

TECHNICAL SUPPORT DOCUMENT
FOR A CAA 110(l) DEMONSTRATION
FOR THE LOGAN, UT-ID PM_{2.5} NONATTAINMENT AREA

MAY 2019
Utah Division of Air Quality
Planning Branch/Mobile Sources

Abstract

This report discusses the CAA section 110(l) demonstration regarding the emissions impact of removing the Inspection and Maintenance Program Two Speed Idle (TSI) testing procedure for Cache County in 2021. This report includes the on-road mobile inventory impacts for the Logan, UT-ID PM_{2.5} nonattainment area. This assessment will cover the service life of the TSI program from 2021-2026.

On-road inventories were calculated using the EPA MOVES2014b (Motor Vehicle Emission Simulator) and were developed by the following agencies:

Cache Metropolitan Planning Organization (CMPO): Cache County
Utah Division of Air Quality (UDAQ)

Summary on-road emissions table inventories for a representative winter weekday are located at the end of the TSD for the following years: 2021-2026.

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ii. Overview

The State of Utah submitted a State Implementation Plan (SIP) for the EPA designated 24-hour PM_{2.5} Logan, Utah UT-ID nonattainment area in December of 2014. EPA approved the Cache County Inspection and Maintenance program (implemented by the Bear River Health Department) on September 9, 2015 (80 FR 54237) and it was included as an additional reasonable control measure in the SIP on November 23, 2018 (83 FR 59315). Pursuant to Utah Code Annotated 41-6a-1642(1), Cache County officials successfully implemented an I/M program on January 1, 2014. Cache County's I/M program is comprised of a decentralized test and repair network and requires a biennial test for all light duty gasoline vehicles 1969 and newer. Vehicles that are older than Model Year 1995 undergo Two Speed Idle (TSI) testing procedures while vehicles newer than Model Year 1996 are required to undergo On Board Diagnostic (OBD) testing procedures. The program exempts vehicles less than six years old from an emission inspection. The details of the program can be found in Section X Part F of the Utah SIP.

In December 2018 the Bear River Health Department proposed amending the Vehicle Emissions and Maintenance program. The proposal made to the Cache County Council was to discontinue the TSI program due to a diminishing fleet of older light duty gasoline vehicles participating within the program combined with increasing cost of maintaining TSI testing equipment. The Cache County Council passed the proposal to discontinue the TSI program with an effective date of January 1, 2021. The Utah Division of Air Quality, EPA Region 8, and the Bear River Health Department have been coordinating to ensure that the proposed I/M program changes do not interfere with State and Federal air quality regulations.

Section 110(l) of the Clean Air Act (CAA) allows for revisions to a SIP so long as it does not interfere with any applicable requirement concerning attainment and reasonable further progress or any other applicable requirement of this chapter of the CAA. This 110(l) demonstration addresses the removal of the I/M Program TSI biennial testing procedure for Cache County in 2021 and shows that there will be minimal impact on the overall on-road mobile source inventory within the Logan, UT-ID PM_{2.5} nonattainment area (NAA) from 2021-2026 and demonstrates non-interference for other National Ambient Air Quality Standards (NAAQS) being monitored in Cache County, Utah.

The removal of the TSI program will not interfere with the ability of the Logan, UT-ID NAA to continue to attain the EPA 24 hour PM_{2.5} national ambient air quality standard despite a very small increase in emissions. This document explains the emissions modeling assumptions used to develop the on-road mobile emissions estimates for the 110(l) demonstration. The modeling portion of the demonstration will cover the EPA MOVES model service life emissions credit for the TSI program for the years 2021-2026. The TSI testing program covers light duty gasoline vehicles that are older than Model Year 1995 and was established as a control strategy in the Logan, UT-ID PM_{2.5} Nonattainment SIP (December 3, 2014).

The analysis simply looks at the emissions credit assigned to the overall I/M program, including On Board Diagnostic (OBD) and TSI within Cache County within the 2021-2026 period and compares it to the emissions credit without the TSI program (OBD only). Emission estimates are

based on meteorological conditions that occurred during three PM_{2.5} episodes: 2011 January 1-12, 2013 December 7-19, and 2016 February 1-17. Inventory estimations were created at the county level representing an average January weekday.

Emission estimates are confined to the EPA approved MOVES2014b (May 2017) emissions model. This model produces emissions estimates for on-road vehicles by providing emissions profiles for exhaust, evaporative, and wear conditions. Inputs include speeds, vehicle fuel profiles and specifications, vehicle miles traveled (VMT), I/M program profiles, VMT mix, vehicle age distributions, and meteorological conditions. Specific MOVES input parameters and outputs can be found in the Cache IM Program 110(l).xlsx workbook and specific MOVES modeling inputs can be furnished upon request.

