UTAH STATE IMPLEMENTATION PLAN

$PM_{2.5}$ Maintenance Provisions for the Logan, UT-ID Nonattainment Area

SECTION IX.A.28

UTAH DEPARTMENT *of* ENVIRONMENTAL QUALITY

AIR QUALITY

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List of Acronyms and Abbreviations

BACM	Best Available Control Measure
BACT	Best Available Control Technology
CAA	Clean Air Act
CDD	Clean Data Determination
CFR	Code of Federal Regulations
CAMx	Comprehensive Air Quality Model with Extensions
DAQ	Utah Division of Air Quality (also UDAQ)
EPA	Environmental Protection Agency
FR	Federal Register
MOVES	Motor Vehicle Emission Simulator
MPO	Metropolitan Planning Organization
MVEB	Motor Vehicle Emissions Budget
$\mu g/m^3$	Micrograms Per Cubic Meter
Micron	One Millionth of a Meter
NAAQS	National Ambient Air Quality Standards
NH_3	Ammonia
NO_x	Nitrogen Oxides
NNSR	Nonattainment New Source Review
PM	Particulate Matter
PM_{10}	Particulate Matter Smaller Than 10 Microns in Diameter
$PM_{2.5}$	Particulate Matter Smaller Than 2.5 Microns in Diameter
R-307	Utah Administrative Code Air Quality Rules
RACM	Reasonably Available Control Measures
RACT	Reasonably Available Control Technology
RFP	Reasonable Further Progress
SIP	State Implementation Plan
SLC NAA	Salt Lake City Nonattainment Area
SMAT	Software for Model Attainment Test
SMOKE	Sparse Matrix Operator Kernal Emissions
SO_2	Sulfur Dioxide
SO_x	Sulfur Oxides
TPWW	Tons Per Winter Weekday
TPY	Tons Per Year
TSD	Technical Support Document
UAC	Utah Administrative Code
UT	Utah
VMT	Vehicle Miles Travelled
VOC	Volatile Organic Compounds
WRF	Weather Research and Forecasting

Section IX.A.28

$PM_{2.5}$ Maintenance Provisions for the Logan, UT-ID Nonattainment Area

IX.A.28.a Introduction

The Logan, UT-ID Nonattainment Area (Logan NAA) has attained the 2006 $PM_{2.5}$ 24-hour National Ambient Air Quality Standard (NAAQS). As a result, this Section has been added to the State Implementation Plan (SIP) to demonstrate that the Logan NAA is eligible for redesignation to attainment status. Under Section 107(d)(3)(E) of the Clean Air Act (CAA or the Act), a nonattainment area is eligible for redesignation when the area has met the following requirements: (1) the area has attained the national ambient air quality standard, (2) the area has an Environmental Protection Agency (EPA) approved attainment SIP, (3) the improvement in air quality is due to permanent and enforceable reductions in emissions resulting from implementation of the SIP, (4) the state has met the SIP requirements of Section 110 and Part D of the Act, and (5) the area has an EPA approved Maintenance Plan.

As demonstrated in Subsection IX.A.28.b, the Logan NAA has satisfied the redesignation requirements of Section 107 and is eligible for redesignation pending the EPA's approval of the Logan NAA Maintenance Plan. The maintenance plan is included in Subsection IX.A.28.c and was written in compliance with Section 175A of the Act. The maintenance plan demonstrates that the Logan NAA will continue to maintain 2006 24-hour $PM_{2.5}$ NAAQS through at least the year 2035. The maintenance plan also includes contingency measures to assure that the State will promptly correct any violation of the standard that may occur after redesignation. Upon the EPA's approval of the maintenance plan, the State is requesting that the Logan NAA be redesignated to attainment for the 2006 $PM_{2.5}$ 24-hour NAAQS.[1]

a) Background

In October of 2006, EPA revised the 1997 NAAAQS for $PM_{2.5}$. While the annual standard remained unchanged at 15 µg /m^3 (until 2012), the 24-hr standard was lowered from 65 µg /m^3 to 35 µg /m^3. The Utah Division of Air Quality ("UDAQ") has monitored $PM_{2.5}$ since 2000 and found that all areas have been in compliance with the 1997 standards. Since the promulgation of the 2006 standard, all or parts of seven Utah counties have recorded monitoring data that was not in compliance with the new 24-hr standard. In 2012, EPA lowered the annual standard to 12 µg /m^3, and all areas of the state meet this new standard.

On November 13, 2009, EPA designated the Logan NAA, which includes Cache County in Utah and Franklin County in Idaho, as nonattainment for the 2006 24-hour $PM_{2.5}$ NAAQS under the Act's general provisions for nonattainment areas. On January 4, 2013, the D.C. Circuit Court of Appeals issued a decision holding that the specific provisions for PM_{10} nonattainment areas, which are found in Part D, Subpart 4 of the Act, also apply to $PM_{2.5}$ nonattainment areas. These provisions require EPA to classify a PM nonattainment area as "moderate" at the time it is designated nonattainment. On June 2, 2014, the

[1] Concurrent with the State's submittal of SIP Section IX.A.28 to the EPA, Governor Gary Herbert will submit a letter to EPA requesting that EPA approve the maintenance plan and redesignate the Logan NAA to attainment.

EPA classified the Logan NAA as a Moderate nonattainment area with an attainment date of December 31, 2015. Under CAA section 188(d) and 40 CFR 51.1005, the EPA may grant a state's request to extend the attainment date for a moderate area for a 24-hr $PM_{2.5}$ standard. EPA granted two 1-year extensions to both Utah and Idaho, resulting in an attainment date of December 31, 2017 (82 FR 42447).

The Act requires areas failing to meet the federal ambient $PM_{2.5}$ standard to develop a state implementation plan (SIP) with sufficient control requirements to expeditiously attain and maintain the standard. On December 3, 2014, UDAQ submitted a moderate area SIP[2] for the Logan NAA that demonstrated attainment of the $PM_{2.5}$ NAAQS by December 31, 2015. EPA approval of the SIP will be discussed in Section IX.A.28.b(2).

Under the 24-hour NAAQS, compliance is determined by the average of 3 years of 98th percentile values. Since the statutory deadline for the implementation of RACM was not until December 31, 2014, it was reasonable to presume that the area might not be able to show attainment with a 3-year data set until the end of 2015 even if the control measures were having the desired effect. Presumably for this reason, Section 188(d) of the Act, (42 U.S.C. 7513(d)) allows a state to request up to two 1-year extensions of the attainment date. In doing so, the state must show that it has met all requirements of the SIP, and that the 98th percentile 24-hour concentration at each monitor in the area for the calendar year that includes the applicable attainment date is less than or equal the standard.

On September 8, 2017, EPA published notice in the Federal Register (82 FR 42447) that Utah and Idaho's extension requests were granted. As a result, EPA must examine monitor data values from 2015-2017 to determine whether the Logan, UT-ID area attained the NAAQS by the extended attainment date.

On October 19, 2018 (83 FR 52983), the EPA published a final determination based on the validated data from 2015-2017, that the Logan, UT-ID nonattainment area attained the 2006 primary and secondary 24-hour $PM_{2.5}$ NAAQS by the December 31, 2017, attainment date. The purpose of this SIP submittal is to request redesignation of the area to attainment (IX.A.28.b) and document a ten-year maintenance plan (IX.A.28.c).

IX.A.28.b Redesignation Requirements

Section 107(d)(3)(E) of the Act outlines five requirements that a nonattainment area must satisfy before an area may be eligible for redesignation from nonattainment to attainment status. Table IX.A.28.1 identifies the redesignation requirements as they are stated in Section 107(d)(3)(E) of the Act. Each element will be addressed in turn, with the central element being the maintenance plan found in Subsection IX.A.28.c below.

[2] UDAQ. December 3, 2014. Utah State Implementation Plan. Control Measures for Area and Point Sources, Fine Particulate Matter, $PM_{2.5}$ SIP for the Logan, UT-ID Nonattainment Area. Section IX. Part A.23. https://deq.utah.gov/legacy/laws-and-rules/air-quality/sip/docs/2014/12Dec/SIP%20IX.A.23_Logan_FINAL_Adopted12-3-2014.pdf

Category	Requirement	Reference	Addressed in Section
Attainment of Standard	Three consecutive years of $PM_{2.5}$ monitoring data must show that violations of the standard are no longer occurring	CAA §107(d)(3)(E)(i)	IX.A.28.b(1)
Approved SIP	The attainment SIP for the area must be fully approved	CAA §107(d)(3)(E)(ii)	IX.A.28.b(2)
Permanent and Enforceable Emissions Reductions	The State must be able to reasonably attribute the improvement in air quality to emission reductions that are permanent and enforceable	CAA §107(d)(3)(E)(iii), Calcagni memo (Sect 3, para 2)	IX.A.28.b(3)
Section 110 and Part D requirements	The State must verify that the area has met all requirements applicable to the area under section 110 and Part D	CAA: §107(d)(3)(E)(v), §110(a)(2), Sec 171	IX.A.28.b(4)
Maintenance Plan	The Administrator has fully approved the Maintenance Plan for the area as meeting the requirements of CAA §175A	CAA: §107(d)(3)(E)(iv)	IX.A.28.b(5) and IX.A.28.c

Table IX.A.28. 1 Prerequisites to Redesignation in the Clean Air Act

1) The Area Has Attained the $PM_{2.5}$ NAAQS

CAA 107(d)(3)(E)(i) – *The Administrator determines that the area has attained the national ambient air quality standard*. To satisfy this requirement, the State must show that the area is attaining the applicable NAAQS. According to EPA's guidance[3] concerning area, there are generally two components involved in making this demonstration. The first relies upon ambient air quality data which should be representative of the area of highest concentration and should be collected and quality assured in accordance with 40 CFR 58. The second component relies upon supplemental air quality modeling. Each component will be addressed in turn.

a) Ambient Air Quality Data (Monitoring) and Utah's Monitoring Network

The NAAQS for $PM_{2.5}$ are listed in 40 CFR 50.13. The 2006 24-hour NAAQS is 35 micrograms per cubic meter ($\mu g/m^3$) for a 24-hour period and is met when the 98th percentile 24-hr concentration is less than or equal to 35 $\mu g/m^3$. Each year's 98th percentile is the daily value beneath which 98% of all daily values would fall. The procedure for evaluating $PM_{2.5}$ data with respect to the NAAQS is specified in Appendix N of 40 CFR Part 50. Generally speaking, the 24-hr $PM_{2.5}$ standard is met when a three-year average of 98th percentile values is less than or equal to 35 $\mu g/m^3$.

$PM_{2.5}$ has been monitored in Utah since 2000, following the promulgation of the 1997 $PM_{2.5}$ NAAQS. UDAQ's monitors are appropriately located to assess concentration, trends, and changes in $PM_{2.5}$ concentrations. During Utah's wintertime temperature inversions, daily sampling and real time monitoring are necessary for both public notification and to provide data for the air quality models.

The UDAQ Air Monitoring Section maintains an ambient air monitoring network in Utah in accordance with 40 CFR 58 that collects both air quality and meteorological data. Figure IX.A.28.1 on the following

[3] John Calcagni. September 4, 1992. EPA Memorandum authored by John Calcagni "Procedures for Processing Requests to Redesignate Areas to Attainment.

page shows the location of sites along the Wasatch Front and in the Cache Valley that collect $PM_{2.5}$ data. The ambient air quality monitoring network along Utah's Wasatch Front and in the Cache Valley is routinely audited by the EPA, and meets the agency's requirements for air monitoring networks.

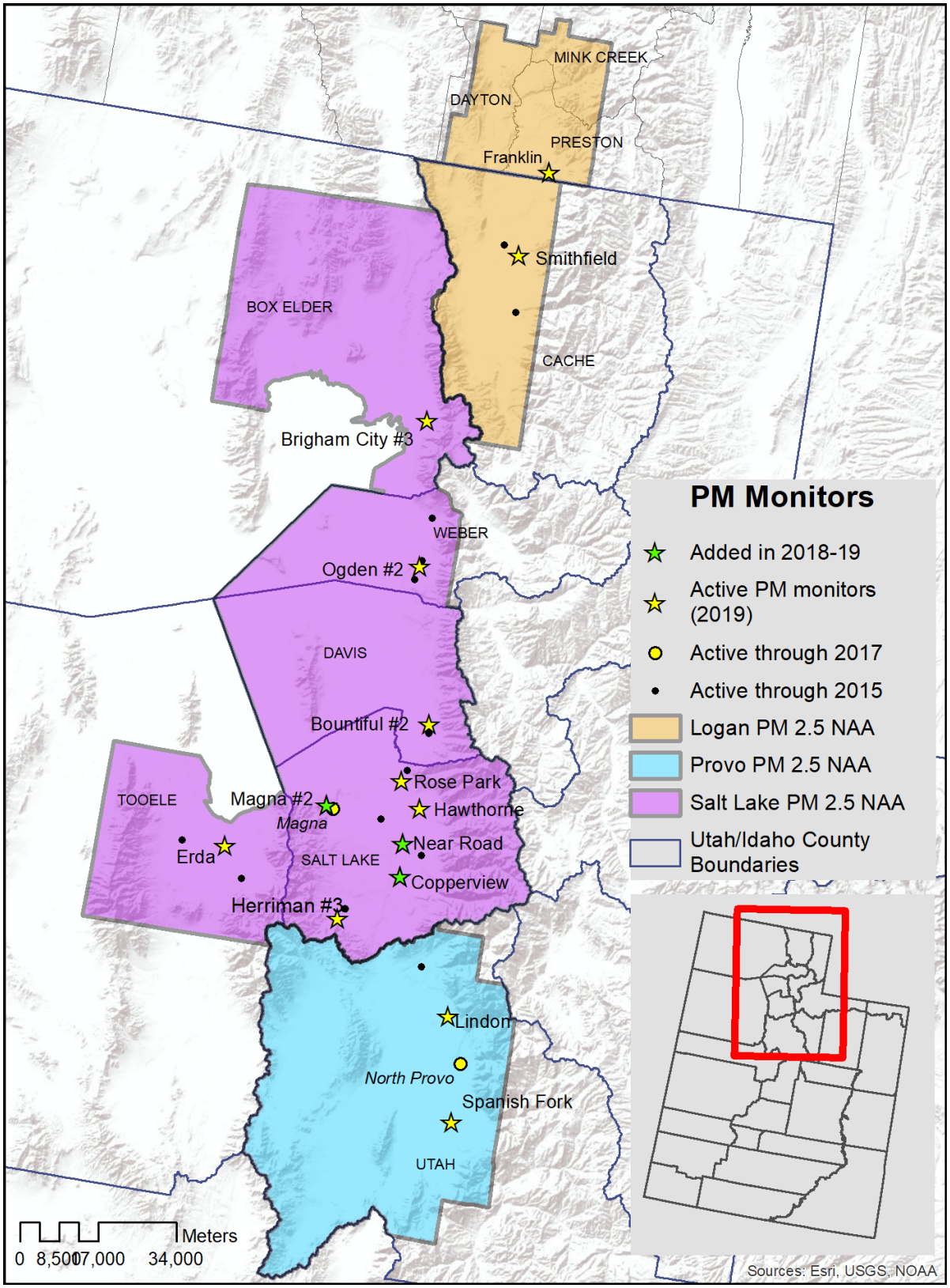

Figure IX.A.28. 1 Utah's $PM_{2.5}$ Monitoring Network

Data may be flagged when circumstances indicate that it would represent an event in the data set and not be indicative of the entire airshed or the efforts to reasonably mitigate air pollution within. 40 CFR 50.14, *Treatment of air quality monitoring data influenced by exceptional events*, anticipates this, and says that a State may request EPA to exclude data showing exceedances or violations of any national ambient air quality standard that are directly due to an event that affects air quality, is not reasonably controllable or preventable, is an event caused by human activity that is unlikely to recur at a particular location or a natural event, from use in determinations. The protocol for data handling dictates that flagging is initiated by the state or local agency, and then the EPA either concurs or indicates that it has not concurred.

