State of Utah

GARY R. HERBERT
Governor

SPENCER J. COX
Lieutenant Governor

Department of
Environmental Quality

Alan Matheson
Executive Director

DIVISION OF AIR QUALITY
Bryce C. Bird
Director

DAQ-055-18a

UTAH AIR QUALITY BOARD MEETING

FINAL AGENDA

Wednesday, September 5, 2018 - 1:30 p.m.
195 North 1950 West, Room 1015
Salt Lake City, Utah 84116

I. Call-to-Order

II. Annual Election of Chair and Vice-Chair

III. Date of the Next Air Quality Board Meeting: October 3, 2018

IV. Approval of the Minutes for June 6 and August 7, 2018, Board Meetings.

V. R. Chapman Construction Company. Settlement Agreement. Presented by Jay Morris.

VI. Propose for Public Comment: New Rule R307-511. Oil and Gas Industry: Associated Gas Flaring. Presented by Thomas Gunter.

VII. Propose for Public Comment: Amend UTAH State Implementation Plan. Control Measures for Area and Point Sources, Fine Particulate Matter, Serious Area $PM_{2.5}$ SIP for the Salt Lake City, UT Nonattainment Area. Section IX. Part A.31. Presented by Bill Reiss.

VIII. Propose for Public Comment: Amend R307-110-10. Section IX, Control Measures for Area and Point Sources, Part A, Fine Particulate Matter. Presented by Thomas Gunter.

IX. Informational Items.
- A. Air Toxics. Presented by Robert Ford.
- B. Compliance. Presented by Jay Morris and Harold Burge.
- C. Monitoring. Presented by Bo Call.
- D. Other Items to be Brought Before the Board.
- E. Board Meeting Follow-up Items.

In compliance with the Americans with Disabilities Act, individuals with special needs (including auxiliary communicative aids and services) should contact Larene Wyss, Office of Human Resources at (801) 536-4281, TDD (801) 536-4284 or by email at lwyss@utah.gov.

ITEM 4

State of Utah
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UTAH AIR QUALITY BOARD MEETING
June 6, 2018 – 1:30 p.m.
195 North 1950 West, Room 1015
Salt Lake City, Utah 84116

DRAFT MINUTES

I. Call-to-Order

Michael Smith called the meeting to order at 1:30 p.m.

Board members present: Michael Smith, Erin Mendenhall, Kevin Cromar, Mitra Kashanchi, Cassady Kristensen, Randal Martin, Alan Matheson, Arnold Reitze

Excused: William Stringer

Executive Secretary: Bryce Bird

II. Date of the Next Air Quality Board Meetings: June 19, 2018 and August 1, 2018

III. Approval of the Minutes for May 2, 2018, Board Meeting.

- Arnold Reitze moved to approve the minutes. Cassady Kristensen seconded. The Board approved unanimously.

IV. Final Adoption: Change in Proposed Rule R307-403. Permits: New and Modified Sources in Nonattainment Areas and Maintenance Areas. Presented by Thomas Gunter.

Thomas Gunter, Rules Coordinator at DAQ, stated that EPA determined potential deficiencies in Utah's nonattainment new source review permitting rules. In response, the DAQ sent a letter to EPA committing to revise portions of R307-403 no later than December 8, 2017. Amendments to R307-403 attempting to fulfill the commitments made to the EPA were proposed in September 2017. On December 6, 2017, the Board voted to let the proposed amendment lapse, raising concerns over the exclusion of ammonia as a precursor pollutant. As a result, DAQ is now in breach of the commitment letter. EPA has indicated that it would issue a Finding of Failure to Submit within six to eight months from the December 8, 2017, deadline. Such finding would put Utah on notice that if it failed to rectify the commitments made in the letter, EPA would be forced to apply sanctions.

On March 7, 2018, the DAQ re-addressed R307-403, attempting to satisfy the ammonia precursor issues raised in the December 2017 Board meeting, and still conform to the commitments made in the letter to EPA. In a revised version of R307-403, the Board proposed exempting ammonia as a $PM_{2.5}$ precursor only in the Logan nonattainment area (NAA), where a demonstration supporting that conclusion has been submitted to EPA. In the Salt Lake and Provo nonattainment areas, where any such conclusion has yet to be demonstrated, ammonia remains a $PM_{2.5}$ precursor as per the federal rules in 40 CFR 51.165. A 30-day public comment period was held from April 1 through April 30, 2018. Multiple comments were received. Staff recommends that the Board adopt the change in proposed R307-403 as amended.

Bill Reiss, Environmental Scientist at DAQ, then explained why the 70 tons per year limit was decided upon rather than 40 tons per year. EPA's $PM_{2.5}$ implementation rule presumes that ammonia is a precursor for the purposes of both the state implementation plan (SIP) implementation and new source review (NSR). For NSR, EPA's rule left it up to states to run their own air quality models and determine, for each specific area, what a "significant" emission rate would be in order to define a "major modification." Recently, as part of the PM implementation rule, EPA established its significance rate for VOC at 40 tons per year, which is the same level for NO_x and SO_2 throughout permitting requirements. 40 CFR 51.165 includes a supplemental definition of "major stationary source" that captures any modification that would rise to the level of 70 tons per year (tpy). Such determination would thereby trigger the same nonattainment NSR review requirements as would a major modification. So, any determination the state might make to establish a significance level would seemingly lie somewhere between 40 tpy and 70 tpy. Right now the model does not seem capable of determining a level between these end points with a great deal of confidence. DAQ chose 70 tpy to match the major source trigger, and to move forward with the rest of the rule. DAQ recognizes that as it continues to evaluate the airshed and come up with control strategies, it will have better inventories and have measurements to better validate the models. At that time, if it's appropriate, the level of significance can be modified.

Board member, Randy Martin, also mentioned that currently there are ammonia studies being conducted, including kinetic studies. Once those studies are published, it was suggested that a presentation on the results be given at a future Board meeting.

- Erin Mendenhall moved for final adoption of change in proposed rule R307-403. Randal Martin seconded. The Board approved unanimously.

V. Final Adoption: Change in Proposed Rule R307-101-2. Definitions. Presented by Thomas Gunter.

Thomas Gunter, Rules Coordinator at DAQ, stated that on March 7, 2018, the Board proposed amendments to R307-101-2. The rule had been amended to update the definition of "PM2.5 Precursor," adding ammonia to the list of $PM_{2.5}$ precursors, and accommodating provisions in the federal PM implementation rule which allow for demonstrations exempting any $PM_{2.5}$ precursor from certain requirements in specific $PM_{2.5}$ nonattainment areas. A 30-day public comment period was held from April 1 through April 30, 2018. One comment was received. Staff recommends that the Board adopt change in proposed R307-101-2.

In response to the question of what are the differences between the previous text and the modified version before the Board, staff responded that the EPA wanted assurance that the Administrator of the EPA approved any analysis/demonstration made by DAQ before being submitted to EPA.

- Cassady Kristensen moved for final adoption of change in proposed R307-101-2. Arnold Reitze seconded. The Board approved unanimously.

VI. Final Adoption: Revision to Carbon Monoxide Maintenance Plan, Provo Area, State Implementation Plan, Section IX, Part C. Presented by Thomas Gunter.

Thomas Gunter, Rules Coordinator at DAQ, stated that in 1993-1994, it was determined through modeling that the only areas in Utah County where carbon monoxide (CO) violations were potentially occurring were in Provo and Orem. The Provo and Orem areas were subsequently classified as one moderate NAA. On September 20, 2002, EPA published a determination that the Provo NAAhad attained the CO national ambient air quality standard (NAAQS) by December 31, 1995. EPA subsequently approved a vehicle inspection and maintenance (I/M) program and an oxygenated fuels program. On November 2, 2005, the EPA approved the Provo CO re-designation request to attainment and the first 10-year maintenance plan.

On March 7, 2018, the Board proposed revisions to the Provo Area CO maintenance plan for public comment. The Board made comments at the meeting which were addressed during the public comment period and changes have been implemented. A 30-day public comment period was held from April 1 through April 30, 2018. No comments were received. Staff recommends that the Board adopt the amended Carbon Monoxide Maintenance Plan, Provo Area, as proposed.

In response to the question of has using traffic counts instead of actual measurements to monitor the CO been statically looked at, staff responded that the methodology in the plan is what EPA wants and what has been approved in other regions in many other cities.

- Kevin Cromar moved for final adoption of the revision to Carbon Monoxide Maintenance Plan, Provo Area, Section IX, Part C. Erin Mendenhall seconded. The Board approved unanimously.

VII. Final Adoption: Amend R307-110-12. Section IX, Control Measures for Area and Point Sources, Part C, Carbon Monoxide. Presented by Thomas Gunter.

Thomas Gunter, Rules Coordinator at DAQ, stated that on March 7, 2018, the Board proposed for public comment an amendment to R307-110-12, which would incorporate amendments to Section IX, Control Measures for Area and Point Sources, Part C, for Carbon Monoxide, into the Utah air quality rules. A 30-day public comment period was held from April 1 through April 30, 2018. No comments were received. Staff recommends that the Board adopt the amended R307-110-12.

- Arnold Reitze moved for final adoption of amended R307-110-12, Section IX, Control Measures for Area and Point Sources, Part C, Carbon Monoxide. Cassady Kristensen seconded. The Board approved unanimously.

VIII. Propose For Public Comment: Revisions to Section IX, Control Measures for Area and Point Sources, Part H, Emission Limits. Presented by Bill Reiss.

Bill Reiss, Environmental Engineer at DAQ, stated that in December 2016, the Board adopted the SIP limits in Part H, Subsection IX. Since that time EPA has reclassified the Salt Lake and Provo nonattainment areas to serious, which means DAQ will need to re-evaluate its control strategy to

ensure that the benchmark is now best available control measures and technologies rather than reasonably available controls for the moderate SIP. Part H is the instrument that DAQ used to incorporate these limits into the SIP, specifically for the Salt Lake City NAA. The source specific BACT reviews are essentially the technical basis for what appears in Part H. These source specific reviews will be made available for public inspection on the DAQ website.

EPA's PM implementation rule indicates that the provisions to ensure best available control measures (BACM) and best available control technology (BACT) are "generally independent" of the attainment demonstration which is a bit different that it had been under the moderate area SIP. This has allowed DAQ staff to bring forward to the Board, these proposed revisions to Part H even though we do not have a modeled attainment demonstration. Additionally, as DAQ did the control strategies for the moderate SIP, staff was already looking ahead to 2019 and dealing with sources that were already used to the idea of BACT. Staff recommends that the Board propose revisions to Section IX, Control Measures for Area and Point Sources, Part H, Emission Limits, for public comment.

In response to questions, Mr. Reiss explained that the typical interaction between each affected source and staff. Each source was assigned a review engineer for direct contact back and forth. With direct contact, sources were made aware of the requirements that the state has to meet in order to satisfy the Clean Air Act and the PM implementation rule. Each source was also asked to look at their own facility and give an assessment of what BACT might mean to their facility.

The reason that some sources were eliminated from Part H is because when the Salt Lake area was reclassified to serious it meant a 70 ton threshold for sources that would be listed in Part H. Staff found that some sources were not emitting actual amounts close to the 70 ton threshold and were not included. Some sources accepted smaller limits in which they became what are called a synthetic minor source. In becoming a synthetic minor source, a source would not be on the list, but would still be tracked through the permitting program.

As to the question of does DAQ anticipates different results after the model is complete, Mr. Reiss answered that as long as attainment is still reached in 2019, DAQ does not expect different results when the modeling is complete. Staff is optimistic that the model will show we will be in attainment in 2019.

Staff explained that a 30-day public comment period is being proposed so that staff has adequate time to review and respond to all comments. Given the options available, a 45-day public comment period would potentially be the longest amount of time for comment for staff to meet the 120-day deadline before the rule would expire, as established by the Office of Administrative Rules. In addition, the technical support materials are going to be posted on the web site on a rolling basis as the information is received and approved by the division, which should allow just less than 2 months for review of most of the technical source documents.

Public comment from Lea Peacock of the Utah Petroleum Association (UPA) was introduced. Mr. Peacock states that UPA as an organization supports the efforts to establish controls that are technically and economically feasible and necessary to bring the Salt Lake County NAA to attainment for the $PM_{2.5}$ NAAQS. Refineries are among the most complex sources being addressed by the SIP and they anticipate DAQ's BACT analysis will be detailed and lengthy. At the May 2018 Board meeting, sources learned that DAQ intended to accelerate the BACT determination and decided to separate it from the attainment demonstration. Today, staff presented their work on finalizing the controls that would be presented as BACT; but the technical support material will likely not be available until the BACT proposal is published in the Utah State Bulletin. The limits to be established through this rulemaking will be legally binding and enforceable on sources as a matter of law. Therefore, sources

will need time to carefully evaluate the proposed limits to ensure their feasibility. UPA requests that the Board provide a 60-day public comment period to allow sources adequate time to review and evaluate the proposed BACT limits.

- Erin Mendenhall moved that the Board propose a 45-day public comment period for revisions to Section IX, Control Measures for Area and Point Sources, Part H, Emission Limits. Kevin Cromar seconded. The Board approved unanimously.

IX. Propose For Public Comment: Amend R307-110-17. Section IX, Control Measures for Area and Point Sources, Part H, Emission Limits. Presented by Thomas Gunter.

Thomas Gunter, Rules Coordinator at DAQ, stated that the amendments to Section IX, Control Measures for Area and Point Sources, Part H, for Emission Limits will have to be incorporated into the Utah air quality rules. R307-110-17 is the rule that incorporates the new amendments of Part H into the rules. If the Board adopts the amendments proposed to Part H, these amendments will become part of Utah's SIP when the rule is finalized. Staff recommends that the Board propose R307-110-17 for public comment.

- Arnold Reitze moved to propose the amended R307-110-17, Section IX, Control Measures for Area and Point Sources, Part H, Emission Limits, for public comment. Erin Mendenhall seconded. The Board approved unanimously.

X. Informational Items.

A. Air Toxics. Presented by Robert Ford.

B. Compliance. Presented by Jay Morris and Harold Burge.

C. Monitoring. Presented by Roman Kuprov.

Roman Kuprov, Environmental Scientist at DAQ, updated that since May the ozone standard has been exceeded three times.

In response to questions regarding at what levels are action days called and how many days in advance do staff forecasters work, staff responded that forecasters look out to three days of forecasting. Currently, there is no rule authority or defined process to make the calls. Forecasts are made for informational purposes to reinforce the actions people can take and to encourage the public to be aware of their impact on air quality. Staff is looking at bringing a rule package to the Board in the future that would define a process to establish what the action levels and calls would be for forecasting.

D. Other Items to be Brought Before the Board.

The DEQ is working on an audio visual system in its board room so that meetings can be live-streamed over the department's YouTube channel. This improvement will allow the public to view board meetings in real-time without having to travel to the DEQ offices.

Board member, Kevin Cromar, asked if the Board is agreeable to have discussion on EPA's proposed transparency rule currently out for comment. Mr.Cromar is asking if the Board thinks it is appropriate to submit comments on the proposed EPA transparency rule as a Board. In

discussion, the Board will tentatively set aside some time at the June 19, 2018, meeting where Mr. Cromar will give a brief presentation on the issue. Staff will set up a date and time for a teleconference meeting to finalize the Board's comments.

E. Board Meeting Follow-up Items.

Meeting adjourned at 2:26 p.m.

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Alan Matheson
Executive Director

DIVISION OF AIR QUALITY
Bryce C. Bird
Director

UTAH AIR QUALITY BOARD
TELECONFERENCE MEETING
August 7, 2018 – Room 1015
195 North 1950 West, Salt Lake City, Utah 84116

DRAFT MINUTES

I. Call-to-Order

Michael Smith called the meeting to order at 2:03 p.m.

Board members present: Michael Smith (attendance by phone), Randal Martin (attendance by phone), Alan Matheson, Arnold Reitze, and William Stringer (attendance by phone)

Excused: Erin Mendenhall, Kevin Cromar, Mitra Kashanchi, Cassady Kristensen

Executive Secretary: Bryce Bird

II. Discussion on Comment Letter to EPA, "Strengthening Transparency in Regulatory Science."

As counsel for the Air Quality Board (Board), Christian Stephens of the Utah Office of the Attorney General made a brief statement regarding what authority the Board has versus the authority of the division director. As opposed to the director, the Board does not have clear authority to represent the state to the federal government. The Board's authority under its current statute mostly relates to rulemaking. Because the Board is created by law it has to operate under the law that created it. The Board has specific enumerated powers which are in Section 19.2.104. Mr. Stephens listed a few options, if the Board chooses to move forward with the comment letter as follows:

Option one, the Board can make a recommendation that the director submits the comments. Option two, the Board could send the letter to the Governor. Option three, Board members can submit comments in their individual capacities as a citizen. And the fourth option which is not as clear, the Board can vote to allow one Board member to speak for the Board, but if the Board doesn't have independent authority to submit comments then Mr. Stephens believes that option would not be valid.

Mr. Bird was asked to explain the process of how the National Association of Clean Air Agencies (NACAA) organization collects comments from member organizations and decides whether or not to submit comment. In this case, Utah did not provide any adverse comments but also did not approve per se those comments and actions by the NACAA Board in its July 2018 comments to EPA.

Mr. Stringer commented on his opposition to resisting disclosure in academia and he's also opposed to the notion that peer review by itself is sufficient. In reading the documents, it appears to be coming from a lobbying standpoint of scientists trying to preserve a way of life rather than looking at more disclosure. At this time, Mr. Stringer would not be willing to sign on to a comment letter today given the information that has been discussed.

Mr. Martin commented that the peer review process and the ultimate publication of the data make the information very publically available. In addition, documents are thoroughly vetted before being published. Mr. Martin is opposed to the phrase "at Administrator's discretion" where there is potential possibility of the Administrator being able to pick and choose studies.

Mr. Reitze supports Mr. Cromar's proposal. One concern is the EPA's proposal of basically wiping out all of the past health based studies that required the use of data for which it is illegal to identify individuals. He feels that the way the proposal is written the ability to use a lot of health data that has been created over the past half century will be restricted.

Mr. Smith commented that Mr. Cromar's proposed letter was very detailed and comprehensive but he felt the wording was too strong and absolute in the way that it was written.

Mr. Matheson clarified that the issue seems to be less about controversy over more disclosure versus less disclosure but is more of an issue of what scientific studies can be considered in setting standards. The state has not taken a position on this issue and as a state employee he will not weigh in on the merits in this discussion. It is his suggestion that if the Board decides to go forward with submitting comments to EPA, that comments be submitted as individuals and not as representatives of the state.

Mr. Bird stated that he does not have independent authority to speak for the state as Mr. Matheson mentioned. In addition, under statute there is an obligation that he not take any action or coordination with any other entities outside the state without coordination with the state's Executive Branch.

- William Stringer motioned that any comments submitted to the EPA are submitted individually by members of the Board. Randal Martin seconded. The Board approved unanimously.

Meeting adjourned at 2:39 p.m.

ITEM 5

State of Utah

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Department of
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Director

DAQ-057-18

M E M O R A N D U M

TO: Air Quality Board

THROUGH: Bryce C. Bird, Executive Secretary

FROM: Chad Gilgen, Environmental Scientist

DATE: August 21, 2018

SUBJECT: R. Chapman Construction Company – Settlement Agreement

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R. Chapman Construction Company (Chapman) owns and operates an aggregate, asphalt, and concrete production facility (Harmston) two miles northwest of Roosevelt, Utah. On September 26, 2016, the Division of Air Quality (DAQ) sent Chapman a compliance advisory for 23 violations observed during an inspection conducted on August 16, 2016. On November 22, 2016, Chapman submitted a response to the September 2016 compliance advisory agreeing with the listed violations and explaining how the company would return to compliance. The source received a second compliance advisory on September 18, 2017, for two repeat violations found during a compliance inspection conducted on August 22, 2017.

On August 9, 2018, Chapman accepted the settlement agreement and returned the signed settlement agreement to the DAQ. Chapman also submitted documentation committing to remedy the remaining outstanding violation by September 17, 2018.

Under Section 19-2-104(3)(b)(i) of the Utah Code, this memorandum is submitted to the Board for review since the penalty exceeds $25,000. A copy of the settlement agreement is provided. The DAQ will withhold any further action on this case until the Board approves or disapproves the settlement.

Recommendation: Staff recommends that the Board approve the settlement of $37,667.00.

American Environmental Testing Company Inc.

6823 South 3600 West
Spanish Fork, Utah 84660
(801) 794-2950 Fax (801) 794-2951

August 9, 2018

Utah Department of Environmental Quality
Attn: Mr. Jay Morris, Minor Source Compliance Manager
Division of Air Quality
195 North 1950 West
P.O. Box 144820
Salt Lake City, Utah 84116-4820

Dear Mr. Morris:

For and in behalf of R. Chapman Construction Company's Mr. Steven Mackay, American Environmental Testing Company, Inc. will be conducting NSPS Opacities on the Harmston facility (Approval Order: DAQE-AN144840002-15) located near Roosevelt, Utah. We will be submitting a "Pretest Protocol" with a list of equipment that will be tested for Opacities within a week. Our fist available test date is September 17, 2018.

If you have any questions, or if we can be of further service, please give me a call.

Sincerely,

Beckie Hawkins
CFO AET

Acceptance of Settlement Agreement

I have received a copy of the Settlement Agreement Penalty Worksheet and I agree to pay the Total Penalty amount.

R. Chapman Construction Company

Name:

Title:

Signature	Date	Telephone Number
	8/9/14	801-631-3849

Utah Division of Air Quality General Administrative Penalty Worksheet

Source: R Chapman Construction				**Class: Minor**						
SID No.: 14484	**HPV: No**			**Violation Date: 8-16-16**						Home
Table 1: Gravity Criteria				**Gravity Criteria (Gc)**						Gravity Criteria
Citation	**Description of the Violation**	**Events**	**Category**	Gc 1	Gc 2	Gc 3	Gc 4	**Daily Gravity**	**Accumulated Gravity**	
UAC R307-205	Excessive sitewide fugitive emissions	1	C	2	1	2	3	$1,289	$1,289	
UAC R307-401 and AO Condition I.3	Operating unapproved equipment	3	C	2	1	1	3	$1,149	$3,447	
AO Condition I.5, II.B.1.d - C and II.B.1.d - F	Asphalt Plant exceeding opacity limits at conveyors, screens, drop points, and transfer points.	4	C	2	1	2	3	$1,289	$5,156	
AO Conditions II.A.5 through II.A.8, II.A.10 and Section III	Failure to conduct Subpart OOO initial opacity readings	6	C	1	1	2	3	$1,149	$6,894	
AO Condition II.A.14	Operating a drum heater rated at 99 MMBtu/hr	1	B	2	1	1	3	$4,700	$4,700	
AO Condition II.B.1.b - C	Exceeding asphalt production with dryer operating on fuel oil	1	C	2	1	1	3	$1,149	$1,149	
AO Conditions I.4 and II.B.1.b - D	Incomplete concrete production records submitted	1	C	1	1	2	3	$1,149	$1,149	
AO Conditions II.B.1.c, II.B.2.b, II.B.2.c, and II.B.2.f	Source operations fugitive emissions in excess of 80% opacity. No water truck at source location.	1	C	2	1	2	3	$1,289	$1,289	
AO Conditions I.4 and II.B.2.c.1	Incomplete water records submitted	1	C	1	1	2	3	$1,149	$1,149	
AO Condition II.B.2.d	Haul road exceeding 0.78 miles	1	C	2	1	1	3	$1,149	$1,149	
AO Condition II.B.2.e	Water sprays not operating at Asphalt Plant	1	C	2	1	1	3	$1,149	$1,149	
AO Condition II.B.3.a	Asphalt Plant operating solely on fuel oil	1	B	2	1	1	3	$4,700	$4,700	
AO Conditions II.B.3.d and II.B.3.e	Operating a new baghouse that has not been stack tested	2	C	2	1	1	3	$1,149	$2,298	
AO Condition II.B.3.f	Asphalt Plant baghouse stack emissions exceeding established limit	1	C	2	1	1	3	$1,149	$1,149	

Gc 5 History of violations within the last five (5) years

Date of violation	**Description of violation**		Category		
8/22/2017	AO Condition I.4 - Failure to provide requested records during follow-up compliance inspection	☑ Same Violation	C		$500
8/22/2017	AO Condition II.B.2.b - Excessive fugitive dust during follow-up compliance inspection	☑ Same Violation	C		$500
		☐ Same Violation			
		☐ Same Violation			
		☐ Same Violation			
	Total Gravity				**$37,667**

Table 2: Adjustments			
Economic Benefit Collectable	**Use the information that gives you the most correct value of benefit. This may be the BEN Model, Net Income, Tax Records, Company Records, or any other economic benefit information.**		
Other	**Other Monies Collected**		
	Early Settlement Reduction (20%) -	☑ Remove 20%	$0
Total Penalty			**$37,667**

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Document Date: 12/21/2017
DAQ-2017-017625

December 21, 2017

DAQC-1662-17
Site ID: 14484 (B1)

Sent Via Certified Mail No. 70161970000102030742

Chris Chapman
R. Chapman Construction Company
140 West 425 South 330-16
Roosevelt, Utah 84066

Dear Mr. Chapman:

Re: Early Settlement Agreement – R. Chapman Construction Company – Harmston Facility, Utah Administrative Code (UAC) R307-205, UAC R307-401, Approval Order DAQE-AN144840002-15, Duchesne County, Utah

On September 26, 2016, the Utah Division of Air Quality (DAQ) issued a Compliance Advisory to R. Chapman Construction Company – Harmston Facility for violations of UAC R307-205, UAC R307-401, and multiple conditions of Approval Order (AO) DAQE-AN144840002-15 observed during a compliance inspection on August 16, 2016. R. Chapman Construction Company responded to the Compliance Advisory on November 22, 2016, and submitted a Notice of Intent on March 14, 2017.

Based on the findings of the inspection and response to the Compliance Advisory, the DAQ determined that R. Chapman Construction Company was in violation of:

- UAC R307-205 for excessive site wide fugitive emissions.
- UAC R307-401 and Condition I.3 of the Approval Order for failure to submit a Notice of Intent to the Director and receive an Approval Order prior to initiation of construction, modification, or relocation of equipment.
- Conditions I.5, II.B.1.d – C, and II.B.1.d – F of the Approval Order for exceeding opacity limits at conveyors, screens, drop points, and transfer points at the Asphalt Plant.
- Conditions II.A.5 through II.A.8, II.A.10 and Section III of the Approval Order for failure to conduct New Source Performance Standards (NSPS) Subpart OOO initial opacity readings.
- Condition II.A.14 of the Approval Order for operating a drum heater rated at 95 MMBtu/hr.
- Condition II.B.1.b – C of the Approval Order for exceeding the limit of mixed asphalt production with the dryer being fired on fuel oil.

- Conditions I.4 and II.B.1.b – D of the Approval Order for submitting incomplete records of concrete production for the requested rolling 12-month time period.

- Conditions II.B.1.c, II.B.2.b, II.B.2.c, and II.B.2.f of the Approval Order for exceeding fugitive dust limits associated with source operations, haul roads, storage piles, and failure to maintain a water truck at the source location.

- Conditions I.4 and II.B.2.c.1 of the Approval Order for submitting incomplete watering records for the requested rolling 12-month time period.

- Condition II.B.2.d of the Approval Order for unpaved haul roads exceeding 0.78 miles in length.

- Condition II.B.2.e of the Approval Order for failure to operate dust suppression water sprays at the Asphalt Plant.

- Condition II.B.3.a of the Approval Order for the Asphalt Plant operating solely on fuel oil.

- Condition II.B.3.f of the Approval Order for visible emissions from the baghouse stack exceeding established limits.

Section 19-2-115 of the Utah Code Annotated provides that violations of the Utah Air Conservation Act and/or any order issued thereunder may be subject to a civil penalty of up to $10,000 per day for each violation. Based upon our civil penalty policy, we calculated a preliminary civil penalty for the above listed violations of $35,369.

The monetary amount of the DAQ settlement offer specified below is derived from a pre-established schedule of penalties, which takes into account, among other factors, the magnitude and severity of the violation, economic benefit, cooperation of the source as well as the prior history of violations. See the attached penalty worksheet for details.

All parties we deal with, whether private, commercial, or governmental are treated similarly in the settlement process. Settlement offers are based on the evaluation of the same factors and criteria in all cases. The DAQ acknowledges that the violations on August 16, 2016, are being addressed by R. Chapman Construction Company.

If you are interested in settling this violation, we are authorized to offer settlement in accordance with the DAQ Penalty Policy as follows:

1. R. Chapman Construction Company agrees to pay a reduced civil penalty in the sum of $28,295. Payment of a civil penalty precludes further civil prosecution for the above described violations against the named source.

2. The DAQ retains its authority to take any enforcement actions based on any and all violations not specifically described above.

3. In the event any further violations of the Utah Air Quality Rules occur, the DAQ may consider the violations described above in assessing a penalty for the subsequent violations, in accordance with the provisions of Utah Administrative Code R307-130.

4. Entering into this settlement shall not constitute an admission of violation of the Utah Air Quality Rules, nor shall it be inferred to be such an admission in any administrative or judicial proceeding. The described violations will constitute part of the company compliance history for any purpose for which such history is relevant to the DAQ.

At the DAQ's option, you may request a portion of the calculated civil penalty gravity component to be used to complete a Supplemental Environmental Project (SEP) to benefit present and future air quality within Utah. For more information about the SEP process, please contact the DAQ representative listed below.

This letter constitutes an offer of settlement and is not a demand for payment. The agreement reflects a reduced penalty for early settlement of this matter.

If the above terms are acceptable to you, please sign and return this Early Settlement Agreement to the DAQ at the letterhead address within twenty (20) business days of receipt of this agreement. Utah Code 19-2-104(3)(b)(i), requires the Utah Air Quality Board (UAQB) to review and approve/disapprove any settlement negotiated by the Director that results in a civil penalty of $25,000 or more in accordance with Subsection 19-2-107(2)(b)(viii). The DAQ will present this to the UAQB at the February board meeting for review and will recommend approval of the negotiated settlement.

You may write or call to request a settlement conference with the DAQ representative listed below. A conference must be scheduled within twenty (20) business days of your receipt of this Early Settlement Offer. If we do not receive a signed copy of this letter and payment or other correspondence from you within twenty (20) business days of your receipt of this letter, we will assume that you are not interested in resolving this matter as outlined above.

This Early Settlement Agreement is intended to quickly resolve the non-compliance issues listed above and requires the immediate attention of your company. Failure to resolve this matter as outlined in this letter may result in this offer being revoked and/or having this matter referred to a formal enforcement process.

If you have any additional questions regarding this matter, please contact Jay P. Morris at (801) 536-4079 or by email at jpmorris@utah.gov.

Sincerely,

Bryce C. Bird
Director

BCB:JPM:bp

cc: Tri-County Health Department

Acceptance of Early Settlement Agreement

I have read the above Early Settlement Agreement and I agree to the terms and conditions thereof.

R. Chapman Construction Company

Name:

Title:

_____	_____	_____
Signature	Date	Telephone Number

Utah Division of Air Quality General Administrative Penalty Worksheet

Source: R Chapman Construction				**Class: Minor**					
SID No.: 14484	**HPV: No**			**Violation Date: 8-16-16**					Home
Table 1: Gravity Criteria				**Gravity Criteria (Gc)**					Gravity Criteria
Citation	**Description of the Violation**	**Events**	**Category**	Gc 1	Gc 2	Gc 3	Gc 4	**Daily Gravity**	**Accumulated Gravity**
UAC R307-205	Excessive sitewide fugitive emissions	1	C	2	1	2	3	$1,289	$1,289
UAC R307-401 and AO Condition I.3	Operating unapproved equipment	3	C	2	1	1	3	$1,149	$3,447
AO Condition I.5, II.B.1.d - C and II.B.1.d - F	Asphalt Plant exceeding opacity limits at conveyors, screens, drop points, and transfer points.	4	C	2	1	2	3	$1,289	$5,156
AO Conditions II.A.5 through II.A.8, II.A.10 and Section III	Failure to conduct Subpart OOO initial opacity readings	6	C	1	1	2	3	$1,149	$6,894
AO Condition II.A.14	Operating a drum heater rated at 95 MMBtu/hr	1	B	2	1	1	3	$4,700	$4,700
AO Condition II.B.1.b - C	Exceeding asphalt production with dryer operating on fuel oil	1	C	2	1	1	3	$1,149	$1,149
AO Conditions I.4 and II.B.1.b - D	Incomplete concrete production records submitted	1	C	1	1	2	3	$1,149	$1,149
AO Conditions II.B.1.c, II.B.2.b, II.B.2.c, and II.B.2.f	Source operations fugitive emissions in excess of 80% opacity. No water truck at source location.	1	C	2	1	2	3	$1,289	$1,289
AO Conditions I.4 and II.B.2.c.1	Incomplete water records submitted	1	C	1	1	2	3	$1,149	$1,149
AO Condition II.B.2.d	Haul road exceeding 0.78 miles	1	C	2	1	1	3	$1,149	$1,149
AO Condition II.B.2.e	Water sprays not operating at Asphalt Plant	1	C	2	1	1	3	$1,149	$1,149
AO Condition II.B.3.a	Asphalt Plant operating solely on fuel oil	1	B	2	1	1	3	$4,700	$4,700
AO Condition II.B.3.f	Asphalt Plant baghouse stack visible emissions exceeding established limit	1	C	2	1	1	3	$1,149	$1,149

Gc 5 History of violations within the last five (5) years

Date of violation	**Description of violation**	Category		
8/22/2017	AO Condition I.4 - Failure to provide requested records during follow-up compliance inspection	☑ Same Violation	C	$500
8/22/2017	AO Condition II.B.2.b - Excessive fugitive dust during follow-up compliance inspection	☑ Same Violation	C	$500
		☐ Same Violation		
		☐ Same Violation		
		☐ Same Violation		
	Total Gravity			$35,369

Table 2: Adjustments			
Economic Benefit Collectable	**Use the information that gives you the most correct value of benefit. This may be the BEN Model, Net Income, Tax Records, Company Records, or any other economic benefit information.**		
Other	**Other Monies Collected**		
	Early Settlement Reduction (20%) -	☐ Remove 20%	$7,074
Total Penalty			**$28,295**

Gravity Criteria Definitions

Gc 1. Was the violation a result of excess emissions and/or reporting?