Additional analysis was also performed comparing the PM_{2.5} SIP I/M 2015 program credit that the EPA approved for Cache County to the new proposed I/M program for 2021. Ambient air quality monitoring data from the Smithfield, Cache County site also demonstrates non-interference with the NAAQS when looking at the small increase in emissions due to the removal of the TSI program. Cache County, Utah is currently attaining the six NAAQS.

iii. MOVES Modeling Procedure

The discussion below identifies the procedures followed to model the episodic inventories.

The following agencies developed on-road mobile source emissions inventories:

CMPO: Cache Metropolitan Planning Organization
Utah Division of Air Quality

1. MOVES Default Database Enhancement for Local Roads

The local road enhancement allows the EPA MOVES2014b model to produce emissions results according to the Highway Performance Monitoring System (HPMS) utilized by the Federal Highway Administration, Utah Department of Transportation, Cache Metropolitan Planning Organization (CMPO) and the Utah Division of Air Quality (UDAQ). Arterial and local roads have very different travel characteristics. This simplified approach allows each road type to have specific VMT, speed and vehicle distribution by road type (vehicle mix) inputs. Modeling specific road types creates an inventory approach that matches the HPMS road types that are reported within local transportation plans.

Modifications to Local Road Tables

<u>Table Names</u>	<u>Data Columns</u>	<u>Description of Changes</u>
avgspeeddistribution	roadTypeID	Road types rural local(32) and urban local(52) added.
drivescheduleassoc	avgSpeedBinID	
hourvmtfraction	driveScheduleID	
roadtype	hourVMTFraction	
roadtypedist	roadDesc	
zoneroadtype	roadTypeVMTFraction	

2. MOVES2014 Daily Pollutants

Pollutants selected for analysis:

- Ammonia (NH₃)
- Oxides of Nitrogen (NO_x)
- PM_{2.5} & PM₁₀ (Primary Exhaust, Brake, & Tire)
- Sulfur Dioxide (SO₂)
- Volatile Organic Compounds (VOC)

3. MOVES2014b Local Model Inputs

County Data Manager Development

MOVES organizes data inputs into databases called County Data Manager (CDM) tables. CDMs were developed for all of the Logan, UT-ID PM_{2.5} NAA for: 2021-2026, for an average weekday in January.

(1) Average Speed Distribution and VMT

Cache MPO obtained average speed distributions from its 2019 Travel Demand Model. The TDM analyzes thousands of separate traffic segments called "links" that together comprise the network of roads in Cache County. Each link is assigned, for each of the four major time periods during the day (AM peak, midday, PM peak and nighttime), an average speed, an increment of VMT and an increment of VHT (vehicle hours traveled). A specific number of links are assigned to each of the UDOT HPMS functional classes (road types, e.g., rural local, urban local, rural minor arterial, urban minor arterial, and so on). In effect, average speeds, VMT and VHT for each of the functional classes are combined to obtain average speed, VMT and VHT for rural arterials, urban arterials, rural local roads and urban local roads. (There are no interstates in Cache County).

(2) AVFT (Diesel, Gasoline, Electric Fractions)

MOVES AVFT (alternative vehicle and fuel technology) was updated with 2017 State DMV registration data on fuel type for registered light duty vehicles (passenger cars and light duty trucks). The fuel type data provided covers gasoline, diesel, flex, and electric light duty vehicles. The DMV fractions were specifically applied to all model years for passenger car and light duty trucks.

(MOVES source types 21,31,32) MOVES2014a default AVFT values were used for all remaining source type vehicles (MOVES sourcetypes 40-60).

(3) Fuel & HourVMTFraction

MOVES 2014a default fuel and hour VMT fraction parameters were used.

(4) HPMSvTypeYear (VMT)

Cache MPO VMT was constructed from its 2019 Travel Demand Model. UDOT Division of Systems Planning and Programming provided 2017 VMT travel fractions for FHWA vehicle classes grouped by Gross Vehicle Weight Rating (GVWR) ranges. The travel fractions were obtained by county from automated pneumatic counters that detect axle spacing and "weigh-in motion" (WIM) counters placed on arterial, interstate, and local roads. UDOT also provided average VMT daily adjustment factors (2016) to provide winter month and daily activity detail. The VMT daily adjustment factors allow for the modeling of an average weekday, Saturday, and Sunday in January.