Table IX.A.28.2 below shows the 98th percentile values in µg /m^3 for 2015, 2016, and 2017 as well as the three-year average of these values. The validated data in Table IX.A.28.2 excludes several values from a wildfire exceptional event on September 6 and 7, 2017. On June 15, 2018, EPA concurred with this exceptional event and the documentation is included in the Region 8 docket for this action (EPA-R08-OAR-2018-0309). The three-year average, or design value, of 33 µg/m^3 from 2015-2017 was used by EPA in their final action of determination of attainment by attainment date for the Logan NAA (83 FR 52983). The Franklin, ID monitor is within the Logan NAA on the Idaho side of the border.

	2015	2016	2017	3-year average
Smithfield, UT	*28.9	34.4	36.0	33
Franklin, ID	18.8	33.3	38.3	30

Table IX.A.28. 2 Monitored Ambient 24-hr $PM_{2.5}$ Data

*This value combines monitor data from the Logan, UT and Smithfield, UT monitors for 2015.

i. Modeling Element

EPA guidance[4] concerning redesignation requests and maintenance plans (the Calcagni memo) discusses the requirement that the area has attained the standard and notes that air quality modeling may be necessary to determine the representativeness of the monitored data. Areas that were designated nonattainment based on modeling will generally not be redesignated to attainment unless an acceptable modeling analysis indicates attainment. The Logan NAA was not designated based on modeling; therefore, additional modeling is not necessary to determine the representativeness of the monitored data. The Logan NAA attainment by attainment date determination was made based on validated ambient monitored values. Consequently, modeling is not necessary to show attainment. However, modeling was conducted for the purpose of this maintenance demonstration to show continued compliance with the $PM_{2.5}$ NAAQS through the year 2035 (see section IX.A.28.c).

ii. (c) EPA Acknowledgement

The data presented in the preceding paragraphs demonstrates that the Logan NAA is attaining the 24-hr $PM_{2.5}$ NAAQS. On October 19, 2018, EPA published notice in the Federal Register (83 FR 52983) that pursuant to CAA section 199(b)(2), "the EPA is finalizing a determination based on the most recent three years (2015-2017) of valid data, that the Logan NAA attained the 2006 primary and secondary 24-hour

[4] Ibid

$PM_{2.5}$ NAAQS by the December 31, 2017 attainment date." This determination was based on quality-assured, quality-controlled, and validated ambient air monitoring data for 2015-2017.

2) Fully Approved Attainment Plan for $PM_{2.5}$

CAA 107(d)(3)(E)(ii) - The Administrator has fully approved the applicable implementation plan for the area under section 110(k).

On December 3, 2014, Utah submitted a SIP to EPA for the Logan NAA that demonstrated attainment of the $PM_{2.5}$ NAAQS by December 31, 2015, and subsequently, the two 1-year extensions were approved, extending the attainment date to December 31, 2017. Table IX.A.28.3 details the EPA action, date, and FR citation for SIP approval status.

Areas designated as nonattainment that attain the standard prior to the SIP submittal deadline, or prior to an area's approved attainment date, are eligible for reduced regulatory requirements as described in EPA's "Clean Data Policy."[5] Under the Clean Data Policy, a clean data determination was finalized on October 29, 2019 (83 FR 52983), for the Logan NAA. The approval status of the SIP is dependent on the clean data determination requirements as detailed in 81 CFR 51.1015. For a moderate $PM_{2.5}$ nonattainment area, the clean data policy suspends the requirements for the state to submit an attainment demonstration, reasonable further progress (RFP) plans, quantitative milestones, and contingency measures until such time as: (1) the area is redesignated to attainment, after which such requirements are permanently discharged; or (2) the EPA determines that the area has re-violated the $PM_{2.5}$ NAAQS, at which time the state shall submit such attainment plan elements for the nonattainment area by a future date to be determined by the EPA. Table IX.A.28.3 details the EPA SIP approval status. EPA had approved some elements of the moderate SIP prior to the publication of the clean data determination.

Additionally, EPA guidance[6] states that approval action on SIP elements and the redesignation request may occur simultaneously. Requirements listed in Table IX.A.28.3 that show pending approval may fall into this category.

Requirement	EPA Action & Date	FR Citation
Base Year and Projection Year Emission Inventories	Approved on 11/23/2018	82 FR 59315
Modeled Attainment Demonstration	Approved on 11/23/2018	82 FR 59315
RACT	Approved on 11/23/2018	82 FR 59315
On-Road Mobile RACM and Additional Reasonable Measure Demonstrations, including I/M Program	Approved on 11/23/2018	82 FR 59315
Direct $PM_{2.5}$, NO_X and VOC MVEB	Approved on 11/23/2018	82 FR 59315
Non-Road Mobile RACM	Approved on 11/23/2018	82 FR 59315

[5] Steve Page, Director, EPA Office of Air Quality Policy Planning and Standard. December 14, 2004. EPA Memorandum to Air Division Directors, "Clean Data Policy for the Fine Particle National Ambient Air Quality Standards."
[6] Calcagni (n 3)

Area Source RACM	See Table IX.A.28.4	--
Nonattainment New Source Review (R307-403)	Approved on 7/25/2019	84 FR 35832
Reasonable Further Progress	Clean Data Determination 10/29/2018	83 FR 52983
Quantitative Milestones	Clean Data Determination 10/29/2018	83 FR 52983
Contingency Measures	Clean Data determination 10/29/2018	83 FR 52983

Table IX.A.28. 3 Logan, UT-ID SIP Approval Status

As part of the Utah moderate SIPs, 24 area source rules were either introduced or augmented to control $PM_{2.5}$ and $PM_{2.5}$ precursors. On February 25, 2016 (81 FR 9343), and October 19, 2016 (81 FR 71988), the EPA approved area source rule revisions and Reasonably Available Control Measure (RACM) analyses (where appropriate) for the majority of the R307-300 series. See Table IX.A.28.4 for details on rules, approval dates, and implementation schedules. For the SLC NAA, the best available control measure (BACM) analysis resulted in revisions to 13 different area source rules which affect surface coating, graphic arts, and aerospace manufacture and rework facilities. These rule amendments reduce emissions in the Logan NAA as well since the rules apply statewide.

EPA-Approved/Conditionally Approved Control Measures for UT Moderate $PM_{2.5}$ SIPs	Implementation Schedule
R307-302 Solid Fuel Burning Devices [1] EPA conditionally approved* October 19, 2016 (81 FR 71988).	February 1, 2017
R307-303 Commercial Cooking [1] EPA approved February 25, 2016 (81 FR 9343).	December 15, 2015
R307-304 Solvent Cleaning [1]	December 6, 2017
R307-307 Road Salting and Sanding EPA approved February 25, 2016 (81 FR 9343).	January 1, 2014
R307-309 Nonattainment and Maintenance Areas for PM_{10} and $PM_{2.5}$: Fugitive Emissions and Fugitive Dust [1] EPA proposed for approval September 14, 2017 (82 FR 43205).	Salt Lake County, Utah County, and the City of Ogden – January 1, 2013. Remaining NAAs – April 1, 2013. Amended August 4, 2017
R307-312 Aggregate Processing Operations for $PM_{2.5}$ Nonattainment Areas. EPA approved October 19, 2016 (81 FR 71988).	February 4, 2016

EPA-Approved/Conditionally Approved Control Measures for UT Moderate $PM_{2.5}$ SIPs	Implementation Schedule
R307-335 Degreasing and Solvent Cleaning Operations [1] EPA approved February 25, 2016 (81 FR 9343).	All sources within Salt Lake and Davis Counties R307-335-3 through R307-335-6 – January 1, 2013. All other sources defined in R307-335-2 – September 1, 2013. All sources within Box Elder, Cache, Utah, Weber, and Tooele Counties R307-335-7 – August 1, 2014 Amended October 29, 2017, by removing sections 6 & 7 to for rule R307-304
R307-342 Adhesives & Sealants [1] EPA approved February 25, 2016 (81 FR 9343).	December 1, 2014
R307-343 Emissions Standards for Wood Furniture Manufacturing Operations [1] EPA approved February 25, 2016 (81 FR 9343)	Sources in Salt Lake and Davis Counties – September 1, 2013. Sources in Box Elder, Cache, Tooele, Utah, and Weber Counties – January 1, 2014. Amended December 6, 2017
R307-344 Paper, Film & Foil Coatings [1] EPA approved February 25, 2016 (81 FR 9343)	Sources in Salt Lake and Davis Counties – February 1, 2013. Sources in Box Elder, Cache, Tooele, Utah, and Weber Counties – January 1, 2014. Amended December 6, 2017
R307-345 Fabric & Vinyl Coatings [1] EPA approved February 25, 2016 (81 FR 9343)	Sources in Salt Lake and Davis Counties – February 1, 2013. Sources in Box Elder, Cache, Tooele, Utah, and Weber Counties – January 1, 2011. Amended December 6, 2017
R307-346 Metal Furniture Surface Coatings [2] EPA approved February 25, 2016 (81 FR 9343)	Sources in Salt Lake and Davis Counties – February 1, 2013. Sources in Box Elder, Cache, Tooele, Utah, and Weber Counties – January 1, 2014. Amended December 6, 2017
R307-347 Large Appliance Surface Coatings [2] EPA approved February 25, 2016 (81 FR 9343)	Sources in Salt Lake and Davis Counties – February 1, 2013. Sources in Box Elder, Cache, Tooele, Utah, and Weber Counties – January 1, 2014. Amended December 6, 2017

EPA-Approved/Conditionally Approved Control Measures for UT Moderate $PM_{2.5}$ SIPs	Implementation Schedule
R307-348 Magnet Wire Coatings [2] EPA approved February 25, 2016 (81 FR 9343)	Sources in Salt Lake and Davis Counties – February 1, 2013. Sources in Box Elder, Cache, Tooele, Utah, and Weber Counties – January 1, 2014. Amended December 6, 2017
R307-349 Flat Wood Panel Coatings [1] EPA approved February 25, 2016 (81 FR 9343)	Sources in Salt Lake and Davis Counties – February 1, 2013. Sources in Box Elder, Cache, Tooele, Utah, and Weber Counties – January 1, 2014. Amended December 6, 2017
R307-350 Miscellaneous Metal Parts and Products Coatings [1] EPA approved February 25, 2016 (81 FR 9343)	Sources in Salt Lake and Davis Counties – September 1, 2013. Sources in Box Elder, Cache, Tooele, Utah, and Weber Counties – January 1, 2014. Amended December 6, 2017
R307-351 Graphic Arts [1] EPA approved February 25, 2016 (81 FR 9343)	Sources in Salt Lake and Davis Counties – February 1, 2013. Sources in Box Elder, Cache, Tooele, Utah, and Weber Counties – January 1, 2014. Amended December 6, 2017
R307-352 Metal Containers, Closure, and Coil Coatings [2] EPA approved February 25, 2016 (81 FR 9343)	January 1, 2014 Amended December 6, 2017
R307-353 Plastic Parts Coatings [1] EPA approved February 25, 2016 (81 FR 9343)	January 1, 2014 Amended December 6, 2017
R307-354 Automotive Refinishing Coatings [1] EPA approved February 25, 2016 (81 FR 9343)	January 1, 2014 Amended December 6, 2017
R307-355 Control of Emissions from Aerospace Manufacture and Rework Facilities [1] EPA approved February 25, 2016 (81 FR 9343)	January 1, 2014 Amended March 8, 2018
R307-356 Appliance Pilot Light [1] EPA approved February 25, 2016 (81 FR 9343)	January 1, 2013

EPA-Approved/Conditionally Approved Control Measures for UT Moderate $PM_{2.5}$ SIPs	Implementation Schedule
R307-357 Consumer Products [1] EPA approved February 25, 2016 (81 FR 9343)	May 8, 2014
R307-361 Architectural Coatings [1] EPA approved February 25, 2016 (81 FR 9343)	October 31, 2013

Table IX.A.28. 4 Area Source Rules Implementation Xchedule and EPA Approval Status

[1] control measure implementation schedule and confirmation that measures have been implemented
[2] control measure implementation schedule and review if any new sources located in the NAA
*UDAQ submitted the committed revisions on February 1, 2017, within the one-year conditional approval window

Part of Franklin County, ID is included in the Logan, UT-ID NAA. As a result, Idaho DEQ submitted a moderate SIP to Region 10 in 2014. Table IX.A.28.5 outlines control measures developed by Idaho DEQ. On January 4, 2017 (82 FR 729), the EPA approved the residential woodstove curtailment program and change-out program. On March 25, 2014 (79 FR 16203), the EPA approved the road sanding agreements as a voluntary measure.

EPA-Approved Control Measures for the Idaho Portion of the Logan NAA	Implementation Schedule	Estimated Reductions (uncontrolled-to-controlled emissions) in tons-per-day
Residential Woodstove Curtailment Program	Fully implemented summer and fall 2012	0.06 tpd direct $PM_{2.5}$, 0.009 tpd NO_X, and 0.078 tpd volatile organic compounds (VOC)
Residential Woodstove Change-Out Program	2006–2007, 2011–2012, and 2013–2014	0.05 tpd direct $PM_{2.5}$, 0.003 tpd NO_X, 0.13 tpd VOC
Road Sanding Agreements	July 16, 2012 and October 25, 2012	0.10 tpd direct $P_{M2.5}$

Table IX.A.28. 5 Idaho Control Measures and Implementation Schedule

Considering the suspended SIP elements through the clean data policy and the approval or expected approval of required elements, Utah has met requirement 107(d)(3)(E)(ii) for the Logan NAA.

3) Improvements in Air Quality Due to Permanent and Enforceable Reductions in Emissions

CAA 107(d)(3)(E)(iii) - *The Administrator determines that the improvement in air quality is due to permanent and enforceable reductions in emissions resulting from implementation of the applicable implementation plan and applicable Federal air pollutant control regulations and other permanent and*

enforceable reductions. Speaking further on the issue, EPA guidance[7] reads that the State must be able to reasonably attribute the improvement in air quality to emission reductions which are permanent and enforceable. In the following sections, both the improvement in air quality and the emission reductions themselves will be discussed.

a) Improvement in Air Quality

The improvement in air quality with respect to $PM_{2.5}$ can be shown in a number of ways. Improvement, in this case, is relative to the various control strategies that affected the airshed. For the Logan NAA, these control strategies were implemented as the result of the SIP submitted to EPA in December 2014 with a statutory control deadline of December 31, 2014. With this deadline in mind, the emission reduction results of the controls would not be reflected in the ambient data until 2015.