Gravity Criteria Definitions

Gc 1. Was the violation a result of excess emissions and/or reporting?	
0	If the violation was not a result of excess emissions and/or reporting
1	If a minor reporting or other problem occurred, but no emissions were involved
2	If a reporting or other problem occurred which involved minor emissions
3	If a reporting or other problem occurred involving significant emissions
Gc 2. Did the violation appear to be willful or due to gross negligence?	
0	If the source clearly did not know that the action/inaction constituted a violation
1	If the source should have known that the action/inaction would result in a violation
2	If the source clearly knew that the action/inaction would result in a minor violation
3	If the source clearly knew that the action/inaction would result in a significant violation
Gc 3. Was the violator unresponsive in correcting the violation?	
0	If the source was cooperative and the violation was corrected as soon as possible
1	If the source was cooperative but the violation was corrected in a less timely manner
2	If the source was cooperative but did not correct the problem
3	If the source was not cooperative and did not attempt to correct the problem
Gc 4. Was the violation a result of improper operation or inadequate maintenance?	
0	If the source was following an acceptable O & M plan at the time the violation occurred
1	If the source was following an inadequate/incomplete O & M plan at the time the violation occurred
2	If the source did not have and O & M plan at the time the violation occurred
3	If the source did not have an O & M plan and the violation was clearly the result of improper O & M

R307-130. General Penalty Policy

R307-130-1 Scope.
This policy provides guidance to the executive secretary of the Air Quality Board in negotiating with air pollution sources penalties for consent agreements to resolve non-compliance situations. It is designed to be used to determine a reasonable and appropriate penalty for the violations based on the nature and extent of the violations, consideration of the economic benefit to the sources of non-compliance, and adjustments for specific circumstances.

R307-130-2. Categories.
Violations are grouped in four general categories based on the potential for harm and the nature and extent of the violations. Penalty ranges for each category listed:

Category A - $7,000 to $10,000 per day
Violations with high potential for impact on public health and the environment including:
(a) Violations of emission standards and limitations of NESHAP
(b) Emissions contributing to non-attainment area or PSD increment exceedaences.
(c) Emissions resulting in documented public health effects and/or environmental damage.

Category B $2,000 to $7,000 per day
Violations of the Utah Air Conservation Act, applicable state and federal regulations, and orders to include:
(a) Significant levels of emissions resulting from violations of emission limitations or other regulations not within Category A
(b) Substantial non-compliance with monitoring requirements.
(c) Significant violations of approval orders, compliance orders, and consent agreements not within Category A
(d) Significant and/or knowing violations of "notice of intent" and other notification requirements.
(e) Violations of reporting requirements

Category C Up to $2,000 per day
Minor violations of the Utah Air Conservation Act, applicable state and federal regulations, and orders having no significant public health or environmental impact to include:
(a) Reporting violations
(b) Minor violations of monitoring requirements, orders and agreements.
(c) Minor violations of emission limitations or other regulatory requirements

Category D Up to $299.00
Violations of specific provisions of which are considered minor to include:
(a) Violations of automobile emission standards and requirements.
(b) Violation of wood-burning regulations by private individuals
(c) Open burning violations by private individuals.

ITEM 6

State of Utah

GARY R. HERBERT
Governor

SPENCER J. COX
Lieutenant Governor

Department of
Environmental Quality

Alan Matheson
Executive Director

DIVISION OF AIR QUALITY
Bryce C. Bird
Director

DAQ-058-18

M E M O R A N D U M

TO: Air Quality Board

THROUGH: Bryce C. Bird, Executive Secretary

FROM: Sheila Vance, Environmental Scientist

DATE: August 24, 2018

SUBJECT: PROPOSE FOR PUBLIC COMMENT: New Rule R307-511. Oil and Gas Industry: Associated Gas Flaring

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In January of 2018, the Air Quality Board adopted a series of oil and gas rules that allowed the source category's minor source permitting process to be streamlined. These rules require the majority of oil and gas wells in the state to follow a set of rules instead of obtaining and complying with an approval order. As the rules have been implemented and applied, the Division of Air Quality (DAQ) has learned that some oil and gas wells have been unable to take advantage of this streamlined approach as the set of rules did not include the control of associated gas from some wells. To support the ability of some sources to follow the permit-by-rule process, the DAQ is proposing to add an additional rule to the oil and gas 500 series rules to require the flaring of associated gas.

The proposed rule requires the associated natural gas from operating wells to be controlled as is required for other equipment, like storage vessels and dehydrators. The rule reflects current requirements from other regulatory agencies. Additionally, throughout the pre-rulemaking stakeholder process, there have been no comments made that the application of this rule would be burdensome. In fact, this allows these sources to take advantage of the streamlined permitting process in the same way other sources have.

Recommendation: Staff recommends that the Board propose new rule R307-511 for a 30-day public comment period.

Appendix 1: Regulatory Impact Summary Table*

Fiscal Costs	FY 2019	FY 2020	FY 2021
State Government	$0	$0	$0
Local Government	$0	$0	$0
Small Businesses	$0	$0	$0
Non-Small Businesses	$0	$0	$0
Other Person	$0	$0	$0
Total Fiscal Costs:	**$0**	**$0**	**$0**
Fiscal Benefits			
State Government	$0	$0	$0
Local Government	$0	$0	$0
Small Businesses	$0	$0	$0
Non-Small Businesses	$0	$0	$0
Other Persons	$0	$0	$0
Total Fiscal Benefits:	**$0**	**$0**	**$0**
Net Fiscal Benefits:	$0	$0	$0

***This table only includes fiscal impacts that could be measured. If there are inestimable fiscal impacts, they will not be included in this table. Inestimable impacts for State Government, Local Government, Small Businesses and Other Persons are described above. Inestimable impacts for Non-Small Businesses are described below.**

Appendix 2: Regulatory Impact to Non-Small Businesses

No non-small businesses are expected to be impacted by this rulemaking. Large industrial businesses are already required to maintain and utilize the controls that this rule would require. This rule will primarily apply to smaller oil and gas operations that are susceptible to releases of produced gas. Therefore, non-small businesses will not be impacted.

There are an inestimable amount of oil and gas extraction (extraction) small businesses (NAICS 2111) operating in Utah. These extraction sites can be included in the Utah oil and gas registration, but their total numbers are currently unknown. These businesses could experience a one-time fiscal cost of $800-$1,500 associated with purchasing and installing the required control devices. The full impact to these small businesses cannot be estimated because the lack of extraction site inventory and control equipment already installed at those sites is not available.

Regardless of the fiscal impact possible on these small extraction sites, there is also a possibility for these same sites to experience a one-time benefit associated with the installation of the control devices. Sites identified as needing

to flare releases are likely required to be permitted. With the recently passed rule that allows permitting by rule, these small extraction sites will be eligible for the one-time permitting cost of $250 if they have the controls installed, as opposed to the original one-time cost of $2,300 to obtain a permit. That equals a potential benefit of $2,050. The amount saved through the use of this rule is greater than the amount required to purchase and install the controls.

The Executive Director of the Department of Environmental Quality, Alan Matheson, has reviewed and approved this fiscal analysis.

R307. Environmental Quality, Air Quality.
R307-511. Oil and Gas Industry: Associated Gas Flaring
R307-511-1. Purpose.

R307-511 establishes control requirements for the flaring of produced gas associated with well sites.

R307-511-2. Definitions.

“Emergency release” means a temporary, infrequent and unavoidable situation in which the loss of gas is uncontrollable or necessary to avoid risk of an immediate and substantial adverse impact on safety, public health, or the environment. An “emergency” is limited to a short-term situation of 24 hours or less caused by an unanticipated event or failure that is out of the operator's control and is not due to operator negligence.

"Flaring" means use of a thermal oxidation system designed to combust hydrocarbons in the presence of a flame.

"Associated Gas" means the natural gas that is produced from an oil well during normal production operations and is either sold, re-injected, used for production purposes, vented (rarely) or flared. All gas from storage vessels and low pressure separators is not associated gas.

R307-511-3. Applicability.

(1) R307-511 applies to each producing well located at a well site as defined in 40 CFR 60.5430a Subpart OOOOa Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution.

(2) VOC control devices used for controlling associated gas are subject to R307-508.

(3) R307-511 does not apply to producing wells that are subject to an approval order issued under R307-401-8.

R307-511-4. Associated Gas Flaring Requirements.

(1) Associated gas from a completed well shall either be routed to a process unit, routed to a sales pipeline, or routed to an operating VOC control device except for the following condition:

(a) Under emergency release situations as defined in R307-511-2.

R307-511-5. Recordkeeping.

(1) The owner or operator shall maintain records for releases under R307-511-4(1)(a).

(a) The time and date of event, volume of emissions and any corrective action taken shall be recorded.

(b) These records shall be kept for a minimum of three years.

KEY: air quality, nonattainment, offset
Date of Enactment or Last Substantive Amendment: 2018
Authorizing, and Implemented or Interpreted Law: 19-2-104; 19-2-108

ITEM 7

State of Utah

GARY R. HERBERT
Governor

SPENCER J. COX
Lieutenant Governor

Department of
Environmental Quality

Alan Matheson
Executive Director

DIVISION OF AIR QUALITY
Bryce C. Bird
Director

DAQ-060-18

M E M O R A N D U M

TO: Air Quality Board

THROUGH: Bryce C. Bird, Executive Secretary

FROM: Bill Reiss, Environmental Engineer

DATE: August 27, 2018

SUBJECT: PROPOSE FOR PUBLIC COMMENT: Amend UTAH State Implementation Plan. Control Measures for Area and Point Sources, Fine Particulate Matter, Serious Area $PM_{2.5}$ SIP for the Salt Lake City, UT Nonattainment Area. Section IX. Part A.31

On December 14, 2009, EPA designated the Salt Lake City, UT PM2.5 Nonattainment Area. Utah was required to submit a Moderate Area nonattainment plan for the area that demonstrated either 1) attainment of the National Ambient Air Quality Standard (NAAQS) by an attainment date, established as December 31, 2015, or alternately 2) that attainment by such date was impracticable.

The plan submitted by Utah demonstrated the latter, and after the attainment date had arrived EPA determined that the area did not meet the NAAQS. This finding led to a re-classification of the SLC $PM_{2.5}$ nonattainment area from Moderate to Serious, and a new requirement for the state to submit a Serious Area State Implementation Plan (SIP) to the EPA.

A Serious Area SIP must insure Best Available Controls Measures and Technologies (BACM/BACT), and must include a demonstration of attainment no later than 10 years after the year in which the area had been initially designated (December 31, 2019).

The Division of Air Quality is proposing its plan to address these requirements. The BACM / BACT requirements have been addressed for stationary point sources in a companion piece of the SIP that the Board released for public comment in July. The demonstration of attainment includes a modeled evaluation of the airshed with respect to emission reductions expected in time for 2019. It is supplemented by additional information that comprises a weight of evidence that concludes the SLC nonattainment area will be able to demonstrate attainment of the 2006, 24-hour $PM_{2.5}$ health standard by the attainment date of December 31, 2019.

The plan includes necessary elements to support the demonstration, control strategy, and implementation of the plan. These elements include emissions inventories, mobile source emission budgets, quantitative milestones which demonstrate reasonable further progress toward attainment, and contingency measures.

Recommendation: Staff recommends that the Board propose SIP Subsection IX.A.31: Control Measures for Area and Point Sources, Fine Particulate Matter, Serious Area PM2.5 SIP for the Salt Lake, UT Nonattainment Area, for a 30-day public comment period.

UTAH

State Implementation Plan

Control Measures for Area and Point Sources, Fine Particulate Matter, Serious Area $PM_{2.5}$ SIP for the Salt Lake City, UT Nonattainment Area

Section IX. Part A.31

Adopted by the Utah Air Quality Board

December 5, 2018

Table of Contents

Acronyms

BACT	Best Available Control Technology
CAA	Clean Air Act
CFR	Code of Federal Regulations
CAMx	Comprehensive Air Quality Model with Extensions
CTG	Control Techniques Guideline Documents
DAQ	Utah Division of Air Quality (also UDAQ)
EPA	Environmental Protection Agency
FRM	Federal Reference Method
MACT	Maximum Available Control Technology
MATS	Model Attainment Test Software
MPO	Metropolitan Planning Organization
$\mu g/m^3$	Micrograms Per Cubic Meter
Micron	One Millionth of a Meter
NAAQS	National Ambient Air Quality Standards
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NH_3	Ammonia
NO_x	Nitrogen Oxides
NSPS	New Source Performance Standard
NSR	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
RACM	Reasonably Available Control Measures
RACT	Reasonably Available Control Technology
RFP	Reasonable Further Progress

1	SIP	State Implementation Plan
2	SMAT	Software for Model Attainment Test
3	SMOKE	Sparse Matrix Operator Kernal Emissions
4	SO_2	Sulfur Dioxide
5	SO_x	Sulfur Oxides
6	TSD	Technical Support Document
7	VOC	Volatile Organic Compounds
8	UAC	Utah Administrative Code
9	UWFPS	Utah Wintertime Fine Particulate Study
10	WRF	Weather Research and Forecasting

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Chapter 1 – INTRODUCTION AND BACKGROUND

1.1 Fine Particulate Matter

According to EPA's website, particulate matter, or PM, is a complex mixture of extremely small particles and liquid droplets. Particulate matter is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles.

The size of particles is directly linked to their potential for causing health problems. EPA is concerned about particles that are 10 micrometers in diameter or smaller because those are the particles that generally pass through the throat and nose and enter the lungs. Once inhaled, these particles can affect the heart and lungs and cause serious health effects. Other negative effects are reduced visibility and accelerated deterioration of buildings.

EPA groups particle pollution into two categories:

- "Inhalable coarse particles," such as those found near roadways and dusty industries, are larger than 2.5 micrometers and smaller than 10 micrometers in diameter. Utah has previously addressed inhalable coarse particles as part of its PM_{10} SIPs for Salt Lake and Utah Counties, but this fraction is not measured as $PM_{2.5}$ and will not be a subject for this nonattainment SIP.

- "Fine particles," such as those found in smoke and haze, are 2.5 micrometers in diameter and smaller and thus denoted as $PM_{2.5}$. These particles can be directly emitted from sources such as forest fires, or they can form when gases emitted from power plants, industries and automobiles react in the air.

PM concentration is reported in micrograms per cubic meter or $\mu g/m^3$. The particulate is collected on a filter and weighed. This weight is combined with the known amount of air that passed through the filter to determine the concentration in the air.

1.2 Health and Welfare Impacts of $PM_{2.5}$

Numerous scientific studies have linked particle pollution exposure to a variety of problems, including:

- increased respiratory symptoms, such as irritation of the airways, coughing, or difficulty breathing, for example;
- decreased lung function;
- aggravated asthma;
- development of chronic bronchitis;
- irregular heartbeat;
- nonfatal heart attacks; and
- pre-mature death in people with heart or lung disease.

People with heart or lung diseases, children and older adults are the most likely to be affected by particle pollution exposure. However, even healthy people may experience temporary symptoms from exposure to elevated levels of particle pollution.

1.3 Fine Particulate Matter in Utah

Excluding wind-blown desert dust events, wild land fires, and holiday related fireworks, elevated $PM_{2.5}$ in Utah occurs during the winter season when certain meteorological conditions create stagnant cold pools of air.

During a winter-time cold pool episode, dispersion is very poor due to the very stable air mass and $PM_{2.5}$ emissions become trapped in the valley. Furthermore, emissions of $PM_{2.5}$ precursors react quickly to create secondary PM and overall concentrations of primary and secondary $PM_{2.5}$ become elevated.

Cold pool episodes persist until meteorological conditions change to once again allow for good mixing. Episodes may last from a few days to tens of days.

The meteorological conditions that lead to the formation of cold pools in Utah's nonattainment areas are: synoptic scale ridging, subsidence, light winds, snow cover (often), and cool-to-cold surface temperatures. These conditions occur during winter months, generally mid-November through early March.

The scenario described above leads to exceedances and violations of the 2006, 24-hour health standard for $PM_{2.5}$. In other parts of the year concentrations are generally low, and even with the high peaks incurred during winter, average concentrations are well within the 2013, annual health standard for $PM_{2.5}$.

1.4 2006 NAAQS for $PM_{2.5}$

In September of 2006, EPA revised the (1997) National Ambient Air Quality Standards (NAAQS) for $PM_{2.5}$. While the annual standard remained unchanged at 15 $\mu g/m^3$, the 24-hr standard was lowered from 65 $\mu g/m^3$ to 35 $\mu g/m^3$.

DAQ has monitored $PM_{2.5}$ since 2000, and found that all areas within the state were in compliance with the 1997 standards. However, using the new 2006 standard as the benchmark, all or parts of five counties were found to be out of compliance with the 24-hr standard.

In 2013, EPA lowered the annual average to 12 $\mu g/m^3$. Monitoring data shows no instances of noncompliance with this revised standard.

1.5 $PM_{2.5}$ Nonattainment Areas in Utah

There are three distinct nonattainment areas for the 2006, 24-hour $PM_{2.5}$ standard. These are the Salt Lake City, UT, and Provo, UT nonattainment areas, which together encompass what is referred to as the Wasatch Front. A third nonattainment area is more or less geographically defined by the Cache Valley which straddles the border between Utah and Idaho (the Logan, UT – ID nonattainment area.) Figure 1.1 below shows the geographic extent of these areas.

None of these three areas has violated the annual NAAQS for $PM_{2.5}$. Without exception, the exceedances leading to 24-hr NAAQS violations are associated with relatively short-term meteorological occurrences.

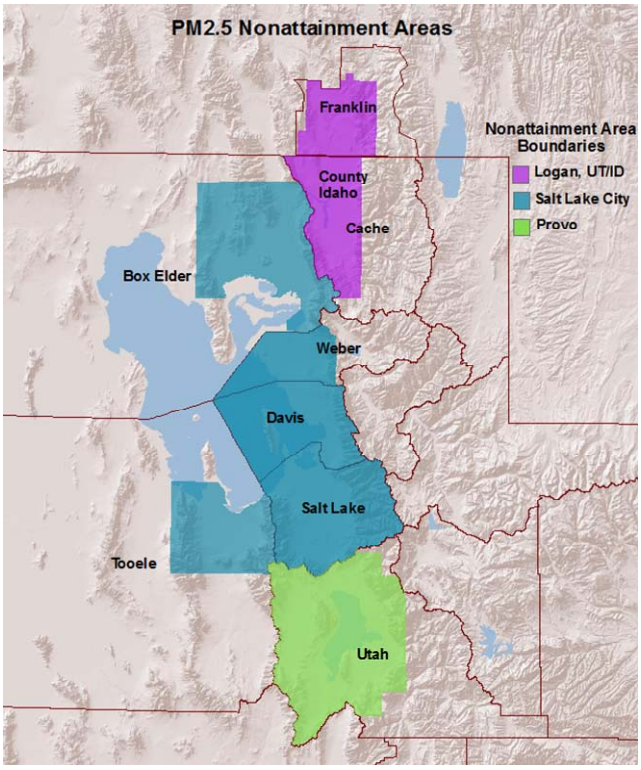


Figure 1.1, Nonattainment Areas for the 2006, $PM_{2.5}$ 24-hr. NAAQS

Each of these three areas was effectively designated as nonattainment on Dec. 14, 2009 by the EPA (74 FR 58688) based on weights of evidence belonging to the following nine factors:

- pollutant emissions
- air quality data
- population density and degree of urbanization

- traffic and commuting patterns
- growth
- meteorology
- geography and topography
- jurisdictional boundaries
- level of control of emissions sources

EPA also used analytical tools and data such as pollution roses, fine particulate composition monitoring data, back trajectory analyses, and the contributing emission score (CES) to evaluate these areas.

1.6 Reclassification to Serious

The EPA originally designated the Salt Lake City nonattainment area under the general provisions of CAA title I, part D, subpart 1 (''subpart 1''), under which attainment plans must provide for the attainment of a specific NAAQS (in this case, the 2006 $PM_{2.5}$ standards) as expeditiously as practicable, but no later than five years from the date the areas were designated nonattainment (December 14, 2014).

On December 11, 2013, Utah submitted a SIP that contained multiple area source rules intended to reduce emissions in the area. Subsequently, on January 4, 2013, the U.S. Court of Appeals for the District of Columbia Circuit held that the EPA should have implemented the 2006 24-hour $PM_{2.5}$ standard based on both the general nonattainment area requirements in subpart 1 and the PM-specific requirements of CAA title I, part D, subpart 4 (''subpart 4''). Under subpart 4, PM nonattainment areas are initially classified as Moderate, and Moderate area attainment plans must address the requirements of subpart 4 as well as subpart 1. Additionally, CAA subpart 4 establishes a different SIP submittal due date and attainment year. For a Moderate $PM_{2.5}$ nonattainment area, the attainment SIP is due no later than 18 months after designation and the attainment year is as expeditiously as practicable after designation but no later than the end of the sixth calendar year after designation (December 31, 2015).

On June 2, 2014 (79 FR 31566), the EPA finalized the Identification of Nonattainment Classification and Deadlines for Submission of State Implementation Plan (SIP) Provisions for the 1997 Fine Particulate ($PM_{2.5}$) NAAQS and 2006 $PM_{2.5}$ NAAQS (''the Classification and Deadlines Rule''). This rule classified the areas that were designated in 2009 as nonattainment to Moderate, and set the attainment SIP submittal due date for those areas at December 31, 2014. This rule did not affect the Moderate area attainment date of December 31, 2015.

After the court's decision, the Utah Department of Air Quality (UDAQ) withdrew all prior Salt Lake City, UT $PM_{2.5}$ SIP submissions and submitted a new SIP to address both the general requirements of subpart 1 and the PM-specific requirements of subpart 4 for Moderate areas[1]. The modeled attainment

[1] The Moderate Area SIP for the Salt Lake City, UT $PM_{2.5}$ nonattainment area was adopted by the Utah Air Quality Board on December 3, 2014 and submitted to the EPA on December 22, 2014. The narrative appears in the SIP at Section IX.A.21 and the Emission Limits and Operating Practices which apply to specific stationary sources located in the nonattainment area are listed in Section IX. Part H. 11 and 12.

demonstration underlying the new Moderate Area SIP made its assessment concerning attainment by the applicable attainment date (December 31, 2015), and concluded that it would be impracticable to do so.

After reaching the statutory attainment date, the EPA is compelled to determine whether the area has or has not achieved compliance with the standard by evaluating the prior three years of quality assured data. That determination was published on May 10, 2017 (89 FR 21711) and concluded that the Salt Lake City nonattainment area did not reach attainment of the 2006 24-hour standard by its attainment date, and would therefore be effectively re-classified from a Moderate $PM_{2.5}$ nonattainment area to a Serious $PM_{2.5}$ nonattainment area as of June 9, 2017.

Under subpart 4 of the CAA, Serious PM nonattainment areas require, in addition to the provisions submitted to meet the Moderate area planning requirements, the submittal of a SIP revision that: 1) provides for attainment of the applicable NAAQS no later than the end of the 10^{th} calendar year after the area's designation as nonattainment (December 31, 2019), and 2) includes provisions to assure that the Best Available Control Measures for the control of $PM_{2.5}$ shall be implemented no later than four years after the date the area is re-classified as a Serious Area.

On August 24, 2016, the EPA finalized the Fine Particulate Matter National Ambient Air Quality Standards: State Implementation Plan Requirements (''$PM_{2.5}$ Implementation Rule''), 81 FR 58010, which addressed the January 4, 2013 court ruling. The final implementation rule provides the EPA's interpretation of the requirements applicable to $PM_{2.5}$ nonattainment areas and explains how air agencies can meet the statutory SIP requirements that apply under subparts 1 and 4 to areas designated nonattainment for any $PM_{2.5}$ NAAQS. These statutory requirements are further addressed in Chapter 2.

1.7 $PM_{2.5}$ Precursors

The majority of ambient $PM_{2.5}$ collected during a typical cold-pool episode of elevated concentration is secondary particulate matter, born of gaseous precursor emissions. $PM_{2.5}$ precursors include sulfur dioxide (SO_2), oxides of nitrogen (NO_x), volatile organic compounds (VOC), and ammonia (NH_3).

Clean Air Act Section 189(e) requires that the control requirements applicable in plans for major stationary sources of PM_{10} shall also apply to major stationary sources of PM_{10} precursors, except where the Administrator determines that such sources do not contribute significantly to PM_{10} levels which exceed the standard in the area.

The new $PM_{2.5}$ Implementation Rule interprets this requirement as it applies to $PM_{2.5}$. As part of this rule, a state may elect to submit one or more demonstrations to assert that reducing the emission level of a particular precursor will not result in a significant benefit to the area in terms of $PM_{2.5}$ concentrations. Generally speaking, if a state elects to do so and the EPA subsequently approves the demonstration, the state would not be required to include emission controls for that precursor in its SIP control strategy.

Utah has not included any such demonstration with this Serious Area SIP submittal. As such, the requirement to ensure the implementation of best available control measures applies to emissions of $PM_{2.5}$ and to each of the four $PM_{2.5}$ precursors listed above. As such, each of these $PM_{2.5}$ precursors is also defined as a $PM_{2.5}$ plan precursor within the Salt Lake City, UT $PM_{2.5}$ nonattainment area.

Chapter 2 – REQUIREMENTS FOR 2006, $PM_{2.5}$ PLAN REVISIONS

2.1 Requirements for Nonattainment SIPs

Section 110 of the Clean Air Act lists the requirements for implementation plans. Many of these requirements speak to the administration of an air program in general. Section 172 of the Act contains the plan requirements for nonattainment areas in general.

The Clean Air Act also contains provisions, at Subpart 4 of Part D, that apply specifically to PM_{10} nonattainment areas. On January 4, 2013, D.C. Circuit Court of Appeals found that these provisions should also apply to $PM_{2.5}$ nonattainment areas.

Under Subpart 4, nonattainment areas for particulate matter may carry the classification of either moderate or serious. Addressed therein are the attainment dates and planning provisions for both moderate and serious areas. Of note is that the planning requirements for serious areas are *in addition to* those required for moderate areas.

EPA's new $PM_{2.5}$ Implementation Rule interprets the requirements of Subpart 4 as they apply to $PM_{2.5}$. In particular, this rulemaking (81 FR 58010) recodifies Subpart Z of 40 CFR Part 51 ("Provisions for Implementation of $PM_{2.5}$ National Ambient Air Quality Standards") which had been revoked as part of the January 4, 2013 Court ruling. Subpart Z details what is required of plan revisions addressing both moderate and serious $PM_{2.5}$ nonattainment areas.

Utah has already addressed the moderate area planning requirements in the SIP it adopted on December 3, 2014. This SIP will now address the serious area requirements as articulated in Subpart Z.

This Serious Area implementation plan was developed to meet the requirements specified in the law, rule, and appropriate guidance documents identified above. Some of the more notable requirements that pertain to this SIP include:

- A demonstration, including air quality modeling, that the plan provides for attainment of the applicable NAAQS no later than the end of the 10th calendar year after the area's designation as nonattainment (December 31, 2019)
- A comprehensive base-year inventory of actual emissions as well as a projected inventory of emissions in the attainment year
- Provisions for the implementation of Best Available Control Measures including Technologies (BACM / BACT) no later than 4 years after the date the area is re-classified as a Serious Area
- Enforceable emission limits as well as schedules for compliance
- Transportation Conformity, including motor vehicle emission budgets
- Quantitative Milestones that demonstrate Reasonable Further Progress (RFP) toward attainment of the National Ambient Air Quality Standards by the applicable attainment date
- Contingency measures to be undertaken if the area fails to make reasonable further progress or attain the NAAQS by the applicable attainment date

Additional information is provided in the technical support document (TSD).

Chapter 3 – Ambient Air Quality Data

3.1 Measuring Fine Particle Pollution in the Atmosphere

Utah has monitored $PM_{2.5}$ in its airsheds since 2000, following the promulgation of the 1997, $PM_{2.5}$ NAAQS which was set at 65 $\mu g/m^3$ for a 24-hour averaging period. $PM_{2.5}$ concentrations, especially during Utah's wintertime cold pool episodes, tend to be regionally homogenous within a specific airshed. This means that just a few monitors can adequately determine compliance with the NAAQS for these airsheds. UDAQ's monitors are appropriately located to assess concentration, trends, and changes in $PM_{2.5}$ concentrations. During Utah's wintertime temperature inversions, every day sampling and real time monitoring are needed public notification and for subsequent air quality modeling.

3.2 Utah's Air Monitoring Network

The Air Monitoring Section maintains an ambient air monitoring network in Utah that collects both air quality and meteorological data. Figure 3.1 shows the location of sites along the Wasatch Front and in the Cache Valley that collect $PM_{2.5}$ data.

Data collected at three of the sites along the Wasatch Front is analyzed to determine the various species of $PM_{2.5}$ that collectively make up the total mass. Particulate matter collected on the speciation filters is analyzed for organic and inorganic carbon and a list of 48 elements. $PM_{2.5}$ speciation data is particularly useful in helping to identify sources of particulate matter.

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.

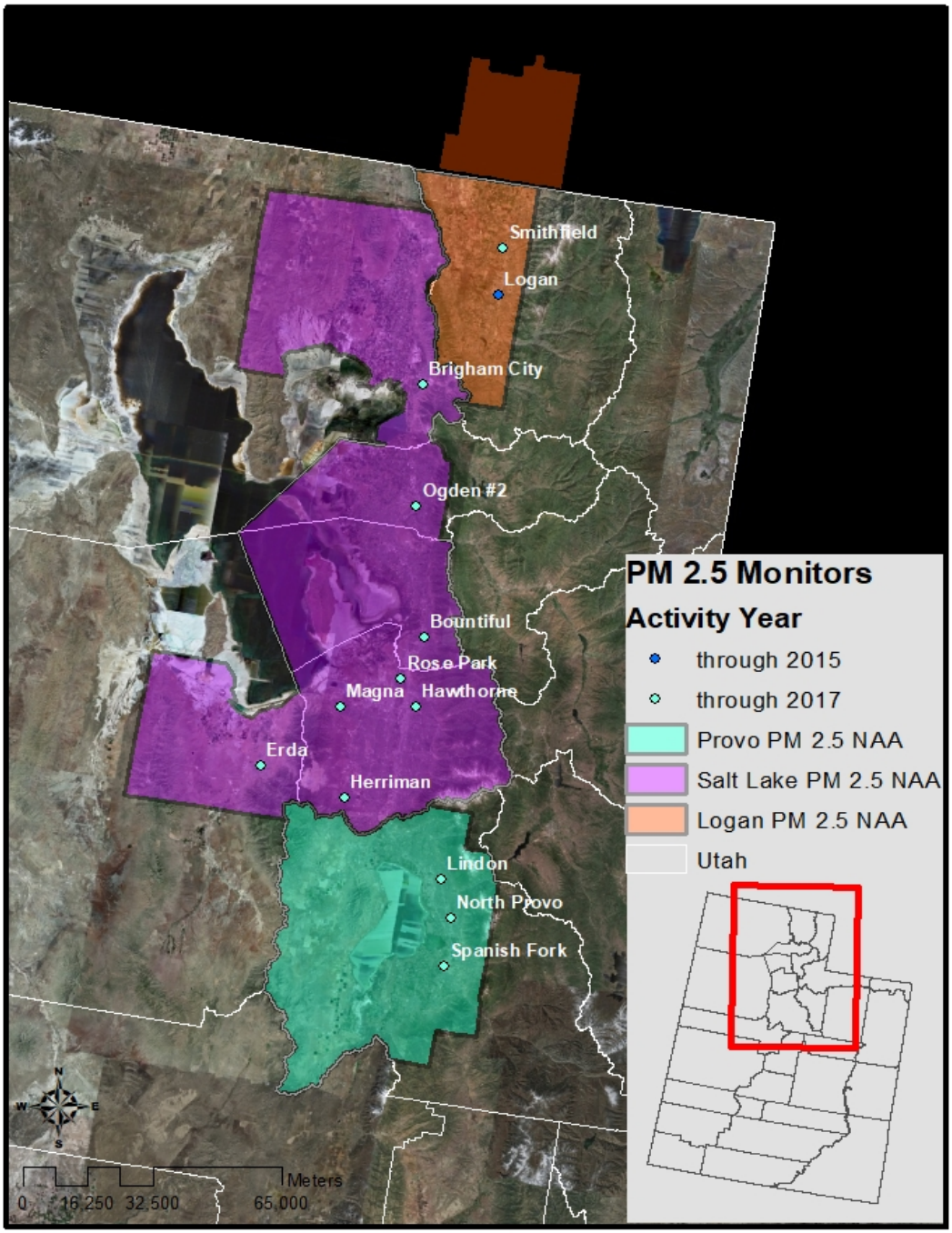


Figure 3.1, Utah's $PM_{2.5}$ Air Monitoring Network

3.3 Data Handling

$PM_{2.5}$ collected on filter media must be weighed and calibrated in order that a concentration may be determined for a 24-hour period. Once determined, the data is entered into a database maintained by the EPA (called AQS). In order to be used for regulatory purposes, data determined from filters must include verification that it was handled in accordance with certain quality assurance specifications; among these are appropriate ranges of temperature and relative humidity (RH) within which the processing must take place. A routine audit of Utah's air quality data collected from 2013 - 2015 identified numerous instances for which the temperature and RH parameters were either not recorded at all or were recorded outside of their specified range. It appeared, therefore, that this data could not be used for regulatory purposes. Particularly important was data collected in 2015, one of the years used to construct a monitored design value for this SIP.