(5) I/M Coverage

UDAQ constructed I/M Program coverages in consultation with the Bear River Health Department in Cache County. The Cache County I/M program exempts the first six model years and performs a biennial test on light duty gasoline vehicles beginning in the seventh model year. Vehicles older than 1995 undergo a TSI test and vehicles newer than 1996 undergo OBD. The EPA MOVES model service life emissions credit for the TSI program is essentially removed in 2026. The compliance rate was calculated utilizing EPA I/M reports and incorporated the waiver rate, total OBD and TSI failures, and regulatory class coverage. This work is shown in the Cache IM Program 110(l).xlsx workbook.

(6) Road Type Distribution

UDOT Division of Systems Planning and Programming provided 2017 VMT travel fractions for FHWA vehicle classes grouped by Gross Vehicle Weight Rating (GVWR) ranges. The travel fractions were obtained by county from automated pneumatic counters that detect axle spacing and "weigh-in motion" (WIM) counters placed on arterial, interstate, and local roads. CMPO TDM 2019

VMT and Vehicle Mix data were used to construct road type distribution and VMT by sourcetype.

(7) Source Type Age Distribution

Utah Department of Motor Vehicle (DMV) provided a single age distribution for passenger cars (21) and light trucks (31,32) for 2017. The age distribution was held constant for all years modeled. MOVES2014b default age distribution values were used for all remaining source type vehicles.

(8) Source Type Year (Vehicle Population)

CMPO utilized Utah DMV 2017 registration data for Model Years 2017-1969 for motor cycles, passenger cars, and light duty trucks up to 10,000 GVWR. The MOVES default vehicle fraction for these vehicles was used to determine the difference between cars and trucks since the DMV data could not discern between a passenger car and light duty truck. MOVES 2014a default vehicle populations were used for heavy duty vehicles. The VMT growth rate from the CMPO travel demand model was used to estimate future population growth.

(10) ZoneMonthHour (Meteorological Data)

The UDAQ Technical Analysis Section provided metrological conditions from Meso West University of Utah from three PM_{2.5} episodes: 2011 January 1-12, 2013 December 7-19, and 2016 February 1-17. The UDAQ modeling section provided hourly temperature and relative humidity profiles from representative weather stations in Cache County. The meteorology data represents the hour by hour average for all of the days in the 2011 January 1-12, 2013 December 7-19, and 2016 February 1-17 PM_{2.5} episodes. The average of all the hourly temperatures and relative humidity readings over the three episodes for each representative weather station was used to reflect the atmospheric conditions that represent the PM_{2.5} season.

iv. Emissions Trend Estimates

The Logan, UT-ID PM_{2.5} Nonattainment SIP (December 3, 2014) established the TSI testing biennial emissions control strategy that covers light duty gasoline vehicles that are older than Model Year 1995. The purpose of this 110(l) demonstration is to show the amount of emissions credit being lost by the removal of the TSI testing program in the Logan, UT-ID NAA in 2021. Specifically, the demonstration shows the small amount of emissions credit being lost will not interfere with the ability of the NAA to continue to attain the EPA 24 hour PM_{2.5} standard from 2021-2026.

The MOVES model service life credit for the TSI program will essentially phased out completely by the year 2026. The MOVES model only accepts vehicle inputs covering 30

model years. In 2026 the model year coverage is 2026-1996. This modeling concept does not allow for the input of vehicles that are model year 1995 and older to be modeled in the year 2026. The emissions trends in Table 1 on page 12 shows the fading impact of the TSI program in terms of reduced vehicles being tested and the result of diminishing emissions credit through the 2021-2025 testing period.

MOVES 2014b vehicle input estimates regarding the removal of the TSI emissions program for the years 2021-2026 for the Logan, UT-ID PM_{2.5} NAA shows that the number of pre-1996 biennial TSI vehicles being tested over time is declining. Meanwhile, the number of vehicles undergoing biennial OBD testing program is growing (1996 and newer). In the year 2021, it is estimated that the amount of pre-1996 TSI vehicles are estimated to be 1,899 vehicles. In 2025, the number of pre-1996 TSI vehicles is trending downward toward 1,341 vehicles. This is a result of the pre-1996 TSI vehicles getting older and leaving the fleet. Meanwhile in the same period the number of vehicles that are 1996 and newer undergoing OBD is increasing. In the year 2021 it is estimated that the number of 1996 and newer vehicles will be 28,325. In 2025, that number is trending upward 30,958 vehicles being tested. The vehicle population of pre-1996 TSI vehicles TSI is declining as older vehicles are being scrapped, while the 1996 OBD vehicle population is growing as brand new vehicles are being purchased.