An assessment of the ambient air quality data collected at monitors in the NAA from the year monitoring began to 2018 (the last year of validated data) shows an observable decrease in monitored $PM_{2.5}$ (see Figures IX.A.28.2 and IX.A.28.3). The Logan NAA is designated nonattainment only for the 24-hour health standard, not for the annual standard. However, it is useful to observe both the 98th percentile average of 24-hr data as well as the annual arithmetic mean to understand trends (see Figure IX.A.28.2). Ambient concentrations in excess of the 24-hr standard are typically only incurred during winter months when cold-pool conditions drive and trap secondary $PM_{2.5}$. The actual cold-pool temperature inversions vary in strength and duration from year to year, and the $PM_{2.5}$ concentrations measured during those times reflect this variability far more than they reflect gradual changes in the emissions of direct $PM_{2.5}$ and $PM_{2.5}$ precursors. This variability is apparent in Figure IX.A.28.3. Despite the variability, if a line is fit through the 24-hr data, the trend is noticeably downward and indicates an improvement of a little under one µg /m^3 per year.

This episodic variability is reduced by looking at annual mean values of $PM_{2.5}$ concentrations shown in Figure IX.A.28.2. The data is still skewed more by winter data than summer data. It includes all of the high values identified as the 98th percentiles, as well as the values ranked even higher. Still the trend is downward. Fitting a line through the data collected at the Logan site reveals a trend that noticeably decreases, and indicates an improvement of approximately four µg /m^3 over the 18-year span.

Table IX.A.28.3 shows the annual 98th percentile values at the Logan or Smithfield monitor including the years used for nonattainment designation (2006-2008) to 2017. The statutory deadline for controls to be in place was December 31, 2014. Thus, 2015 marked the first year in which these control measures would be reflected in the data.

[7] Ibid

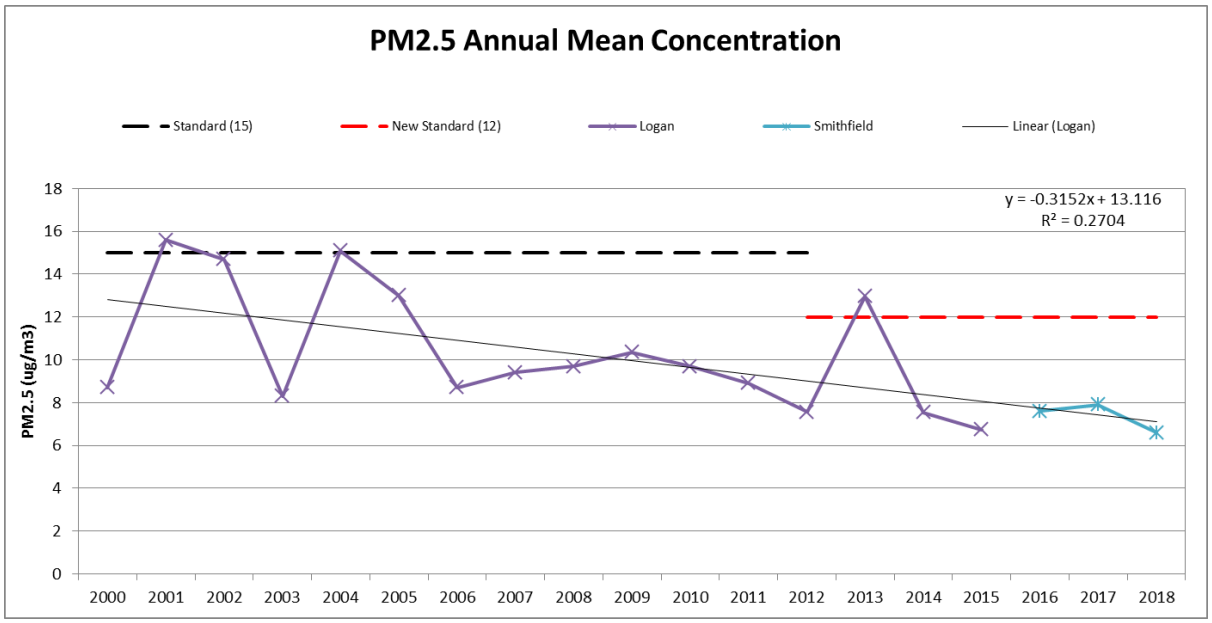

Figure IX.A.28. 2 Logan NAA $PM_{2.5}$ Annual Mean Concentration

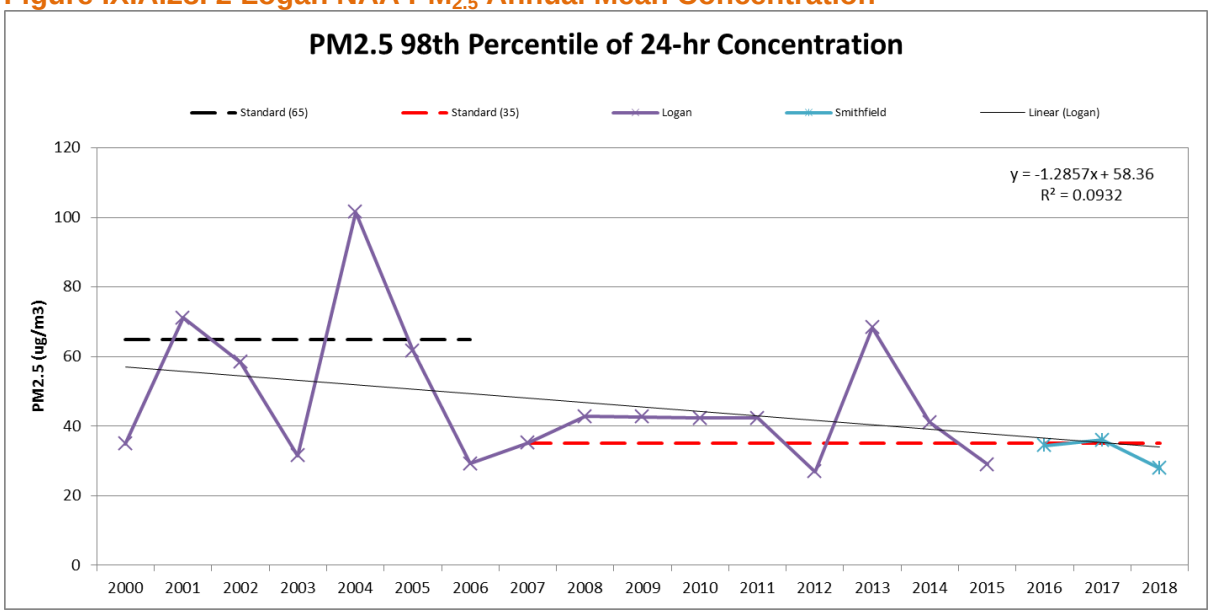

Figure IX.A.28. 3 Logan NAA $PM_{2.5}$ 98th Percentile of 24-hr Concentration

b) Reduction in Emissions

As stated above, EPA guidance[8] says that the State must be able to reasonably attribute the improvement in air quality to emission reductions that are permanent and enforceable. In making this showing, the State should estimate the percent reduction (from the year that was used to determine the design value)

[8] Ibid

achieved by Federal measures such as motor vehicle control, as well as by control measures that have been adopted and implemented by the State.

As mentioned, the ambient air quality data presented in Subsection IX.A.28.b(3)(a) includes values prior to the nonattainment designation through 2018 to illustrate the lasting effect of the implemented control strategies. In discussing the effect of the controls, as well as the control measures themselves, however, it is important to keep in mind the time necessary for their implementation.

The moderate nonattainment SIP for the Logan NAA included a statutory date for the implementation of RACM/RACT of December 31, 2014. Thus, 2015 marked the first year in which RACM/RACT was reflected in the emissions inventories for the Logan NAA. Section 189(c) of the CAA identifies, as a required plan element, quantitative milestones which are to be achieved every three years, and which demonstrate reasonable further progress (RFP) toward attainment of the standard by the applicable date. As defined in CAA Section 171(1), the term reasonable further progress means "such annual incremental reductions in emissions of the relevant air pollutant as are required by this part or may reasonably be required by the Administrator for the purpose of ensuring attainment of the applicable national ambient air quality standard by the applicable date." Hence, the milestone report must demonstrate that the control strategy is achieving reasonable progress toward attainment.

The nonattainment SIP for the Logan NAA included a new vehicle inspection I/M program for on-road vehicles as well as a suite of area source rules targeting emissions of $PM_{2.5}$, NO_X, and VOC. This is discussed in SIP Subsection IX.A.23(6), and is reflected in the attainment demonstration presented in Subsection IX.A.23(4). The RACM prescribed by the nonattainment SIP and the subsequent implementation by the State is discussed in more detail in a milestone report submitted for the NAA to the EPA in 2017, which is included in the TSD. There are no stationary point sources in the Logan NAA with the potential to emit 100 tons per year of $PM_{2.5}$ or any $PM_{2.5}$ plan precursor.

Existing controls not implemented through the SIP process also affect the emission rates from non-stationary source categories. The federal motor vehicle control program has been one of the most significant control strategies affecting emissions that produce $PM_{2.5}$. Tier 1 and 2 standards were implemented by 1997 and 2008 respectively. Tier 3 vehicle/engine standards were initiated with new vehicles coming to market in 2017 (25% of new sales) with full phase in by 2021 (100% of new sales). For gasoline, the five Wasatch Front refineries and the Sinclair refinery in Wyoming that also supplies gasoline to the Wasatch Front market, are considered small refineries by EPA's rule. As such, these refineries have a tier 3 delayed implementation date of January 1, 2020, to produce a tier 3 (10 ppm sulfur) gasoline product or produce a gasoline product (greater than 10 ppm sulfur) with compensating sulfur credits. Similarly, the Heavy-Duty Engine and Vehicle Standards took effect in 2007 and were fully phased in by 2010. Air quality benefits, particularly those stemming from the light-duty and heavy-duty vehicle standards, continue to be realized as older, higher-polluting vehicles are replaced by newer, cleaner vehicles.

UDAQ submitted quantitative milestone reports to EPA on March 23, 2018, within the 90-day post-milestone date required by CAA 189(c)(2) and 51.1013(b). On October 24, 2018, EPA sent Governor Gary Herbert a letter stating "The Environmental Protection Agency has determined that the 2017 Quantitative Milestone Reports are adequate. The basis for this determination is set forth in the

enclosures. This determination is based on the EPA's review of information contained in the moderate area plans and additional information provided in the 2017 Quantitative Milestone Reports." This approval letter is included in the TSD.

Furthermore, since these control measures are incorporated into the Utah SIP, the emission reductions that resulted are consistent with the notion of permanent and enforceable improvements in air quality. Taken together, the trends in ambient air quality illustrated previously, along with the continued implementation of the nonattainment SIP for the Logan NAA, provide a reliable indication that these improvements in air quality reflect the application of permanent steps to improve the air quality in the region.

4) State has Met Requirements of Section 110 and Part D

CAA 107(d)(3)(E)(v) - The State containing such area has met all requirements applicable to the area under section 110 and part D. Section 110 of the Act deals with the broad scope of state implementation plans and the capacity of the respective state agency to effectively administer such a plan. Part D deals specifically with plan requirements for nonattainment areas, including those requirements that are specific to $PM_{2.5}$.

a) Section 110

The State has met all requirements applicable to the Logan NAA under Section 110 of the Act. Section 110(a)(2) contains the general requirements or infrastructure elements necessary for EPA approval of the SIP. On September 21, 2010, the State submitted an Infrastructure SIP to EPA demonstrating compliance with the requirements of Section 110 that are applicable to the 2006 $PM_{2.5}$ NAAQS. EPA approved the State's Infrastructure SIP on November 25, 2013 (78 FR 63883), for all Section 110 requirements that are applicable to redesignation.

b) Part D Subpart 1 and 4

Part D of the Act addresses "Plan Requirements for Nonattainment Areas." Subparts 1 and 4 of Part D contain planning elements that must be included in the SIP. This includes the requirement to submit an attainment demonstration, reasonable further progress plans, quantitative milestones and milestone reports, a motor vehicle emission budget for the attainment year for the purposes of transportation conformity, and contingency measures for the area. However, upon EPA's issuance of a final clean data determination demonstrating that the Logan NAA has attained the standard, these requirements are suspended (40 C.F.R. § 51.1015(b) and 84 FR 26054).

The remaining Part D requirements that are relevant to redesignation are requirements that are independent of helping the area achieve attainment. This includes the requirement to have a nonattainment new source review ("NNSR") program and emissions inventory submission. The State has satisfied these remaining requirements. Utah's NNSR program can be found in Utah Administrative Rule R307-403, Permits: New and Modified Sources in Nonattainment Areas and Maintenance Areas. EPA fully approved the current version of the NNSR program on July 25, 2019 (84 FR 35832). The emissions inventory as included in the moderate SIP for the Logan NAA and was approved by the EPA on November 23, 2018 (82 FR 39315). Therefore, Utah has complied with all applicable Part D requirements.

5) Maintenance Plan for $PM_{2.5}$ Areas

As stated in the Act, an area may not be redesignated to attainment without first submitting and receiving EPA approval of a maintenance plan. The maintenance plan is a quantitative showing that the area will continue to attain the NAAQS for an additional 10 years (from EPA approval), accompanied by sufficient assurance that the terms of the numeric demonstration will be administered by the State and by the EPA in an oversight capacity. The maintenance plan is the central criterion for redesignation. It is contained in the following subsection.

IX.A.28.c Maintenance Plan

CAA 107(d)(3)(E)(iv) - The Administrator has fully approved a maintenance plan for the area as meeting the requirements of section 175A. An approved maintenance plan is one of several criteria necessary for area redesignation as outlined in Section 107(d)(3)(E) of the Act. The maintenance plan itself, as described in Section 175A of the Act and further addressed in EPA guidance[9] has its own list of required elements. The following table is presented to summarize these requirements. Each will then be addressed in turn.

Category	Requirement	Reference	Addressed in Section
Maintenance demonstration	Provide for maintenance of the relevant NAAQS in the area for at least 10 years after redesignation.	CAA: 175A(a)	IX.A.28.c (1)
Revise in 8 Years	The State must submit an additional revision to the plan, 8 years after redesignation, showing an additional 10 years of maintenance.	CAA: 175A(b)	IX.A.28.c (6)
Continued Implementation of Nonattainment Area Control Strategy	The Clean Air Act requires continued implementation of the NAA control strategy unless such measures are shown to be unnecessary for maintenance or are replaced with measures that achieve equivalent reductions.	CAA: 175A(c), 110(l), Calcagni memo	IX.A.28.c (5)
Contingency Measures	Areas seeking redesignation from nonattainment to attainment are required to develop contingency measures that include State commitments to implement additional control measures in response to future violations of the NAAQS.	CAA: Sec 175A(d)	IX.A.28.c (8)
Verification of Continued Maintenance	The maintenance plan must indicate how the State will track the progress of the maintenance plan.	Calcagni memo	IX.A.28.c (7)

Table IX.A.28. 6 CAA Maintenance Plan Requirements

[9] Ibid

1) Demonstration of Maintenance - Modeling Analysis

CAA 175A(a) - Each State which submits a request under section 107(d) for redesignation of a nonattainment area as an area which has attained the NAAQS shall also submit a revision of the applicable implementation plan to provide for maintenance of the NAAQS for at least 10 years after the redesignation. The plan shall contain such additional measures, if any, as may be required to ensure such maintenance. The maintenance demonstration is discussed in EPA guidance[10] as one of the core provisions that should be considered by states for inclusion in a maintenance plan.