The form of the $PM_{2.5}$ NAAQS takes into consideration the percentage of data captured throughout each calendar quarter. There is a general expectation that at least 75% of the data scheduled for collection will actually be captured. The degree of data capture affects what value will be entered into the AQS database for comparison with the NAAQS. If data capture is poor, a higher more conservative value will be selected for use, particularly with respect to the 24-hour value denoted as the 98^{th} percentile.

Further investigation into the suspect temperature and RH values identified the problem as a software error that affected the recording of the values measured by the filter robot rather than the values themselves. Data handling procedures allow for the substitution of temperature and RH data from other sources, and by substituting the temperature and RH data from instruments situated in the room within which the filter robot operates, UDAQ has been able to recover most of the suspect filter data from 2015. The entire problem had been rectified by 2016.

The number of filters recovered from the 2015 data record sits at four or five hundred. Priority was given to those filters that most directly affected this SIP. Still, there are more filters that UDAQ would like to recover, and this work will continue for some time after this SIP has been completed. This means that there will continue to be some discrepancies between the $PM_{2.5}$ values reported herein and the values one may access in the AQS database. In order that a filter becomes fully recovered, EPA must remove a (null) code associated with each filter record.

Another reason the $PM_{2.5}$ values reported in this SIP may not match the values appearing in AQS concerns data flagged by UDAQ resulting from an exceptional event. Until EPA affixes a second flag indicating that it has concurred with UDAQ's assertion, the data will be considered useful for regulatory purposes. This will be discussed further in Chapter 6.

3.4 Annual $PM_{2.5}$ – Mean Concentrations

The procedure for evaluating $PM_{2.5}$ data with respect to the NAAQS is specified in Appendix N to 40 CFR Part 50. Generally speaking, the annual $PM_{2.5}$ standard is met when a three-year average of annual mean values is less than or equal to 12.0 $\mu g/m^3$. Each annual mean is itself an average of four quarterly averages.

Table 3.1, below shows the mean values for 2015, 2016, and 2017. These are the years surrounding 2016, the year for which the baseline modeling inventory was prepared. It also shows the 3-year average of those values, as a comparison against the NAAQS for each of Utah's monitoring locations. All locations are in compliance with the annual NAAQS.

		Annual Mean Values (µg/m3)			3-Yr Average (µg/m3)
Location	**County**	**2015**	**2016**	**2017**	
Logan	Cache	7.3			**7.3**
Smithfield	Cache	5.5	7.6	7.9	**7.0**
Brigham City	Box Elder	5.6	7.4	8.5	**7.1**
Ogden 2	Weber	9.7	9	7.3	**8.6**
Bountiful	Davis	6.5	8	9	**7.8**
Magna	Salt Lake	7.1	7.1	7.3	**7.1**
Hawthorne	Salt Lake	7.4	7.9	8.2	**7.8**
Rose Park	Salt Lake	8.7	9.4	7.8	**8.6**
Herriman 3	Salt Lake		4.6	5.7	**5.1**
Erda	Tooele		6.3	6.5	**6.4**
North Provo	Utah	7	8.2	5	**6.7**
Lindon	Utah	7.4	8.8	8.4	**8.2**
Spanish Fork	Utah	6.5	7.4	7.3	**7.0**

Table 3.1, $PM_{2.5}$ Annual Mean Concentrations

3.5 24-hour $PM_{2.5}$ – Averages of 98th Percentiles and Monitored Design Values

The procedure for evaluating $PM_{2.5}$ data with respect to the NAAQS is specified in Appendix N to 40 CFR Part 50. Generally speaking, the 24-hr. $PM_{2.5}$ standard is met when a 3-year average of 98th percentile values is less than or equal to 35 µg/m^3. Each year's 98th percentile is the daily value beneath which 98% of all daily values would fall.

Table 3.2, below shows the 98th percentile values for 2015, 2016, and 2017. These are the years surrounding 2016, the year for which the baseline modeling inventory was prepared. It also shows the 3-year average of those values, as a comparison against the NAAQS for each of Utah's monitoring locations. It can be seen from the data that the 24-hr. NAAQS is violated at the Rose Park monitoring location. This SIP has been structured to specifically address the 24-hr. standard.

It is important to note that the data in **Tables 3.1 and 3.2** excludes several values from 2017, at certain stations, that were flagged by UDAQ as having been affected by wildland fire or fireworks. UDAQ expects that EPA will eventually concur with UDAQ's flags, thereby excluding them from regulatory use. Two such values were measured at Rose Park, and would therefore affect the 98th percentile value for that

year. No exceptional events were flagged at the Hawthorne site. EPA has indicated to UDAQ that it is appropriate to exclude these values from the design values calculated in this SIP.

		98th Percentile Values (µg/m3)			3-Yr Average (µg/m3)
Location	**County**	**2015**	**2016**	**2017**	
Logan	Cache	29.0			**29.0**
Smithfield	Cache	28.9	34.0	36.0	**32.9**
Brigham City	Box Elder	26.7	34.8	34.4	**31.9**
Ogden 2	Weber	32.9	39.0	25.3	**32.4**
Bountiful	Davis	29.2	24.7	35.2	**29.7**
Magna	Salt Lake	22.9	30.7	30.1	**27.9**
Hawthorne	Salt Lake	28.8	38.4	35.7	**34.3**
Rose Park	Salt Lake	33.3	43.2	32.4	**36.3**
Herriman 3	Salt Lake		24.9	28.2	**26.5**
Erda	Tooele		25.1	20.5	**22.8**
North Provo	Utah	25.0	36.6	21.9	**27.8**
Lindon	Utah	27.3	36.3	27.6	**30.4**
Spanish Fork	Utah	28.1	29.2	27.6	**28.3**

Table 3.2, 24-hour $PM_{2.5}$ Monitored Design Values

As mentioned in the foregoing paragraph, this SIP is structured to address the 24-hr. $PM_{2.5}$ NAAQS. EPA's modeling guidance[1] prescribes a modeled attainment test that includes a monitored baseline design value for each monitoring location. It notes that the design values should be consistent with the form of the applicable NAAQS. The 24-hour $PM_{2.5}$ NAAQS is based on a 3-year average of 98th percentile values. The modeling guidance suggests several possible methodologies to calculate baseline design values, including a 3-year average that coincides with the years used to designate the area to nonattainment as well as a 3-year average that straddles the baseline inventory year. In this case, the area was designated as nonattainment in 2006, too long ago for those years to still be considered representative. However, the three years used to construct the design values (2015 – 2017) straddle the baseline inventory year (2016) and include 2015, one of the years used to reclassify the area from moderate to serious.

[1] Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze (EPA -454B-07-002, April 2007)

3.6 Composition of Fine Particle Pollution – Speciated Monitoring Data

DAQ operates three $PM_{2.5}$ speciation sites. The Hawthorne site in Salt Lake County is one of 52 Chemical Speciation Network sites (CSN) operated nationwide on an every-third-day sampling schedule. Sites at Bountiful/Viewmont in Davis County and Lindon in Utah County are State and Local Air Monitoring Stations (SLAMS) $PM_{2.5}$ speciation sites that operate on an every-sixth-day sampling schedule.

Filters are prepared by the EPA contract laboratory and shipped to Utah for sampling. Samples are collected for particulate mass, elemental analysis, identification of major cations and anions, and concentrations of elemental and organic carbon as well as crustal material present in $PM_{2.5}$. Carbon sampling and analysis changed in 2007 to match the Interagency Monitoring of Protected Visual Environments (IMPROVE) method using a modified IMPROVE sampler at all sites.

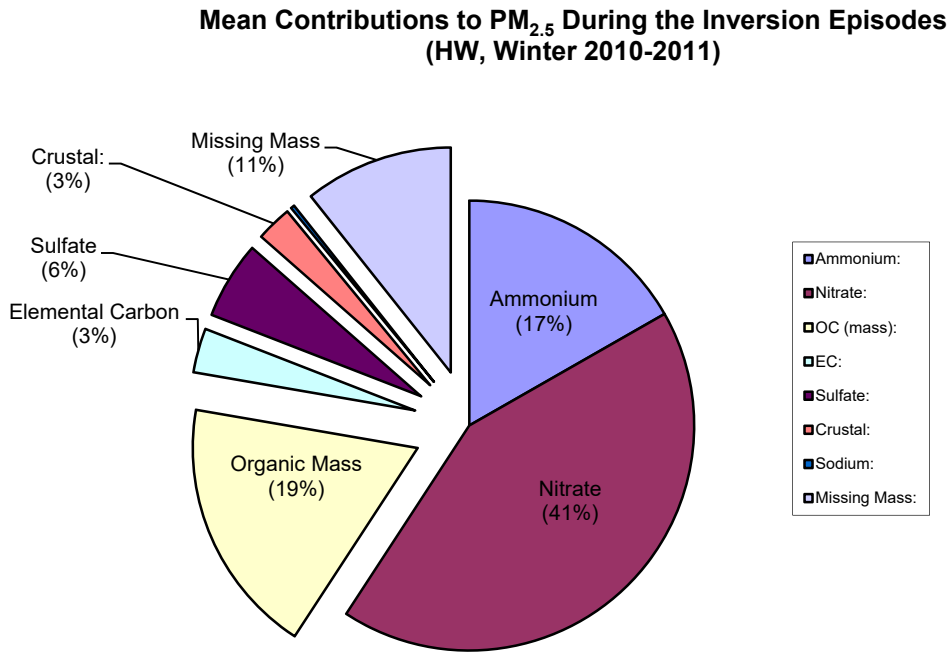
The $PM_{2.5}$ is collected on three types of filters: Teflon, nylon, and quartz. Teflon filters are used to characterize the elemental content of $PM_{2.5}$. Nylon filters are used to quantify the amount of major inorganic ions, and quartz filters are used to quantify the organic and elemental carbon content in the ambient $PM_{2.5}$.

Data from the speciation network show the importance of volatile secondary particulates, particularly ammonium nitrate, during the colder months. A significant number of these particles are lost in FRM $PM_{2.5}$ sampling.

During the winter periods between 2009 and 2011, UDAQ conducted special winter speciation studies aimed at better characterization of $PM_{2.5}$ during the high pollution episodes. These studies were accomplished by shifting the sampling of the Chemical Speciation Network monitors to 1-in-2-day schedule during the months of January and February. Speciation monitoring during the winter high-pollution episodes produced similar results in $PM_{2.5}$ composition each year.

The results of the speciation studies led to the conclusion that the exceedances of the $PM_{2.5}$ NAAQS are a result of the increased portion of the secondary $PM_{2.5,}$ mainly ammonium nitrate, that was chemically formed in the air and not primary $PM_{2.5}$ emitted directly into the troposphere.

Figure 3.2 below shows the contribution of the identified compounds from the speciation sampler both during a winter temperature inversion period and during a well-mixed winter period.



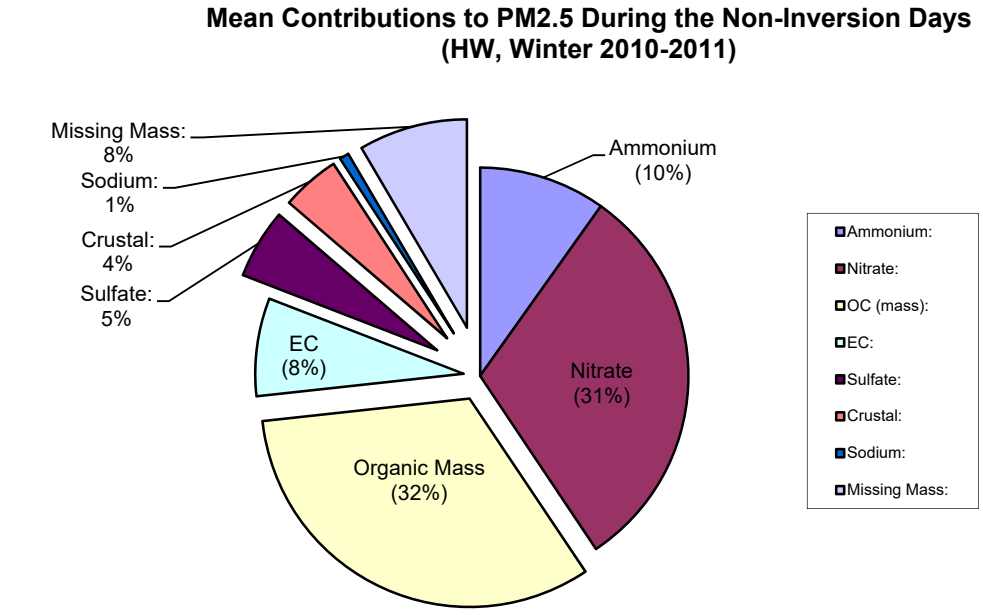


Figure 3.2, Composite Wintertime $PM_{2.5}$ Speciation Profiles

3.7 Utah Winter Fine Particulate Study (UWFPS)

The Utah Winter Fine Particulate Study aimed to address the scientific uncertainties surrounding winter $PM_{2.5}$ pollution. The study took place during the winter of 2017, during which NOAA's specially equipped light aircraft known as the Twin Otter flew over the Cache, Salt Lake, and Utah valleys to survey the chemical conditions responsible for the formation of $PM_{2.5}$. This study was a collaborative project between scientists from the Division of Air Quality, the National Oceanic and Atmospheric Administration (NOAA) Earth System Research Laboratory (ESRL) and the Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado Boulder, the Environmental Protection Agency (EPA), United States Department of Agriculture (USDA), University of Utah, University of Washington, University of Toronto, University of Minnesota, Utah State University, and Brigham Young University. The survey looked to investigate the chemistry, transport, and spatial and vertical distribution of species relevant to particulate formation.

Seven multi-day pollution episodes with elevated $PM_{2.5}$ were observed during 2016 – 2017 winter. Two dominating episodes with multiple NAAQS exceedances occurred during the UWFPS period, providing an opportunity to study the chemical and meteorological conditions during and outside pollution episodes in different environments and examine the temporal, spatial, and vertical variability of chemical conditions. Consistent with prior studies ammonium nitrate was found to dominate the $PM_{2.5}$ mass. One of the main questions with respect to ammonium nitrate is the attribution of the limiting reagents in each of the three valleys. The study found that Cache Valley is nitrate limited, while Salt Lake and Utah Valleys are predominately nitrate limited, but also may have periods where they are ammonium limited. Salt Lake Valley is the least nitrate limited and often is ammonium limited later in a persistent cold air pool episode.

Additionally, during the study high time resolution ammonia measurements were taken aboard the Twin Otter in Cache Valley, and some limited continuous ammonia measurements were taken along the Wasatch Front. Passive ammonia measurements were also collected in all three valleys in Utah. Ammonia concentrations were generally found to be much higher in the Cache valley compared to the Wasatch Front, and ammonia levels in the Salt Lake Valley were on average lower than in Utah Valley. This high level of spatial variability is in disagreement with the current inventory which shows comparable inventories for Cache, Utah, and Salt Lake Counties, indicating a potential misrepresentation of ammonia sources in the inventory. These same spatial discrepancies were not seen for the nitrogen oxide emissions inventory[1]. While limited, VOCs and halogens measurements were also collected during this study. These measurements highlighted the important role of VOCs and halogens in wintertime $PM_{2.5}$ formation and provided information on their potential sources. VOCs and halogens, particularly nitryl chloride ($ClNO_2$), act as radical sources important for the photochemical production of $PM_{2.5}$.

[1] Baasandorj, M., Brown, S., Hoch, S., Crosman, E., Long, R., Silva, P., . . . Eatough, D. (2018). 2017 Utah Winter Fine Particulate Study Final Report. Retrieved from https://documents.deq.utah.gov/air-quality/planning/technical-analysis/research/northern-utah-airpollution/utah-winter-fine-particulate-study/DAQ-2018-004037.pdf

The chemical pathway where $ClNO_2$ is formed through the heterogeneous uptake of N_2O_5 on chloride-containing particles is also particularly active in the Salt Lake Valley. HCl also plays an important role in $PM_{2.5}$ formation. In the presence of excess ammonia, HCl will partition to aerosol particles forming ammonium chloride, with ammonium chloride accounting for up to 15% of $PM_{2.5}$ mass during high wintertime $PM_{2.5}$ pollution episodes[1].

While the UWFPS has shed light on many questions surrounding $PM_{2.5}$ formation, continued research and further analysis of the collected data is needed to reach more definitive findings regarding sources and processes leading to winter fine particulate matter in northern Utah and elsewhere.

[1]Kelly, K.E., R. Kotchenruther, R. Kuprov, and G.D. Silcox, Receptor model source attributions for Utah's Salt Lake City airshed and the impacts of wintertime secondary ammonium nitrate and ammonium chloride aerosol. Journal of the Air & Waste Management Association, 2013. 63(5): p. 575-590.

Chapter 4 – EMISSION INVENTORY DATA

4.1 Introduction

The emissions inventory is one means used by the state to assess the level of pollutants and precursors released into the air from various sources. The methods by which emissions inventories are collected and calculated are constantly improving in response to better analysis and more comprehensive rules. The inventories underlying this SIP were compiled using the best information available.

The sources of emissions that were inventoried may be discussed as belonging to four general categories: industrial point sources; on-road mobile sources; off-road mobile sources; and area sources which represent a collection of smaller, more numerous point sources, residential activities such a home heating, and in some cases biogenic emissions.

This SIP is concerned with $PM_{2.5}$, both primary in its origin and secondary, referring to its formation removed in time and space from the point of origin for certain precursor gasses. Hence, the pollutants of concern for inventory development purposes included $PM_{2.5}$, SO_2, NO_x, VOC, and NH_3.

On-road mobile sources are inventoried using EPA's MOVES2014a model, in conjunction with information generated by travel demand models such as vehicle speeds and miles traveled. The inventory information is calculated in units of tons per day, adjusted for winter conditions. Emissions from the other three categories are calculated in terms of tons per year.

Prior to use in the air quality model, the emissions are pre-processed to account for the seasonality of Utah's difficulty with secondary $PM_{2.5}$ formation during winter months. These temporal adjustments also account for daily and weekly activity patterns that affect the generation of these emissions.

EPA's $PM_{2.5}$ Implementation Rule requires that the emission values shall be either: annual total emissions, average-season-day, or both, as appropriate for the relevant $PM_{2.5}$ NAAQS.

Utah's long-running difficulties with fine PM may be characterized as a short-term (24-hour NAAQS) problem belonging to the winter months when meteorological conditions are conducive to the both the trapping of air in the valleys due to temperature inversions and to the secondary formation of $PM_{2.5}$. SIP analyses inventories have historically been adjusted to reflect this seasonality.

"Average-season-day emissions" are defined, in 40 CFR 51.1000, as the sum of all emissions during the applicable season divided by the number of days in that season.

Again, Utah's inventory is compiled using a variety of different averaging periods. The inventory is then gridded into the air model, using a pre-processor called SMOKE, along with an hourly temporal component for each 24 hour period. Emissions may then be extracted from SMOKE and reported in consistent time averaged units of "tons-per-day".

Each projection of the emissions inventory will be modeled with meteorology reflecting the actual episode used to validate the air quality model. This episode, spanning 11 days, was incurred from Friday, December 31 through Monday, January 10, 2011.

Thus, Utah's SIP will report, in its narrative, average-season-day emissions, with the definition of season spanning the 2011 episode. Original EI calculations will be included as part of the Technical Support Document (TSD).

There are various time horizons that are significant to the development of this SIP. It is first necessary to look at actual emissions incurred during past episodes of elevated $PM_{2.5}$ concentrations in order to develop the air quality model. The episodes studied as part of the SIP occurred in 2011, 2013, and 2016. It is then necessary to look several years into the future when developing emission control strategies. The significant time horizon for this plan relates to the statutory attainment date, December 31, 2019. A projected inventory is prepared for 2019 and then compared with a baseline inventory that is contemporaneous with the monitored design values discussed in Section 3.4. In this case the baseline is represented by the year 2016. In addition, it will be necessary to evaluate progress towards attainment by looking at specific milestone years. In this case there are two significant mileposts; 2017 and 2020. Inventories must be prepared to evaluate all of these time horizons.

4.2 The 2014 Emissions Inventory

The forgoing paragraph identified numerous points in time for which an understanding of emissions to the air is important to plan development. The basis for each of these assessments was the 2014 tri-annual inventory. This inventory represented, at the time it was selected for use, the most recent comprehensive inventory compiled by UDAQ. In addition to the large major point sources that are required to report emissions every year, the tri-annual inventories consider emissions from many more, smaller point sources. These inventories are collected in accordance with state and federal rules that ensure proper methods and comprehensive quality assurance.

Thus, to develop other inventories for each of the years discussed above, the 2014 inventory was either back-cast and adjusted for certain episodic conditions, or forecast to represent more typical conditions.

4.3 Geographic Area: Nonattainment Areas and Modeling Domain

As said at the outset, an emissions inventory provides a means to assess the level of pollutants and precursors released into the air from various sources. This in turn allows for an overall assessment of a particular airshed.

The modeling analysis used to support this SIP considers a regional domain that encompasses three distinct airsheds belonging to three distinct $PM_{2.5}$ nonattainment areas; The Cache Valley (the Logan UT/ID nonattainment area), the central Wasatch Front (Salt Lake City, UT nonattainment area), and the southern Wasatch Front (Provo, UT nonattainment area).

Within each nonattainment area greater attention will be given to the accuracy of the inventories. For example, point sources will be included at a threshold of 70 tons per year inside these areas, while outside the threshold will be 100 tpy. On-road mobile source emissions will make use of travel demand models in the nonattainment areas to make projections of Vehicle Miles Traveled. This is not possible in the outlying areas.

The actual modeling domain will encompass a much greater geographical area to ensure that all pollutants, including short-range transported pollutants, are included in the modeling process. This

additional area encompasses the remaining 22 counties in Utah and some additional areas in Nevada, Arizona, New Mexico, Colorado, Wyoming, and Idaho. See **Figure XX in Chapter 6**.

In some ways, these outlying areas will be inventoried at a lesser level of detail than the non-attainment areas. UDAQ will compile information directly for all areas of the state. By source category, this includes Point Sources, Area Sources, and Mobile Sources (both on-road and off). By contrast, UDAQ will import National Emissions Inventory (NEI) data from the EPA's website to fill in the outlying areas in other states.

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

Table 4.1 is specific to the Salt Lake City, UT nonattainment area, and shows actual emissions for the baseline year (2016), as well as projected emissions for the attainment year (2019), and each of two "milestone years" (2017 and 2020). All projections incorporate assumptions concerning growth in population and vehicle miles traveled. They also include the effects of emissions control strategies that are either already promulgated or will be required as part of the SIP. Emissions modeled for the remainder of the modeling domain are contained in the Technical Support Document.

Emissions [tons/day]	Sector	PM2.5	NOx	VOC	NH3	SO2
2016 Base Year	Area Sources	6.13	13.63	45.96	14.22	0.17
	Mobile Sources	4.98	55.38	31.84	1.29	0.41
	NonRoad Sources	1.01	16.41	8.70	0.02	0.32
	Point Sources	3.26	18.18	5.25	0.44	4.70
	Total	**15.38**	**103.61**	**91.74**	**15.97**	**5.60**
2017 Milestone Year	Area Sources	6.19	13.57	46.02	14.21	0.22
	Mobile Sources	5.02	52.53	30.87	1.30	0.43
	NonRoad Sources	0.96	15.77	8.47	0.02	0.33
	Point Sources	3.58	18.32	6.13	0.44	4.61
	Total	**15.75**	**100.18**	**91.48**	**15.97**	**5.59**
2019 Attainment Year	Area Sources	6.23	11.84	44.34	14.21	0.22
	Mobile Sources	4.78	44.02	27.26	1.25	0.43
	NonRoad Sources	0.88	15.18	9.01	0.02	0.35
	Point Sources	4.25	23.86	6.21	0.48	3.90
	Total	**16.13**	**94.90**	**86.82**	**15.96**	**4.89**
2020 Milestone Year	Area Sources	6.24	9.54	43.73	14.20	0.20
	Mobile Sources	4.68	40.38	25.42	1.23	0.42
	NonRoad Sources	0.82	14.08	8.10	0.02	0.36
	Point Sources	4.26	23.86	6.22	0.49	3.90
	Total	**16.00**	**87.86**	**83.47**	**15.94**	**4.88**

Table 4.1, Emissions Summaries for the Salt Lake City, UT $PM_{2.5}$ Nonattainment Area; Baseline, Milestone and Attainment Years (SMOKE). Emissions are presented in tons per average-episode-day.

All estimates are calculated from the Sparse Matrix Operator Kernel Model (SMOKE) and presented in units of tons per average-episode-day. More detailed inventory information may be found in the Technical Support Document (TSD).

Table 4.2 is specific to the point sources located within the Salt Lake, UT nonattainment area, and shows actual emissions for the baseline year (2016), as well as projected emissions for the attainment year (2019), and each of two "milestone years" (2017 and 2020). All projections incorporate assumptions concerning growth and also include the effects of emissions control strategies that are either already promulgated or will be required as part of the SIP.

	2016 Emissions					2017 Emissions				
Site Name	$PM_{2.5}$ (tons/yr)	SO_X (tons/yr)	NO_X (tons/yr)	VOC (tons/yr)	NH_3 (tons/yr)	$PM_{2.5}$ (tons/yr)	SO_X (tons/yr)	NO_X (tons/yr)	VOC (tons/yr)	NH_3 (tons/yr)
*ACH Foam Technologies	0.05	0.00	0.67	75.82	0.00	0.05	0.00	0.67	75.82	0.00
ATK Launch Systems - Promontory	19.13	1.86	44.84	31.18	0.44	19.13	1.86	44.84	31.18	0.44
Big West Oil - Flying J Refinery	10.64	43.14	92.31	307.37	4.37	10.64	43.14	92.31	307.37	4.37
*Bimbo Bakeries USA Salt Lake City Plant	0.20	0.02	2.64	79.44	0.08	0.20	0.02	2.64	79.44	0.08
*Brigham Young University- Main Campus	3.35	117.92	151.21	5.07	0.54	3.35	117.92	151.21	5.07	0.54
Chevron Products Co - Salt Lake Refinery	33.99	23.62	260.87	304.98	8.90	33.99	23.62	260.87	304.98	8.90
Compass Minerals Ogden Inc. - Production Plant	80.50	9.81	134.50	72.82	3.61	80.50	9.81	134.50	72.82	3.61
*Geneva Nitrogen Inc.- Geneva Nitrogen Plant	28.28	0.00	109.14	0.02	2.70					
Hexcel Corporation- Salt Lake Operations	72.96	37.80	169.38	163.81	84.98	70.99	42.42	175.58	161.43	85.53
Hill Air Force Base - Main Base	8.45	4.01	151.42	126.36	1.45	26.10	34.14	283.95	306.86	1.45
Holly Corp- HRMC and HEP Woods Cross Operations	13.27	109.96	181.71	157.86	17.82	13.27	109.96	181.71	157.86	17.82
Kennecott Utah Copper LLC- Mine & Copperton Concentrator	274.05	1.99	4,199.63	213.70	1.75	274.05	1.99	4,199.63	213.70	1.75
Kennecott Utah Copper LLC- Power Plant Lab Tailings Impoundment	71.78	1,500.34	1,322.52	8.21	0.24	49.90	914.68	652.45	6.17	0.17
Kennecott Utah Copper LLC- Smelter & Refinery	421.19	704.35	160.21	10.37	5.62	421.19	704.35	160.21	10.37	5.62
Lhoist North America - Grantsville Plant	0.25	0.02	0.21	0.14	0.00	0.25	0.02	0.21	0.14	0.00
McWane Ductile - Utah	13.34	3.90	38.60	29.55	0.50	13.34	3.90	38.60	29.55	0.50
Nucor Steel- Nucor Steel	37.47	135.01	156.77	31.72	1.92	33.27	85.63	200.09	36.46	2.11
Pacificorp Energy- Gadsby Power Plant	16.86	1.52	117.39	9.57	13.15	16.86	1.52	117.39	9.57	13.15
PacifiCorp Energy- Lake Side Power Plant	58.39	10.58	246.67	38.59	152.04	58.39	10.58	246.67	38.59	152.04
Procter and Gamble-Paper Manufacturing Plant	38.94	0.30	27.23	18.58	0.17	150.15	1.45	124.86	162.37	0.17
*Snowbird Development Corporation	3.52	1.48	93.33	12.11	0.64	3.52	1.48	93.33	12.11	0.64
Tesoro Refining & Marketing Company LLC	89.35	544.38	360.09	249.28	3.77	89.35	544.38	360.09	249.28	3.77
University of Utah- University of Utah facilities	15.28	0.80	73.25	10.49	3.38	15.23	0.80	73.04	10.46	3.37
Utah Municipal Power Agency - West Valley Power Plant	3.94	0.36	8.55	1.25	0.00	3.94	0.36	8.55	1.25	0.00
Vulcraft - Division of Nucor Corporation- Steel Products Manufacturing	9.68	0.50	6.68	44.91	0.04	9.87	0.53	7.10	48.29	0.04
*Wasatch Integrated Waste Mgt District- County Landfill & Energy Recovery Facility (DCERF)	9.79	17.16	236.44	23.18	0.00					
Total =	**1,334.65**	**3,270.83**	**8,346.25**	**2,026.36**	**308.12**	**1,397.53**	**2,654.57**	**7,610.50**	**2,331.13**	**306.09**

	2019 Emissions					2020 Emissions				
Site Name	$PM_{2.5}$ (tons/yr)	SO_X (tons/yr)	NO_X (tons/yr)	VOC (tons/yr)	NH_3 (tons/yr)	$PM_{2.5}$ (tons/yr)	SO_X (tons/yr)	NO_X (tons/yr)	VOC (tons/yr)	NH_3 (tons/yr)
*ACH Foam Technologies										
ATK Launch Systems - Promontory	19.13	1.86	44.84	31.18	0.44	19.13	1.86	44.84	31.18	0.44
Big West Oil - Flying J Refinery	10.64	43.14	92.32	291.97	4.37	10.64	43.14	92.32	291.97	4.37
*Bimbo Bakeries USA Salt Lake City Plant										
*Brigham Young University- Main Campus										
Chevron Products Co - Salt Lake Refinery	33.99	23.62	260.87	304.98	8.90	33.99	23.62	260.87	304.98	8.90
Compass Minerals Ogden Inc. - Production Plant	80.50	9.81	137.90	82.29	3.61	80.50	9.81	137.90	82.29	3.61
*Geneva Nitrogen Inc.- Geneva Nitrogen Plant										
Hexcel Corporation- Salt Lake Operations	77.09	50.15	188.81	171.86	92.65	78.15	50.31	186.51	174.97	93.82
Hill Air Force Base - Main Base	26.10	34.14	283.95	306.86	1.45	26.10	34.14	283.95	306.86	1.45
Holly Corp- HRMC and HEP Woods Cross Operations	13.27	109.96	181.71	157.86	17.82	13.27	109.96	181.71	157.86	17.82
Kennecott Utah Copper LLC- Mine & Copperton Concentrator	411.25	6.60	6,178.81	316.45	2.65	411.25	6.60	6,178.81	316.45	2.65
Kennecott Utah Copper LLC- Power Plant Lab Tailings Impoundment	165.61	1,344.13	1,039.39	33.80	1.56	165.61	1,344.13	1,039.39	33.80	1.56
Kennecott Utah Copper LLC- Smelter & Refinery	443.16	863.74	208.34	12.49	9.75	443.16	863.74	208.34	12.49	9.75
Lhoist North America - Grantsville Plant	0.25	0.02	0.21	0.14	0.00	0.25	0.02	0.21	0.14	0.00
McWane Ductile - Utah	13.34	3.90	38.60	29.55	0.50	13.34	3.90	38.60	29.55	0.50
Nucor Steel- Nucor Steel	33.87	93.59	214.04	39.50	2.32	33.87	93.59	214.04	39.50	2.32
Pacificorp Energy- Gadsby Power Plant	16.86	1.52	117.39	9.57	13.15	16.86	1.52	117.39	9.57	13.15
PacifiCorp Energy- Lake Side Power Plant	58.39	10.58	246.67	38.59	152.04	58.39	10.58	246.67	38.59	152.04
Procter and Gamble-Paper Manufacturing Plant	150.15	1.45	124.86	162.37	0.17	150.15	1.45	124.86	162.37	0.17
*Snowbird Development Corporation										
Tesoro Refining & Marketing Company LLC	91.38	91.20	275.00	268.63	3.77	91.38	91.20	275.00	268.63	3.77
University of Utah- University of Utah facilities	15.64	0.87	60.36	10.92	3.45	17.46	0.89	61.66	11.15	3.52
Utah Municipal Power Agency - West Valley Power Plant	3.94	0.36	8.55	1.25	0.00	3.94	0.36	8.55	1.25	0.00
Vulcraft - Division of Nucor Corporation- Steel Products Manufacturing	13.94	0.77	10.56	69.86	0.07	13.94	0.77	10.56	69.86	0.07
*Wasatch Integrated Waste Mgt District- County Landfill & Energy Recovery Facility (DCERF)										
Total =	**1,678.50**	**2,691.42**	**9,713.18**	**2,340.11**	**318.66**	**1,681.37**	**2,691.60**	**9,712.18**	**2,343.45**	**319.90**

Table 4.2 Emissions from Point Sources

Chapter 5 – PROVISIONS TO ENSURE BEST AVAILABLE CONTROL MEASURES

5.1 Introduction

This chapter summarizes the requirement for a Serious Area plan revision to ensure the implementation of best available control measures (BACM) no later than four years after reclassification. Additional detail concerning the assessment of specific emission control measures is contained in the Technical Support Document.