The MOVES 2014b emissions estimates for the TSI program shows that the emissions credit from pre-1996 vehicles TSI is declining over a period of time as the overall vehicle population of pre-1996 TSI vehicles declines. In 2021, the removal of the TSI program is projected to increase emissions by an estimated .053 tons per day of NO_x and VOC emissions combined, an increase of 2.53%. This is equivalent to increasing emissions by 107 pounds per day. In 2025 the removal of the TSI program is projected to increase emissions by an estimated .036 tons per day of NO_x and VOC combined, an increase of 2.27%. This is equivalent to increasing emissions by 73 pounds per day. In 2026 the TSI emissions credit is essentially phased out of the EPA MOVES emission model. (Please note that MOVES emissions model only provides TSI emissions credits for Oxides of Nitrogen (NO_x) and Volatile Organic Compounds (VOC).

Additional analysis was performed comparing the original 2015 SIP I/M program credit to the new proposed I/M program for 2021. The original SIP I/M program (OBD+TSI) was estimated to reduce emissions by .426 tons per day of NO_x and VOC combined in 2015. In 2021, the removal of the TSI program is projected to increase emission by an estimated .053 tons per day of NO_x and VOC emissions combined. This is equivalent to increasing emissions by 107 pounds per day. Using the emissions increase from the removal of the TSI program the original 2015 I/M program would have seen an estimated increase in NO_x emissions by 11% and VOC by 13%, or a combined 12% increase. This analytical approach is conservative and does not take into account the shrinking vehicle population and emissions of pre 1996 vehicles, increase vehicle population and emissions of 2017 newer model year vehicles that meet Federal Tier 3 emissions standards, and VMT growth. The conservative analysis does indicate that the previous MOVES modeling demonstration showing a 2.53% increase in emissions in 2021 is within a reasonable range.

	Cache Attainment SIP I/M Emissions Credit for 2015 OBD + TSI			TSI I/M Credit to be removed for 2021			Cache Attainment SIP I/M Emissions Credit for 2015 OBD			Lost TSI Credit % for 2015		
	NOx	VOC	NOx +VOC	NOx	VOC	NOx +VOC	NOx	VOC	NOx +VOC	NOx	VOC	NOx +VOC
Tons Per Day	0.214	0.2	0.426	0.025	0.029	0.053	0.189	0.183	0.372	-11.45%	-13.44%	-12.44%
LBS Per Day	428	424	852	49	57	107	379	367	746			

The design values at the monitor in Smithfield, Cache County are in compliance with the following NAAQS and indicate that a 2.5% increase in NOx and VOC emissions combined will not interfere with Cache County, Utah being able to attain the NAAQS.

Smithfield NAAQS Design Value						
Parameter	2016	2017	2018	Design Value (3 yr. Average)	Standard	Unit
Ozone	0.062	0.063	0.069	0.064	0.07	ppm
PM 2.5 98 %tile	34	36	27.9	33	35	µg/m ³
PM 2.5 Annual Mean	7.6	7.9	7.3	7.6	12	µg/m ³
PM 10	0	0	0	0	1	Est. Exceedances
NO2	37	37	30	35	100	ppb

The table below shows the most current air quality standards for the six criteria air pollutants and Cache County's designation status with respect to each standard.

Current National Ambient Air Quality Standards and Designation Status For Cache County, UT				
Pollutant	Primary/ Secondary NAAQS	Averaging Time	Level	Designation Status
CO	Primary	8-hour	9 ppm	Attainment
		1-hour	35 ppm	Attainment
Lead	Primary and Secondary	Rolling 3 month average	0.15 µg/m ³	Attainment
NO ₂	Primary	1-hour	100 ppb	Attainment
	Primary and Secondary	Annual	53 ppb	Attainment
Ozone	Primary and Secondary	8-hour	0.070 ppm	Attainment
PM _{2.5}	Primary	Annual	12 µg/m ³	Attainment
	Secondary		15 µg/m ³	Attainment
	Primary and Secondary	24-hour	35 µg/m ³	Nonattainment
PM ₁₀	Primary and Secondary	24-hour	150 µg/m ³	Attainment
SO ₂	Primary	1-hour	75 ppb	Attainment
	Secondary	3-hour	0.5 ppm	Attainment

Although Logan, UT-ID is currently designated as a nonattainment area for the 24-hr PM_{2.5} NAAQS, on October 19, 2018 (83 FR 52983), the EPA published a final determination that based on the validated data from 2015-2017, the Logan, UT-ID nonattainment area attained the 2006 primary and secondary 24-hr PM_{2.5} NAAQS by the December 31, 2017 attainment date. Utah will submit a redesignation request to EPA in 2019.