According to the EPA guidance, a State may generally demonstrate maintenance of the NAAQS by either showing that future emissions of a pollutant or its precursors will not exceed the level of the attainment inventory (discussed below) or by modeling to show that the future mix of sources and emission rates will not cause a violation of the NAAQS. Utah has elected to make its demonstration based on air quality modeling.

a) Introduction

The following chapter presents an analysis using observational datasets to detail the chemical regimes of Utah's NAAs. Prior to the develop of this maintenance plan, UDAQ conducted a technical analysis to support the development of the serious SIP for the SLC NAA. The analysis included preparation of emissions inventories and meteorological data, and the evaluation and application of a regional photochemical model. Part of this process included episode selection to determine the episode that most accurately replicates the photochemical formation of ambient $PM_{2.5}$ during a persistent cold air pool episode in the airshed. For this maintenance plan, UDAQ is using the same episode that was used for the serious SIP modeling.

b) Photochemical Modeling

UDAQ used the Comprehensive Air Quality Model with Extensions (CAMx) version 6.30 for air quality modeling. CAMx v6.30 is a state-of-the-art air quality model that includes State of Utah funded enhancements for wintertime modeling. These enhancements include snow chemistry, topographical and surface albedo refinements. CAMx is an EPA approved model for use in SIP modeling. Its configuration for use in this SIP, with respect to model options and model adjustments, is discussed in the Technical Support Document.

c) Emissions Preparation

The emissions processing model used in conjunction with CAMx is the Sparse Matrix Operator Kernel Emissions Modeling System (SMOKE) version 3.6.5[11]. SMOKE prepares the annual emissions inventory for use in the air quality model. There are three aspects to the preparation of an annual emissions inventory for air quality modeling:

- Temporal: Convert emissions from annual to daily, weekly, and hourly values.

[10] Ibid
[11] https://www.cmascenter.org/smoke/

- Spatial: Convert emissions from a county-wide average to gridded emissions.
- Speciation: Decompose $PM_{2.5}$ and VOC emissions estimates into individual subspecies using the latest Carbon Bond 6 speciation profiles.

The process of breaking down emissions for the air quality model was done with sets of activity profiles and associated cross reference files. These are created for point or large industrial source emissions, smaller area sources, and mobile sources. Direct $PM_{2.5}$ and $PM_{2.5}$ precursor estimates were modified via temporal profiles to reflect wintertime conditions.

Activity profiles and their associated cross reference files from the EPA's 2011v6[12] modeling platform were used. For stationary non-point and mobile sources, spatial surrogates from the EPA Clearinghouse for Inventories and Emissions Factors (CHIEF[13]) were used to distribute emissions in space across the modeling domain. Emissions from large industrial sources (point sources) were placed at the location of the source itself. Where reliable local information was available (population density, traffic demand modeling, residential heating), profiles and surrogates were modified or developed to reflect that information.

i. Photochemical Modeling Domains and Grid Resolution

The UDAQ CAMx v6.30 modeling framework consists of two spatial domains: a high-resolution 1.33 km domain nested inside of a coarser 4 km domain (see Figure IX.A.28.4). This configuration allows one to efficiently integrate regional effects with local impacts within the Logan NAA. Vertical resolution in the model consists of 41 layers extending to the top of the atmosphere.

[12] https://www.epa.gov/air-emissions-modeling/2011-version-6-air-emissions-modeling-platforms
[13] https://www.epa.gov/chief

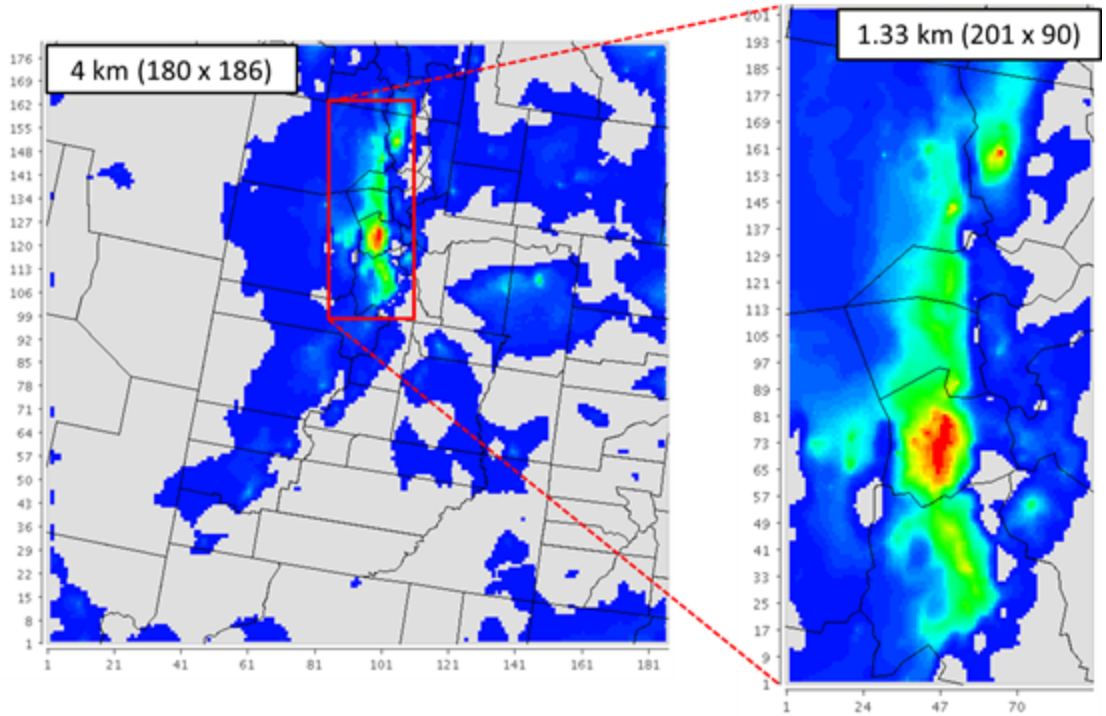

Figure IX.A.28. 4 CAMx Photochemical Modeling Domain in Two-Way Nested Configuration

The UDAQ 4 km coarse domain covers the entire state of Utah, a significant portion of Eastern Nevada (including Las Vegas), as well as smaller portions of Idaho, Wyoming, Colorado, and Arizona. The fine 1.33 km domain covers all of Utah's three $PM_{2.5}$ nonattainment areas, including the Logan NAA. Throughout this document, we will refer to the fine 1.33 km domain as the "modeling domain" when the coarse domain is not specified.

ii. Meteorological Data

Meteorological modeling was carried out by the University of Utah (University) with financial support from UDAQ.

Meteorological inputs were derived using the Weather Research and Forecasting[14] (WRF) Advanced Research WRF (WRF-ARW) model to prepare meteorological datasets for our use with the photochemical model. WRF contains separate modules to compute different physical processes such as surface energy budgets and soil interactions, turbulence, cloud microphysics, and atmospheric radiation. Within WRF, the user has many options for selecting the different schemes for each type of physical process. There is also a WRF Preprocessing System (WPS) that generates the initial and boundary conditions used by WRF, based on topographic datasets, land use information, and larger-scale atmospheric and oceanic models.

[14] https://www.mmm.ucar.edu/weather-research-and-forecasting-model

Model performance of WRF was assessed against observations at sites maintained by the University. WRF has reasonable ability to replicate the vertical temperature structure of the boundary layer (i.e., the temperature inversion), although it is difficult for WRF to reproduce the inversion when the inversion is shallow and strong (i.e., an 8-degree temperature increase over 100 vertical meters). A summary of the performance evaluation results for WRF is included in the TSD.

iii. Episode Selection

Part of the modeling exercise involves a test to see whether the model can successfully replicate the $PM_{2.5}$ mass and composition that was observed during prior episode(s) of elevated $PM_{2.5}$ concentration. The selection of an appropriate episode, or episodes, for use in this exercise requires some forethought and should determine the meteorological episode that helps produce the best air quality modeling performance.

EPA Guidance[15] identifies some selection criteria that should be considered for SIP modeling, including:

- Select episodes that represent a variety of meteorological conditions that lead to elevated $PM_{2.5}$.
- Select episodes during which observed concentrations are close to the baseline design value.
- Select episodes that have extensive air quality data bases.
- Select enough episodes such that the model attainment test is based on multiple days at each monitor violating NAAQS.

After careful consideration, the following meteorological episodes were selected as candidates for Utah's SIP modeling:

- January 1-10, 2011
- December 7-19, 2013
- February 1-16, 2016

In addition to the criteria identified in the modeling guidance, each of these candidate episodes may be characterized as having the following atmospheric conditions:

- Nearly non-existent surface winds
- Light to moderate winds aloft (wind speeds at mountaintop < 10-15 m/s)
- Simple cloud structure in the lower troposphere (e.g., consisting of only one or no cloud layer)
- Singular 24-hour $PM_{2.5}$ peaks suggesting the absence of weak intermittent storms during the episode

Previous work conducted by the University and UDAQ showed the four conditions listed above improve the likelihood for successfully simulating wintertime persistent cold air pools in the WRF model[16]. A

[15] Environmental Protection Agency. April 2007. Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze.
[16] https://www.mmm.ucar.edu/weather-research-and-forecasting-model

comprehensive discussion of the meteorological model performance for all three episodes may be found in the Technical Support Document for the meteorological modeling[17].

a) Model Adjustments and Settings

In order to better simulate Utah's winter-time inversion episodes six different adjustments were made to CAMx input data:

1. Increased vertical diffusion rates (Kvpatch)
2. Lowered residential wood smoke emissions to reflect burn ban compliance during forecasted high $PM_{2.5}$ days (burn ban)
3. Ozone deposition velocity set to zero and increased urban area surface albedo (snow chemistry)
4. Ammonia injection to account for missing ammonia sources in UDAQ's inventory. This is defined as artificially adding non-inventoried ammonia emissions to the inventoried emissions that are input into CAMx.
5. Reduced the dry deposition rate of ammonia by setting ammonia Rscale to 1. Rscale is a parameter in CAMx that reflects surface resistance.
6. Applied a 93% reduction to paved road dust emissions.

Depending on the episode, different adjustments were applied. All adjustments were applied to the January 2011 episode while select adjustments were applied to the other two episodes.

Kvpatch improved overall model performance by enhancing vertical mixing over urban areas. Snow chemistry modifications, which included reducing ozone deposition velocity and increasing surface albedo over urban areas, helped improve the model performance by better representing secondary ammonium nitrate formation during winter-time inversion episodes in Utah.

Rscale modification and burn ban adjustments were also only applied to the January 2011 episode. The burn ban adjustments reflect the compliance rate with the state's two-stage policy ban on wood-burning.

A 93% reduction in paved road dust emissions was only applied to the January 2011 emissions. This adjustment helped improve the model performance for crustal material.

b) Episodic Model Performance

Shown below for each of three episodes are the CAMx performance results for total 24-hour $PM_{2.5}$ mass and $PM_{2.5}$ chemical species, including nitrate (NO_3), sulfate (SO_4), ammonium (NH_4), organic carbon (OC), elemental carbon (EC), chloride (Cl), sodium (Na), crustal material (CM) and other species (other mass).

January 1-10, 2011

[17] https://documents.deq.utah.gov/air-quality/planning/technical-analysis/research/model-improvements/3-wintertime-episodes/DAQ-2017-014342.pdf

A comparison of 24-hr modeled and observed $PM_{2.5}$ during January 1-10, 2011, at the Logan monitoring station in the Logan NAA showed that the model overall captures the temporal variation in $PM_{2.5}$ well (Figure IX.A.28.5). The gradual increase in $PM_{2.5}$ concentration and its transition back to low levels are generally well reproduced by the model. However, despite the overall good representation of the temporal variation of $PM_{2.5}$, concentrations are generally biased low in the model, particularly on January 4-9, 2011, which can be related to the meteorological model performance on these days. Temperature was overestimated by 5-15 °C in the meteorological model during this period and thick low-level clouds were simulated on January 5 while clouds were not observed on this day[18].

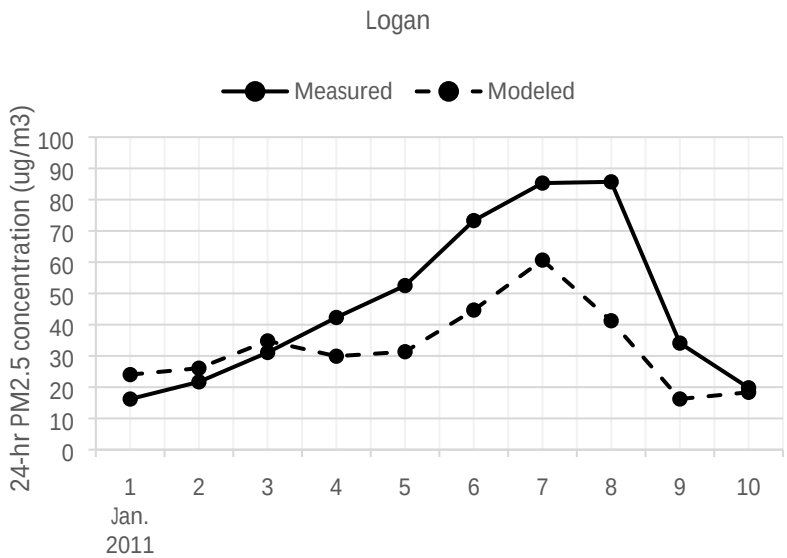

Figure IX.A.28. 5 Measured and Modeled 24-hr $PM_{2.5}$ Concentrations During January 1-10, 2011 at Logan Monitoring Station in the Logan NAA

The model performance for $PM_{2.5}$ species was overall good. Figure IX.A.28.6 shows a comparison of modeled and measured $PM_{2.5}$ chemical species on January 7, which corresponds to a $PM_{2.5}$ exceedance day. The model performance for SO_4 was reasonably good, with measured and modeled SO_4 accounting for 3 and 5% of $PM_{2.5}$ mass, respectively. The model also underestimated NO_3 and NH_4, which is partly related to the meteorological model performance where temperature was overestimated by 5-15 °C in WRF during January 4-10, 2011, as aforementioned. The underestimation in modeled NO_3 and NH_4 can also be related to an underestimation in modeled hydrochloric acid (HCl) and oxidants sources (more details are provided in the TSD). The model, on the other hand, overall overestimated elemental carbon (EC) and organic carbon (OC). The overprediction in these species on days when the simulated atmospheric mixing was particularly strong suggests that this overestimation is potentially related to an

[18] $PM_{2.5}$ State Implementation Plan Meteorological Modeling, available at https://documents.deq.utah.gov/air-quality/planning/technical-analysis/research/model-improvements/3-wintertime-episodes/DAQ-2017-014342.pdf

overestimation in their source emissions. It is, however, noteworthy that despite these biases in modeled $PM_{2.5}$ species, modeled NO_3 and NH_4 account for most of the $PM_{2.5}$ mass, in agreement with measurements.