BACM is defined as any technologically and economically feasible control measure that can be implemented in whole or in part within 4 years after the date of reclassification (to Serious) and that generally can achieve greater permanent and enforceable emissions reductions … than can be achieved through the implementation of reasonable available control measures (RACM) on the same sources. BACM includes best available control technology (BACT).

The requirement to ensure BACM/BACT sits in addition to the requirements from the Moderate Area SIP, which included RACM/RACT. Utah addressed this requirement in its Moderate Area SIP[1] (submitted December 22, 2014).

Unlike the RACM required as part of the Moderate Area SIP, BACM/BACT is regarded by EPA as "generally independent" of attainment. This interpretation maintains the policy expressed in the Addendum [to the implementation rule] for PM_{10} that BACM/BACT is to be determined without regard to the specific attainment demonstration for the area. Essentially, this means that if a control measure is determined to meet the definition of best available control measure or technology, it may not be disregarded simply because the demonstration of attainment might conclude that such measure would not be necessary to meet the NAAQS as expeditiously as practicable.

The BACM/BACT requirement for Serious $PM_{2.5}$ nonattainment areas also applies to $PM_{2.5}$ precursors, unless the state has submitted, and EPA has approved, a precursor analysis demonstrating that emissions from a particular precursor do not contribute significantly to $PM_{2.5}$ levels that exceed the standard in the area. Utah has not included any such precursor demonstration with the Serious Area SIP for the Salt Lake City, UT nonattainment area. The list of $PM_{2.5}$ precursors includes SO_2, NO_x, VOC and ammonia.

5.2 BACM Process

The Process for determining BACM/BACT for Serious $PM_{2.5}$ Areas is articulated in 40 CFR 51.1010, and elaborated upon in the preamble to the rule. Essentially, this is a five step process where:

Step one is the development of a comprehensive inventory for the area, which aids in identifying the various source categories that contribute emissions to the airshed.

[1] See SIP Section IX.A.21, Chapter 6 for a discussion of RACM/RACT in the Salt Lake City, UT $PM_{2.5}$ nonattainment area.

Step two is to identify potential control measures. The list of these potential measures should include options not previously considered as RACM/RACT for the area during the development of the Moderate Area SIP.

In Step three, a determination is made for each of the potential control measures to see whether or not it would be technologically feasible to implement.

Step four is a determination of economic feasibility applied to each of the potential control measures that was determined to be technologically feasible. EPA did not establish a specific fixed $/ton cost threshold for economic feasibility determinations, but indicated that states would need to consider emission reduction measures with higher costs per ton when assessing the economic feasibility of BACM/BACT controls as compared to the criteria applied in the RACM/RACT analysis for the same nonattainment area.

Step five is to determine the earliest date by which an economically feasible control measure can be implemented, in whole or in part.

5.3 Existing Control Measures

Ultimately, all control measures and technologies will have an effect on emission rates, and it is important to reflect these emission rates in the attainment demonstration.

Some of these control measures will be new and will have resulted from the exercise of ensuring that BACM/BACT will be implemented following reclassification of the area to Serious, but other control measures will already exist. Since about 1970 there have been regulations at both state and federal levels to mitigate air contaminants.

Utah's permitting rules require a review of new and modified major stationary sources in nonattainment areas, as is required by Section 173 of the Clean Air Act. Beyond that however, even minor sources and minor modifications to major sources planning to locate anywhere in the state are required to undergo a new source review analysis and receive an approval order to construct. Part of this review is an analysis to ensure the ongoing application of Best Available Control Technology (BACT).

Along the central Wasatch Front, major and minor[1] stationary sources have been required to reduce emissions at several junctures to address nonattainment issues with SO_2, ozone, PM_{10} and $PM_{2.5}$.

In reviewing the existing control measures to see if they meet BACM/BACT, states may not simply rely on prior BACT, LAER, and BART analyses for the purposes of showing that a source has also bet BACT for the $PM_{2.5}$ NAAQS. Rather, EPA expects that in step two of the determination process, the state would identify such measures as "existing measures" that should be further evaluated as potential BACM or BACT.

Existing controls also affect the emission rates from non-stationary source categories.

[1] Within the context of this SIP, minor stationary sources are treated as "area sources". Such sources are typically regulated through promulgation of area source rules affecting various source categories.

The federal motor vehicle control program has been one of the most significant control strategies affecting emissions that lead to $PM_{2.5}$. Tier 1 and 2 standards were implemented by 1997 and 2008 respectively. 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 Tier 2 and heavy-duty vehicle standards -- continue to be realized as older higher polluting vehicles are replaced by newer cleaner vehicles. This trend may be seen in the inventory projections for on-road mobile sources despite the growth in vehicles and vehicle miles traveled that are factored into the same projections. Tier 3 standards will continue the progress made since the late-1960s. Tier 3 became effective in 2017 and will be fully phased in by 2025 and will reduce emissions from a typical passenger vehicle by 70 to 80 percent.

To supplement the federal motor vehicle control program, Inspection / Maintenance (I/M) Programs were implemented in Salt Lake, Davis, and Weber Counties. These programs have been effective in identifying vehicles that no longer meet the emission specifications for their respective makes and models, and in ensuring that those vehicles are repaired in a timely manner.

Emissions from non-road mobile emission sources also benefit from several significant regulatory programs enacted at the federal level. This category of emitters includes airplanes, locomotives, hand-held engines, and larger portable engines such as generators and construction equipment. The effectiveness of these controls has been incorporated into the "NONROAD" model UDAQ uses to compile the inventory information for this source category. These measures affect not only the levels of current emissions, but some continue to affect emissions trends as well.

5.4 SIP Controls

Beyond the benefits attributable to the controls already in place, there are new controls identified by this SIP that provide additional benefit toward reaching attainment. A summary of the BACM/BACT review is presented here for each of the emission source sectors.

Stationary Point sources:

Best Available Control Technology – EPA has long interpreted BACM to include BACT, and in the same way that RACT is generally applied to stationary sources BACT is also regarded as a part of BACM that is typically applied to the review of stationary sources. This is not to say that BACT does not consider control measures other than technologies. The requirement for BACT at existing sources in the context of $PM_{2.5}$ NAAQS implementation is separate and distinct from the BACT requirement for permitting new and modified sources under the Prevention of Significant Deterioration (PSD) program. However, BACT determinations for $PM_{2.5}$ SIP purposes are to follow the same process and criteria that stem from the PSD program.

This SIP used the definition of "major stationary source" to compile a list of sources that would receive a source-specific BACT review. For a serious $PM_{2.5}$ nonattainment area, this means any source that emits, or has the potential to emit, 70 ton per year or more of direct $PM_{2.5}$ or any $PM_{2.5}$ precursor. The 2014 tri-annual emissions inventory was used to assess the actual emissions. The rest of the stationary (point) sources were assumed to represent a portion of the overall "area source" inventory.

Sources meeting the criteria described above were individually evaluated to determine whether their operations would be consistent with BACT.

In conducting the analysis, UDAQ found that, as a whole, the large stationary sources were already operating with a high degree of emission control. It follows that the percentage of SIP related emissions reductions is not large relative to the overall quantity of emissions. As stated before, many of these sources were recently reviewed to ensure RACT as part of the Moderate Area SIP. Routine permitting in the Salt Lake City nonattainment area already includes BACT as an ongoing standard of review, and when developing the Moderate Area SIP, UDAQ generally identified a level of emission control that would be more consistent with best available controls than the reasonably available controls that were required.

For the Salt Lake City, UT nonattainment area, there are 26 stationary point sources that met or meet the threshold of 70 tons or more per year for $PM_{2.5}$ or any precursor. The emissions from these sources that were modeled for 2016, 2017, 2019, and 2020 are shown below in Table 4.2. Note that these emissions also include any growth projections that were applied.

The BACT analysis for each of the listed sources may be found in the Technical Support Document.

The actual emission limits and operating procedures that reflect the implementation of BACM/BACT are listed in SIP Subsection IX. Part H. 11. & 12, which is made enforceable via incorporation into the Utah Air Quality Rules at R307-110-17.

New Source Review / *Banked Emission Reduction Credits* – Under Utah's new source review rules in R307-403-8, banking of emission reduction credits (ERCs) is permitted to the fullest extent allowed by applicable Federal Law as identified in 40 CFR 51, Appendix S, among other documents. Under Appendix S, Section IV.C.5, a permitting authority may allow banked ERCs to be used under the preconstruction review program (R307-403) as long as the banked ERCs are identified and accounted for in the SIP control strategy. For the Moderate Area $PM_{2.5}$ SIP, however, it was not possible to include banked ERCs in the attainment demonstration. The $PM_{2.5}$ SIP adopted by the Air Quality Board on December 4, 2013 did not include banked $PM_{2.5}$ or $PM_{2.5}$ precursor ERCs in the attainment demonstration and therefore under R307-403-8 any ERCs that were banked prior to December 4, 2013 could no longer be used as emission offsets for $PM_{2.5}$ nonattainment areas. The use of these existing banked ERCs to meet the requirements of existing SIPs for PM_{10}, SO_2 and ozone are not affected by the $PM_{2.5}$ SIP and would be evaluated according to the provisions of those SIPs. In this Serious Area SIP, the handful of ERCs generated after December 4, 2013 for $PM_{2.5}$ or $PM_{2.5}$ precursors has been accounted for in the modeled attainment demonstration and are eligible to be used as emission offsets for $PM_{2.5}$ or $PM_{2.5}$ precursors. A listing of these ERCs has been included in the Technical Support Documentation.

<u>Area sources:</u>

Smaller stationary sources are too numerous to warrant individual attention, but they must also implement BACM/BACT.

The area source BACM analysis consisted of a thorough review of the entire seasonally adjusted area source inventory for anthropocentrically derived direct $PM_{2.5}$ and precursor constituents.

The analysis centered on whether best control measures are available for a given source category. A search through the literature identified EPA guidance documents and regulations including: Control Techniques Guidelines (CTG), Alternative Control Techniques (ACT), and New Source Performance Standards (NSPS). Other sources of information included the Ozone Transport Commission's (OTC) model rules as well as rules from other serious nonattainment air districts addressing ozone and/or $PM_{2.5}$.

For the BACM review, each of UDAQ's existing area source rules[1] was re-evaluated with respect to these examples to ensure that all appropriate source categories have been addressed in rulemaking, and that the level of control required is consistent with BACM. For newly identified controls or enhancement of existing controls, an evaluation was made to determine technological and economic feasibility.

The BACM review resulted in revisions to 13 different rules which affect surface coating (for a variety of different surfaces), graphic arts, and Aerospace Manufacture & Rework Facilities. At the same time however, a cleaning solvent VOC limit of 0.21 lb/gal found in some of these rules was found to be overly aggressive and had to be relaxed.

The overall BACT analysis for the area source rules may be found in the Technical Support Document.

The area source rules have been incorporated into the Utah Air Quality Rules at R307.

Table 5.1 shows the effectiveness of the area source rules within the Salt Lake City, UT nonattainment area by indicating the quantities of emissions eliminated from the inventory for each of the relevant years. Emission units are in lb/day.

[1] As part of the Moderate Area $PM_{2.5}$ SIP, UDAQ introduced or augmented 25 area source rules to control emissions of $PM_{2.5}$ or $PM_{2.5}$ precursors.

SLC, UT PM2.5 Nonattainment Area	Emissions Reduced in Pounds Per Day (lb/day)									
Area Source Rule Name	2016 Base Year					2017 Milestone Year				
	NOx	VOC	NH3	SO2	PM2.5	NOx	VOC	NH3	SO2	PM2.5
adhesive/sealants	0.00	869.91	0.00	0.00	0.00	0.00	1,176.59	0.00	0.00	0.00
aerospace										
aggregate operations	0.00	0.00	0.00	0.00	5.59	0.00	0.00	0.00	0.00	5.58
appliance										
autobody	0.00	344.17	0.00	0.00	0.00	0.00	698.06	0.00	0.00	0.00
coil/containers										
commercial cooking	0.00	51.31	0.00	0.00	0.00	0.00	52.01	0.00	0.00	0.00
consumer products	0.00	4,372.48	0.00	0.00	0.00	0.00	4,435.39	0.00	0.00	0.00
degreasing										
fabric/vinyl										
flat wood										
fugitive dust	0.00	0.00	0.00	0.00	1,442.43	0.00	0.00	0.00	0.00	1,455.69
graphic art										
Hydronic heater ban	5.80	188.20	4.80	5.80	178.60	5.60	187.40	4.60	5.60	178.40
Landfill	0.00	276.51	0.00	0.00	0.00	0.00	281.87	0.00	0.00	0.00
magnet wire										
metal furniture										
misc metal										
paint	0.00	6,089.71	0.00	0.00	0.00	0.00	6,177.26	0.00	0.00	0.00
paper/film/foil										
pilot light	3,383.76	197.98	0.00	21.60	15.48	4,511.65	263.95	0.00	28.79	20.62
plastic										
Residential wood burning ban	1,344.82	10,436.32	389.15	133.89	9,046.46	1,339.19	10,405.97	386.33	133.26	9,019.87
water heaters										
wood furniture manuf										
Total Area Source Emissions Reduced	**4,734.4**	**22,826.6**	**393.9**	**161.3**	**10,688.6**	**5,856.4**	**23,678.5**	**390.9**	**167.7**	**10,680.2**

SLC, UT PM2.5 Nonattainment Area	Emissions Reduced in Pounds Per Day (lb/day)									
Area Source Rule Name	2019 Attainment Year					2020 Milestone Year				
	NOx	VOC	NH3	SO2	PM2.5	NOx	VOC	NH3	SO2	PM2.5
adhesive/sealants	0.00	1,513.14	0.00	0.00	0.00	0.00	1,533.71	0.00	0.00	0.00
aerospace	0.00	28.73	0.00	0.00	0.00	0.00	43.13	0.00	0.00	0.00
aggregate operations	0.00	0.00	0.00	0.00	5.57	0.00	0.00	0.00	0.00	5.56
appliance	0.00	0.46	0.00	0.00	0.00	0.00	0.69	0.00	0.00	0.00
autobody	0.00	1,435.97	0.00	0.00	0.00	0.00	1,817.76	0.00	0.00	0.00
coil/containers	0.00	83.64	0.00	0.00	0.00	0.00	125.00	0.00	0.00	0.00
commercial cooking	0.00	53.57	0.00	0.00	0.00	0.00	54.29	0.00	0.00	0.00
consumer products	0.00	4,559.88	0.00	0.00	0.00	0.00	4,625.34	0.00	0.00	0.00
degreasing	0.00	1,014.89	0.00	0.00	0.00	0.00	1,527.89	0.00	0.00	0.00
fabric/vinyl	0.00	362.02	0.00	0.00	0.00	0.00	442.96	0.00	0.00	0.00
flat wood	0.00	11.37	0.00	0.00	0.00	0.00	17.15	0.00	0.00	0.00
fugitive dust	0.00	0.00	0.00	0.00	1,483.96	0.00	0.00	0.00	0.00	1,497.15
graphic art	0.00	995.47	0.00	0.00	0.00	0.00	1,062.39	0.00	0.00	0.00
Hydronic heater ban	5.80	186.60	4.80	5.80	177.00	5.80	186.00	4.80	5.80	176.60
Landfill	0.00	293.81	0.00	0.00	0.00	0.00	299.37	0.00	0.00	0.00
magnet wire	0.00	22.03	0.00	0.00	0.00	0.00	22.18	0.00	0.00	0.00
metal furniture	0.00	167.13	0.00	0.00	0.00	0.00	249.51	0.00	0.00	0.00
misc metal	0.00	273.76	0.00	0.00	0.00	0.00	411.43	0.00	0.00	0.00
paint	0.00	6,344.07	0.00	0.00	0.00	0.00	6,441.84	0.00	0.00	0.00
paper/film/foil	0.00	97.89	0.00	0.00	0.00	0.00	147.62	0.00	0.00	0.00
pilot light	5,834.66	396.40	0.00	43.19	31.00	4,926.20	361.78	0.00	39.47	28.29
plastic	0.00	189.32	0.00	0.00	0.00	0.00	222.41	0.00	0.00	0.00
Residential wood burning ban	1,332.30	10,343.10	385.71	132.01	8,964.81	1,327.61	10,311.50	384.46	131.70	8,939.47
water heaters	1,396.75	0.00	0.00	0.00	0.00	1,632.52	0.00	0.00	0.00	0.00
wood furniture manuf	0.00	604.15	0.00	0.00	0.00	0.00	910.88	0.00	0.00	0.00
Total Emissions Reduced: (lb/day)	**8,569.5**	**28,977.4**	**390.5**	**181.0**	**10,662.3**	**7,892.1**	**30,814.8**	**389.3**	**177.0**	**10,647.1**

Table 5.1, Emissions Reductions from Area Source SIP Controls

On-road mobile sources:

Federal Regulations

Section 209(a) of the Clean Air Act (CAA) preempts states other than California from adopting or enforcing standards for on-highway vehicles. Nevertheless, emissions reduction credit for federal on-highway vehicle controls was accounted for because federal control effectiveness has been incorporated into the MOVES model which the Utah Division of Air Quality (UDAQ) uses to calculate on-road emissions. Additional information is provided in the Technical Support Document.

State Regulations

Inspection/Maintenance (I/M) programs are already in place for Salt Lake, Davis and Weber Counties. Utah Code Annotated 41-6a-1642 gives authority to each county to implement and manage an I/M program to attain and maintain any National Ambient Air Quality Standard (NAAQS). I/M programs were implemented in Salt Lake and Davis counties in 1984, and a program for Weber County was added in 1990. These programs have been effective in both identifying vehicles that no longer meet the emission specifications for their respective makes and models and ensuring that those vehicles are repaired in a timely manner.

Davis, Salt Lake and Weber Counties current I/M programs consist of decentralized, test-and-repair network for the testing of all model year 1968 and newer vehicles except for exempt vehicles registered in the applicable county. Vehicles less than two years old as of January 1 on any given year are exempt from an emissions inspection. Vehicles from two to five years old as of January 1 on any given year are inspected biennially. Vehicles six years old and older as of January 1 on any given year are inspected annually. Vehicles 1996 and newer are subject to an OBD II inspection. Vehicles 1995 and older are subject to a two-speed idle test. To ensure that analyzers are the highest quality and to take advantage of improved technology, Davis, Salt Lake and Weber Counties recently updated the test analyzers used in their respective I/M programs.

Off-road mobile sources:

Section 209(e) of the Clean Air Act (CAA) preempts states other than California from adopting or enforcing emissions standards for terrestrial and marine non-road engines or vehicles. Similarly, CAA section 233 preempts states from adopting or enforcing emissions standards from aircraft or aircraft engines. For this reason, the Utah Division of Air Quality (UDAQ) did not consider any SIP controls for non-road mobile sources beyond those already promulgated at the federal level. Nevertheless, emissions reduction credit for these federal controls was accounted for because their effectiveness has been incorporated into the NONROAD model which UDAQ uses to calculate non-road emissions. Additional information is provided in the Technical Support Document.

Chapter 6 – ATTAINMENT DEMONSTRATION

6.1 Air Quality 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.

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[1]. 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.
- 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[2] modeling platform were used. For stationary non-point and mobile sources, spatial surrogates from the EPA Clearinghouse for Inventories and Emissions Factors (CHIEF[3]) were used to distribute emissions in space across the modeling domain. Emissions from large industrial sources (i.e., point) were placed at the location of the source itself. Where reliable local information was available (e.g., population density, traffic demand modeling, residential heating), profiles and surrogates were modified or developed to reflect that information.

[1] https://www.cmascenter.org/smoke/

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

[3] https://www.epa.gov/chief

Photochemical Modeling Domains and Grid Resolution

The UDAQ CAMx 6.30 modeling framework consists of two spatial domains: a high-resolution 1.33 km domain nested inside of a coarser 4 km domain (**see Figure 6.1, below**). This configuration allows one to efficiently integrate regional effects with local impacts within the Salt Lake City nonattainment area. Vertical resolution in the model consists of 41 layers extending to the top of the atmosphere.

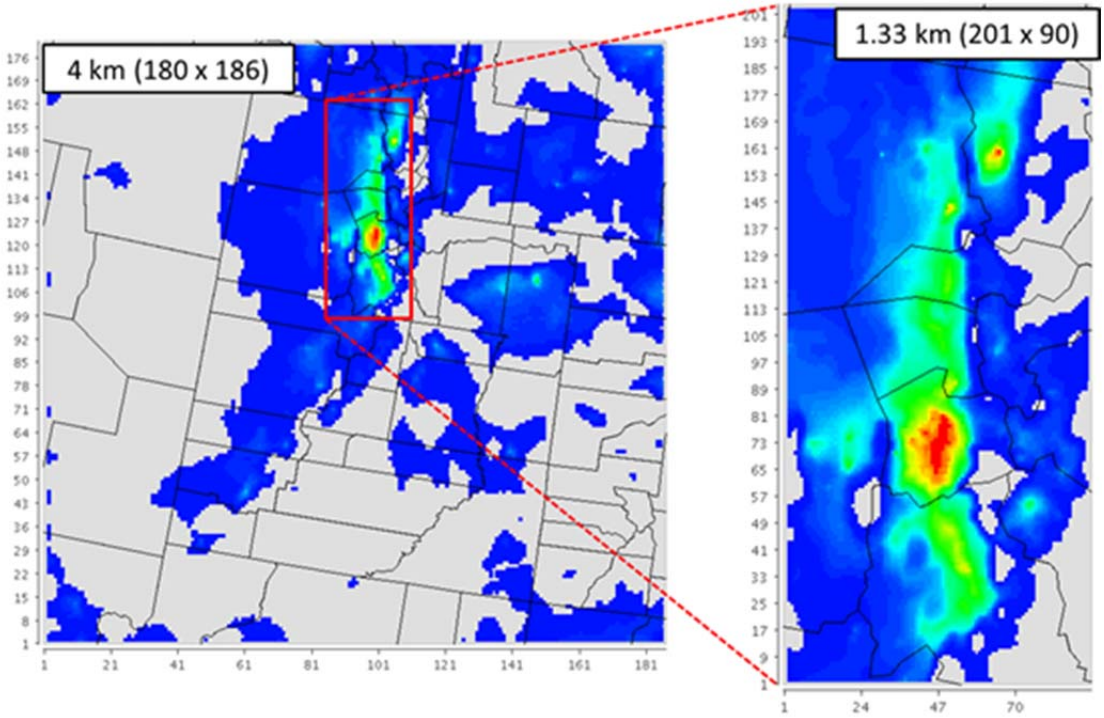


Figure 6.1: Two CAMx modeling domains in two-way nesting configuration.

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 Salt Lake City nonattainment area. Throughout this document, we will refer to the fine 1.33 km domain as the "modeling domain" when the coarse domain is not specified.

Meteorological Data

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

Meteorological inputs were derived using the Weather Research and Forecasting[1] (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

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

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.

Model performance of WRF was assessed against observations at sites maintained by the University. A summary of the performance evaluation results for WRF is included in the Technical Support Document:

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).

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 some 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's 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" 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 of Utah and Utah Division of Air Quality (DAQ) showed the four conditions listed above improve the likelihood for successfully simulating wintertime persistent cold air pools in the Weather Research and Forecasting (WRF) model[1].

A comprehensive discussion of the meteorology model performance for all three episodes may be found in the Technical Support Document, as well as at the link below.

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

Model adjustments

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. Cloud water content reduced during certain days (cloud adjustment)
5. 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.
6. Reduced the dry deposition rate of ammonia by setting ammonia Rscale to 1. Rscale is a parameter in CAMx that reflects surface resistance.

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

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

albedo over urban areas, helped improve the model performance by better representing secondary ammonium nitrate formation during winter-time inversion episodes in Utah.

Ammonia injection values were based on measurements conducted during February 2016. These measurements were used to determine the ammonia injection values for the February 2016 episode. Similar injection values were then assumed for the January 2011 episode.

Cloud adjustments were only applied to the January 2011 episode, which was characterized by cloud cover on January 6-8 over the Salt Lake Valley. This cloud cover led to a high bias in sulfate due to the effect of ammonia on the gas-to-particle partitioning of sulfate in clouds. Application of the cloud adjustment scheme helped reduce this bias.

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.

Episodic model performance

Shown below for each of three episodes are the CAMx performance results in total 24-hour $PM_{2.5}$ concentrations.

January 1-10, 2011

For the January meteorological episode, CAMx performance in 24-hour $PM_{2.5}$ is generally good at Hawthorne (Salt Lake County) (**Fig. 6.2.1**). However, the earlier part of the modeled episode at Hawthorne is impacted by the absence of thin mid-level clouds that were present during January 3-5. The absence of clouds here had the effect of warming the surface and increasing the mixing height in the simulation. Kvpatch depth was lowered during this period to account for this, while keeping modeled primary aerosol concentrations reasonable.

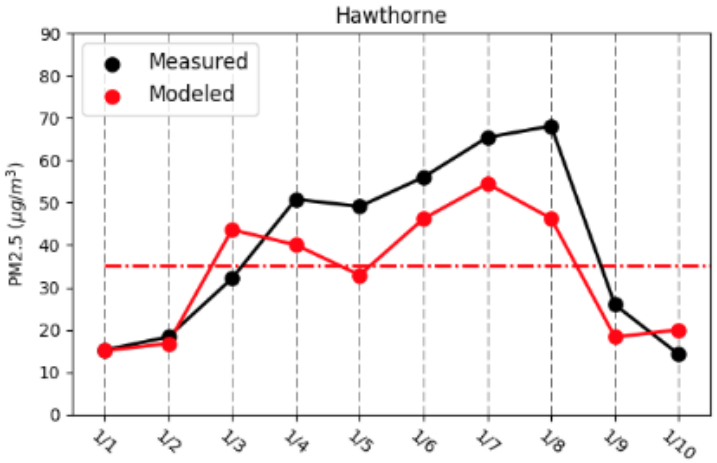


Figure 6.2.1: 24-hr $PM_{2.5}$ concentrations during January, 2011 episode. Observed (black) vs. modeled (red) for Hawthorne, Salt Lake County

Looking at **Fig. 6.2.2,** observed speciated $PM_{2.5}$ mass from the Hawthorne Chemical Speciation Network (CSN) monitor (January 7), there is good agreement in nitrate (NO_3) and ammonium (NH_4) with the CAMx modeling results. The agreement between modeled and observed NO_3 is a benefit from the ammonia injection. Simulated fine crustal matter (CM) and elemental carbon (EC) concentrations were a bit higher than observed. The overestimation in these two primary aerosols were the likely result of a high bias in MOVES 2014a (EC) and the re-suspended road dust calculation tool provided by the EPA (CM).

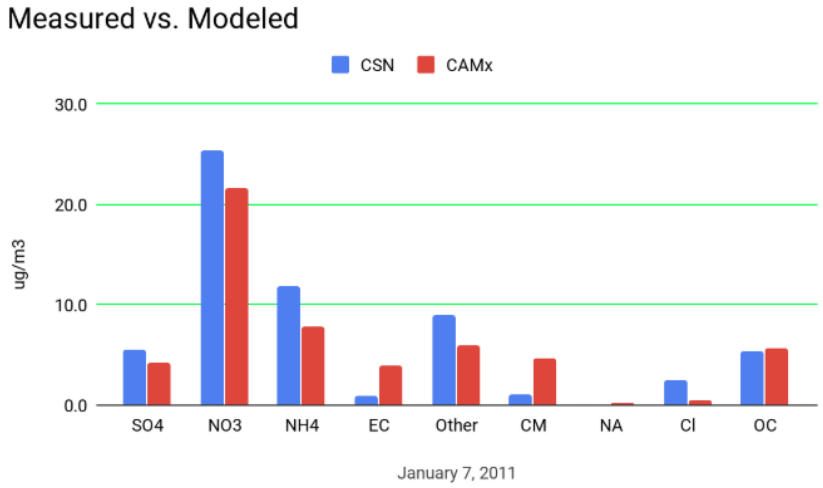


Figure 6.2.2: 24-hr speciated $PM_{2.5}$ mass (µg/m^3) for January 7, 2011. Blue (red) bars represent measured (modeled) mass for Hawthorne, Salt Lake County.

December 7-19, 2013

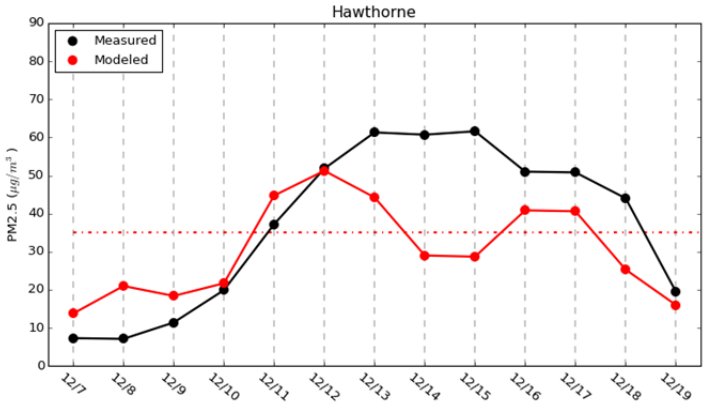


Figure 6.3.1: 24-hr $PM_{2.5}$ concentrations during December, 2013 episode. Observed (black) vs. modeled (red) for Hawthorne, Salt Lake County.

Fig. 6.3.1 indicates that, at Hawthorne, modeled $PM_{2.5}$ was of a similar magnitude as observed. However, there was a bimodality in the modeled results not observed in measurements. While observations show peak $PM_{2.5}$ concentrations during December 13-15, CAMx is producing a local minima.

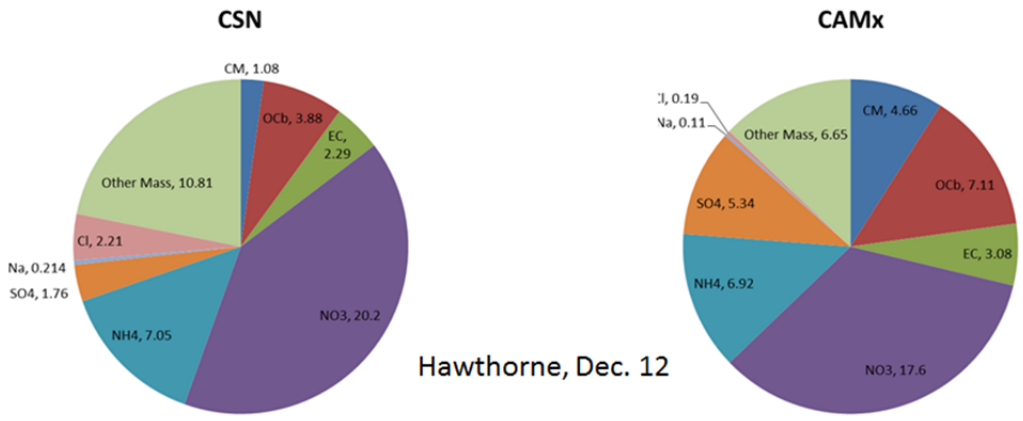


Figure 6.3.2: 24-hr speciated $PM_{2.5}$ mass (ug/m3), December 12, 2013. Observed (left) vs. modeled (right). Hawthorne, Salt Lake County.

Speciated AQS data was available for only one day (December 12) at the onset of the multi-day peak $PM_{2.5}$ period (December 12-16). NH_4 and NO_3 appear well simulated. As with the January, 2011 episode, the modeled crustal matter apportionment is much higher than the observed. Modeled SO_4 was roughly 3 times higher than observed (see **Fig. 6.3.2**).

Overall, the speciation for December 12 appears reasonable, but the use of the December, 2013 episode data may not be a good choice for attainment demonstration modeling. The anti-correlation between modeled and observed results during the peak $PM_{2.5}$ shows that the December, 2013 CAMx performance is undesirable for SIP development.

February 1-16, 2016

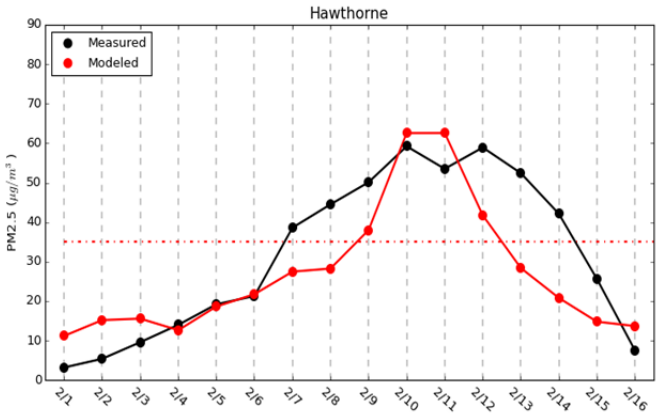


Figure 6.4.1: 24-hr $PM_{2.5}$ concentrations during February, 2016 episode. Observed (black) vs. modeled (red) for Hawthorne, Salt Lake County.

Fig. 6.4.1 shows that CAMx was able to simulate the peak $PM_{2.5}$ concentration levels seen in monitored observations at Hawthorne for February, 2016. At Hawthorne, modeled $PM_{2.5}$ tapered off rapidly during the latter part of the February episode (February 12-16).

