternative local data is not available. The national default fuel usage fractions were used for all source types.

7 Meteorology

ZoneMonthHour(monthID, zoneID, hourID, temperature, relHumidity)

The meteorology inputs provide the average hourly temperature and relative humidity for each month in 2020 for each county. Average hourly temperature and relative humidity data for each month from a representative weather station for each county were used. Stations were selected from those available from MESOWEST (2021) to represent the most populated areas in each county where the majority of the vehicle travel occurs. This method avoids a bias that may be present in county-wide averages toward the cooler temperatures at higher elevation mountainous areas where there is very little traffic. MESOWEST screens all data for quality based on out-of-range limits. In addition, DEQ evaluated 100% of the data for consistency with nearby sites and dropped stations with unusual behavior or regional inconsistencies.

In the event that a representative station provided an incomplete dataset, datasets from one to three other nearby stations were used to gap-fill the original dataset. The weather stations used in the process, identified by their MESOWEST (2021) site IDs are shown in Figure B-2. IDs beginning with “K-” indicate National Weather Service sites, “ITD-” indicates Idaho Transportation Department sites, three letter IDs indicate NOAA AIR Resources Laboratory Field Research Division sites operated at the INL, and the remainder are US Forest Service RAWS sites, Union Pacific (UP-), or cooperative citizen observer sites (C- or D-).

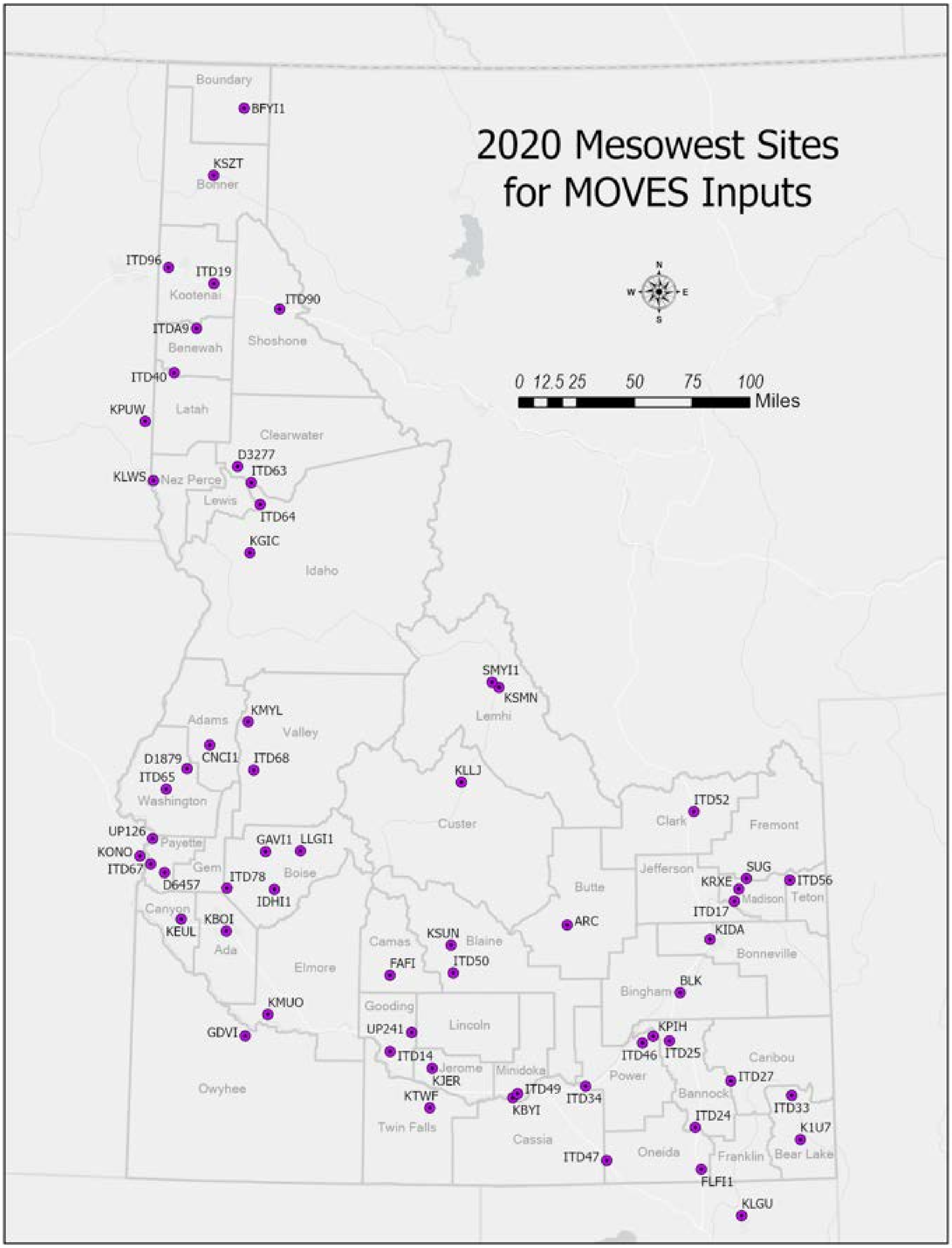

Figure B-2. Meteorology stations.

8 Inspection and Maintenance Programs

IMCoverage(polProcessID, stateID, countyID, yearID, sourceTypeID, fuelTypeID, IMProgramID, inspectFreq, testStandardsID, begModelYearID, endModelYearID, useIMyn, complianceFactor)

I/M programs require registered vehicles to undergo periodic emissions tests.

Ada and Canyon Counties are the only two counties in Idaho that had I/M programs in place during 2020. All other counties were modeled without I/M programs designated in the model. For the counties where I/M programs were implemented, DEQ gathered the I/M program information from the I/M program operators for 2020 and prepared them in a format required by MOVES.

9 Quality Assurance and Quality Control

To ensure the highest quality emissions estimates, a number of different quality assurance/quality control steps were implemented while developing the mobile source emissions inventory. Each input and output was checked for internal consistency, compared with national defaults, and assessed for reasonableness. These steps are outlined below:

- Quality assurance checks were naturally embedded in the model input development process by the data generator.
- MOVES model inputs, outputs, and message files were checked by the data generator.
- Each set of inputs were checked by a staff member not directly involved with developing the input. This evaluation reviewed the reasonableness with respect to expected behavior and compared it to MOVES default inputs (the alternative if any local inputs were determined to be unrealistic).
- MOVES model outputs were also compared with inputs such as VMT and source population to ensure they were consistent.
- The emissions generated were compared with NEI 2014 and NEI 2017 to check the reasonableness of the results.

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