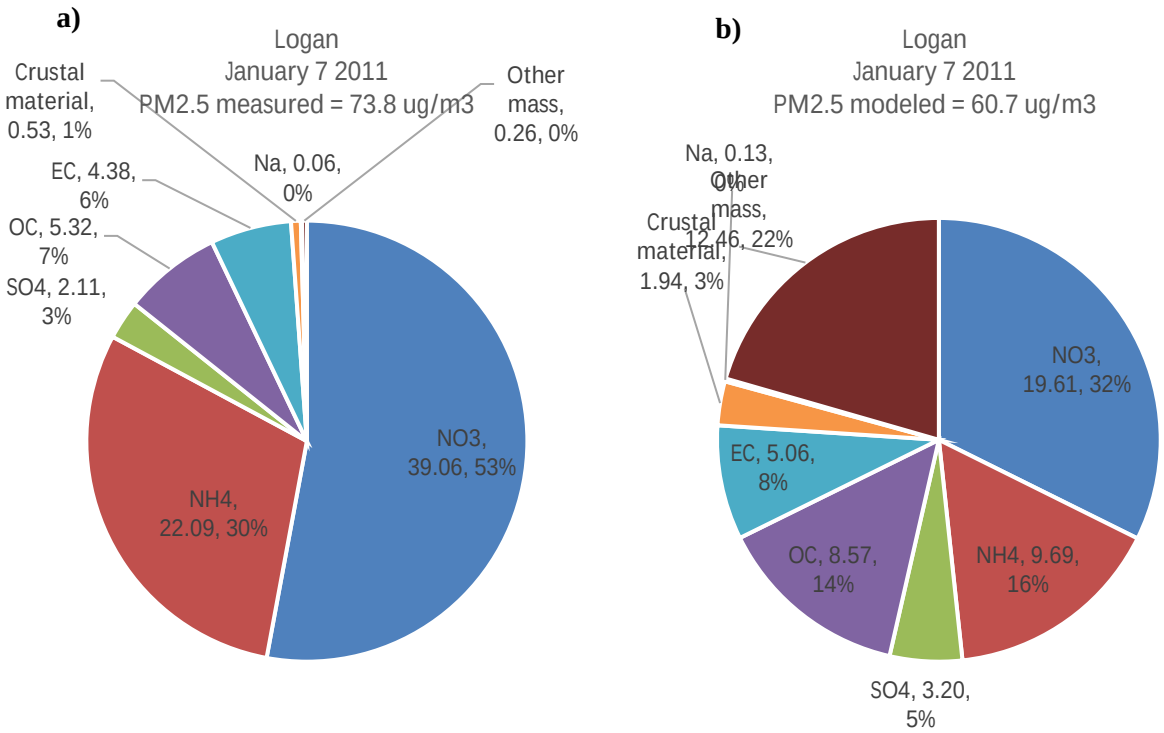

Figure IX.A.28. 6 a) Measured and b) Modeled Chemical Composition of 24-hour $PM_{2.5}$ (in ug/m³ and %) of $PM_{2.5}$ at Logan monitoring station on January 7, 2011

Overall, the model simulated well the timing of the capping inversion during this January episode. PM2.5 chemical species are also reasonably well simulated in the model, suggesting that this episode is suitable for modeling.

December 7-19, 2013

A comparison of modeled and measured 24-hr $PM_{2.5}$ at Logan during the December 7-19, 2013, episode showed that the model did not represent well the temporal variation in $PM_{2.5}$ and the capping inversion (Figure IX.A.28.7). While observations show a peak in $PM_{2.5}$ concentrations on December 14, CAMx is simulating a drop in $PM_{2.5}$ levels. This can be attributed to the meteorological model performance, where the model did not properly capture the cold overnight low temperatures that were observed on this day[19].

[19] https://documents.deq.utah.gov/air-quality/planning/technical-analysis/research/model-improvements/3-wintertime-episodes/DAQ-2017-014342.pdf.

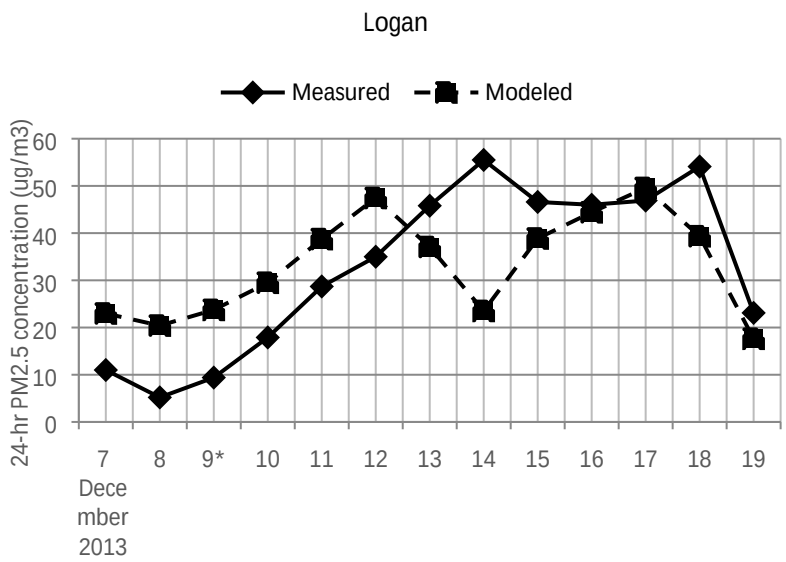

Figure IX.A.28. 7 Measured and Modeled 24-hr $PM_{2.5}$ Concentrations During December 7-19, 2013, at Logan Monitoring Station in the Logan NAA

The model performance for $PM_{2.5}$ chemical species was overall poor for this episode as indicated by a comparison of measured and modeled $PM_{2.5}$ chemical composition at Logan monitoring station on a $PM_{2.5}$ exceedance day (Figure IX.A.28.8). Given that measurements of $PM_{2.5}$ chemical species were not available for a $PM_{2.5}$ exceedance day during the December 7-19 modeling episode, this analysis is based on a comparison of the fraction of individual $PM_{2.5}$ chemical species in total $PM_{2.5}$ mass between 2013 model outputs and measurements from 2011. Measurements correspond to filter speciation data collected at Logan during a typical winter-time inversion event in 2011. As can be seen, NO_3 and NH_4 are both significantly underpredicted in the model, which can be related to the meteorological model performance, where WRF overpredicted surface temperatures, leading to increased mixing. Moreover, similarly to the model performance for the January 2011 episode, crustal material is overpredicted in the model. An adjustment to paved road dust emissions was not applied in the December 2013 simulations. OC was also overestimated in the model while the performance for SO_4 and EC was reasonably good.

Given that $PM_{2.5}$ species were poorly represented in this episode and that the strength of the capping inversion and timing of the $PM_{2.5}$ peaks were not well simulated, the December 2013 episode for the maintenance demonstration modeling is not desirable.

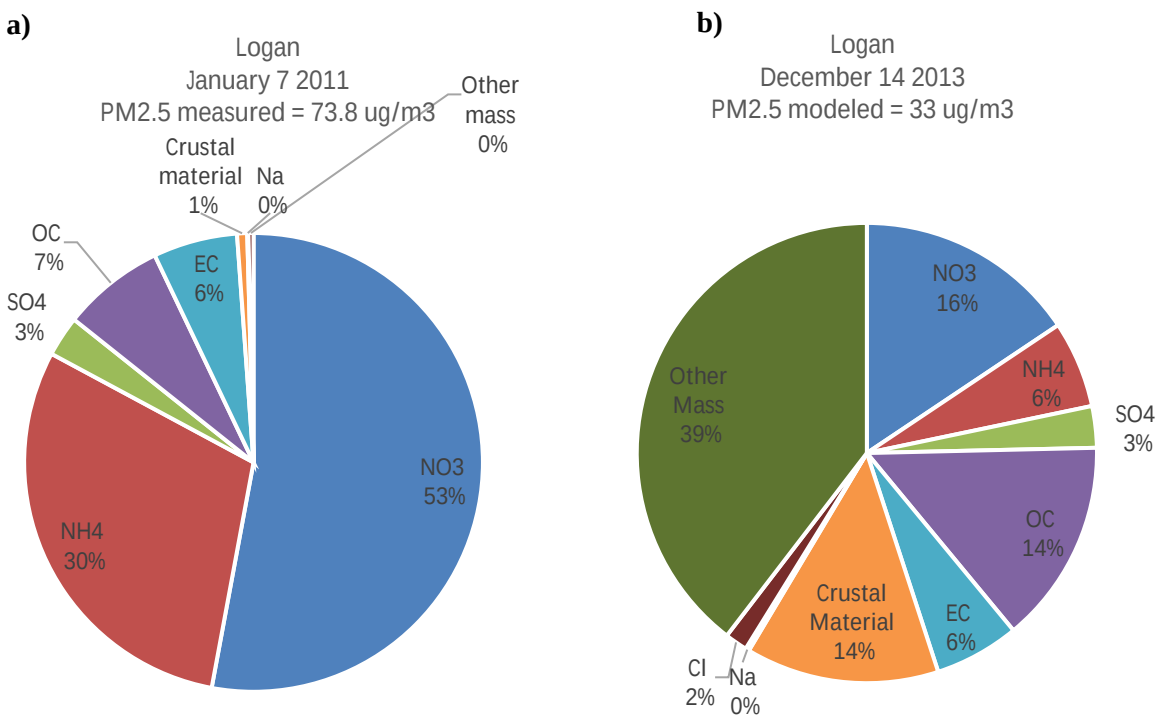

Figure IX.A.28. 8 a) Measured and b) Modeled Species Contribution (in ug/m³ and %) to $PM_{2.5}$ at Logan Monitoring Station in the Logan NAA on a Typical 24-hr $PM_{2.5}$ Exceedance Day

February 1-16, 2016

A comparison of modeled and measured 24-hr $PM_{2.5}$ at Smithfield monitoring station in the Logan NAA shows that $PM_{2.5}$ concentrations are biased low in the model (Figure IX.A.28.9). The timing of the $PM_{2.5}$ peaks is also poorly simulated. This can be mainly related to the meteorological model performance. A warm modeled temperature bias in the Cache Valley due to early snow melt-out and premature dissipation of simulated clouds in the model likely contributed to increased mixing and dispersion of $PM_{2.5}$ in the photochemical model[20].

[20] https://documents.deq.utah.gov/air-quality/planning/technical-analysis/research/model-improvements/3-wintertime-episodes/DAQ-2017-014342.pdf

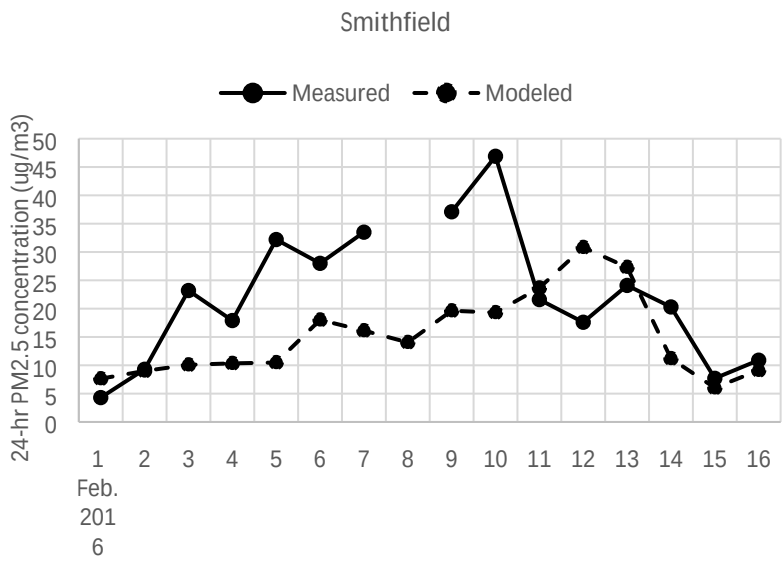

Figure IX.A.28. 9 Measured and Modeled 24-hr $PM_{2.5}$ Concentrations During February 1-16, 2016, at Smithfield Monitoring Station in the Logan NAA. Note that FRM filter data was missing for February 8, 2016.

The model performance for $PM_{2.5}$ chemical species was overall weak for this episode as indicated by a comparison of measured and modeled $PM_{2.5}$ chemical composition at Logan monitoring station on a $PM_{2.5}$ exceedance day (Figure IX.A.28.10). Given that measurements of $PM_{2.5}$ chemical species were not available for a PM2.5 exceedance day during the February 1-16 modeling episode, this analysis is based on a comparison of the fraction of individual $PM_{2.5}$ chemical species in total $PM_{2.5}$ mass between 2016 model outputs and measurements from 2011. Measurements correspond to filter speciation data collected at Logan during a typical winter-time inversion event in 2011. As can be seen, NO_3 and NH_4 are both underpredicted in the model, which can be partly related to the meteorological model performance, where WRF overpredicted surface temperatures. Moreover, similarly to the model performance for the January 2011 episode, EC and crustal material are overpredicted in the model. An adjustment to paved road dust emissions was not applied in the February 2016 simulations.

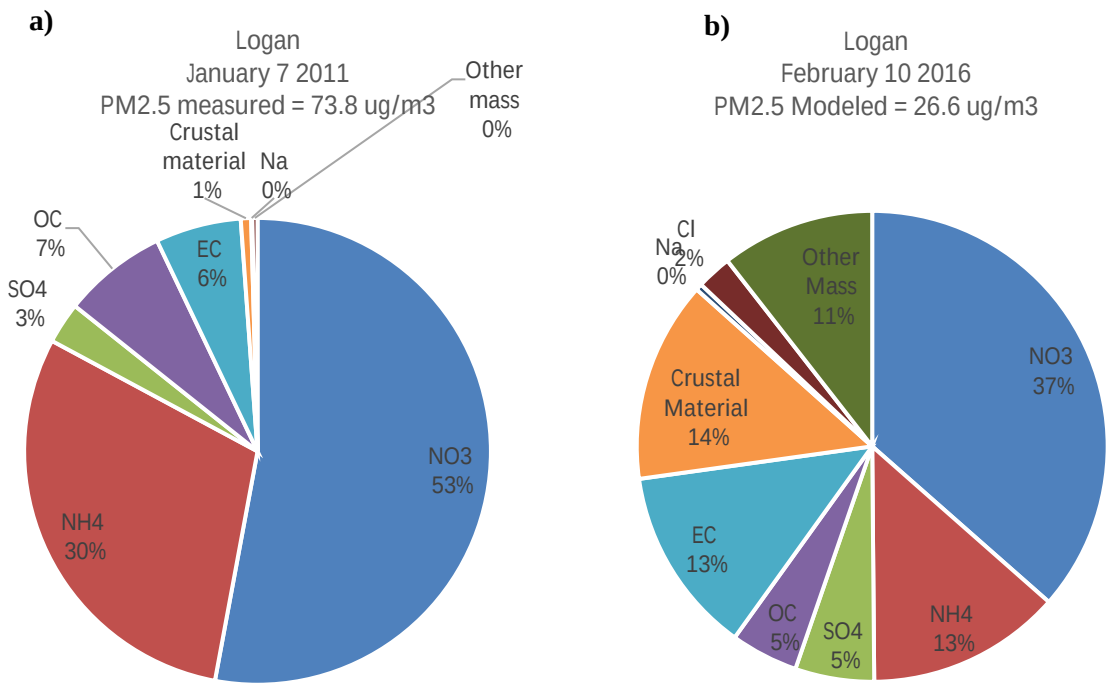

Figure IX.A.28. 10 a) Measured and b) Modeled Species Contribution (in %) to $PM_{2.5}$ at Logan Monitoring Station in the Logan NAA on a Typical 24-hr $PM_{2.5}$ Exceedance Day

Given that $PM_{2.5}$ species and total mass are not well simulated and that the timing of the $PM_{2.5}$ peaks is poorly represented in the model, this episode is not suitable for maintenance demonstration modeling.