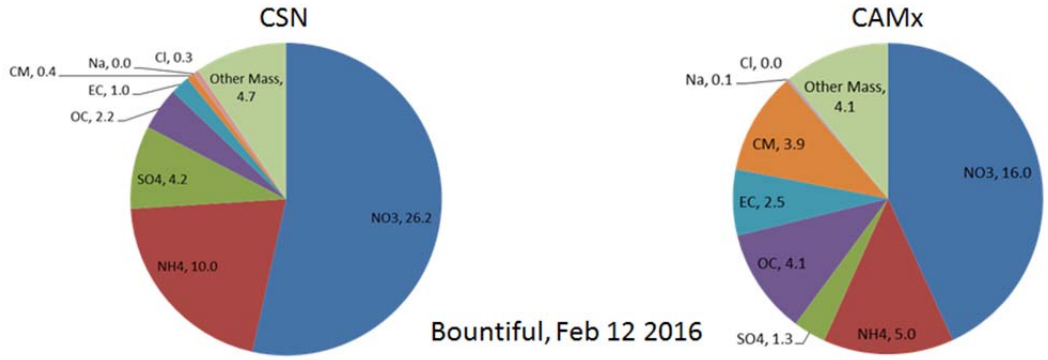


Figure 6.4.2: 24-hr speciated $PM_{2.5}$ mass (ug/m3), February 12, 2016. Observed (top) vs. modeled (bottom). Bountiful, Davis County. Bountiful is used since Hawthorne measurements were unavailable.

It can be seen from **Fig. 6.4.2** that the February 12, NO_3 and NH_4 simulations were relatively poor compared to the other two episodes considered. Modeled organic carbon (OC) was twice as high measured and SO_4 was under-represented. The CAMx results don't quite reflect the high wintertime $PM_{2.5}$ composition one would expect during this period.

Conclusion

Examining the $PM_{2.5}$ model performance for all three episodes, it's clear that CAMx performed best when using the January, 2011 WRF output.

The WRF model was specifically calibrated to the meteorological conditions experienced during January, 2011; a period that coincided with the Persistent Cold Air Pool Study[1] (PCAPS), an exhaustive field campaign focused exclusively on the Salt Lake Valley.

The scatter plots below (**Figure 6.5**) show simulated $PM_{2.5}$ (CAMx) against the $PM_{2.5}$, measured at Utah's Hawthorne federal reference method (FRM) monitor. Linear regression fits are also shown (dashed lines). The relatively tight dispersion in (FRM, CAMx) points along the diagonal black line (x=y) for January, 2011 implies that model bias is low and temporal correlation is high relative to when using WRF output for the other two episodes.

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

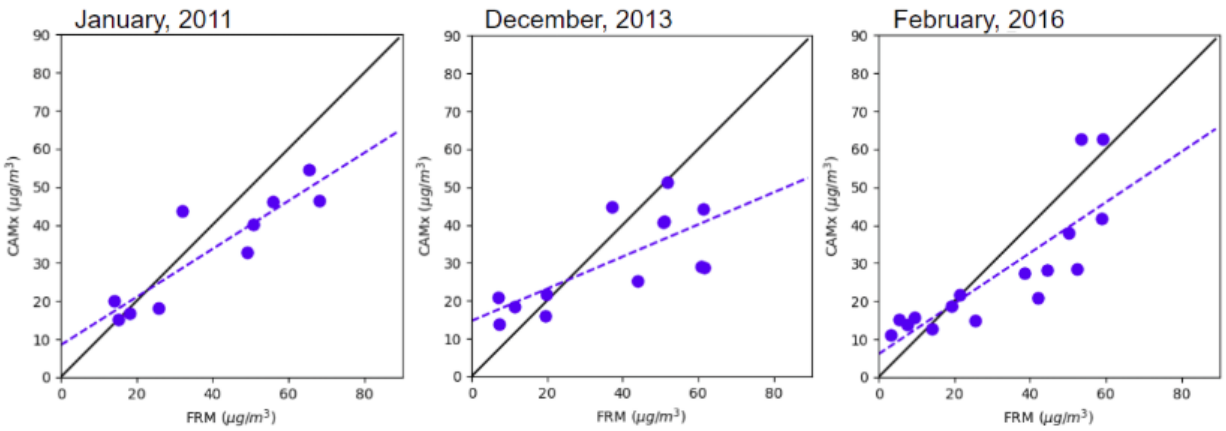


Figure 6.5: Modeled (vertical axis) versus measured (horizontal axis) 24-hour $PM_{2.5}$ for three meteorological episodes. Dots represent each individual day of the modeling episode. Linear regression fits are shown for each episode (dashed line).

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 attainment demonstration work. A more thorough discussion is provided in the Technical Support Document.

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 that were implemented (ammonia injection, albedo, snow cover, ozone deposition velocity, cloud-water content and vertical diffusion modifications) to more accurately reproduce winter-time inversion episodes. A detailed explanation of these model modifications as well as a more thorough examination of the model performance is provided in the Technical Support Document.

Available ambient monitoring data was 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 UDAQ's Hawthorne monitoring station in the Salt Lake City non-attainment area. Ammonia measurements collected during special field studies carried out in winters of 2016 were also used for this performance evaluation. These ammonia measurements were used since measurements of ammonia were not available during 2011. The evaluation was based on the December 31 – January 10, 2011 episode, which will be used for the modeled attainment test. The 2011 emissions inventory was considered for this purpose. The evaluation was also focused on days with $PM_{2.5}$ concentration exceeding the 24-hr national ambient air quality standard (> 35 $\mu g/m^3$). December 31, which is a spin-up day, was excluded from this evaluation. A more detailed model performance evaluation that examines the model performance for ozone (O_3), nitrogen oxides (NO_x=NO+NO_2), carbon monoxide (CO) and volatile organic compounds (VOCs) is

provided in the Technical Support Document. More details on the model performance at various sites within the Salt Lake City non-attainment area are also included.

Daily $PM_{2.5}$ Concentrations

Figure 6.6 shows 24-hr modeled and observed $PM_{2.5}$ during January 1-10, 2011 at the Hawthorne monitoring station in the Salt Lake non-attainment area. Overall, the model accurately captures the temporal variation in $PM_{2.5}$. The gradual increase in $PM_{2.5}$ concentration and its transition back to low levels are generally well reproduced by the model.

It is noteworthy that the overestimation in $PM_{2.5}$ on January 3 at Hawthorne is related to the meteorological model performance on this day. While thin mid-level clouds were observed on January 3-4, these clouds were not simulated in the meteorological model, leading to an increasingly stable low-level boundary layer, particularly at night (details provided in Utah's meteorological model performance final report[1]). This limited the mixing of pollutants on January 3 in the model, resulting in an over-prediction in $PM_{2.5}$ levels. The underestimation in $PM_{2.5}$ on January 5, 2011 is also related to the meteorological model performance on this day, where the meteorological model overestimated the wind shear near the mixing height, leading to increased vertical instability in the simulated temperature structure and therefore lower modeled $PM_{2.5}$ concentrations.

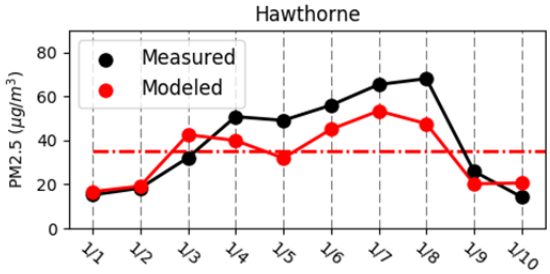


Figure 6.6: Ten-day time series of observed (black) and modeled (red) mean 24-hour $PM_{2.5}$ concentrations (red) for January 1 - 10, 2011 (MDT) at Hawthorne, Salt Lake County. Dashed red line shows 24-hr $PM_{2.5}$ NAAQS.

$PM_{2.5}$ Chemical Speciation

To further investigate the model performance, UDAQ compared measured and modeled $PM_{2.5}$ chemical species at the Hawthorne monitoring site, which is part of EPA's Chemical Speciation Network (CSN). **Figure 6.7** shows a comparison of the bulk chemical composition of measured and modeled $PM_{2.5}$ at Hawthorne on January 7, 2011, which is the only $PM_{2.5}$ exceedance day where measurement data is available. Chemical species, including nitrate (NO_3), sulfate (SO_4), ammonium (NH_4), organic carbon

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

(OC), elemental carbon (EC), chloride (Cl), sodium (Na), crustal material (CM) and other species (other), were considered in this analysis.

The model performance for particulate nitrate (NO_3), which is the major $PM_{2.5}$ component, was good, with both modeled and measured particulate nitrate accounting for similar contributions to $PM_{2.5}$ filter mass (40 and 41% respectively) (**panels b and d**). Modeled and observed nitrate concentrations were also comparable, with modeled concentration being biased low by about 15%. The model performance for particulate sulfate was also reasonably good, with measured and modeled concentrations accounting for 5.6 $\mu g/m^3$ and 4.2 $\mu g/m^3$ of total $PM_{2.5}$ mass, respectively (**panels a and c**), resulting in a low model bias of about 25%. Similarly to its performance for sulfate and nitrate, the model was also biased low for ammonium by about 33.5%. This low model bias in particulate ammonium can be attributed to the underestimation of ammonium chloride (NH_4Cl) in the model.

Conversely, the model performance for organic carbon was quite good for January 7, with modeled and observed concentrations being quite comparable. The model, on the other hand, overestimated EC which can be related to an overestimation of EC in Utah's mobile emissions modeling using MOVES 2014a. Crustal material was also overestimated, likely due to an overestimation of re-suspended road dust in the emissions inventory.

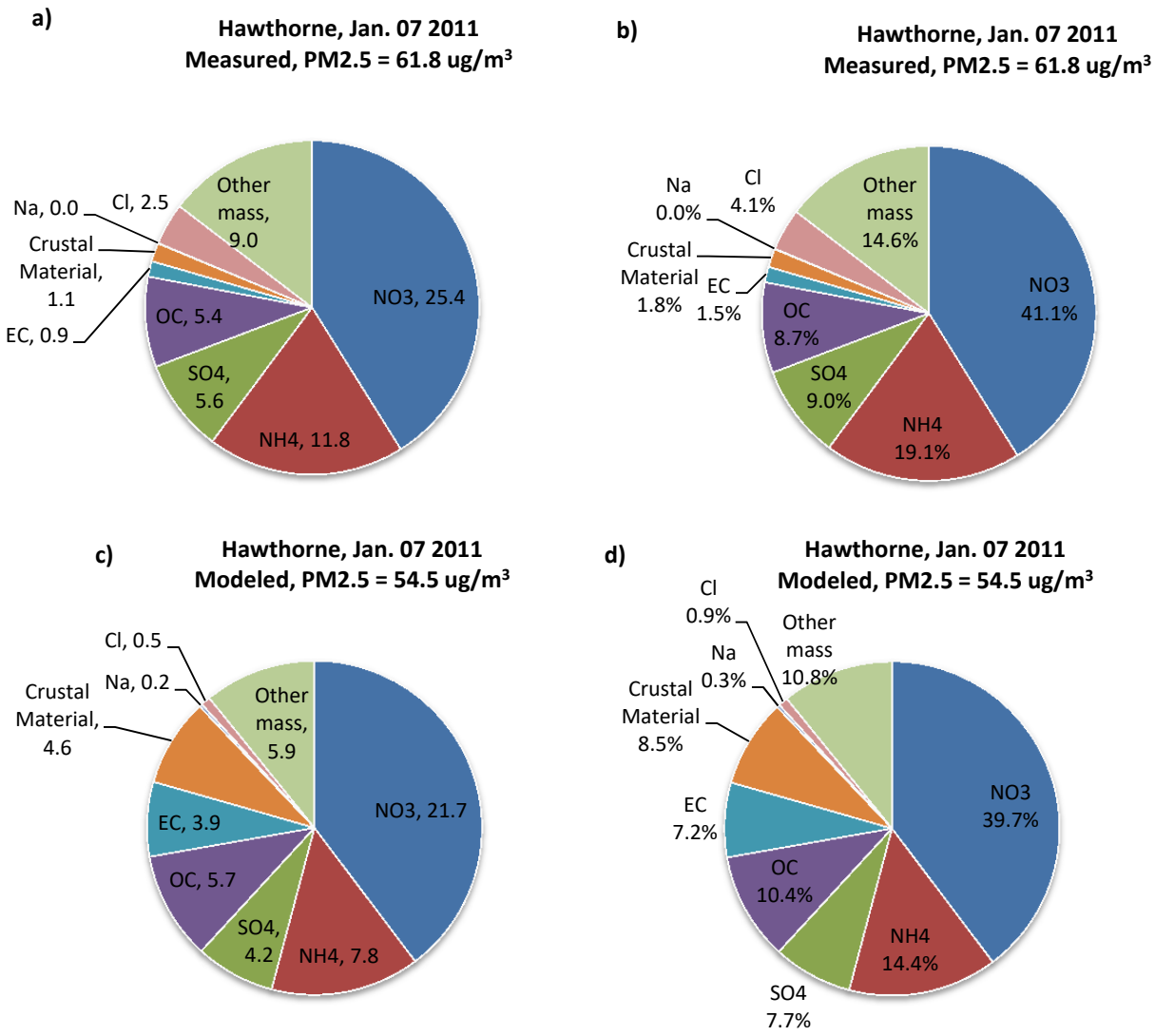


Figure 6.7, a-d: Measured (a,b) and modeled (c,d) mean 24-hour $PM_{2.5}$ species for January 7, 2011 (MDT) at Hawthorne, Salt Lake County. Panels a and c show absolute concentrations (µg/m^3) of $PM_{2.5}$ chemical species while panels b and d display their percent contributions to total $PM_{2.5}$.

The model performance was also evaluated for ammonia (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 inversion events.

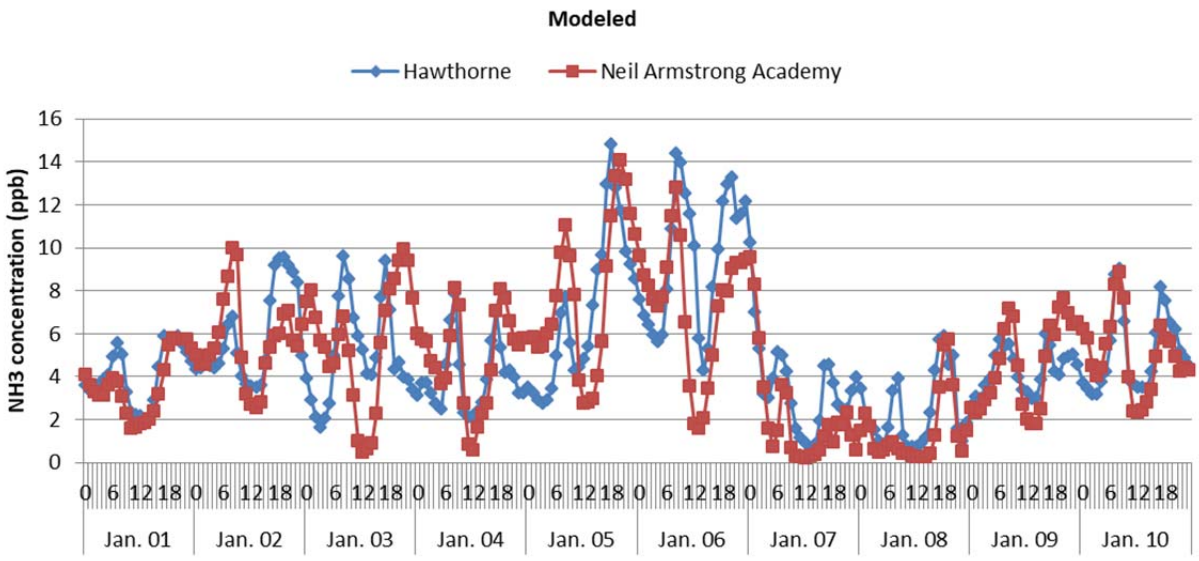


Figure 6.8: Hourly time series of modeled ammonia (ppm) for January 1 - 10, 2011 at Hawthorne, and Neil Armstrong Academy, Salt Lake County.

Modeled ammonia (**figure 6.8**) was compared to hourly ammonia measurements (**figure 6.9**) conducted at Neil Armstrong Academy during a special field study in winter 2016. Measurements from 2016 were considered since measurements of ammonia were not available during 2011. Hourly measurements were also only available at Neil Armstrong Academy, located in West Valley City in the Salt Lake non-attainment area. However, while these 2016 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 ammonia during strong inversion conditions.

A comparison of measured and modeled ammonia shows that modeled ammonia at Hawthorne and Neil Armstrong Academy is well within the range observed in 2016. It also displays a similar behavior to measured NH_3, with NH_3 concentration dropping during peak $PM_{2.5}$ events during which the airshed is saturated and virtually all near-surface ambient ammonia has yielded to particulate ammonium.

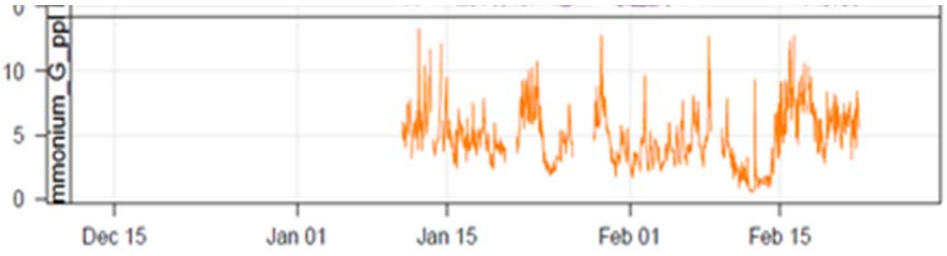


Figure 6.9: Hourly ammonia measurements from Neal Armstrong Academy (West Valley City, Salt Lake County). Note that ammonia drops during the persistent cold air pool period during Feb. 7 - 14, 2016.

Summary of Model Performance

The model performance replicating the buildup and clear out of $PM_{2.5}$ is good overall. The model captures well the temporal variation in $PM_{2.5}$. The gradual increase in $PM_{2.5}$ concentration and its transition back to low levels are generally well reproduced by the model. The model also predicts reasonably well $PM_{2.5}$ concentration on peak days. It also overall replicates well the composition of $PM_{2.5}$ on exceedance days, with good model performance for secondary nitrate and ammonium which account for over 50% of $PM_{2.5}$ mass. Simulated ammonia concentrations are also within the range of those observed, further indicating that the model overall performs well.

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." Furthermore, the attainment modeling is supplemented by additional information to provide a weight of evidence determination.

Modeled Attainment Test

The UDAQ used the Software for Model Attainment Test - Community Edition (SMAT-CE) v. 1.01 utility from EPA[1] 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 relative response factor (RRF) for grid cells near each monitor and uses these to calculate 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 relative response factor (RRF) calculations.

The State of Utah operates three Chemical Speciation Network (CSN) monitors: Hawthorne, Bountiful, Lindon. Hawthorne is located in Salt Lake County, while Bountiful is in Davis to the North, and Lindon is located in Utah County to the South. Of the three, Hawthorne samples one out of three days, while the other two sample only 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 nonattainment area. UDAQ believes this is a reasonable assumption that is supported by recently conducted special studies. Further discussion may be found in the Technical Support Document.

SMAT results are shown in **Table 6.1** for all projection years as well as the base year 2016.

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

Monitor ID	Monitor Name	2016 Baseline DV	2017 Milestone FDV	2019 Future DV	2020 Horizon FDV
490030003	Box Elder	31.9	31.9	30.4	29.6
490110004	Bountiful	29.7	29.6	29.3	29.2
490351001	Magna	27.9	27.7	28.0	27.6
490353006	Hawthorne	34.3	34.4	33.8	33.8
490353010	Rose Park	36.3	36.2	35.9	35.6
490570002	Ogden #2	32.4	32.3	32.2	31.9

Table 1: Design values for base year and projected years. Purple numbers highlight design values greater than the NAAQS (35 µg/m^{-3}).

Table 6.1: Design Values for base year and projected years. Purple numbers highlight design values greater than the NAAQS (35 µg/m3).

Air Quality as of the Attainment Date

The attainment date for this Serious $PM_{2.5}$ nonattainment area is December 31, 2019. The plan provisions for serious areas call, in Section 189(b)(1)(A), for a demonstration that the plan provides for attainment by the applicable attainment date, or if impracticable, by the most expeditious alternative applicable date practicable.

As shown in the modeled attainment test, the emissions reductions achievable in 2019 do not conclusively allow for a demonstration that the Salt Lake City, UT nonattainment area will attain the 24-hour $PM_{2.5}$ NAAQS. Although predictions at seven of the eight monitors are less than 35.5 µg/m3, the predicted concentration at the Rose Park monitor is still above the standard.

Nevertheless, the EPA acknowledges that there is other information that may be considered when determining whether attainment may be reached by the attainment date. This is discussed in the next section.

6.2 Weight of Evidence

The requirement for a plan revision that includes assessment of attainment in Section 189(b)(1)(A) calls for a demonstration, "including air quality modeling." Despite the heavy reliance of photochemical modeling, there is other information that may be considered when determining whether attainment may be reached by the attainment date. The $PM_{2.5}$ Implementation Rule notes that "the modeling guidance continues to describe the opportunity for states to supplement their modeling with a "weight of evidence" demonstration. States may use other information and analyses, in addition to the modeled attainment test to estimate whether future attainment of the NAAQS in an area is likely. Other analyses may include, but are not limited to emissions trends, ambient data trends and analyses, other modeling analyses and documentation of other non-modeled emissions control strategies including voluntary programs." The following is an assemblage of such additional evidence in support of attainment by 2019.

Uncertainties in the Analysis

The underlying reason for suggesting other evidence is necessary to assess a finding of attainment, is the inherent uncertainty in a comprehensive analysis such as this. Each subset of information fed to the air quality model is developed using the best information available and steps are taken to minimize bias and uncertainty, but still involves some degree of estimation.

Emissions inventories make up a significant amount of this information. The approved methods of estimating emissions are continually improving, minimizing to a degree the uncertainties involved, and in some cases the information is quite good. Point sources in particular have a long history of testing results. Wherever possible, the actual stack test results or data from continuous emissions monitors is used to describe emissions. Where this is not feasible, measurements at similar sources have resulted in the development of emission factors that provide users with a good degree of confidence. This is particularly true of the criteria pollutants. Emissions from area sources, however, are far less certain. Estimation of emissions from particular categories of area sources has improved, yet the presence of such source categories within any given airshed is difficult to verify. Typically, population (or in some cases acreage) is used as a surrogate to estimate the amount of activity associated with such source categories. Naturally, this assumes a "standard" urban mix of these source categories that is applied to any given area, such as the Wasatch Front. Emissions from mobile sources are estimated through the use of models developed by EPA. EPA's NONROAD model serves in that role to estimate emissions from mobile sources such as planes, trains, and miscellaneous non-road engines including construction equipment. Some of the information required by this model is easily verified, such as the number of take-offs and landings at each airport. However, much like any area source, the numbers of miscellaneous engines are estimated using population as a surrogate. MOVES2014a is the current model used to describe emissions from on-road mobile source emissions. These models are developed using both laboratory and in use testing, and again they make use of the most recent information available. Yet 2014a is already the 4th version of this model utilized by UDAQ in preparing its implementation plans, and before MOVES there were ten versions of the MOBILE model. Estimations of NO_x have differed significantly as one model replaced the next. Already there is some discussion that MOVES2014a may be underestimating NO_x emissions from heavy-duty diesel vehicles, and that the model may be revised again in the near future. Additionally, the development of the emission factors for ammonia has undoubtedly received far less attention than those for NO_x, VOC, and PM, itself. Another layer of uncertainty associated with the

estimation of on-road mobile source emissions originates at the transportation planning process. Agencies responsible for efficient transportation planning employ what are called travel demand models to forecast important parameters such as vehicle miles traveled, vehicle speeds on various roadway types, and the number of trips made by the driving public. These are all parameters that make use of the emission factors generated by the MOVES model.

Meteorological data is another subset of information necessary to run the air quality model. It becomes necessary in any gridded model to describe the meteorology at the boundary of every single grid cell in order to derive information about emission transport and chemical activity. Naturally it is not practical to situate a weather station at all of these locations, so the met-data that is available must be interpolated to generate the information for the spaces in between. This task is performed with a whole other layer of modeling. While this step in the air quality modeling is performed using the most advanced techniques available, there is still an inherent degree of uncertainty. It is simply not possible to ground-truth the results of the met-modeling. Furthermore, the terrain surrounding the Salt Lake City nonattainment area is very complex due to the high mountains and numerous canyon mouths that allow exchange with air from above in a diurnal pattern.

The Air Quality Modeling itself is another potential source of uncertainty. In general terms, the air quality model is approved for regulatory purposes and performs well enough in reproducing concentrations experienced in historical episodes to make its predictions in the projection years evaluated herein. Yet, it is still just a model. Any model makes assessments of physical and chemical laws within each of its grid-cells. There is no uncertainty about that. However, the atmosphere itself must be approximated and is certainly more complex than the model can describe. Air quality modeling now is far more accurate than it was in previous decades, but that only implies that there is still room to improve. This is especially the case when considering the understanding and description of photochemistry that is programmed into the model. The Salt Lake City nonattainment area has such a high proportion of secondary chemistry at the heart of its $PM_{2.5}$ problem that any uncertainties associated with the photochemistry will certainly become more prominent than for nonattainment areas that are less complex.

Furthermore, and in a synergistic way, our advances in the understanding of the various photochemical pathways to $PM_{2.5}$ also serve to underscore the afore-mentioned uncertainties in the emissions inventory. As certain compounds reveal their importance in these chemical reactions, it becomes clear that they may have been under-prioritized when the inventories were compiled. These inventories have historically concerned themselves with criteria pollutants such as NO_x and SO_2, and as noted they are generally accurate in their assessment of these emissions. Yet it is becoming evident that additional information will be required to support a greater understanding of secondary $PM_{2.5}$ formation. This is discussed in the next two sections.

Missing HCl and Cl from the Emissions Inventory: Both hydrochloric acid (HCl) and aerosol chloride play an important role in $PM_{2.5}$ formation. In the presence of excess ammonia, HCl will partition to aerosol particles, ultimately forming ammonium chloride, which has been shown to account for 10 – 15%

of $PM_{2.5}$ mass during high wintertime $PM_{2.5}$ pollution episodes[1]. Aerosol chloride can also contribute to the formation of nitryl chloride ($ClNO_2$), a source of radicals which act to enhance the daytime photochemical production of ozone and nitrate, both of which are important contributors to $PM_{2.5}$ formation. This formation of $ClNO_2$ is particularly active in the Salt Lake Valley, as shown by recent aircraft measurements (2017 Utah Winter Fine Particulate Study (UWFPS))[2]. Measurements of chloride indicate that it is significantly underestimated in the model; however, the sources of HCl and aerosol chloride are unclear, suggesting that significant sources of chloride and HCl are either not included or have been underestimated in the emissions inventory. Potential sources may include the Great Salt Lake, road salt, playa dusts from dry salt beds and the US Magnesium plant. An analysis of chemical speciation data collected at the Hawthorne site over previous years showed that the monthly average sodium ion and chloride concentrations overall increase with snowfall, suggesting that road salt may be a significant contributor to particulate chloride in winter. Emissions from road salt and the Great Salt Lake are not accounted for in the emissions inventory.

Measured HCl is also underestimated by the model, particularly in the vicinity of US Magnesium, where values as high as 100 ppb were observed during the 2017 UWFPS[3]. By contrast, CAMx expects that only 35ppm would be available to participate in the $PM_{2.5}$ chemistry.

This apparent underestimation in chloride and HCl emissions adds uncertainty to the modeling results. By not accounting for these emissions and their impact on $PM_{2.5}$ formation through the availability of various oxidants, the model's sensitivity to NO_x controls may be limited. The model is likely creating an oxidant-limited regime, and may therefore be less responsive to simulated NO_x controls.

UDAQ is planning a field sampling campaign during winter 2018-2019 and summer 2019 in order to improve the emissions inventory for chloride and HCl.

See the Technical Support Document for a more complete discussion of HCl and chloride.

Uncertainties in Ammonia Emissions: Ammonia is a key precursor to ammonium nitrate, the predominant (up to 60%) $PM_{2.5}$ component during persistent wintertime inversion periods in northern Utah. While NO_x emission sources are generally well understood, there are many uncertainties surrounding the origins and distribution of ammonia emissions. This is examined in the following discussion of recent studies and current modeling progress.

2017 Utah Winter Fine Particulate Study Results: The scope of the UWFPS included all three air basins in northern Utah that are presently designated nonattainment for the 2006 24-hour $PM_{2.5}$ NAAQS. Each

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[1] Kelly, K.E., R. Kotchenruther, R. Kuprov, and G.D. Silcox, Receptor model source attributions for Utah's Salt Lake City airshed and the impacts of wintertime secondary ammonium nitrate and ammonium chloride aerosol. Journal of the Air & Waste Management Association, 2013. 63(5): p. 575-590.

[2] https://www.esrl.noaa.gov/csd/groups/csd7/measurements/2017uwfps/finalreport.pdf

[3] https://www.esrl.noaa.gov/csd/groups/csd7/measurements/2017uwfps/finalreport.pdf. Chapter 3.

of these nonattainment areas sees elevated concentrations of secondary PM as a result of cold pool meteorology. The study indicates that each of these areas is most commonly nitrate limited (2017 UWFPS Final Report[1]). These findings are based on measurements made both on the ground and aloft.

However, of the three basins, the Salt Lake Valley is nitrate limited to the least degree, exhibiting generally the largest ratio of total nitrate to reduced nitrogen. Measurements also show the Salt Lake Valley as having lower concentrations of ambient ammonia than the other two areas. This is illustrated in **Figure 6.11** with a comparison between Salt Lake and the Cache Valley. Concentrations in the Provo nonattainment area would likely sit between these other two.

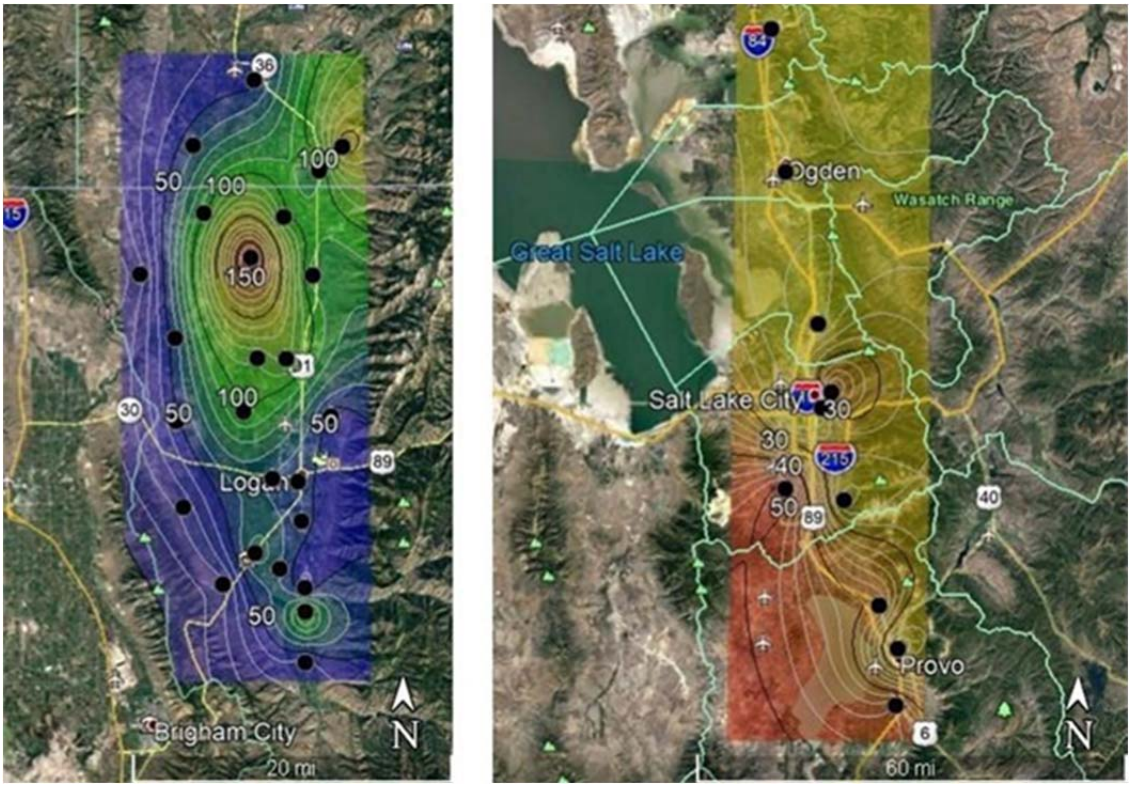

Figure 6.11: Contour plots of average ambient NH_3 concentrations [ppb] for Cache Valley and the Wasatch Front during the 2017 UWFPS. Panel comparison shows concentrations were much lower in the Salt Lake Valley (right) than Cache Valley (left). Sampler locations are depicted by black dots.

However, the emission inventory compiled for ammonia does not reflect these observed regional differences. This can be seen in **Fig. 6.12**, where ammonia emissions for all three air basins appear to be more or less within the same range.