The CAA 110(l) demonstration regarding the removal of the I/M TSI for Cache County, Utah in 2021 finds that there will be minimal impact on the overall on-road mobile source inventory within the Logan, UT-ID PM_{2.5} NAA from 2021-2026. The TSI test program covers light duty gasoline vehicles that are older than Model Year 1995. The MOVES 2014b vehicle population and emissions estimates clearly indicate a shrinking vehicle population and emissions from pre-1996 TSI light duty gasoline vehicles. The increase in emissions from the MOVES analysis indicated a 2.5% increase of NO_x and VOC combined.

Table 1. Cache County On-Road Mobile Source Emissions for Average Winter Weekday (Tons Per Day)

Cache County On-Road Mobile Source Emissions for Average Winter Weekday (Tons Per Day) DMV																	
Year	I/M Test Type	NH3	NOx TPD	PM10	PM25	SO2	VOC TPD	VOC_Refuel	VMT	Vehicles Tested	NOx TPD Shortfall	NOx TPD % Change	VOC TPD Shortfall	VOC TPD % Change	NOx + VOC TPD (Total) Shortfall	NOx + VOC LBS (Total) Shortfall	NOx + VOC TPD % Change
2021	OBD + TSI	0.10	2.51	0.43	0.17	0.01	1.85	0.08	3,312,467	30,224							
	OBD	0.10	2.54	0.43	0.17	0.01	1.88	0.08	3,312,467	28,325							
	(-)TSI		-0.02	0.00	0.00	0.00	-0.03	0.00		1,899	-0.025	-0.98%	-0.029	-1.55%	-0.053	-107	-2.53%
2022	OBD + TSI	0.10	2.29	0.42	0.16	0.01	1.75	0.08	3,373,213	30,730							
	OBD	0.10	2.31	0.42	0.16	0.01	1.77	0.08	3,373,213	29,181							
	(-)TSI		-0.02	0.00	0.00	0.00	-0.02	0.00		1,549	-0.021	-0.93%	-0.025	-1.41%	-0.046	-92	-2.34%
2023	OBD + TSI	0.10	2.09	0.42	0.15	0.01	1.65	0.07	3,433,958	31,244							
	OBD	0.10	2.11	0.42	0.15	0.01	1.67	0.07	3,433,958	29,671							
	(-)TSI		-0.02	0.00	0.00	0.00	-0.02	0.00		1,573	-0.018	-0.87%	-0.021	-1.25%	-0.039	-78	-2.12%
2024	OBD + TSI	0.10	1.91	0.41	0.14	0.01	1.59	0.07	3,494,700	31,767							
	OBD	0.10	1.92	0.41	0.14	0.01	1.62	0.07	3,494,700	30,447							
	(-)TSI		-0.01	0.00	0.00	0.00	-0.03	0.00		1,320	-0.015	-0.77%	-0.026	-1.64%	-0.041	-81	-2.40%
2025	OBD + TSI	0.10	1.78	0.41	0.13	0.01	1.53	0.07	3,568,339	32,298							
	OBD	0.10	1.79	0.41	0.13	0.01	1.55	0.07	3,568,339	30,958							
	(-)TSI		-0.01	0.00	0.00	0.00	-0.02	0.00		1,341	-0.013	-0.74%	-0.023	-1.53%	-0.036	-73	-2.27%
2026	OBD	0.10	1.61	0.41	0.13	0.01	1.42	0.07	3,641,979	32,865							

v. Appendix: Inventories For 110(l) Demonstration

Input files will be furnished upon request:

vi. References

The following documents were used as references in creating the 110(l) demonstration:

1. U.S. Environmental Protection Agency, Office of Transportation and Air Quality (OTAQ), Assessment and Standards Division, "MOVES2014a User Guide", EPA-420-B-095, November 2015, <https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100NNCY.txt>
2. U.S. Environmental Protection Agency, OTAQ, Transportation and Regional Programs Division, "MOVES2014 and 2014a Technical Guidance: Using MOVES to Prepare Emission Inventories for State Implementation Plans and Transportation Conformity", EPA-420-B-15-093), <https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100NN9L.txt> , November 2015.
4. I/M Programs Bear River Health Department, 655 East 1300 North. Logan, UT 84341, 801-792-6500
5. MESOWEST UTAH, (met data archive), University of Utah, Department of Atmospheric Sciences, <http://mesowest.utah.edu/>.
6. US EPA Design Value Report May 6, 2019