Conclusion

Examining the $PM_{2.5}$ model performance for all three episodes, it is clear that CAMx performed best when using the January 2011 WRF output, which was specifically calibrated to the meteorological conditions experienced during January 2011, a period that coincided with the Persistent Cold Air Pool Study (PCAPS)[21], an exhaustive field campaign. This was further confirmed by a linear regression analysis that showed that modeled and measured $PM_{2.5}$ at Logan monitoring station were more strongly correlated during the January 2011 episode (R^2 = 0.72) compared to the other two episodes (R^2 =0.18 and 0.39) (Figure IX.A.28.11).

[21] http://www.pcaps.utah.edu/

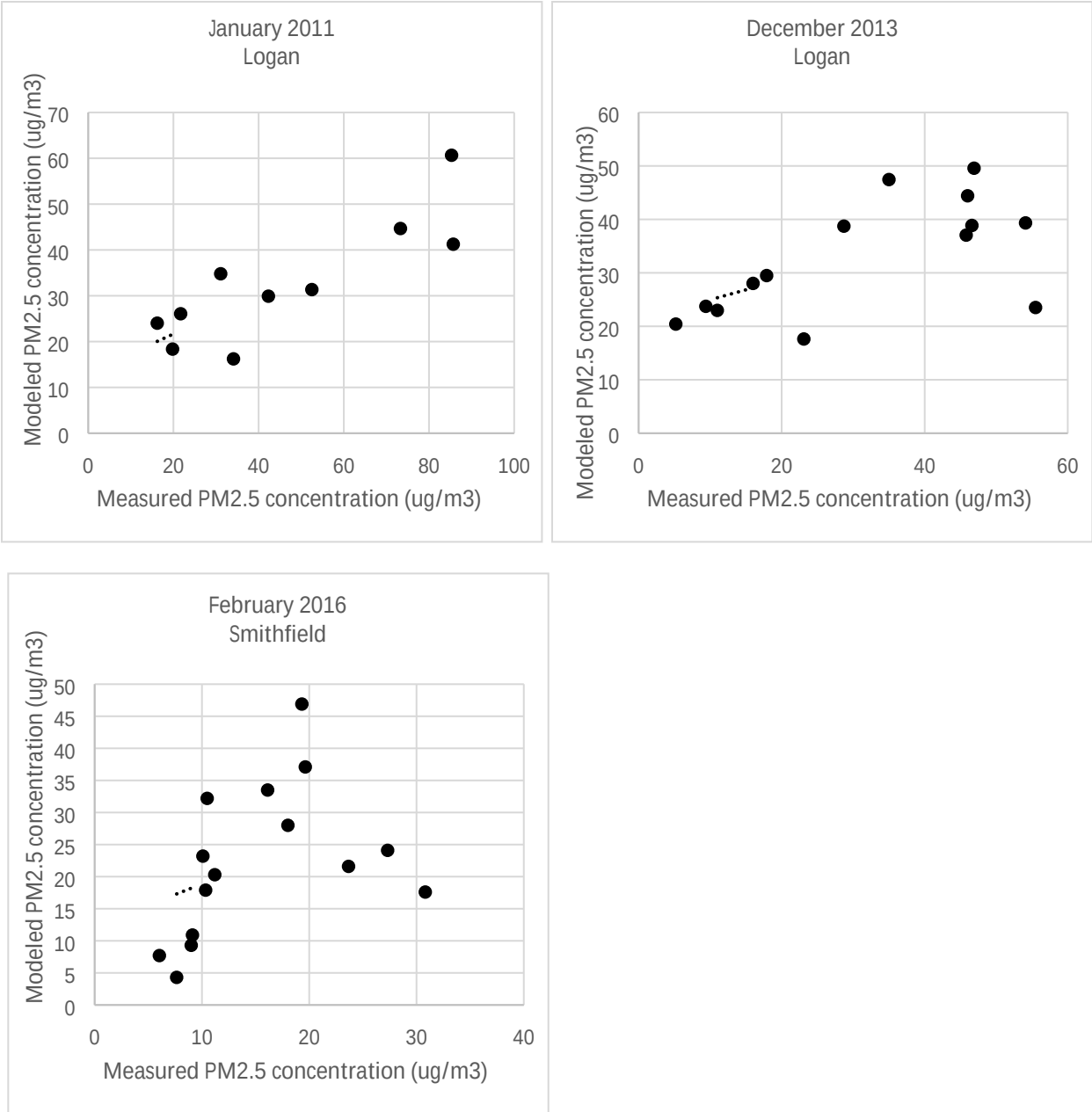

Figure IX.A.28. 11 Modeled vs. Measured 24-hr $PM_{2.5}$ for Each of the Three Modeling Episodes: January 2011, December 2013, and February 2016. Dots represent each individual day of the modeling episode. Linear regression fits (dashed line) and equation are shown for each episode,

The January 2011 WRF data produced superior performance for all important metrics when compared with the other two episodes. Therefore, UDAQ selected the January 2011 episode to conduct its modeled maintenance demonstration work. A more thorough discussion is provided in the Technical Support Document.

(c) Photochemical Model Performance Evaluation

Introduction

To assess how accurately the photochemical model predicts observed concentrations and to demonstrate that the model can reliably predict the change in pollution levels in response to changes in emissions, a model performance evaluation was conducted. This model performance evaluation also provides support for the model modifications and settings that were applied (ammonia injection, increase of surface resistance to ammonia, zeroing-out of ozone deposition velocity, snow albedo enhancement, vertical diffusion modifications and paved road dust emissions adjustment) to more accurately reproduce winter-time inversion episodes.

Available ambient monitoring data were used for this photochemical model performance evaluation. Data included 24-hr total $PM_{2.5}$ and 24-hr chemically-speciated $PM_{2.5}$ measurements collected at Logan monitoring station in the Logan NAA. Ammonia measurements collected during special field studies were also used for this performance evaluation. The evaluation was based on the January 1-10, 2011, episode and the 2011 emissions inventory were used as input data for the model simulations. The evaluation focused on days with $PM_{2.5}$ concentration exceeding the 24-hr national ambient air quality standard (> 35 µg/m^3).

A more detailed model performance evaluation that examines the model performance for gaseous species is provided in the TSD. More details on the model performance at various sites within the Logan NAA are also included in the TSD.

Daily $PM_{2.5}$ Concentrations

A comparison of 24-hr modeled and observed $PM_{2.5}$ during January 1-10, 2011, at the Logan monitoring station in the Logan NAA showed that the model overall captures the temporal variation in $PM_{2.5}$ well (Figure IX.A.28.12). The gradual increase in $PM_{2.5}$ concentration and its transition back to low levels are generally well reproduced by the model. However, despite the overall good representation of the temporal behavior of $PM_{2.5}$, concentrations are overall biased low in the model, particularly on January 4-9, 2011, which can be partly related to the meteorological model performance on these days, as aforementioned. Temperature was overestimated by 5-15 ^{o}C during this period and thick low-level clouds were simulated on January 5 while clouds were not observed on this day[22]. This resulted in an increasingly deep sub-cloud mixing layer in the model compared to reality, which led to an underprediction in modeled $PM_{2.5}$ concentrations.

[22] $PM_{2.5}$ State Implementation Plan Meteorological Modeling, available at https://documents.deq.utah.gov/air-quality/planning/technical-analysis/research/model-improvements/3-wintertime-episodes/DAQ-2017-014342.pdf

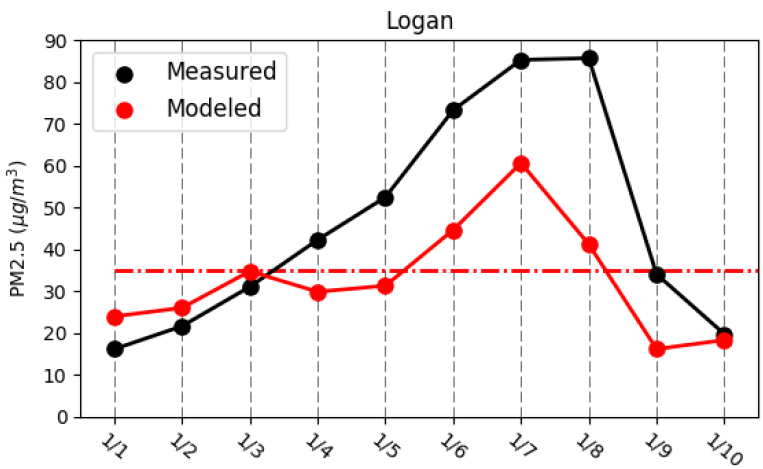

Figure IX.A.28. 12 Ten-day Time Series of Observed (black) and Modeled (red) 24-hour Average $PM_{2.5}$ Concentrations during January 1 – 10, 2011 at Logan Monitoring Station in the Logan NAA. Dashed red line shows 24-hr $PM_{2.5}$ NAAQS.

$PM_{2.5}$ Chemical Speciation

To further investigate the model performance, measured and modeled $PM_{2.5}$ chemical species were compared at the Logan monitoring site. Figure IX.A.28.13 shows a comparison of the bulk chemical composition of measured and modeled $PM_{2.5}$ at Logan on January 7, 2011, which corresponds to the only $PM_{2.5}$ exceedance day when measurement data are available. Chemical species, including nitrate (NO_3), sulfate (SO_4), ammonium (NH_4), organic carbon (OC), elemental carbon (EC), chloride (Cl), sodium (Na), crustal material (CM), and other species (other mass), were considered in this analysis. The model performance evaluation for non-$PM_{2.5}$ exceedance days is provided in the TSD.

The model performance for SO_4 was reasonably good, with measured and modeled SO_4 accounting for 3% and 5% of $PM_{2.5}$, respectively. The model also underestimated NO_3 and NH_4, which can be related to the meteorological model performance, where the model simulated a weaker temperature inversion compared to reality[23]. The underestimation in modeled NO_3 and NH_4 can also be related to an underestimation in modeled HCl and ClNO2 (more details are provided in the TSD). The model also overall overestimated primary $PM_{2.5}$ species, including crustal material and EC. OC was also overpredicted. The overprediction in these species on days when the simulated atmospheric mixing was particularly strong suggests that this overestimation is potentially related to an overestimation in their source emissions.

[23]https://documents.deq.utah.gov/air-quality/planning/technical-analysis/research/model-improvements/3-wintertime-episodes/DAQ-2017-014342.pdf

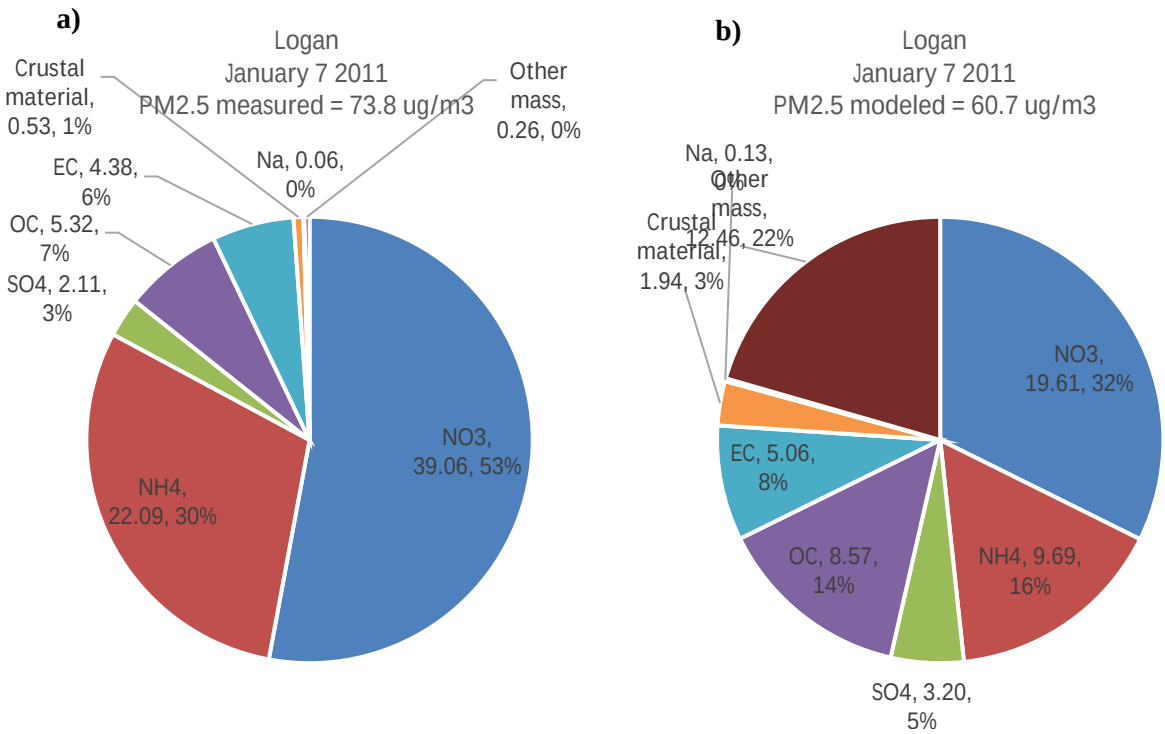

Figure IX.A.28. 13 a) Measured and b) Modeled Chemical Composition of 24-hour $PM_{2.5}$ in ug/m^3 and % of $PM_{2.5}$ at Logan Monitoring Station on January 7, 2011

The model performance was also evaluated for NH_3, which is an important precursor to the formation of ammonium nitrate, ammonium sulfate, and ammonium chloride, all of which are important $PM_{2.5}$ species accounting for over 50% of the $PM_{2.5}$ mass during winter-time inversion events.

Hourly modeled NH_3 (Figure IX.A.28.14) was compared to hourly NH_3 measurements (Figure IX.A.28.15) conducted at the Logan air monitoring station during a special field study in winter 2017. Measurements from 2017 were considered since measurements of NH_3 were not available during 2011. However, while these 2017 field study measurements cannot be directly compared to day-specific 2011 model simulations, the measurements are qualitatively useful to assess if the model predicts similar levels of NH_3 during strong inversion conditions.

A comparison of measured and modeled NH_3 shows that modeled NH_3 at the Logan site is well within the range observed in 2017.