[1]https://documents.deq.utah.gov/air-quality/planning/technical-analysis/research/northern-utah-airpollution/utah-winter-fine-particulate-study/DAQ-2018-004037.pdf

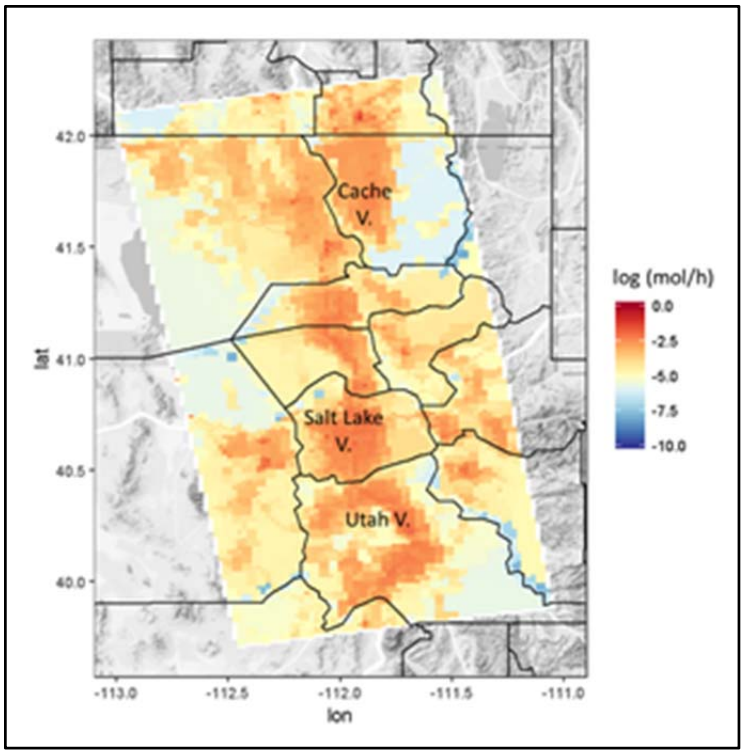

Figure 6.12: 24-hour average of 2014 NEI NH_3 emission rates (moles/hr) allocated across a 1.33 km Northern Utah modeling domain. Emission rates reflect a typical winter weekday in February. Ammonia injection is not included as to highlight the current state of the Utah ammonia emissions inventory.

Clearly, there is an inconsistency between the discernable information presented in **Figures 6.11 and 6.12**. Furthermore, using the emission inventory for ammonia depicted in **Figure 6.12**, CAMx was not able to re-create the observed concentrations of ammonium nitrate.

Ammonia injection: Recognizing that the emission inventory for ammonia was likely not very accurate, this discrepancy was addressed by adjusting the inventory until model results aligned more closely with the actual observations. This is achieved by artificially "injecting" non-inventoried ammonia emissions into the air quality model alongside the inventoried emissions.

In order to match modeled ammonia with observations at controlling nonattainment monitors, UDAQ used information from 2016 ammonia measurements (Dr. Randy Martin, Utah State Univ.) to determine how much ammonia would need to be injected.

To account for the spatial differences observed through measurement, the injected ammonia is varied on a county-to-county basis. Also, ammonia is only injected in relatively low elevation areas (< 6,000 ft ASL) in order to better associate the missing ammonia with anthropogenic sources.

Ammonia deposition: Within the modeled simulation, ammonia is emitted and there is a temporal rate ascribed to the emissions. There is also however, an ascribed rate at which ammonia is removed from the system through deposition onto the ground. It is the combination of these two rates that determines the

overall abundance of ammonia that would be available to participate in chemical reactions that lead to ammonium nitrate.

Early runs with the model were not able to re-create the concentrations of ammonium nitrate that were observed at the monitoring stations. It seemed this was likely due to a deposition rate that was too high, and more specifically that the modeled resistance to such deposition was characterized as too low.

To address the high ammonia dry deposition rate in the air quality model, UDAQ modified CAMx to maximize surface resistance to ammonia and keep as much free ammonia available for chemistry as possible[1].

While it may be relatively simple to adjust the rates of deposition, and resistance thereto, it is important to keep in mind that the real world is far more complex than what is presently characterized in the model. The CAMx model does not currently account for the re-volatilization of ammonia. Re-volatilization occurs when some forms of nitrogen (e.g., urea) changes to an ammonia gas. Ammonia is then transported from soil and emitted to the atmosphere.

Why it matters to Utah air quality modeling: Like the 2017 Utah Fine Particulate Study (UWFPS) observations, UDAQ $PM_{2.5}$ modeling also shows that the highest sensitivity to ammonia is in Salt Lake Valley. This is perhaps due to the abundance of NO_x emissions in the Salt Lake Valley compared to elsewhere in Utah. The Salt Lake Valley is more urban and features a relatively small animal husbandry sector compared to Cache Valley. The high abundance of NO_x emissions suggests that ammonia potentially plays a more important role in secondary $PM_{2.5}$ formation.

In the absence of any reliable measurements of ambient ammonia, the model performance was used as an indicator of how much ammonia would be injected. In the final configuration, fully 40% of the emission inventory was artificially introduced into the SLC nonattainment area. This represents a large portion of ammonia about which nothing is really known. The spatial location of its release and its deposition are unknown. The temporal characteristics of its abundance are also poorly understood. This includes any daily or seasonal fluctuations. By contrast, NO_x, the other chief constituent of ammonium nitrate is very well characterized in both space and time. NO_x emissions from motor vehicles are spatially distributed within the model to reflect the network of roadways, and it is temporally reflective of vehicle usage by the hour of each day of the week. Point sources of NO_x are precisely located on the grid, and include parameters that affect its release such that a vertical distribution may also be assigned. Each source also reports its hours of operation such that these emissions may be assigned a temporal profile. This is the level of characterization expected in an analysis of this type, yet where ammonia is concerned we see only a static quantity of homogenous distribution.

Furthermore, it is not possible to consider any long-term trends in ammonia emissions. Therefore, unlike any of the other precursor pollutants, the amount of injected ammonia is assumed to be identical in both base-year and future-year inventories. This has importance beyond the relatively short span of time evaluated in the analysis for this SIP.

[1] Recent versions of CAMx released by Ramboll now maximize the surface resistance to ammonia in order to lower the ammonia dry deposition rate. However, bidirectional flux is still not emulated in the model physics at this time.

Downward trends in NO_x emissions are well established, and as will be discussed in **section 6.9**, have been coincident with downward trends in $PM_{2.5}$ concentrations. Since such trends in $PM_{2.5}$ are skewed by elevated wintertime concentrations it seems likely that the SLC airshed has for a long time existed in a chemical regime that is in fact NO_x (or in past times SO_2) limited. As noted above, this is also the conclusion of the UWFPS, although by comparison to Utah's other two airsheds perhaps less so. Certainly this is not a static condition, yet because of the uncertainties surrounding the origin of ammonia emissions, model projections into the future are left to compare trends in NO_x against a static quantity of ammonia. This should lead to some caution in accepting any prediction concerning a near-term change from what has been a NO_x limited environment to one that is limited by ammonia. This is perhaps especially so if such chemical regimes are described now with a resolution that varies by the hour of the day. The effect of holding the amount of injected ammonia constant potentially makes the model stiff and unresponsive to modeled reductions in NO_x emissions.

Although the 2017 UWFPS was helpful, more observational studies are needed to further our understanding of ammonia in Salt Lake Valley. The lack of reliable measurements of ammonia impairs UDAQ's ability to properly characterize ammonia in the atmosphere and thus, provides a weak basis for making improvements in Utah's ammonia emissions inventory.

To help address some of this uncertainty, UDAQ plans to take ambient measurements of gaseous ammonia and hydrochloric acid (HCl) during the winter of 2018/2019 and the summer of 2019. Passive sampling will be focused on the Wasatch Front; twenty samplers alone placed within the Salt Lake City airshed. Additional measurements of $PM_{2.5}$ distribution and composition as well as mobile measurements of temporally-refined ammonia will also be conducted.

Missing Nitryl Chloride Chemistry Pathway in CAMx: Beyond the uncertainties in the emission inventories that support the analysis, other uncertainties within the air quality model itself also warrant some discussion. Recent measurements have shown that nitryl chloride ($ClNO_2$) formation, through the heterogeneous uptake of N_2O_5 onto particles containing chloride, is particularly active in the Salt Lake Valley. However, this is not accounted for in the carbon bond chemistry mechanisms within CAMx.

Halogens play an important role in $PM_{2.5}$ formation during wintertime inversion episodes. They act as radical sources important for the photochemical production of $PM_{2.5}$. $ClNO_2$, in particular, is an important source of radicals for daytime photochemical production of ozone and nitrate, as shown by recent aircraft measurements conducted in the Salt Lake Valley (2017 UWFPS[1]). These measurements showed that $ClNO_2$ is typically elevated over the Salt Lake City and Provo urban regions, reaching mixing ratios greater than 0.8 ppb at night. Similar levels of $ClNO_2$ were also detected in the plume of the U.S. Magnesium plant. These measurements also suggested that the chemical pathway, where $ClNO_2$ is formed through the heterogeneous uptake of N_2O_5 on chloride-containing particles, is particularly active in the Salt Lake Valley, where ammonium chloride aerosol generally accounts for 10 – 15% of $PM_{2.5}$

[1] https://www.esrl.noaa.gov/csd/groups/csd7/measurements/2017uwfps/finalreport.pdf

mass during high-$PM_{2.5}$ episodes[1]. This formation of $ClNO_2$ occurs mainly at night since the formation of N_2O_5, which is produced by a chemical reaction involving NO_2 and NO_3, is suppressed during the day (R1-R3).

$$O_3+NO_2 \rightarrow NO_3 \quad \text{(R1)}$$

$$NO_2+NO_3 \rightarrow N_2O_5 \quad \text{(R2)}$$

$$N_2O_5 + Cl^- \text{(het)} \rightarrow NO_3^- + ClNO_2 \quad \text{(R3)}$$

Once produced $ClNO_2$ will then photolyze into chlorine radicals and NO_x, thereby contributing to the oxidant budget and NO_x recycling.

However, while this heterologous pathway for N_2O_5 uptake on Cl-containing particles is potentially important for $PM_{2.5}$ formation in the Salt Lake Valley, the carbon bond chemistry mechanisms in CAMx, including cb6r2h that was used in UDAQ's simulations, do not include this pathway. Given $ClNO_2$'s role in contributing to the oxidants budget, an exclusion of this pathway in CAMx may increase the model's sensitivity to oxidants and may limit its sensitivity to NO_x emissions. Without this pathway, the model may be less responsive to proposed NO_x controls.

Misrepresentation of Formaldehyde in the Model: The model's sensitivity to changes in NO_x emissions may be obscured by an under-estimation of formaldehyde during mid-day hours.

Carbonyls, such as formaldehyde, act as radical sources which are important for the photochemical production of $PM_{2.5}$ during wintertime inversion episodes in the Salt Lake Valley. The photolysis of these compounds may be important for daytime generation of radicals, as shown by recent observations[2,3]. However, although formaldehyde is important for $PM_{2.5}$ formation, it may be underrepresented in the model during mid-day hours. Given that measurements of VOC species were not available during 2011, the modeling results were compared to observations conducted in winter 2017 at the University of Utah (2017 UWFPS). While these field study measurements from 2017 cannot be directly compared to day-specific 2011 model simulations, they're qualitatively useful to assess if the model predicts similar levels of VOCs during strong inversion conditions.

On average during peak $PM_{2.5}$ exceedance days, measured formaldehyde peaked at about 3 ppb around 11 am (Figure 6.11) while modeled formaldehyde displayed a concentration of 1.8 ppb (figure 6.10) at 11

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[1] Kelly, K.E., R. Kotchenruther, R. Kuprov, and G.D. Silcox, Receptor model source attributions for Utah's Salt Lake City airshed and the impacts of wintertime secondary ammonium nitrate and ammonium chloride aerosol. Journal of the Air & Waste Management Association, 2013. 63(5): p. 575-590.

[2] Baasandorj, M., S.W. Hoch, R. Bares, J.C. Lin, S.S. Brown, D.B. Millet, R. Martin, K. Kelly, K.J. Zarzana, C.D. Whiteman, W.P. Dube, G. Tonnesen, I.C. Jaramillo, and J. Sohl, Coupling between Chemical and Meteorological Processes under Persistent Cold-Air Pool Conditions: Evolution of Wintertime $PM_{2.5}$ Pollution Events and N2O5 Observations in Utah's Salt Lake Valley. Environmental Science & Technology, 2017. 51(11): p. 5941- 5950

[3] https://www.esrl.noaa.gov/csd/groups/csd7/measurements/2017uwfps/finalreport.pdf. Chapter 3.

am. Modeled formaldehyde also displayed a temporal trend different from that of measured formaldehyde, with observations indicating direct emission as well as secondary production of formaldehyde. Similarly, modeled acetaldehyde exhibited a temporal trend different from that measured on peak $PM_{2.5}$ days. This comparison suggests that acetaldehyde and formaldehyde, an important source of radicals, may be underestimated in the model during mid-day hours. Given the role of formaldehyde in the generation of radicals, an underestimation of formaldehyde in CAMx may increase the model's sensitivity to oxidants.

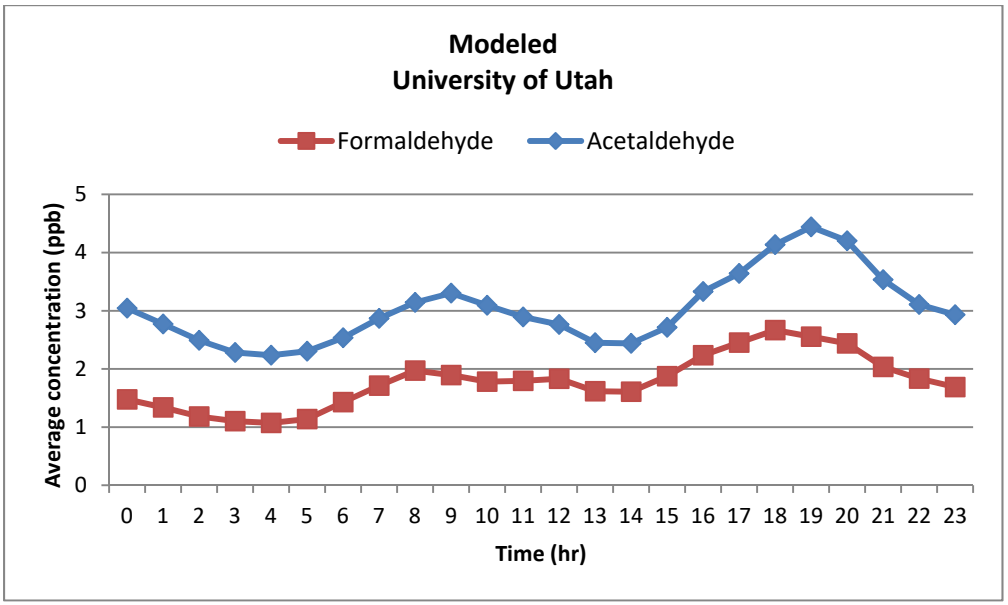

Figure 6.10: Hourly time series of average modeled formaldehyde and acetaldehyde during January 6-8 2011 at the University of Utah.

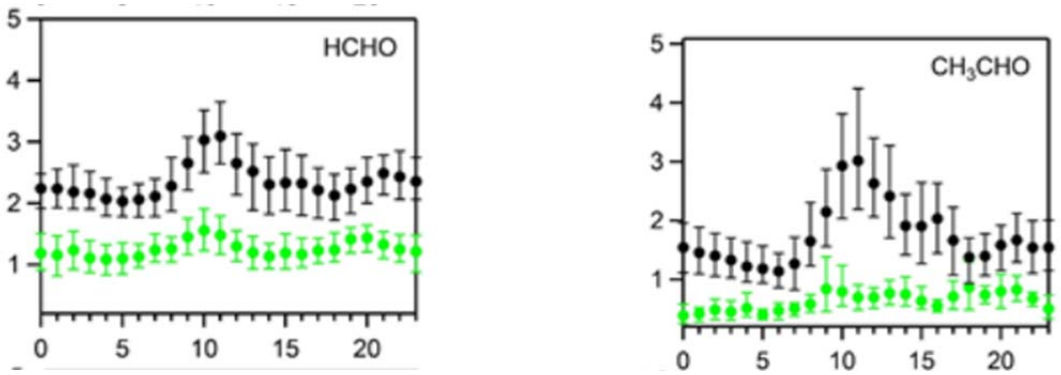

Figure 6.11: Diurnal trend of hourly averaged formaldehyde (HCHO) and acetaldehyde (CH3CHO) measured at the University of Utah during polluted (black lines) and clean (green lines) conditions in winter 2017. Figure retrieved from the 2017 Utah Winter Fine Particulate Study, final report, Figure 3.59 (https://www.esrl.noaa.gov/csd/groups/csd7/measurements/2017uwfps/finalreport.pdf).

The model's sensitivity to formaldehyde emissions was further evaluated by conducting a modeling sensitivity run where formaldehyde emissions from all sectors were increased by 50%. Formaldehyde emissions from the 2019 inventory were considered for this sensitivity simulation. Both modeled ozone and nitrate (Figure 6.12) increased after increasing formaldehyde emissions, suggesting that the model is oxidant-limited and may have a limited sensitivity to a reduction in NO_x emissions. An underestimation of formaldehyde will lead to an underestimation in the production of HNO3, leading to a reduced response to proposed NO_x controls.

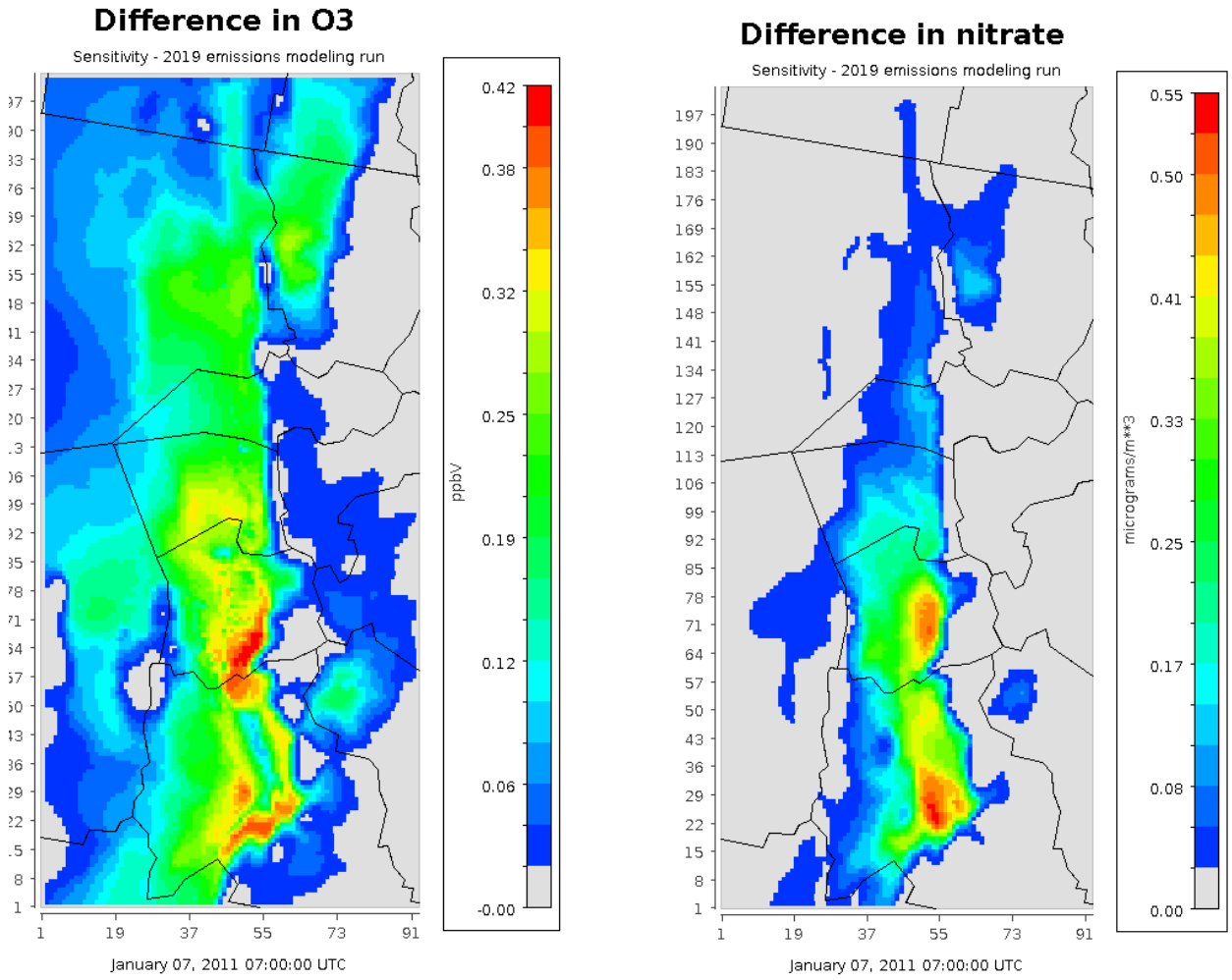

Figure 6.12: Spatial plots of the difference in mean ozone and nitrate levels between the sensitivity modeling run, where formaldehyde 2019 emissions were increased by 50%, and the 2019 emissions modeling run, where formaldehyde emissions were kept unchanged. Plots are shown for January 7 2011.

Trends in Monitored Data

Certainly the most significant information to assess would be the ambient air quality data collected throughout the nonattainment area, and in particular, any observable trends in the data. The Salt Lake City nonattainment area is designated such only for the 24-hour health standard, so it should be simple to

focus on the 24-hour $PM_{2.5}$ values. This, however, is somewhat confounding because of the nature of the problem. As described in Section 1.3, concentrations in excess of the 24-hour NAAQS are only incurred during winter months when cold-pool conditions drive the formation of 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 $PM_{2.5}$ and $PM_{2.5}$ precursors. This variability may easily be seen in **Figure 6.14** below. Still, if one fits a line through the data collected at the Hawthorne site, the NCORE site for the SLC metropolitan statistical area, the trend is noticeably downward and indicates an improvement of about one microgram per cubic meter, per year.

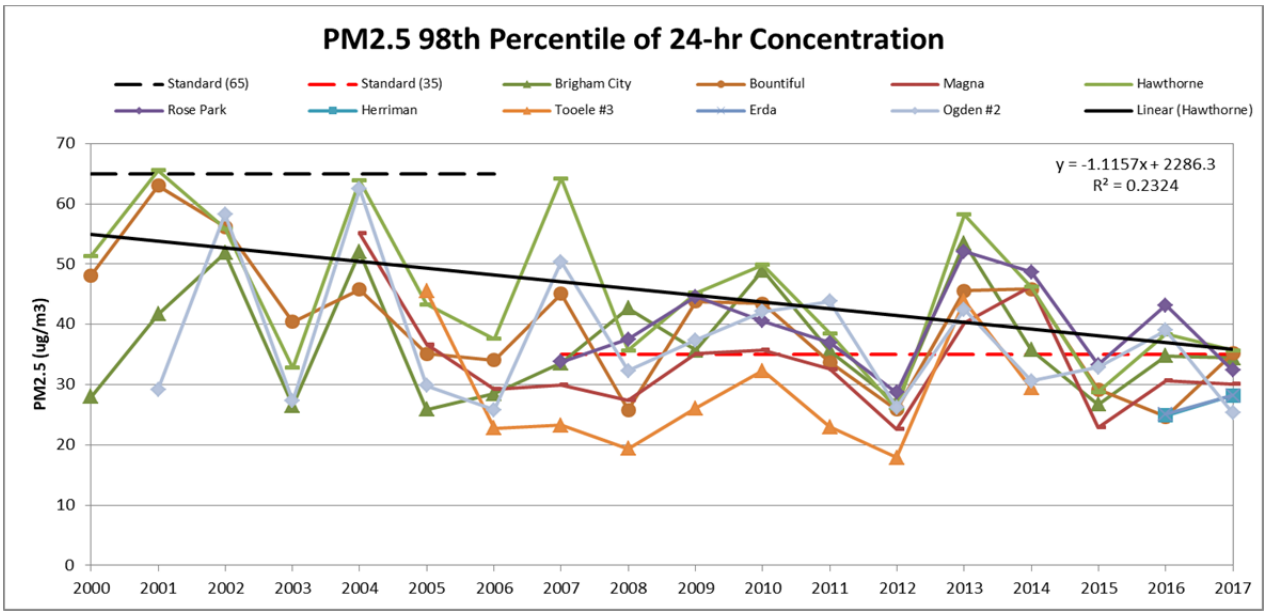

Fig. 6.14 Trend in Monitored $PM_{2.5}$ (98^{th} Percentiles of 24-hour Concentrations)

This episodic variability is generally removed by looking at annual mean values of $PM_{2.5}$ concentrations as shown in **Fig 6.15**. This 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 Hawthorne site reveals a trend that is noticeably downward, and indicates an improvement of about 4.5 micrograms per cubic meter, over the 17-year span. Such improvement is noteworthy in the face of this area's rapid growth in both population and vehicle miles traveled (vmt).

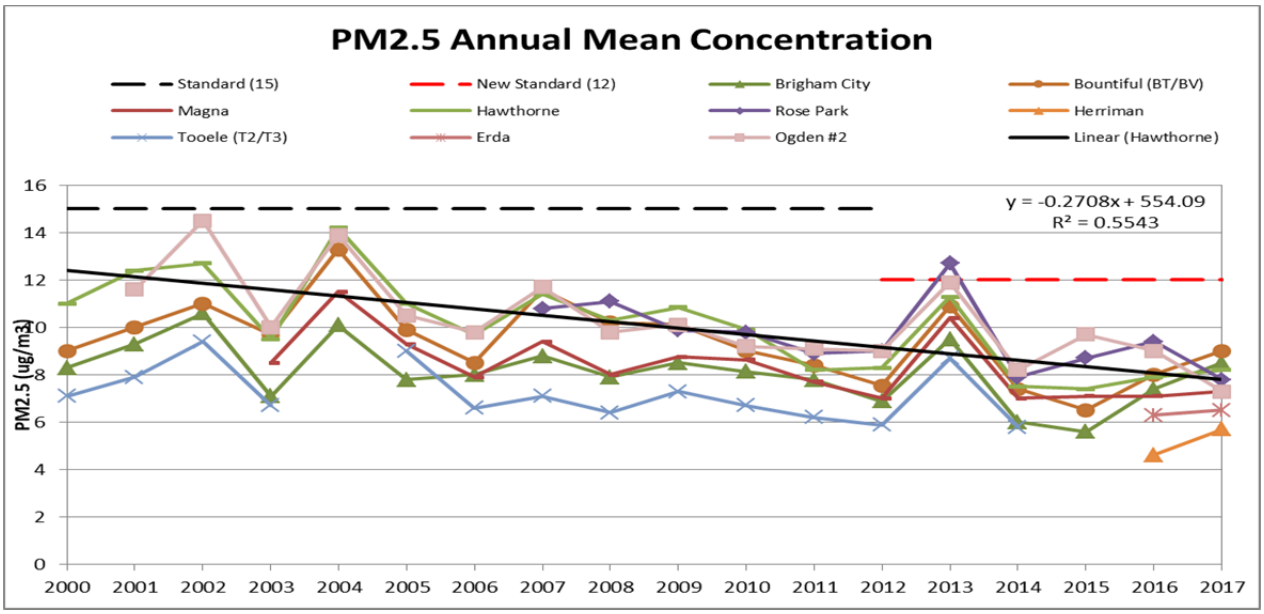

Fig. 6.15 Trend in Monitored $PM_{2.5}$ (Annual Mean Concentrations)

UDAQ also monitors two of the four $PM_{2.5}$ precursors, NO_x and SO_2, and it is also useful to observe the trends in their concentrations.

Figures 6.16 and 6.17 chart trends in nitrogen dioxide, from which NO_x concentrations may be inferred. Whether measured as peak concentrations or long-term averages, the trend has remained steadily downward for a long time.

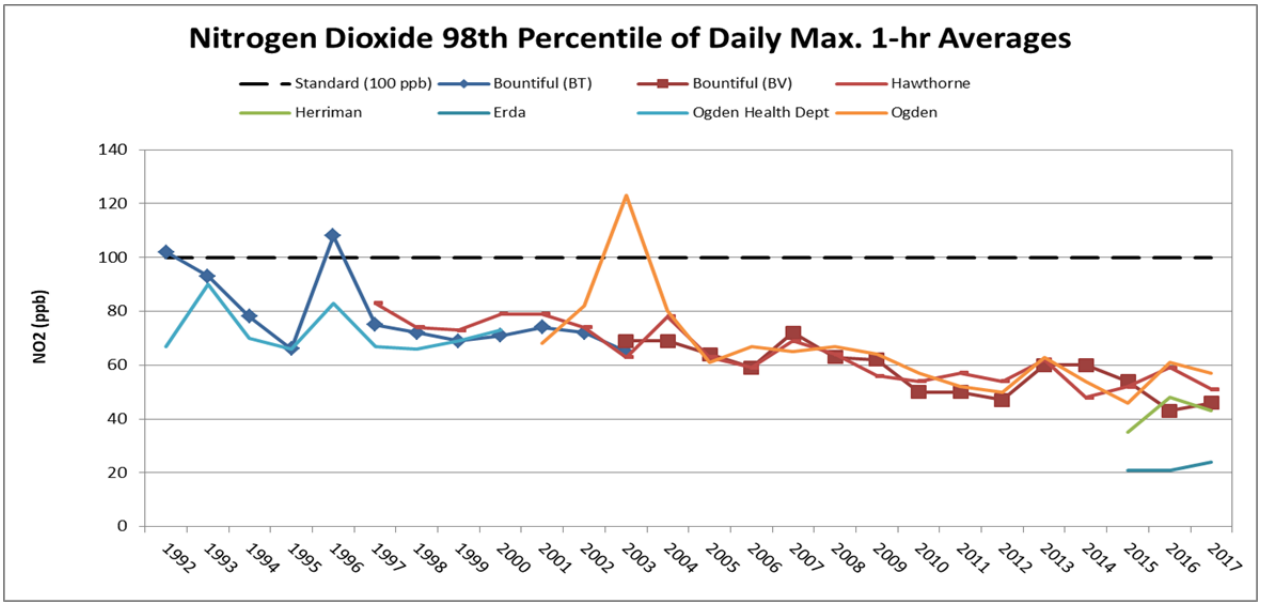

Fig. 6.16 Trend in Monitored NO_2 (98^{th} Percentiles of Daily 1-hour Max.)

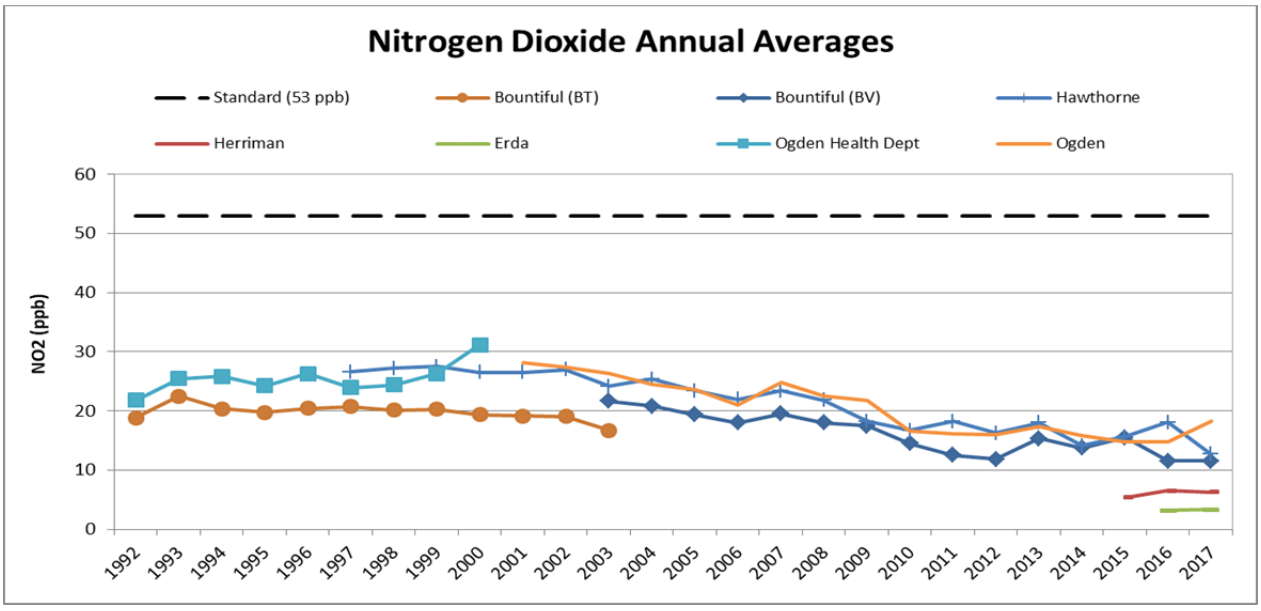

Fig. 6.17 Trend in Monitored NO_2 (Annual Averages)

Sulfur dioxide has also diminished over time, from a sharp decline in the 1990s to a steady degree of progress over the last 20 years. This is shown in **Fig. 6.18**.