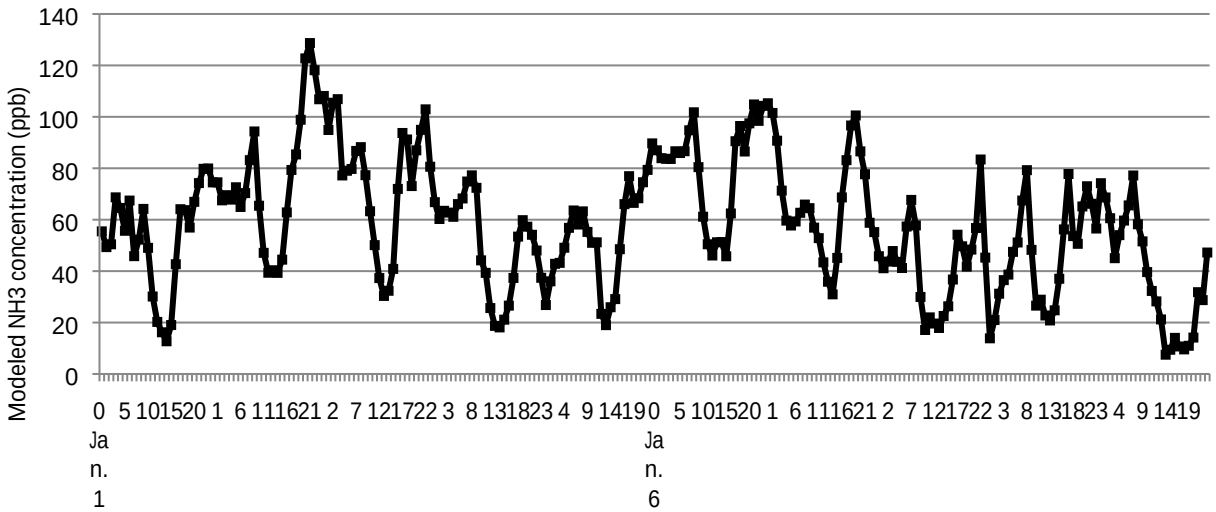

Figure IX.A.28. 14 Hourly Time Series of Modeled NH_3 (ppb) at Logan Monitoring Station During January 1-10, 2011

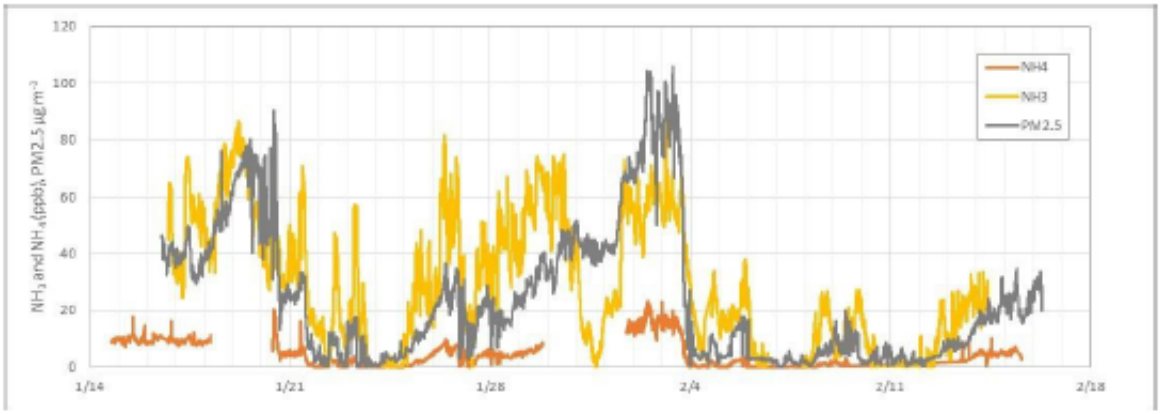

Figure IX.A.28. 15 Measured NH_3, Ammonium and $PM_{2.5}$ at Logan Monitoring Site During the 2017 Utah Winter Fine Particulate Study (UWFPS). Figure Retrieved from the UWFPS Final Report[24]

Summary of Model Performance

The model performance replicating the buildup and clear out of $PM_{2.5}$ is good overall. The model captures the temporal variation in $PM_{2.5}$ well. Moreover, total modeled $PM_{2.5}$ mass is dominated by NO_3, in agreement with measurements, and simulated concentrations of NH_3 are within the range of those observed. However, while $PM_{2.5}$ mass is dominated by NO_3, the model tends to underestimate ammonium nitrate, which is potentially due to an underestimation in free radical sources. Future research is needed to

[24] 2017 Utah Winter Fine Particulate Study https://www.esrl.noaa.gov/csd/groups/csd7/measurements/2017uwfps/finalreport.pdf

evaluate how accurately the model simulates free radical sources, which would help further improve the model performance.

Several observations should be noted on the implications of these model performance findings on the attainment modeling presented in the following section. First, it has been demonstrated that model performance overall is good and, thus, the model can be used for air quality planning purposes. Second, consistent with EPA guidance, the model is used in a relative sense to project future year values. EPA suggests that this approach "should reduce some of the uncertainty attendant with using absolute model predictions alone."

d) Modeled Attainment Test

Introduction

With acceptable performance, the model can be utilized to make future-year attainment projections. For any given (future) year, an attainment projection is made by calculating a concentration termed the Future Design Value (FDV). This value is calculated for each monitor included in the analysis, and then compared to the NAAQS (35 µg/m^3). If the FDV at every monitor located within a NAA is less than the NAAQS, this demonstrates attainment for that area in that future year.

A maintenance plan must demonstrate continued attainment of the NAAQS for a span of ten years. This span is measured from the time EPA approves the plan, a date which is somewhat uncertain during plan development. To be conservative, attainment projections were made for 2035. An assessment was also made for 2026 as a "spot-check" against emission trends within the ten-year span.

$PM_{2.5}$ Baseline Design Values

For any monitor, the FDV is greatly influenced by existing air quality at that location. This can be quantified and expressed as a Baseline Design Value (BDV). The BDV is consistent with the form of the 24-hour $PM_{2.5}$ NAAQS, which is the 98th percentile value averaged over a three-year period. Quantification of the BDV for each monitor is included in the TSD, and is consistent with EPA guidance.

Relative Response Factors

In making future-year predictions, the output from the CAMx model is not considered to be an absolute answer. Rather, the model is used in a relative sense. In doing so, a comparison is made using the predicted concentrations for both the year in question and a pre-selected baseline year, which for this plan is 2017. This comparison results in a relative response factor (RRF).

The UDAQ used the Software for Model Attainment Test - Community Edition (SMAT-CE) v. 1.01 utility from EPA[25] to perform the modeled attainment test for daily $PM_{2.5}$. SMAT is designed to interpolate the species fractions of the PM mass from the Speciation Trends Network (STN) monitors to the FRM monitors. It also calculates the RRF for grid cells near each monitor and uses these to calculate

[25] https://www.epa.gov/scram/photochemical-modeling-tools

a future year design value for these grid cells. A grid of 3-by-3 (9) cells surrounding the monitors was used as the boundary for RRF calculations.

The State of Utah operates three Chemical Speciation Network (CSN) monitors: Hawthorne, Bountiful, and Lindon. Hawthorne is located in Salt Lake County, the Bountiful monitor is in Davis to the north, and the Lindon monitor is located in Utah County to the south. Of the three, Hawthorne samples one out of three days, while the other two sample one in six days.

This mismatch in sampling frequency lead, initially, to interpolated speciation profiles that were unexpectedly non-uniform across the Salt Lake Valley. To create more realistic speciation profiles, the CSN data collected at the Hawthorne monitor were applied to all of the FRM sites in the SLC NAA. UDAQ believes this is a reasonable assumption that is supported by recently conducted special studies. Further discussion may be found in the TSD.

For each monitor, the FDV is calculated by multiplying the BDV by the relative response factor: **FDV = RRF * BDV**. These FDV's are compared to the NAAQS in order to determine whether attainment is predicted at that location or not. The results for each of the monitors are shown below in Table IX.A.28.7.

For all projected years and monitors, no FDV exceeds the NAAQS. Therefore, continued attainment is demonstrated for the Logan NAA.

Monitor Location	2016-2018 BDV	2026 FDV	2035 FDV*
Smithfield	32.6	28.0	28.2

Table IX.A.28. 7 Baseline and Future Design Values (ug/m³) at the Monitor in Logan NAA
*This value includes additional emissions added to the CMPO MVEB from the safety margin

2) Attainment Inventory

The attainment inventory is discussed in EPA guidance[26] as another one of the core provisions that should be considered by states for inclusion in a maintenance plan. According to the guidance, the stated purpose of the attainment inventory is to establish the level of emissions during the time periods associated with monitoring data showing attainment.

In cases such as this, where a maintenance demonstration is founded on a modeling analysis that is used in a relative sense, the modeled baseline inventory is used for comparison with every projection year model run. For this analysis, the state compiled a baseyear inventory for the year 2017. This year falls within the span of data representing current attainment of the $PM_{2.5}$ NAAQS. The guidance discusses the projection inventories as well, and notes that they should consider future growth, including population and industry, should be consistent with the baseyear inventory, and should document data inputs and assumptions. Any assumptions concerning emission rates must reflect permanent, enforceable measures.

[26] Calcagni (n 3)

Utah compiled projection inventories for use in the quantitative modeling demonstration. The years selected for projection include 2026 and 2035. The emissions contained in the inventories include sources located the modeling domain, encompassing all three $PM_{2.5}$ nonattainment areas, as well as a bordering region. See Figure IX.A.28. 4.

Since this bordering region is so large, the State identified a "core area" within this domain wherein a higher degree of accuracy is important. Within this core area (which includes Weber, Davis, Salt Lake, Utah, Box Elder, Tooele, Cache, and Franklin, ID counties), SIP-specific inventories were prepared to include seasonal adjustments and forecasting to represent each of the projection years. In the bordering regions away from this core, the State used the most current (2014) National Emissions Inventory from EPA for the analysis.

There are four general categories of emission sources included in these inventories: point sources, area sources, on-road mobile sources, and non-road mobile sources. For each of these source categories, the pollutants that were inventoried included: $PM_{2.5}$, SO_2, NO_X, VOC, and NH_3. The unit of measure for point and area sources is the traditional tons per year. Mobile source emissions are reported in terms of tons per day. The pre-processing model, SMOKE, converts all emissions to daily, weekly, and hourly values.

Area source emissions were projected to 2017 from the 2014 triannual inventory. Growth data from appropriate data sources, including information from the Governor's Office of Management and Budget, was used to project inventories to 2026 and 2035. Point source emissions are represented as the actual emissions from the 2017 triannual emissions inventory. Point sources were grown to 2026 and 2035 on a case-by-case basis for the projection inventories.

On-road mobile source emissions were calculated for each year using MOVES2014b in conjunction with the appropriate estimates for vehicle miles traveled (VMT). VMT estimates for the urban counties were provided by the local metropolitan planning organizations (MPOs), including the Wasatch Front Regional Council, the Mountainland Association of Governments, and the Cache Metropolitan Planning Organization and are based on their travel demand modeling for 2017, 2026, and 2035. Non-road mobile source emissions were calculated for each year using MOVES2014b. Growth data from appropriate data sources was used to project to 2026 and 2035. The TSD accompanying this SIP includes the Inventory Preparation Plan that details the growth factors used for each emissions source.

Source category emission inventories are expected to look quite different between 2017 and 2035. Population is expected to steadily increase between the 18-year span. On-road mobile emissions dominate the 2017 inventory; however, in 2035 area source emissions dominate the inventory. This is due to the tier 3 federal fuel standards and phase-in of newer cars driving on-road emission reductions. Area source emissions are relatively stable from 2017 to 2026 to 2035, besides a decrease in NOx from 2017 to 2026 due to the phase-in of area source rules.

Since this SIP subsection takes the form of a maintenance plan, it must demonstrate that the area will continue to attain the $PM_{2.5}$ NAAQS throughout a period of ten years from the date of EPA approval. It is also necessary to "spot check" this ten-year interval. Hence, projection inventories were prepared for 2026 and 2035. Table IX.A.28.8 summarizes these inventories. As described, it represents point, area,

on-road mobile, and non-road mobile sources in the modeling domain and include $PM_{2.5}$, as well as the precursors SO_2, NO_X, VOC, and NH_3 as defined in 40 CFR Parts 50, 51, and 93. More detail concerning any element of the inventory can be found in the appropriate section of the TSD. More detail about the general construction of the inventory can be found in the Inventory Preparation Plan.

Emissions (tons/day)	Sector	$PM_{2.5}$ Filterable	$PM_{2.5}$ Condensable	$PM_{2.5}$ Total	NOx	VOC	NH3	SO2
2017	Area Sources	0.56	0.04	0.6	0.92	3.8	13.48	0.03
	Mobile Sources	–	–	0.23	3.76	2.46	0.1	0.02
	NonRoad Sources	–	–	0.1	0.79	2.19	0	0
	Point Sources	0	0	0	0	0	0	0
	Total			**0.93**	**5.47**	**8.45**	**13.58**	**0.05**
2026	Area Sources	0.60	0.04	0.64	0.7	3.88	13.27	0.03
	Mobile Sources	–	–	0.13	1.52	1.39	0.09	0.01
	NonRoad Sources	–	–	0.06	0.59	1.27	0	0
	Point Sources	0	0	0	0	0	0	0
	Total			**0.83**	**2.81**	**6.54**	**13.36**	**0.04**
2035	Area Sources	0.63	0.04	0.67	0.71	4.29	13.11	0.03
	Mobile Sources	–	–	0.19	1.76	1.91	0.1	0.01
	NonRoad Sources	–	–	0.05	0.57	1.04	0	0
	Point Sources	0	0	0	0	0	0	0
	Total			**0.91**	**3.04**	**7.24**	**13.21**	**0.04**

Table IX.A.28. 8 Emissions Inventories in Tons per Average Episode Day by Year and Source Category

3) Additional Controls for Future Years

Since the emission limitations discussed in subsection IX.A.28.b(3) are federally enforceable and, as demonstrated in IX.A.28.c(1) above, are sufficient to ensure continued attainment of the $PM_{2.5}$ NAAQS, there is no need to require any additional control measures to maintain the $PM_{2.5}$ NAAQS.

4) Mobile Source Budget for Purposes of Conformity

The transportation conformity provisions of section 176(c)(2)(A) of the Clean Air Act (CAA) requires regional transportation plans and programs to show that "…emissions expected from implementation of plans and programs are consistent with estimates of emissions from motor vehicles and necessary emissions reductions contained in the applicable implementation plan…" EPA's transportation conformity regulation (40 CFR 93, Subpart A, last amended at 77 FR 14979, March 14 2012) also requires that motor vehicle emission budgets must be established for the last year of the maintenance plan, and may be established for any years deemed appropriate (see 40 CFR 93.118((b)(2)(i)).

For an MPO's Regional Transportation Plan, analysis years that are after the last year of the maintenance plan (in this case 2035), a conformity determination must show that emissions are less than or equal to the maintenance plan's motor vehicle emissions budget(s) for the last year of the implementation plan.

a) Mobile Source $PM_{2.5}$ Emissions Budgets

In this maintenance plan, Utah is establishing transportation conformity motor vehicle emission budgets (MVEB) for direct $PM_{2.5}$, NO_X, and VOC for 2035. The MVEBs are established for tons per average winter weekday for NOx, VOC, and direct $PM_{2.5}$ (primary exhaust $PM_{2.5}$ + brake and tire wear).

(i) Direct $PM_{2.5}$, NO_x, and VOC

Direct (or "primary") $PM_{2.5}$ refers to $PM_{2.5}$ that is not formed via atmospheric chemistry. Rather, direct $PM_{2.5}$ is emitted straight from a mobile or stationary source. With regard to the emission budget presented herein, direct $PM_{2.5}$ includes road dust, brake wear, and tire wear as well as $PM_{2.5}$ from exhaust. Through atmospheric chemistry, NO_X and VOC emissions can substantially contribute to secondary $PM_{2.5}$ formation. For this reason, NO_X and VOC are considered $PM_{2.5}$ precursors and are the only $PM_{2.5}$ precursors emitted at a significant level by on-road mobile, and therefore included in the MVEBs.

EPA's conformity regulation (40 CFR 93.124(a)) allows the implementation plan to quantify explicitly the amount by which motor vehicle emissions could be higher while still demonstrating compliance with the maintenance requirement. These additional emissions that can be allocated to the applicable MVEB are considered the "safety margin." As defined in 40 CFR 93.101, the safety margin represents the amount of emissions by which the total projected emissions from all sources of a given pollutant are less than the total emissions that would satisfy the applicable requirement for demonstrating maintenance. The implementation plan can then allocate some or all of this "safety margin" to the applicable MVEBs for transportation conformity purposes.