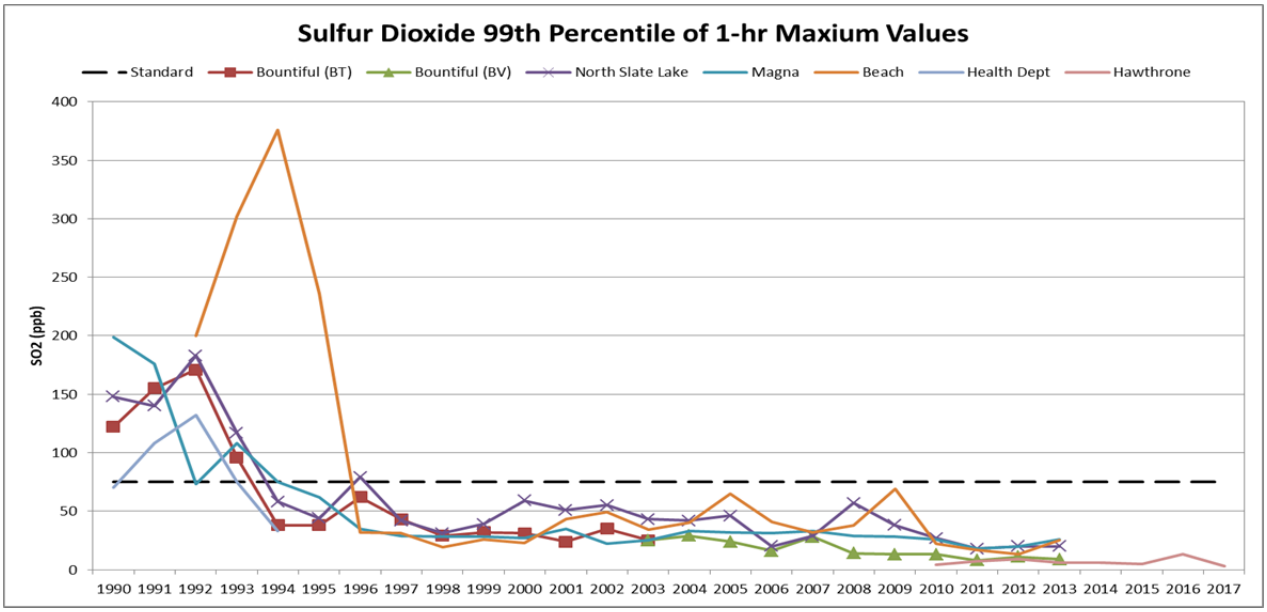

Fig. 6.18 Trend in Monitored SO_2 (99^{th} Percentiles of Daily 1-hour Max)

Trends in Emissions

Another way to evaluate trends in air quality is to compare inventories of emissions on a periodic basis. For purposes of this SIP, UDAQ has developed a suite of emissions inventories for several years between 2011 and 2024. These inventories are based on the 2014 tri-annual emissions inventory and are tailored to suit wintertime conditions pertinent to this SIP. Specifically, these emissions inventories reflect winter weekday emissions for all five Salt Lake nonattainment area counties and include parts of the counties that are outside the nonattainment boundary. For this reason, the values shown here may not match nonattainment area emissions summaries shown elsewhere in this document. Still, these emission inventories provide a useful tool for comparing emissions trends over time.

Figure 6.19 below charts the emissions of NO_x, VOC, $PM_{2.5}$ and SO_2 throughout the period of time represented in some way by this Serious Area SIP.

Because wintertime emissions inventories are unavailable prior to 2011, it is useful to consider the tri-annual emissions inventories routinely compiled by UDAQ to evaluate longer-term emissions trends.

Annual emissions trends from the 1999-2014 tri-annual inventories for the five Salt Lake nonattainment area counties are shown in **Figure 6.20** below.

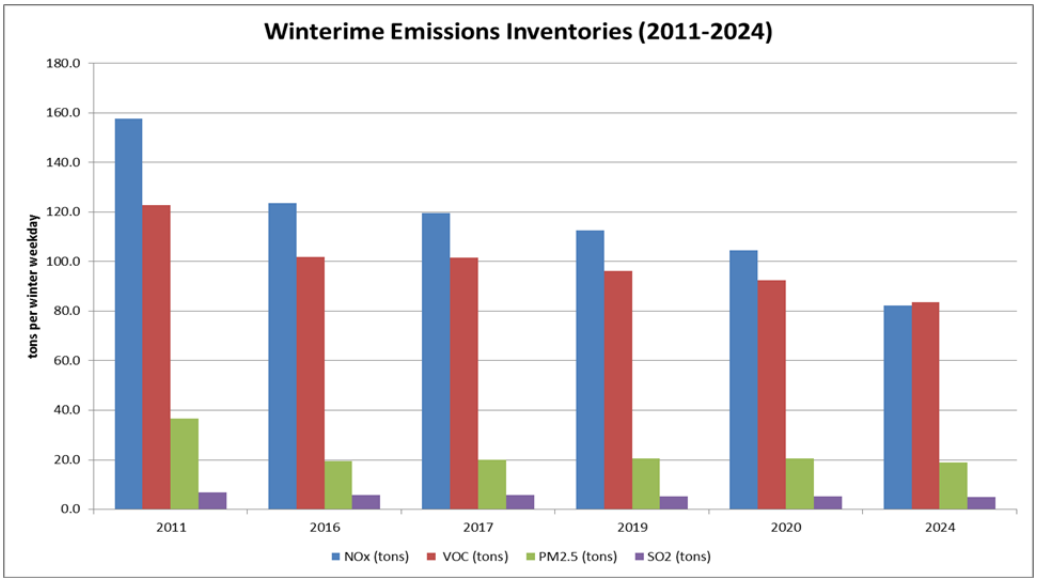

Fig. 6.19 Emissions Trends (2011 – 2024)

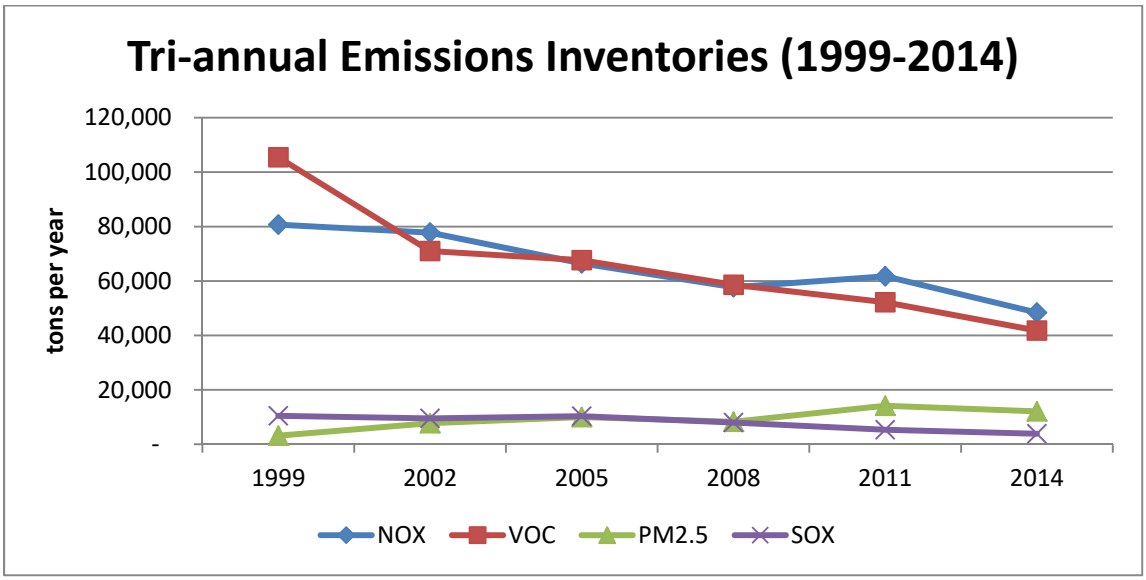

Fig. 6.20 Emissions Trends (1999 – 2014)

Seen together, **Figs. 6.19 and 6.20** illustrate trends in $PM_{2.5}$ and $PM_{2.5}$ precursor emissions that reach back almost as far as the establishment of $PM_{2.5}$ as the indicator of fine particulate matter.

Qualitatively, it is easy to see that NO_x and VOCs are emitted in much larger quantities than are $PM_{2.5}$ or SO_2. Also, the trend in each of these $PM_{2.5}$ precursors has been steadily downward for roughly the last 20 years. This is largely attributable to Tiers 1 and 2 of the federal motor vehicle control program, but there are other drivers.

Looking back at the trend charts showing ambient NO_x concentrations (**Figs. 6.16 and 6.17**), one finds good agreement between the diminishing emissions and the ambient NO_x.

UDAQ does not monitor ambient concentrations of VOC, but one would assume that the reductions in VOC emissions would be detected as a continuous trend over this same period.

Where SO_2 is considered, it is again useful to refer back to **Fig. 6.18** where the ambient concentrations are charted. Here one may observe that by 1999 the airshed had seen an end to what had been a history of NAAQS violations due to very large emissions of SO_2 at a local copper mine. This decline in ambient concentrations was driven first by a SIP addressing SO_2 itself in 1982, and then by a focus on SO_2 control in a 1992 PM_{10} SIP that required SO_2 reductions at not only the copper smelter, but also five oil refineries and a steel mill. From 1999 forward, SO_2 emissions and SO_2 concentrations have remained relatively flat, perhaps trending slightly downward, but at levels that might be described as "background".

$PM_{2.5}$ emissions have also remained somewhat constant over this period, perhaps even trending upward. It is instructive, therefore, to refer back to **Figs. 6.14 and 6.15** showing the monitored trends in ambient $PM_{2.5}$ concentrations.

Both of these charts show that $PM_{2.5}$ concentrations have been declining over the same span of time depicted in the emissions trends charts.

Taken together, this would suggest that the persistent decline in NO_x and VOC emissions is most directly responsible for the commensurate improvement in $PM_{2.5}$ concentrations, particularly with respect to the secondary $PM_{2.5}$ that dominates the highest exceedances.

Throughout any calendar year, $PM_{2.5}$ concentrations in Northern Utah exhibit a background level well beneath the annual standard, marked by episodes of very high concentrations predominantly in the months of December through February which are dominated by secondary $PM_{2.5}$ **(as shown in Figure 6.2.2)**,. Since the early 1990s, Utah has addressed these "spikes" in fine particulate by focusing emission control on precursor emissions (SO_2, and NO_x), and maintained that by reducing the magnitude of such exceedances that the annual standard (which has never been violated) would be kept in check. This seems to have been supported by the data concerning both emissions and concentrations.

Over this same period of time, it has always been assumed that the Salt Lake City airshed was NO_x (or even SO_2) limited with respect to the atmospheric chemistry that supports formation of secondary PM during periods of cold pool meteorology.

Looking forward at the emissions projected in **Fig. 6.19**, one will see a continuation of the trends of NO_x and VOC emissions, from the present out to 2024. Again, this reflects the continued implementation of Tier 2 standards and now the introduction of Tier 3.

Given the apparent co-benefit of ambient $PM_{2.5}$ improvement between 2000 and 2017, one would expect this co-benefit to continue between now and 2024.

Additionally, direct $PM_{2.5}$ emissions are projected to decrease from 20.5 tons per winter weekday in 2019 to 19.0 tons per winter weekday in 2024, and SO_2 emissions are projected to decrease from 5.2 tons per winter weekday to 4.9 tons over the same span.

Supplemental Analyses

Additional Modeling Result / Exceptional Event

As discussed in Chapter 3, data captured during the years important to the SIP was initially found to be invalid for a number of reasons, including some values identified by UDAQ is perhaps being influenced by exceptional events (EEs). EPA's Exceptional Events Rule allows for data that has been heavily influenced by wild land fires, fireworks, etc. to be excluded from the data set in its use for regulatory purposes. The rule requires that states first identify such incidences by affixing a flag to the data it submits, and then submit supporting documentation for EPA to consider. If EPA concurs with the state, it will affix a second flag to the value.

As mentioned already in the discussion surrounding **Tables 3.1 & 3.2**, UDAQ has flagged several values in 2017 that have yet to be concurred with, but with agreement from EPA, excluded these values from the Monitored Design Value (MDV) calculations.

There is, however, another value in 2015 that may warrant additional scrutiny. August 20, 2015 was a day influenced by wildland fire. In fact, UDAQ flagged and documented a number of values affected by that event at other monitoring stations (Logan, Brigham City and Ogden). Although smoke from wildfires filled all of Northern Utah, only these three monitors recorded exceedances of the NAAQS. UDAQ; however, UDAQ believes that all monitors in Northern Utah were impacted by smoke.

Even though monitored values at Rose Park were impacted by the smoke event, UDAQ did not flag the value collected at Rose Park because those values did not exceed the standard. This value presently sits as the 8th highest value collected at Rose Park during 2015, and is identified as the 98th percentile value for that year. The reason this value was not flagged is because, at 33.3 µg/m3, it did not exceed the 24-hr NAAQS; perhaps an oversight on the part of UDAQ.

Nevertheless, if this value were to be documented as an exceptional event, the 98th percentile value for Rose Park would become the next highest value which was measured as 31.2 µg/m3, a difference of 2.1 µg/m3. Furthermore, when averaged with the 98th percentile values for 2016 and 2017, the 3-year Monitored Design Value (MDV) for Rose Park would drop from 36.3 to 35.6 µg/m3.

Taking the next step and applying the Relative Response Factor (RRF), calculated for 2019 by the CAMx model, to the reduced MDV, would yield a lower prediction for the future concentration in 2019. This is shown in Table **6.2**.

Rose Park Monitor	98th Percentile Values (µg/m3)			2016 Baseline DV	2019 Future DV
	2015	2016	2017		
As presented in Table 6.1	33.3	43.2	32.4	36.3	35.9
Excluding data from 8/20/15	**31.2**	43.2	32.4	35.6	**35.2**

Table 6.2 Air Quality Modeling Results; as affected, or not, with the inclusion of data potentially qualifying as an Exceptional Event

The predicted concentration at Rose Park for 2019, the attainment year, was just over the NAAQS at 35.9 µg/m3 (**see Table 6.1**). This of course was the controlling monitor within the nonattainment area, and accounted for the only value in the analysis that was over the 24-hour standard.

Using the new MDV, with the value for August 20, 2015 excluded as an EE, would change the prediction for 2019 to 35.2 µg/m3 and change the conclusion of the modeling result to a likelihood of attainment by 2019 (35.5 rounds up to 36… numbers below 35.5 round to 35).

How likely is it then, that this value could actually be excluded as an EE? It's true that 33.3 does not exceed the 24-hour standard (35 µg/m3), and for only this reason did UDAQ not include the value for Rose Park in the documentation compiled for that event, yet it is greater than the annual NAAQS.

EPA has acknowledged that even if a value does not exceed the standard for a 24-hr averaging period, it may still affect a determination of compliance with the 24-hr standard. This is certainly true of the $PM_{2.5}$ standard, where the form of the standard requires the averaging of three distinct 24-hr values. In such cases, EPA indicates that the level of a longer averaging period, in this case the annual standard, can serve as the cut-point for whether the rule may be used to determine that the value was influenced by an exceptional event. In fact, this interpretation was codified into the EE rule, but not until 2016, after the event in 2015.

Whether in fact this value receives additional attention in the data set, it remains pertinent to a discussion surrounding a weight of evidence to be considered in the assessment of whether attainment of the $PM_{2.5}$ standard can likely be reached by the attainment date in 2019.

Overstated Conservatism in Projected Emissions:

We have mentioned some of the uncertainties inherent in the modeled demonstration of attainment already. However, there is another aspect of the analysis that bears some mention, and that is the conservatism that is also built into such a demonstration.

The SIP is a legal document, with consequences to be enforced in the event certain conditions are not met. For this reason a certain amount of conservatism is built into the estimates used to construct the attainment demonstration, its quantitative foundation.

Thus, the discussion herein is not to suggest that such conservatism is misplaced. Rather it is to help, in the context of evaluating a weight of evidence, where perhaps one might give more or less weight.

The aforementioned conservatism might be broken into two distinct categories: 1) overstating the emissions to be expected throughout the projection years, and 2) omission of some controls that are expected to help mitigate $PM_{2.5}$ concentrations, but which may not be suited to the assignment of SIP credit. Examples of each are presented below.

Emissions from Point Sources – are depicted differently in the base-year inventory than they are in the projection-years. Actual emissions are used in the base-year, whereas the SIP takes more of a worst-case

view of these emissions in the projection years and uses in some cases the legal potentials to emit. While this makes legal sense, it tends to overstate a somewhat artificial "growth" in emissions from this sector.

Actually, most point sources included in this analysis were already operating in the base year at or near their potentials to emit. Therefore, emissions from these sources remained essentially flat throughout the analysis period.

Emission totals for the point source category did in fact exhibit some growth between 2016 and 2019. $PM_{2.5}$, NO_x, and VOC emissions increased by 20, 14, and 13 percent. Virtually all of this increase is shown to be associated with three sources that were not operating near their respective PTEs in 2016, Hill Air Force Base, Proctor & Gamble, and Kennecott. The inventories are detailed in the technical support document.

On-Road Mobile Source Emissions – like point sources, are legally bound to remain within the emission totals that are included in the SIP. This leads to some conservatism in the establishment of the projected emissions. Actual data is available to calculate emissions in the base-year, whereas projections are made using a travel demand model to estimate what emissions will likely be in the future. Transportation planning considers time horizons well beyond those used for air quality planning, and many assumptions are made when projecting transportation tendencies well into the future.

Again this makes legal sense, but tends to overstate a somewhat artificial "growth" in emissions from this sector.

In addition to the assumptions inherent in a travel demand model, there is another factor at play concerning mobile source emissions in the Salt Lake Valley. Tier 3 of the federal motor vehicle control program becomes effective in 2017, and it requires refiners of gasoline to limit the sulfur content of the fuel in order to achieve better overall performance in catalytic converters. The default value for sulfur in fuel beginning in 2017 is 10 ppm. The limit under Tier 2 had been 30 ppm. All of the refiners in the Salt Lake Valley are small (< 75,000 barrels per day) and have until 2020 to comply with the Tier 3 sulfur limit. Furthermore, corporate producers may average their compliance over the aggregation of their individual refineries. This means there is no legal guarantee that the Salt Lake Valley will see the Tier 3 fuel slated for 2017, even by 2020. For this reason, mobile source emissions in the analysis underlying the attainment demonstration were assumed to remain at 30 ppm. This is a conservative approach that feeds the air quality model more emissions in 2019, the attainment year.

UDAQ used the model to assess what affect some of this conservatism may be having on the determination of attainment.

No adjustments were made to the point source emissions, but for 2019, on-road mobile sources were adjusted by first assuming a 5% reduction to vehicle-miles-traveled (VMT) throughout the nonattainment area. Secondly, the fuel sulfur parameter was changed in MOVES from 30 ppm to 10 ppm.

Table 6.3 lists the reduction percentages in on-road mobile emissions using the modifications in VMT and fuel sulfur content.

On-road Mobile Emissions Reduction in the Salt Lake Nonattainment Area				
$PM_{2.5}$	**NO_x**	**VOC**	**NH_3**	**SO_2**
4%	**12%**	**4%**	**5%**	**60%**

Table 6.3: Percentage of 2019 on-road mobile inventory reduced in Salt Lake nonattainment area by lowering VMT by 5% and reducing fuel sulfur loading to 10 ppm. Reductions are with respect to on-road mobile sector only.

UDAQ re-ran the SMAT-CE v1.01 tool to develop another set of future design values, which could be compared to the existing set for 2019. **Table 6.4**, below, shows this comparison.

At both the Rose Park and Hawthorne monitors, these adjustments to the on-road mobile source inventory effectively decreased the predicted future design value by 0.2 µg/m^3. While notable, a decrease of this magnitude would not change the conclusion of the modeled attainment test. However, it does serve to illustrate that the result presented in the attainment test is likely conservative by at least this amount.

In addition, this exercise serves to underscore the insensitivity of the air quality model to what might be considered significant reductions in NO_x emissions throughout the Salt Lake City nonattainment area.

Monitor Name	Monitor ID	County	Baseline DV	Future DV (2019 baseline)	Future DV (5pVMT_10ppm)
Brigham City	490030003	Box Elder	31.9	29.4	28.4
Bountiful	490110004	Davis	29.3	29.3	29.2
Magna	490351001	Salt Lake	27.8	28	27.7
Hawthorne	490353006	Salt Lake	34.3	34.4	34.2
Rose Park	490353010	Salt Lake	36.7	36.5	36.3
Ogden #2	490570002	Weber	32.1	31.7	31.4

Table 6.4: Comparison of future design values using two different 2019 on-road mobile emissions inventories: baseline (Column 5), reduced VMT and fuel sulfur content (Column 6).

Note that the future design values presented in the column labeled (2019 baseline) do not exactly agree with those presented in section 6 as the modeled attainment test. Additional refinements were made to the entire analysis between the time this exercise was completed and the final modeling runs. Nevertheless, one would not expect these refinements to change the 0.2 µg/m^3 result of the exercise.

Controls Unaccounted for in the SIP:

Another example of conservatism in the analysis would be the omission of certain control measures that would be expected to improve air quality. Again, these controls were not made part of the quantitative attainment demonstration because they are not suited to the assignment of SIP credit. Still, they are expected to mitigate $PM_{2.5}$ concentrations. Examples include:

VW Settlement Monies

Utah is a beneficiary of over $35 million of the Volkswagen Diesel Emissions Environmental Mitigation Trust as a result of over 7,000 of the non-compliant VW cars operating in Utah. Utah has allocated $25.7 million of this funding specifically for heavy-duty diesel vehicle replacements. The goal for the settlement money is to fully mitigate the excess lifetime NO_x from the non-compliant vehicles that operated in Utah. $PM_{2.5}$ and VOC reductions will occur as well by removing old diesel vehicles from operation.

It is estimated that the non-compliant cars in Utah emitted between 351-1,556 tons of excess NO_x. Depending on VW project applications and selection, Utah has the opportunity to reduce between 351-1,556 tons of NO_x, between 26-115 tons of $PM_{2.5}$, and between 35-156 tons of VOCs. Utah expects to accomplish these reductions in calendar years 2019-2024. The projects will be focused in Utah's nonattainment areas, with greater weight applied to areas of the state that bear a disproportionate amount of the air pollution burden.

Utah has an additional $1.4 million in funding for projects such as lawnmower and snowblower exchanges, where gas-powered equipment is exchanged for electric equipment at a reduced cost.

Targeted Airshed Grant Money

The EPA has awarded the State over $9.5 million to reduce pollution from woodstoves. The UDAQ will use the funding to offer Utah residents generous financial incentives to convert their woodstoves and fire places to cleaner sources of heat. Changing-out an old uncertified woodstove for an EPA-certified stove can reduce the amount of $PM_{2.5}$ by as much as 60%. Converting a wood stove to a natural gas stove is even more beneficial, reducing $PM_{2.5}$ by 99.9%.

Estimates show that the five year program will result in: 1) the destruction or recycling of 503 wood-stoves/inserts, 2) conversion of 496 wood-burning units to gas stoves, and 3) replacement of 1,006 uncertified wood stoves/inserts by EPA-certified wood-burning appliances. On a yearly basis, the change-out program would result in the destruction/recycling of 101 units, conversion of 99 wood-burning units to gas-fueled devices as well as the replacement of 201 uncertified wood-burning units by EPA-certified ones.

Implementation of the program is expected to result in the reduction of nearly 72% (or 18 tons) of $PM_{2.5}$ and 87% (or 36 tons) of VOCs emissions from wood-smoke over the duration of the program. This is equivalent to a reduction of about 3.6 and 7.3 tons/year of $PM_{2.5}$ and VOCs from wood-smoke, respectively.

Diesel Emission Testing

Currently there are three counties within the Salt Lake City Nonattainment Area (Davis, Salt Lake, and Weber) that have implemented a diesel emission inspection program. Each of the three programs is administered by its local health department, which may manage its program somewhat differently than the others. Although each is an independent program, they all share the same purpose of improving air quality through the detection and repair of excessively emitting vehicles.

In Davis County, all light, medium and heavy duty diesel powered vehicles are required to undergo an emission test. The program consists of an On-Board Diagnostic (OBD) and visual tampering inspection for model year 1996 and newer light duty (under 8,500 lbs Gross Vehicle Weight Rating (GVWR)) diesel vehicles and model year 2008 and newer medium duty (between 8,501 and 14, 000 lbs GVWR) diesel vehicles. Davis also tests model year 1968 to 2007 medium duty diesel vehicles using an opacity inspection test using a dynamometer, and finally, 1968 and newer Heavy Duty vehicle (over 14, 001 lbs GVWR) are tested using Society of Automotive Engineers (SAE) J1667 or snap acceleration procedure. Salt Lake County's diesel program consists of an OBD and visual tampering inspection for 1998 and newer light and medium duty diesel powered vehicle 14, 000 lbs GVWR and less. Salt Lake County also tests 1968 and newer Heavy-Duty diesel vehicles over 14, 001 lbs GVWR using the SAE J1667 Snap Acceleration Smoke Test Procedure. Weber County's program consists of an OBD inspection for 2008 and newer vehicles light-and medium duty vehicles (under 14001 lbs GVWR). Weber County also conducts a visual tampering inspection for model year 1998 through 2007 diesel vehicles.

In any of the three counties, the frequency of inspection depends on the age of the vehicle. Vehicles less than two years old, as of January 1 on any given year, are exempt from an emissions inspection. Vehicles that are two years old but less than six are inspected every other year, as per Utah Code 41-6a-1642(6). All vehicles six years old and older are inspected annually.

Davis County reported a total of 9,096 diesel inspections completed during 2017. In aggregate, 816 of these vehicles failed the particular inspection, which amounts to a 9% fail rate. Of the total inspections performed, 3,346 were OBD inspections (12.8% fail rate), 1,556 were snap-idle inspections (4.2% fail rate), and 4,194 were opacity inspections (7.6% fail rate).

Weber County inspected 10,727 diesel vehicles in 2017. OBD inspections resulted in a 19 % failure rate (1999 vehicles), and visual tampering inspections produced a 7.5% failure rate (801 vehicles).

Salt Lake County inspected a total of 42,002 diesel vehicles in 2017; 26,956 OBD inspections with a 4.8% fail rate (1,295 vehicles), and 14,735 snap acceleration inspections with a 2.8% fail rate (419 vehicles failed).

6.3 Conclusion: Air Quality as of the Attainment Date

This demonstration began with a modeled analysis that predicted $PM_{2.5}$ concentrations in 2019, the attainment year, beneath the NAAQS at all stations but one, the Rose Park station. Even at Rose Park, the prediction was very close (35.9 µg/m3). Additional analysis was presented to supplement the modeled demonstration, including: an alternate conclusion that did show a concentration beneath the NAAQS in 2019, trends in ambient concentrations of $PM_{2.5}$, NO_2, and SO_2, trend in emissions of $PM_{2.5}$ and its precursors, some examples of how the modeled analysis might be considered conservative in its assessment of emissions improvement, and perhaps most importantly, some examination of what might be the shortcomings of the model as presently configured.

To this final point, one might consider the following when deciding how much the model may be relied upon.

Despite a significant projected decrease in NO_x and VOC emissions between 2016 and 2019, the modeled $PM_{2.5}$ results only show a slight decrease in predicted nitrate (NO_3). The model simulates an ammonia-limited and oxidant-limited regime in the Salt Lake Valley. However, observations from the recent 2017 UWFPS report suggest that the Salt Lake Valley airshed is actually close to the equivalence point between NH_3 limited and NO_x limited regimes during a wintertime inversion. This implies that if the model more accurately represented the wintertime inversion episode, then one would certainly see a bigger $PM_{2.5}$ decrease relative to the sizable reduction in NO_x and VOC emissions projected for 2019.

To improve modeled NO_3 (and hence, $PM_{2.5}$) performance, ammonia was artificially injected into the emissions inventory. While this adjustment improved NO_3 performance, it is associated with multiple uncertainties. As applied, the model assumes a uniform temporal distribution and a coarse spatial variation in artificial ammonia emissions across the Salt Lake Valley. Even with the additional ammonia, the model was still ammonia-limited during the extent of the episode.

The model may also be too sensitive to oxidants levels. Carbonyls and $ClNO_2$, which are sources of oxidants that promote $PM_{2.5}$ and O_3 production, as shown by recent aircraft measurements in the Salt Lake Valley, are underestimated in the model. Carbonyls, particularly formaldehyde, are misrepresented in the model and the chemical pathway responsible for $ClNO_2$ formation is not emulated at all.

These uncertainties in the model with regard to both the characterization of the regional chemistry to the inventorying of certain constituents, ammonia in particular, may lead one to give more weight to some of the empirical evidence. Past trends in emissions reductions, particularly reductions in NO_x and SO_2, compare favorably with commensurate trends in monitored $PM_{2.5}$. Against a more-or-less constant background of direct $PM_{2.5}$ emissions, these trends suggest that the area has experienced large improvements in the magnitude of $PM_{2.5}$ exceedances incurred during wintertime episodes of cold pool meteorology. These episodes are dominated by secondary $PM_{2.5}$.

All indications are that $PM_{2.5}$ precursor emissions, particularly NO_x and VOC, are expected to decline markedly over the next 5 years. Based on past experience, there is no reason to think that this would not continue to provide an improvement in ambient $PM_{2.5}$.

It is worth noting again that the model would in fact show attainment at all monitor locations in 2019 if the data for August 20, 2015 is documented as being affected by an exceptional event.

Finally, it should be noted that, based on historic monitoring trends and current monitoring values, it is highly likely that the nonattainment area will attain the standard and qualify for a clean data determination as soon as the 2018 monitored data can be certified.

In summary, UDAQ is persuaded by these additional analyses and pieces of information, and after considering the entire weight of evidence, conclude that it is in fact likely that the Salt Lake City, UT $PM_{2.5}$ nonattainment area will attain the 2006 24-hour $PM_{2.5}$ health standard by the attainment date in 2019.

Chapter 7 – TRANSPORTATION CONFORMITY

7.1 Introduction

The federal Clean Air Act (CAA) requires that transportation plans and programs within the Salt Lake City, Utah $PM_{2.5}$ nonattainment area conform to the air quality plans in the region prior to being approved by the Wasatch Front Regional Council (WFRC) Metropolitan Planning Organization. Demonstration of transportation conformity is a condition to receive federal funding for transportation activities that are consistent with air quality goals established in the Utah State Implementation Plan (SIP). Transportation conformity requirements are intended to ensure that transportation activities do not interfere with air quality progress. Conformity applies to on-road mobile source emissions from regional transportation plans (RTPs), transportation improvement programs (TIPs), and projects funded or approved by the Federal Highway Administration (FHWA) or the Federal Transit Administration (FTA) in areas that do not meet or previously have not met the National Ambient Air Quality Standards (NAAQS) for ozone, carbon monoxide, particulate matter less than 10 micrometers in diameter (PM_{10}), or particulate matter 2.5 micrometers in diameter or less ($PM_{2.5}$), or nitrogen dioxide.

The Fixing America's Surface Transportation Act or "FAST Act" and section 176(c)(2)(A) of the CAA require that all regionally significant highway and transit projects in air quality nonattainment areas be derived from a "conforming" transportation plan. Section 176(c) of the CAA requires that transportation plans, programs, and projects conform to applicable air quality plans before being approved by an MPO. Conformity to an implementation plan means that proposed activities must not (1) cause or contribute to any new violation of any standard in any area, (2) increase the frequency or severity of any existing violation of any standard in any area, or (3) delay timely attainment of any standard or any required interim emission reductions or other milestones in any area.

The plans and programs produced by the transportation planning process of the WFRC are required to conform to the on-road mobile source emissions budgets established in the SIP, or absent an approved or adequate budget, required to meet the interim conformity test. Approval of conformity is determined by the FHWA and FTA.

7.2 Consultation

The Interagency Consultation Team (ICT) is an air quality workgroup in Utah that makes technical and policy recommendations regarding transportation conformity issues related to the SIP development and transportation planning process. Section XII of the Utah SIP established the ICT workgroup and defines the roles and responsibilities of the participating agencies. Members of the ICT workgroup collaborated on a regular basis during the development of the $PM_{2.5}$ SIP. They also meet on a regular basis regarding transportation conformity and air quality issues. The ICT workgroup is comprised of management and technical staff members from the affected agencies associated directly with transportation conformity.

ICT Workgroup Agencies

- Utah Division of Air Quality (UDAQ)
- Metropolitan Planning Organizations MPOs
    - Cache MPO
    - Mountainland Association of Governments
    - Wasatch Front Regional Council
- Utah Department of Transportation (UDOT)
- Utah Local Public Transit Agencies
- Federal Highway Administration (FHWA)
- Federal Transit Administration (FTA)
- U.S. Environmental Protection Agency (EPA)

The regional emissions analysis is the primary component of transportation conformity and is administered by the lead transportation agency located in the EPA designated air quality nonattainment area. The responsible transportation planning organization for the Salt Lake City, UT nonattainment area is the Wasatch Front Regional Council (WFRC). During the SIP development process the WFRC coordinated with the ICT workgroup and developed $PM_{2.5}$ SIP motor vehicle emissions inventories using the latest planning assumptions and tools for traffic analysis and the EPA-approved Motor Vehicle Emission Simulator (MOVES2014a) emissions model. The WFRC and the ICT worked cooperatively to develop local MOVES2014a modeling data inputs using EPA recommended methods where applicable.

7.3 Transportation Conformity $PM_{2.5}$ Components

The transportation conformity requirements found in 40 CFR 93.102 requires that the $PM_{2.5}$ SIP include motor vehicle emissions budgets for $PM_{2.5}$ precursor emissions of Nitrogen Oxides (NO_x) and Volatile Organic Compounds (VOC), and direct $PM_{2.5}$ (primary exhaust $PM_{2.5}$ + brake and tire wear) emissions. VOC emissions precursor budgets are required because UDAQ has identified VOCs as a $PM_{2.5}$ precursor that significantly impact $PM_{2.5}$ concentrations.

The EPA conformity rule presumes that $PM_{2.5}$ re-entrained road dust does not need to be included in the interim conformity test unless either the State or EPA decides that re-entrained road dust emissions are a significant contributor to the $PM_{2.5}$ nonattainment problem. The UDAQ conducted a re-entrained road dust study that concluded that $PM_{2.5}$ re-entrained road dust emissions are negligible in the Salt Lake City, Utah $PM_{2.5}$ nonattainment area, and thus meet the criteria of 40 CFR 93.102(b)(3). EPA Region 8 reviewed the study and concurred with the UDAQ's findings. The re-entrained road dust insignificant finding is located in the On-Road Mobile Sources $PM_{2.5}$ Episodic Inventory TSD.