As presented in the TSD for on-road mobile sources, the estimated on-road mobile source emissions of direct $PM_{2.5}$, NOx, and VOC in 2035 for the Logan NAA, are listed in the first row (original MVEB) in Table IX.A.28.9. These mobile source emissions were included in the maintenance demonstration in Subsection IX.A.28.c.(1) which estimates a maximum $PM_{2.5}$ concentration of 25.9 $\mu g/m^3$ in 2035 within the Logan NAA portion of the modeling domain. These emissions numbers are considered the MVEB for the maintenance plan prior to the application of any amount of safety margin.

The safety margin for the Logan NAA portion of the domain equates to 9.1 $\mu g/m^3$ (the 2006 24-hr $PM_{2.5}$ standard of 35.0 $\mu g/m^3$ minus the initial 2035 FDV of 25.9 $\mu g/m^3$). To evaluate the portion of safety margin that could be allocated to the MVEBs, modeling was re-run for 2035 using the same emission projections for point, area and non-road mobile sources with additional emissions attributed to the on-road mobile source (see 2nd row of Table IX.A.28.9 Additional Tons Per Day from Safety Margin). The revised maintenance demonstration for 2035 still shows maintenance of the $PM_{2.5}$ standard with a maximum $PM_{2.5}$ concentration of 28.2 $\mu g/m^3$ at the Smithfield monitor in 2035 within the Logan NAA portion of the modeling domain. The final 2035 MVEB for WFRC is listed in the last row of Table IX.A.28.9 along with the 2035 design value that includes the revised MVEB.

	Direct $PM_{2.5}$	NO_X	VOC	Design Value @ controlling monitor
Original MVEB	0.1	1.02	1.18	25.9 µg/m^3
Additional Tons Per Day from Safety Margin	0.1	1.0	1.0	--
Final 2035 MVEB	0.2	2.02	2.18	28.2 µg/m^3

Table IX.A.28. 9 2035 Cache Metropolitan Planning Organization Motor Vehicle Emission Budget in Tons per Winter Weekday

It is important to note that the MVEBs presented in Table IX.A.28.9 are somewhat different from the on-road summary emissions inventory presented in Table IX.A.28.8.

Overall the emissions established as MVEBs are calculated using MOVES to reflect an average winter weekday. The totals presented in the summary emissions inventory (Table IX.A.28.8), however, represent an average-episode-day. The episode used to make this average (December 31, 2010 through January 10, 2011) includes seven such winter weekdays, but also includes two weekends. Emissions produced on weekdays are significantly larger than those produced on both Saturdays and Sundays. Therefore, the weighted average of daily emissions calculated for an episode-day will be less than that of a weekday.

There are also some conventions to be considered in the establishment of MVEBs. In particular, $PM_{2.5}$ in the summary emissions inventory totals includes direct exhaust, tire and brake wear, and fugitive dust. For the MVEBs $PM_{2.5}$ includes direct exhaust, tire and brake but no fugitive dust. VOC emissions in the summary emissions inventory include refueling spillage and displacement vapor loss and are counted in the on-road mobile category. MVEBs for VOC do not include these emissions because, in this context, they are regarded as an area source.

40 CFR 93.118((b)(2)(i) also states “If the maintenance plan does not establish motor vehicle emissions budgets for any years other than the last year of the maintenance plan, the conformity regulation requires that a "demonstration of consistency with the motor vehicle emissions budget(s) must be accompanied by a qualitative finding that there are not factors which would cause or contribute to a new violation or exacerbate an existing violation in the years before the last year of the maintenance plan."

Considering this, it is useful to compare the projected future design values in 2026 at all monitors in the NAA to the on-road mobile emission inventory as well as the percent of the total inventory that the on-road mobile sector comprises. As can be seen in Table IX.A.28.7., the design value at Smithfield in the Logan NAA is 28.0 µg/m^3. This value is 7.0 µg/m^3 below the standard. The on-road mobile source contribution to the overall inventory is shown in Table IX.A.28.10

Emissions tons/day	$PM_{2.5}$	NO_X	VOC
2026 emission inventory total	.83	2.81	6.55
2026 on-road mobile inventory	.13	1.52	1.39
On-road mobile % of total inventory	15.66%	54.09%	21.22%

Table IX.A.28. 10 2026 On-Road Mobile Inventory Compared to Total 2026 Emissions Inventory

Although the on-road mobile NO_X contribution is over half of the total NO_X in the inventory, the projected design value is far enough below the standard, UDAQ is confident that there will not be any on-road mobile factors that will cause or contribute to a new violation of the NAAQS.

(ii) Trading Ratios for Transportation Conformity

Per section 93.124 of the conformity regulations, for transportation conformity analyses using these budgets in analysis years beyond 2035, a trading mechanism is established to allow future increases in on-road direct $PM_{2.5}$ emissions to be offset by future decreases in plan precursor emissions from on-road mobile sources at appropriate ratios established by the air quality model. Future increases in on-road direct $PM_{2.5}$ emissions may be offset with future decreases in NO_x emissions from on-road mobile sources at a NO_x to $PM_{2.5}$ ratio of 3.4 to 1. This trading mechanism will only be used if needed for conformity analyses for years after 2035. To ensure that the trading mechanism does not impact the ability to meet the NO_x or VOC budgets, the NO_x emission reductions available to supplement the direct $PM_{2.5}$ budget shall only be those remaining after the 2035 NO_x budget has been met. Clear documentation of the calculations used in the trading should be included in the conformity analysis. The assumptions used to create the trading ratios can be found in the TSD.

5) Nonattainment Requirements Applicable Pending Plan Approval

CAA 175A(c) - *Until such plan revision is approved and an area is redesignated as attainment, the requirements of CAA Part D, Plan Requirements for Nonattainment Areas, shall remain in force and effect.* The Act requires the continued implementation of the nonattainment area control strategy unless such measures are shown to be unnecessary for maintenance or are replaced with measures that achieve equivalent reductions. Utah will continue to implement the emissions limitations and measures from the $PM_{2.5}$ SIP.

6) Revise in Eight Years

CAA 175A(b) - Eight years after redesignation, the State must submit an additional plan revision which shows maintenance of the applicable NAAQS for an additional 10 years. Utah commits to submit a revised maintenance plan eight years after EPA takes final action redesignating the Cache/Franklin County area to attainment, as required by the Act.

7) Verification of Continued Maintenance and Monitoring

Implicit in the requirements outlined above is the need for the State to determine whether the area is in fact maintaining the standard it has achieved. There are two complementary ways to measure this: 1) by monitoring the ambient air for $PM_{2.5}$; and 2) by inventorying emissions of $PM_{2.5}$ and its precursors from various sources.

The State will continue to maintain an ambient monitoring network for $PM_{2.5}$ in accordance with 40 CFR Part 58 and the Utah SIP. The State anticipates that the EPA will continue to review the ambient monitoring network for $PM_{2.5}$ each year, and any necessary modifications to the network will be implemented.

Additionally, the State will track and document measured mobile source parameters (e.g., vehicle miles traveled, congestion, fleet mix, etc.) and new and modified stationary source permits. If these and the resulting emissions change significantly over time, the State will perform appropriate studies to determine: 1) whether additional and/or re-sited monitors are necessary; and 2) whether mobile and stationary source emission projections are on target. The State will also continue to collect actual emissions inventory data from sources at thresholds defined in R307-150.

8) Contingency Plan

CAA 175A(d) - Each maintenance plan shall contain contingency measures to assure that the State will promptly correct any violation of the standard which occurs after the redesignation of the area to attainment. Such provisions shall include a requirement that the State will implement all control measures which were contained in the SIP prior to redesignation.

Upon redesignation, this contingency plan for the Logan NAA supersedes Subsection IX.A.23.9, Contingency Measures, which is part of the moderate Logan NAA $PM_{2.5}$ attainment SIP.

The contingency plan must also ensure that the contingency measures are adopted expeditiously once triggered. The primary elements of the contingency plan are: 1) the list of potential contingency measures; 2) the tracking and triggering mechanisms to determine when contingency measures are needed; and 3) a description of the process for recommending and implementing the contingency measures.

(a) List of Potential Contingency Measures

Section 175(d) of the CAA requires the maintenance plan to include as potential contingency measures all of the $PM_{2.5}$ control measures contained in the attainment SIP that were relaxed or modified prior to redesignation. For the Logan NAA, this includes number one in the list below, followed by other potential contingency measures. If it is determined through the triggering mechanism that additional emissions reductions are necessary, UDAQ will adopt and implement appropriate contingency measure as expeditiously as possible.

1. Reinstate two speed idle (TSI) portion of the Cache County inspection and maintenance program (see section IX.A.28.c.(9) for explanation of 110(l) demonstration.
2. Measures to address emissions from residential wood combustion (i.e. emissions from fireplaces under the existing R307-302 rule), including re-evaluating the thresholds at which red or yellow burn days are triggered. Residential wood combustion represents a large emissions inventory source category at 52.9% of direct $PM_{2.5}$ emissions in 2017.
3. Measures to address fugitive dust from area sources. Fugitive dust represents a large emissions inventory source category at 21.1% of direct $PM_{2.5}$ emissions in 2017.
4. Additional measures to address other $PM_{2.5}$ sources identified in the emissions inventory such as on-road vehicles, and non-road vehicles and engines. These source categories represent 23.1%, 10.8%, respectively, of the overall 2017 baseyear emissions inventory.

In addition, UDAQ administers incentive and grant programs that reduce emissions in Utah's NAAs. The emissions reductions are not included in the quantitative maintenance demonstration; however, they are expected to contribute to the mitigation of $PM_{2.5}$ concentrations. Generally speaking, the

programs target Utah nonattainment areas. The programs include approximately $25.5 million from the Volkswagen settlement and approximately $12.7 million to replace heavy-duty diesel trucks and buses that are operating under old emissions standards. Nonroad diesel upgrades will see approximately $1.3 million on the Wasatch Front. Another $3.8 million of the Volkswagen funding will go towards installing electric vehicle supply equipment in Utah. UDAQ is in the process of using approximately $9.6 million in federal funding to implement wood stove changeout programs throughout the three Utah $PM_{2.5}$ NAAs.

(b) Tracking

The tracking plan for the three NAAs consists of monitoring and analyzing ambient $PM_{2.5}$ concentrations. In accordance with 40 CFR 58, the State will continue to operate and maintain an adequate $PM_{2.5}$ monitoring network in SLC, Provo, and Logan NAAs.

(c) Triggering

Triggering of the contingency plan does not automatically require a revision to the SIP, nor does it mean the that the area will automatically be redesignated once again to nonattainment. Instead, the State will have an appropriate timeframe to correct the potential violation with implementation of one or more adopted contingency measures. In the event that violations continue to occur, additional contingency measures will be adopted until the violations are corrected.

Upon notification of a potential violation of the $PM_{2.5}$ NAAQS, the State will develop appropriate contingency measures intended to prevent or correct a violation of the $PM_{2.5}$ standard. Information about historical exceedances of the standard, the meteorological conditions related to the recent exceedances, and the most recent estimates of growth and emissions will be reviewed. The possibility that an exceptional event occurred will also be evaluated.

Upon monitoring a potential violation of the $PM_{2.5}$ NAAQS, including exceedances flagged as exceptional events but not concurred with by EPA, the State will identify a means of corrective action within six months after a potential violation. The maintenance plan contingency measures will be chosen based on a consideration of cost-effectiveness, emission reduction potential, economic and social considerations, or other factors that the State deems appropriate.

The State will require implementation of such corrective action no later than one year after the violation is confirmed. Any contingency measures adopted and implemented will become part of the next revised maintenance plan submitted to the EPA for approval.

9) CAA Section 110(l) Analysis

CAA Section 110(l) allows for revisions to a SIP as long as it does not interfere with any applicable requirement concerning attainment and reasonable further progress. This maintenance plan includes a 110(l) demonstration that addresses the removal of the Inspection and Maintenance (I/M) Program Two Speed Idle (TSI) biennial testing procedure for Cache County, UT. Only the TSI portion will be removed in 2021 and the demonstration shows that there will be minimal impact on the overall on-road mobile source inventory within the Logan NAA. The 110(l) demonstration also shows non-interference for other

NAAQS being monitored in Cache County, Utah. See the full 110(l) demonstration in Appendix A for a more comprehensive discussion on other NAAQS.

Cache County officials and the Bear River Health Department successfully approved and implemented an I/M program on January 1, 2014. The 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 1996 undergo TSI testing procedures while vehicles newer than Model Year 1996 are required to undergo On Board Diagnostic (OBD) testing procedures. The details of the program can be found in Section X, Part F, of the Utah SIP. The EPA approved the Cache County I/M program as an additional reasonable control measure for the moderate SIP.

In 2019, the Cache County Council adopted a county ordinance that discontinues only the TSI portion of the I/M program with an effective date of January 1, 2021. The TSI-tested vehicles comprise approximately 5% of the vehicles tested through the I/M program, and that percentage decreases each year as older vehicles requiring TSI are no longer operational. The estimated disbenefit of removing the TSI portion of the I/M program is detailed in Table IX.A.28.11 with numbers calculated use the EPA MOVES model.

On-Road Mobile	Vehicles tested	NO_X TPD	VOC TPD	NO_X+VOC TPD
		2021		
OBD+TSI	30,224	2.51	1.85	4.36
TSI	1,899	- .025	- .029	- .05
% change	6.2%	.98%	1.55%	2.53%
		2025		
OBD+TSI	32,298	1.78	1.53	3.31
TSI	1,341	- .013	- .023	- .036
% change	4.1%	.74%	1.53%	2.27%

Table IX.A.28. 11 TSI Removal Disbenefit of On-Road Emissions

	NO_X	VOC	NO_X+VOC TPD
2026 Total Inventory Emissions (tpd)	2.81	6.55	9.36
2025 TSI Emission Reduction (tpd)	0.013	0.023	.036
2026 TSI % of Total Emissions	0.46%	0.35%	.38%

Table IX.A.28. 12 TSI Removal Disbenefit of Total Emissions Inventory

The MOVES model only accepts vehicle inputs for 30 model years. Therefore, by 2026, the TSI program emissions reduction can no longer be quantified because TSI is performed on vehicles 1996 and older. Since MOVES modelling cannot determine the TSI disbenefit in 2026, Table IX.A.28.12 compares the 2025 TSI removal emission additions to the 2026 total inventory emission numbers. When compared to the overall inventory, the emissions addition resulting from TSI removal are minimal at less than half a percent and will not interfere with attainment of any NAAQS or other applicable requirements under the CAA. For the full 110(l) demonstration, see Appendix A.

Appendix A

TECHNICAL SUPPORT DOCUMENT

FOR A CAA 110(l) DEMONSTRATION

FOR THE LOGAN, UT-ID $PM_{2.5}$ NONATTAINMENT AREA

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.

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 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

Table Names	Data Columns	Description of Changes
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 (NOx)
- $PM_{2.5}$ & PM_{10} (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 GVWR ranges. The travel fractions were obtained by county from automated pneumatic counters that detect axle spacing and 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 $PM_{2.5}$ Nonatttaiment 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 NOx 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 NOx 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 (NOx) 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 NOx 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 NOx 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 NOx 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/m3
PM 2.5 Annual Mean	7.6	7.9	7.3	7.6	12	µg/m3
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
SO2	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 PM2.5 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 NOx 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