7.4 Interim $PM_{2.5}$ Conformity Test

The EPA interim conformity test, for the purposes of this plan revision, will require that $PM_{2.5}$ precursor emissions of NO_x and VOC, and direct $PM_{2.5}$ (primary exhaust $PM_{2.5}$ + brake and tire wear) emissions from RTPs, TIPs, and projects funded or approved by the FHWA or the FTA not exceed 2008 levels.

The Interim conformity test requirements apply until EPA has declared the motor vehicle emissions budgets adequate for transportation conformity purposes or until EPA approves the budget in the Federal Register.

7.5 Transportation Conformity $PM_{2.5}$ Budgets

The Wasatch Front Regional Council requested motor vehicle emissions budgets (MVEBs) for the Salt Lake City, $PM_{2.5}$ nonattainment area. In this SIP, the State is establishing transportation conformity MVEBs for the Salt Lake City, $PM_{2.5}$ nonattainment area. The MVEBs are established for tons per average winter weekday (tpww) for $PM_{2.5}$ precursors NO_x and VOC, and for direct $PM_{2.5}$ (primary exhaust $PM_{2.5}$ + brake and tire wear).

Table 7.1, Emissions Budgets for Transportation Conformity Purposes (EPA MOVES2014a).

	Direct $PM_{2.5}$ (tpww)	NO_x (tpww)	VOC (tpww)
2017	2.68	59.92	32.67
2019	2.27	50.07	28.85
2020	2.11	45.84	26.88

Note: TPWW: Tons Per Average Winter Weekday. Direct $PM_{2.5}$ is Primary Exhaust $PM_{2.5}$ total + brake and tire wear. VOC emissions do not include refueling spillage and displacement vapor loss. Budgets are rounded to the nearest hundredth ton.

It is important to note that the MVEBs presented in Table 7.1 are somewhat different from the Summary Emissions Inventory (EI) presented in **Table 4.1**.

Overall the emissions established as MVEBs are calculated using MOVES to reflect an average winter weekday. The totals presented in the Summary EI, however, represent an average-episode-day. The episode used to make this average (December 31, 2010 through January 10) 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 EI totals includes direct exhaust, tire & brake wear, and fugitive dust. For the MVEBs $PM_{2.5}$ includes direct exhaust, tire & brake but no fugitive dust.

VOC emissions in the Summary EI totals include refueling spillage and displacement vapor loss. These emissions were included in the Summary EI as belonging to the On-Road Mobile Source. MVEBs for VOC do not include these emissions because, in this context, they are regarded as an Area Source.

7.6 Trading Ratios

Per section 93.124 of the conformity regulations, for transportation conformity analyses using these budgets in analysis years beyond 2020, 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 12.67 to 1 and/or future decreases in VOC emissions from on-road mobile sources at a VOC to $PM_{2.5}$ ratio of 31.96 to 1. This trading mechanism will only be used if needed for conformity analyses for years after 2020. 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 2020 NO_x budget has been met, and the VOC emissions reductions available to supplement the direct $PM_{2.5}$ budget shall only be those remaining after the 2020 VOC budget has been met. Clear documentation of the calculations used in the trading should be included in the conformity analysis.

Chapter 8 – QUANTITATIVE MILESTONES DEMONSTRATING REASONABLE FURTHER PROGRESS

8.1 Introduction

Clean Air Act Section 172(c)(2) requires that plans for nonattainment areas "shall require reasonable further progress (RFP)." This general requirement is interpreted for $PM_{2.5}$ areas in EPAs' Implementation Rule for Fine Particulate Matter (81 FR, 58010). The definition of RFP is given in 40 CFR 51.1000. It means "such annual incremental reductions in emissions of direct $PM_{2.5}$ and $PM_{2.5}$ plan precursors as are required for the purpose of ensuring attainment of the applicable $PM_{2.5}$ NAAQS in a nonattainment area by the applicable attainment date."

In general terms, the goal of these RFP requirements is for areas to achieve continual progress toward attainment, rather than perhaps deferring implementation of all measures until the attainment deadline.

The pollutants to be addressed in the RFP plan are those pollutants that are identified for purposes of control measures in the attainment plan: $PM_{2.5}$, SO_2, NO_x, VOC, and ammonia.

8.2 Serious Area Planning Requirements

The planning requirements RFP and Quantitative Milestones within $PM_{2.5}$ nonattainment areas are given in 40 CFR 51 paragraphs 1012 and 1013. In summary:

The RFP plan must demonstrate annual incremental reductions in emissions (direct $PM_{2.5}$ and precursors) to ensure attainment by the attainment date. It shall include:

- A schedule describing the implementation of control measures during each year of the plan.
- RFP projected emissions for each applicable milestone year, based on the anticipated implementation schedule for control measures.
- An analysis that demonstrates that by the end of each milestone year emission levels will reflect progress that is either generally linear or stepwise.
- Also, there must be a tracking mechanism for the progress that is expected.
- Finally, for purposes of establishing motor vehicle emissions budgets… (as required in 40 CFR part 93) for a $PM_{2.5}$ nonattainment area, the state shall include in its RFP submission an inventory of on-road mobile source emissions in the nonattainment area for each milestone year.

For areas like the SLC, UT area that were designated nonattainment for the 2006 $PM_{2.5}$ NAAQS prior to January 15, 2015, the first milestone is December 31, 2017. Additional milestones will occur every three years thereafter, up until and including the first such milestone after the attainment date. The attainment date for this plan is December 31, 2019. Therefore, the second and final milestone will come due at December 31, 2020.

8.3 RFP for the Salt Lake City, UT Nonattainment Area

The attainment demonstration for the SLC, UT $PM_{2.5}$ nonattainment area shows that the 2006, 24-hr NAAQS can be achieved by the attainment date of December 31, 2019. Essentially, this may also be considered to demonstrate that the area is achieving RFP.

The emissions reductions associated with the application of BACM and BACT were factored into an inventory for 2019 that was assessed using air quality modeling as well as other information and analyses. The entire analysis demonstrates that these reductions in emissions are likely sufficient to demonstrate attainment of the applicable standard by the applicable attainment date.

The starting point for evaluating RFP should be the baseline year used in the modeling analysis. This is a year (2016) selected to coincide with the period used to establish the monitored design value for the modeling analysis; a period in which the area was violating the applicable NAAQS.

Thus, the magnitude of emissions reductions should be evaluated over a period spanning from 2016 through 2019.

Quantitatively, the following assessment of emissions and incremental emissions reductions in **Table 8.1** will show that RFP is met using the criteria discussed above:

Reasonable Further Progress				
Salt Lake City, UT PM2.5 Nonattainment Area				
***Emissions by Year**	**Base Yr.**	**Projection Years with Growth & Controls**		
	2016	**2017**	**2019**	**2020**	****RFP**
PM2.5	15.4	15.8	16.1	16.0	0.2
NOx	103.6	100.2	94.9	87.9	-2.9
SO2	5.6	5.6	4.9	4.9	-0.2
VOC	91.7	91.5	86.8	83.5	-1.6
NH3	16.0	16.0	16.0	15.9	0.0
PM2.5 Precursors	216.9	213.2	202.6	192.2	-4.8
Total	**232.3**	**229.0**	**218.7**	**208.2**	**-4.5**
*Emissions are reported in tons per average-episode-day				
**Emission change per year, (ton/day) averaged from Base Year (2016) through Attainment Year (2019)				

Table 8.1, Reasonable Further Progress in the SLC, UT Nonattainment Area

Emissions in **Table 8.1** have been aggregated to include all four source categories. RFP projected emissions, however, are defined to look at each source category individually. That information appears already in **Table 4.1**, but is included here also as **Table 8.2** for the ease of discussion.

Emissions in both tables show not just the effect of BACM and BACT, but also growth in population and vehicle miles traveled. Even with the inclusion of growth, the trends are still downward.

Emissions [tons/day]	Sector	PM2.5	NOx	VOC	NH3	SO2
2016 Base Year	Area Sources	6.13	13.63	45.96	14.22	0.17
	Mobile Sources	4.98	55.38	31.84	1.29	0.41
	NonRoad Sources	1.01	16.41	8.70	0.02	0.32
	Point Sources	3.26	18.18	5.25	0.44	4.70
	Total	**15.38**	**103.61**	**91.74**	**15.97**	**5.60**
2017 Milestone Year	Area Sources	6.19	13.57	46.02	14.21	0.22
	Mobile Sources	5.02	52.53	30.87	1.30	0.43
	NonRoad Sources	0.96	15.77	8.47	0.02	0.33
	Point Sources	3.58	18.32	6.13	0.44	4.61
	Total	**15.75**	**100.18**	**91.48**	**15.97**	**5.59**
2019 Attainment Year	Area Sources	6.23	11.84	44.34	14.21	0.22
	Mobile Sources	4.78	44.02	27.26	1.25	0.43
	NonRoad Sources	0.88	15.18	9.01	0.02	0.35
	Point Sources	4.25	23.86	6.21	0.48	3.90
	Total	**16.13**	**94.90**	**86.82**	**15.96**	**4.89**
2020 Milestone Year	Area Sources	6.24	9.54	43.73	14.20	0.20
	Mobile Sources	4.68	40.38	25.42	1.23	0.42
	NonRoad Sources	0.82	14.08	8.10	0.02	0.36
	Point Sources	4.26	23.86	6.22	0.49	3.90
	Total	**16.00**	**87.86**	**83.47**	**15.94**	**4.88**
** Salt Lake nonattainment area only*						

Table 8.2, RFP Projected Emissions in the SLC, UT Nonattainment Area

From **Table 8.2** it can be seen that the overall decrease in total NO_x and VOC emissions is, as expected, dominated by improvements in the On-Road Mobile Source category. Yet, there are significant improvements in the Area Source category as well. Point Sources are responsible for the increase in $PM_{2.5}$ emissions, but also account for the decline in SO_2. Ammonia emissions are essentially flat, but most of the reported ammonia is not attributed to any of the source categories. Rather, it has been artificially introduced into the analysis to improve model performance.

Table 8.2 also shows the emissions from on-road mobile sources in the milestone years. As noted in **section 7.5**, these totals differ somewhat from the MVEBs.

Control Measures: The inventory for 2019 "with growth and controls" reflects the implementation of all the best available control measures and best available control technologies identified in this plan, as well as all pre-existing control measures. As such, this inventory takes into account all controls that "may reasonably be required by the Administrator."

For a complete discussion of BACM and BACT, and the control measures factored into the modeled demonstration for 2019, see Chapter 5 of the Plan.

Schedule for the Implementation of BACM and BACT: RFP must be considered in light of the attainment date as well as the date by which all BACT and BACM must be implemented. Consideration is also given to the attainment demonstration which must make its assessment as of the attainment date. For the SLC-UT nonattainment area the attainment date is December 31, 2019. 40 CFR 51.1011 establishes that control measures must be implemented no later than the beginning of the year containing the applicable attainment date. Thus, for purposes of RFP and SIP credit, the deadline for implementation of all BACT and BACM is January 1, 2019.

The improving trends in emissions are evident from **Table 8.1**, but it is important to look more closely and determine whether the downward trends are either generally linear in character or whether they reveal a more stepwise shape. **Figure 8.1** is included to make this assessment.

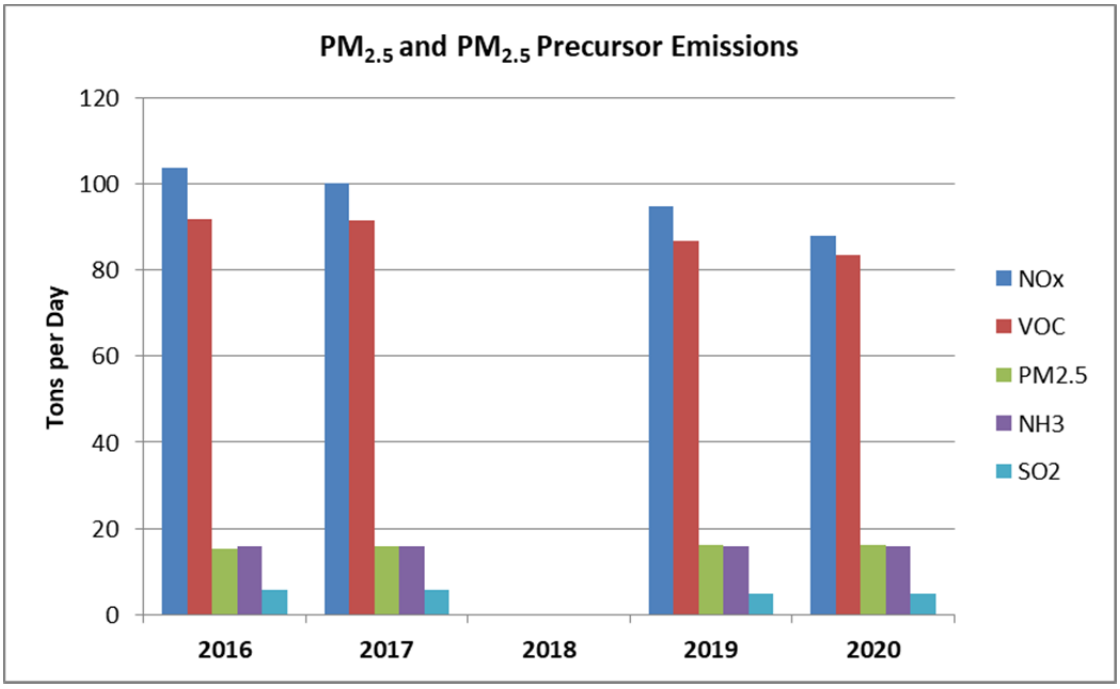

Figure 8.1 Emissions totals for $PM_{2.5}$ and $PM_{2.5}$ precursors in the Base Year (2016), Attainment Year (2019), and Milestone Years (2017 and 2020)

From the figure, it may be seen that the trends in SO_2 and VOC show a stepwise decline between 2017 and 2019. This is supported by the implementation date (Dec. 31, 2018) for BACM & BACT. In particular, Area Source BACM rules were projected to become fully effective by 2019, and most of these rules targeted VOC emissions. The decline in SO_2 emissions is explained by the installation of a wet-gas scrubber at one of the refineries in 2018.

The trend in NO_x is more linear, remaining steadily downward with the continued implementation of Tier 2 of the federal motor vehicle control program. The introduction of Tier 3 in 2017 is likely accelerating the downward trend from 2019 to 2020.

The trend of primary $PM_{2.5}$ emissions is seen to be relatively flat. This is consistent with the trend seen since all the way back to about 2000 (see **Fig. 6.20**).

It is also interesting to note in light of the improvement shown in the ambient monitoring data for $PM_{2.5}$ (**Figs. 6.14 and 6.15**). As noted in the Weight of Evidence discussion **(section 6.2)**, the actual improvement in monitored $PM_{2.5}$ concentrations, both peak and annual values, is likely due to reductions in $PM_{2.5}$ precursor emissions; effectively shaving the peaks off of the wintertime exceedances composed mainly of secondary nitrate.

8.4 Milestones for the SLC, UT Nonattainment Area

The PM Implementation Rule requires quantitative milestones, which demonstrate reasonable further progress, to be achieved every three years.

Not later than 90 days after the milestone comes due, Utah must submit a milestone report that certifies that the SIP control strategy is being implemented. The report must also include a discussion of whether the area will attain the NAAQS by the applicable date.

In order that it may make such certification, Utah will need to track the implementation of BACM and BACT. This will be accomplished for the point sources by the issuance of Approval Orders authorizing construction of any required modifications as well as on-site inspections to verify that any operating practices have been implemented. Utah will also work with the EPA to ensure that any rulemaking actions taken to implement BACM at the many area sources in the nonattainment area have been approved into the Utah SIP.

If it fails to submit the quantitative milestone demonstration, or if EPA determines that the milestone was not met, The State is required to submit a SIP revision ensuring that the next milestone will be met or alternately that the NAAQS will be attained.

UDAQ herein commits to prepare and submit a milestone report no later than 90 days from the attainment date.

Chapter 9 – CONTINGENCY MEASURES

9.1 Background

The Fine Particulate Matter National Ambient Air Quality Standards: State Implementation Plan Requirements; Final Rule details under the contingency measure requirements (40 CFR 51.1014) that the state must include contingency measures that shall take effect with minimal further action by the State or the EPA following a determination by the EPA Administrator that the area has failed to:

1) meet the RFP requirements set forth in this SIP,

2) meet any quantitative milestone detailed in this SIP,

3) submit a quantitative milestone report for this SIP; or

4) attain the standard by the attainment date set forth in this SIP.

The PM Implementation Rule states that the contingency measure(s) shall include control measures that are not already included in the SIP. Each contingency measure shall specify the timeframe that the requirements will become effective following determination by the EPA Administrator that the area has failed to meet one of the requirements listed above in 1-4. The SIP must also contain a description of the specific trigger mechanisms for the contingency measure(s).

The rule does not include any specific level of emission reductions that must be adopted to meet the contingency measures requirement under section 172(c)(9).

9.2 Contingency Measures and Implementation Schedules for the Nonattainment Area

Nothing precludes a State from implementing a contingency measures before it is actually triggered, but the credit for a contingency measure may not be used in either the attainment or reasonable further progress demonstrations.

The following measure is already fully functioning, and it is not currently being used as a control strategy in this SIP:

Heavy-duty diesel engine emissions reduction programs: Through the EPA's Clean Diesel Program funded by the Diesel Emissions Reduction Act (DERA), Utah currently has an estimated $5 million in grants to reduce diesel emissions by replacing or retrofitting old diesel engines that have outdated emissions standards with new, cleaner vehicles or emissions reduction retrofit equipment.

For calendar years 2015-2017, the average annual emissions reductions from Clean Diesel projects within the nonattainment area are as follows:

	NO_x	**$PM_{2.5}$**	**VOC**
2015	49 tons	3.4 tons	4.2 tons
2016	49 tons	3.4 tons	4.2 tons

2017	49 tons	3.4 tons	4.2 tons

Funding amounts have increased in recent years and the projected average annual emissions reduction based on funding sources already in place for the NAA for calendar years 2018-2020 are:

	NO_x	**$PM_{2.5}$**	**VOC**
2018	182 tons	14 tons	20 tons
2019	182 tons	14 tons	20 tons

The grant funding amounts are expected to stay similar or increase, resulting in the following minimum annual emissions reductions in the future:

	NO_x	**$PM_{2.5}$**	**VOC**
2020	182 tons	14 tons	20 tons
2021	182 tons	14 tons	20 tons
2022	182 tons	14 tons	20 tons
2023	182 tons	14 tons	20 tons

Since Clean Diesel projects are continuously being carried out in the State, it is not necessary for a trigger mechanism or implementation schedule. Therefore, this contingency measure will already be fully functioning and implemented in the case that it becomes necessary for credit.

ITEM 8

State of Utah

GARY R. HERBERT
Governor

SPENCER J. COX
Lieutenant Governor

Department of
Environmental Quality

Alan Matheson
Executive Director

DIVISION OF AIR QUALITY
Bryce C. Bird
Director

DAQ-059-18

M E M O R A N D U M

TO: Air Quality Board

THROUGH: Bryce C. Bird, Executive Secretary

FROM: Thomas Gunter, Rules Coordinator

DATE: August 27, 2018

SUBJECT: PROPOSE FOR PUBLIC COMMENT: Amend R307-110-10. Section IX, Control Measures for Area and Point Sources, Part A, Fine Particulate Matter.

The amendments to Section IX, Control Measures for Area and Point Sources, Part A, for Fine Particulate Matter will have to be incorporated into the Utah Air Quality Rules. R307-110-10 is the rule that incorporates the new amendments to Part A into the rules. If the Board adopts the amendments proposed to Part A, these amendments will become part of Utah's State Implementation Plan when the rule is finalized.

Recommendation: Staff recommends the Board propose R307-110-10 for public comment.

R307. Environmental Quality, Air Quality.
R307-110. General Requirements: State Implementation Plan.
R307-110-10. Section IX, Control Measures for Area and Point Sources, Part A, Fine Particulate Matter.

The Utah State Implementation Plan, Section IX, Control Measures for Area and Point Sources, Part A, Fine Particulate Matter, as most recently amended by the Utah Air Quality Board on December [~~2~~]5, 201[~~5~~]8, pursuant to Section 19-2-104, is hereby incorporated by reference and made a part of these rules.

KEY: air pollution, PM10, PM2.5, ozone
Date of Enactment or Last Substantive Amendment: [~~June 7~~], 2018
Notice of Continuation: January 27, 2017
Authorizing, and Implemented or Interpreted Law: 19-2-104

ITEM 9

Air Toxics

State of Utah

GARY R. HERBERT
Governor

SPENCER J. COX
Lieutenant Governor

Department of
Environmental Quality

Alan Matheson
Executive Director

DIVISION OF AIR QUALITY
Bryce C. Bird
Director

DAQA-517-18

M E M O R A N D U M

TO: Air Quality Board

FROM: Bryce C. Bird, Executive Secretary

DATE: June 11, 2018

SUBJECT: Air Toxics, Lead-Based Paint, and Asbestos (ATLAS) Section Compliance Activities – May 2018

Asbestos Demolition/Renovation NESHAP Inspections	27
Asbestos AHERA Inspections	3
Asbestos State Rules Only Inspections	8
Asbestos Notification Forms Accepted	208
Asbestos Telephone Calls	390
Asbestos Individuals Certifications Approved/Disapproved	87/0
Asbestos Company Certifications/Re-Certifications	1/7
Asbestos Alternate Work Practices Approved/Disapproved	6/0
Lead-Based Paint (LBP) Inspections	5
LBP Notification Forms Approved	3
LBP Telephone Calls	54
LBP Letters Prepared and Mailed	10
LBP Courses Reviewed/Approved	3/3
LBP Course Audits	0
LBP Individual Certifications Approved/Disapproved	8/0
LBP Firm Certifications	10

Notices of Violation Sent	0
Compliance Advisories Sent	18
Warning Letters Sent	13
Settlement Agreements Finalized	4
Penalties Agreed to:	
Tintic School District	$ 225.00
Tooele County School District	$ 750.00

State of Utah

GARY R. HERBERT
Governor

SPENCER J. COX
Lieutenant Governor

Department of
Environmental Quality

Alan Matheson
Executive Director

DIVISION OF AIR QUALITY
Bryce C. Bird
Director

DAQA-653-18

M E M O R A N D U M

TO: Air Quality Board

FROM: Bryce C. Bird, Executive Secretary

DATE: July 20, 2018

SUBJECT: Air Toxics, Lead-Based Paint, and Asbestos (ATLAS) Section Compliance Activities – June 2018

Asbestos Demolition/Renovation NESHAP Inspections	19
Asbestos AHERA Inspections	2
Asbestos State Rules Only Inspections	9
Asbestos Notification Forms Accepted	181
Asbestos Telephone Calls	358
Asbestos Individuals Certifications Approved/Disapproved	30/0
Asbestos Company Certifications/Re-Certifications	3/8
Asbestos Alternate Work Practices Approved/Disapproved	9/0
Lead-Based Paint (LBP) Inspections	4
LBP Notification Forms Approved	5
LBP Telephone Calls	25
LBP Letters Prepared and Mailed	4
LBP Courses Reviewed/Approved	0/0
LBP Course Audits	1
LBP Individual Certifications Approved/Disapproved	19/0
LBP Firm Certifications	21

Notices of Violation Sent	0
Compliance Advisories Sent	11
Warning Letters Sent	9
Settlement Agreements Finalized	4
Penalties Agreed to:	
Summit Academy	$ 937.50
Asbestos Abatement of Utah	$3150.00
That Asbestos Guy Environmental, LLC	$1250.00
Seagull Environmental Training	$ 625.00

State of Utah

GARY R. HERBERT
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SPENCER J. COX
Lieutenant Governor

Department of
Environmental Quality

Alan Matheson
Executive Director

DIVISION OF AIR QUALITY
Bryce C. Bird
Director

DAQA-713-18

M E M O R A N D U M

TO: Air Quality Board

FROM: Bryce C. Bird, Executive Secretary

DATE: August 8, 2018

SUBJECT: Air Toxics, Lead-Based Paint, and Asbestos (ATLAS) Section Compliance Activities – July 2018

Asbestos Demolition/Renovation NESHAP Inspections	19
Asbestos AHERA Inspections	14
Asbestos State Rules Only Inspections	2
Asbestos Notification Forms Accepted	170
Asbestos Telephone Calls	427
Asbestos Individuals Certifications Approved/Disapproved	30/0
Asbestos Company Certifications/Re-Certifications	1/2
Asbestos Alternate Work Practices Approved/Disapproved	11/0
Lead-Based Paint (LBP) Inspections	2
LBP Notification Forms Approved	0
LBP Telephone Calls	107
LBP Letters Prepared and Mailed	18
LBP Courses Reviewed/Approved	0/0
LBP Course Audits	1
LBP Individual Certifications Approved/Disapproved	17/0
LBP Firm Certifications	5

Notices of Violation Sent	0
Compliance Advisories Sent	13
Warning Letters Sent	5
Settlement Agreements Finalized	2
Penalties Agreed to:	
Sevier County School District	$ 162.50
Rock Solid Excavation	$ 625.00

Compliance

State of Utah
GARY R. HERBERT
Governor

SPENCER J. COX
Lieutenant Governor

Department of
Environmental Quality

Alan Matheson
Executive Director

DIVISION OF AIR QUALITY
Bryce C. Bird
Director

DAQC-782-18

M E M O R A N D U M

TO: Air Quality Board

FROM: Bryce C. Bird, Executive Secretary

DATE: June 13, 2018

SUBJECT: Compliance Activities – May 2018

Annual Inspections Conducted:

Major	10
Synthetic Minor	3
Minor	56

On-Site Stack Test Audits Conducted: 3

Stack Test Report Reviews: 24

On-Site CEM Audits Conducted: 1

Emission Reports Reviewed: 19

Temporary Relocation Requests Reviewed & Approved: 13

Fugitive Dust Control Plans Reviewed & Accepted: 220

Soil Remediation Report Reviews: 3

[1]Miscellaneous Inspections Conducted: 26

Complaints Received: 11

Breakdown Reports Received: 1

Compliance Actions Resulting From a Breakdown..... 0

Warning Letters Issued:..... 5

Notices of Violation Issued:..... 0

Compliance Advisories Issued:..... 7

No Further Action Letters Issued..... 2

Settlement Agreements Reached:..... 0

[1]Miscellaneous inspections include, e.g., surveillance, level I inspections, VOC inspections, complaints, on-site training, dust patrol, smoke patrol, open burning, etc.

State of Utah
GARY R. HERBERT
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SPENCER J. COX
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Department of
Environmental Quality

Alan Matheson
Executive Director

DIVISION OF AIR QUALITY
Bryce C. Bird
Director

DAQC-957-18

M E M O R A N D U M

TO: Air Quality Board

FROM: Bryce C. Bird, Executive Secretary

DATE: July 17, 2018

SUBJECT: Compliance Activities – June 2018

Annual Inspections Conducted:

Major	11
Synthetic Minor	3
Minor	38

On-Site Stack Test Audits Conducted: 2

Stack Test Report Reviews: 17

On-Site CEM Audits Conducted: 23

Emission Reports Reviewed: 2

Temporary Relocation Requests Reviewed & Approved: 11

Fugitive Dust Control Plans Reviewed & Accepted: 182

Soil Remediation Report Reviews: 1

[1]Miscellaneous Inspections Conducted: 28

Complaints Received: 20

Breakdown Reports Received: 1

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Telephone (801) 536-4000 • Fax (801)536-4099 • T.D.D. (801) 903-3978
www.deq.utah.gov

Compliance Actions Resulting From a Breakdown..... 0

Warning Letters Issued: 1

Notices of Violation Issued:..... 0

Compliance Advisories Issued:..... 12

No Further Action Letters Issued..... 1

Settlement Agreements Reached: 1

Clean Harbors..... $23,750

[1]Miscellaneous inspections include, e.g., surveillance, level I inspections, VOC inspections, complaints, on-site training, dust patrol, smoke patrol, open burning, etc.

State of Utah

GARY R. HERBERT
Governor

SPENCER J. COX
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Department of
Environmental Quality

Alan Matheson
Executive Director

DIVISION OF AIR QUALITY
Bryce C. Bird
Director

DAQC-1127-18

M E M O R A N D U M

TO: Air Quality Board

FROM: Bryce C. Bird, Executive Secretary

DATE: August 14, 2018

SUBJECT: Compliance Activities – July 2018

Annual Inspections Conducted:

Major	11
Synthetic Minor	7
Minor	34

On-Site Stack Test Audits Conducted: 1

Stack Test Report Reviews: 17

On-Site CEM Audits Conducted: 0

Emission Reports Reviewed: 6

Temporary Relocation Requests Reviewed & Approved: 3

Fugitive Dust Control Plans Reviewed & Accepted: 189

Soil Remediation Report Reviews: 2

[1]Miscellaneous Inspections Conducted: 21

Complaints Received: 25

Breakdown Reports Received: 0

195 North 1950 West • Salt Lake City, Utah
Mailing Address: P.O. Box 144820 • Salt Lake City, Utah 84114-4820
Telephone (801) 536-4000 • Fax (801)536-4099 • T.D.D. (801) 903-3978
www.deq.utah.gov

Compliance Actions Resulting from a Breakdown..... 0

Warning Letters Issued:..... 4

Notices of Violation Issued:..... 1

Compliance Advisories Issued:..... 6

No Further Action Letters Issued..... 8

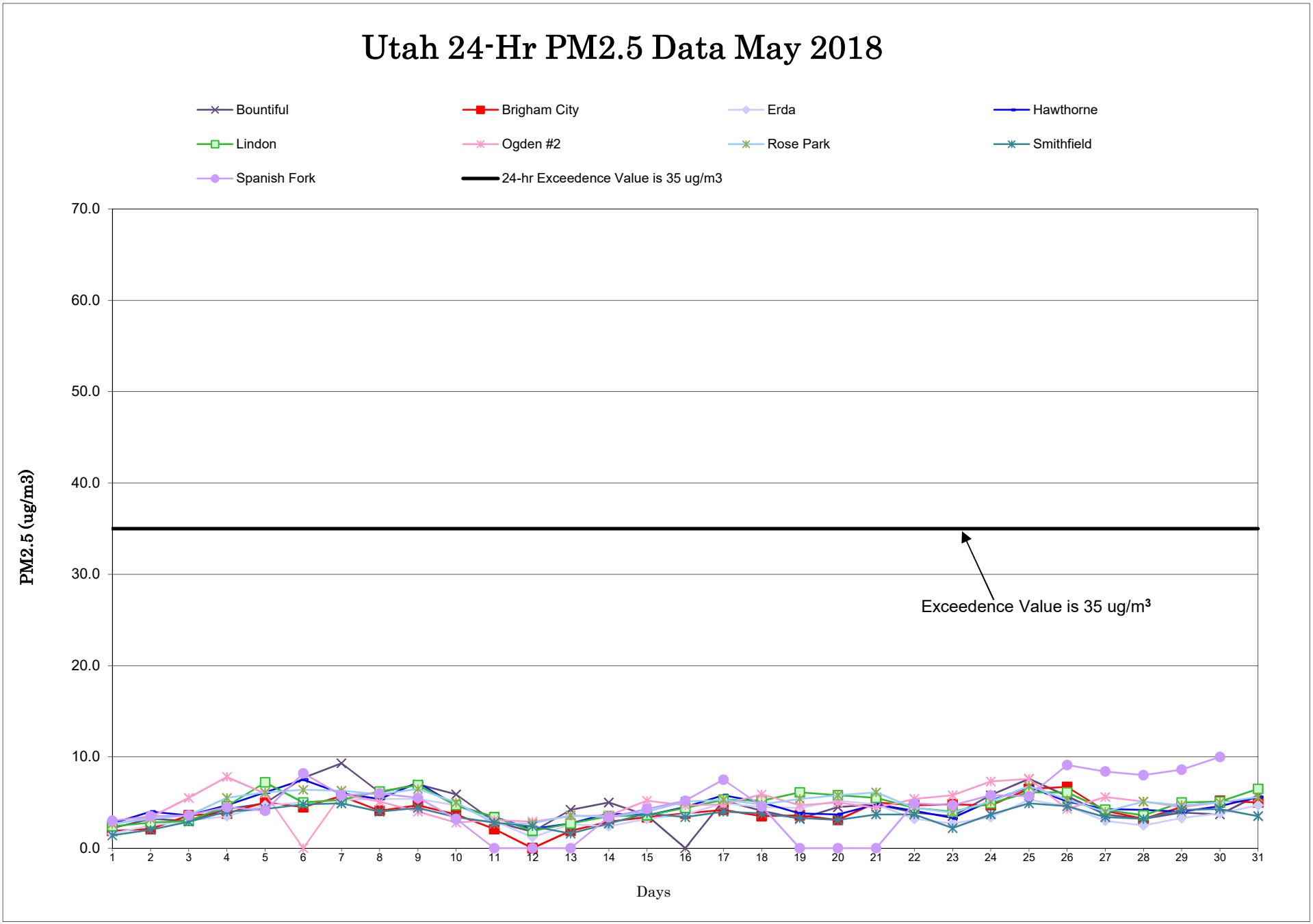
Settlement Agreements Reached:..... 2

Barnes Aerospace..... $695.00
Staker Parsons..... $239.00

[1]Miscellaneous inspections include, e.g., surveillance, level I inspections, VOC inspections, complaints, on-site training, dust patrol, smoke patrol, open burning, etc.

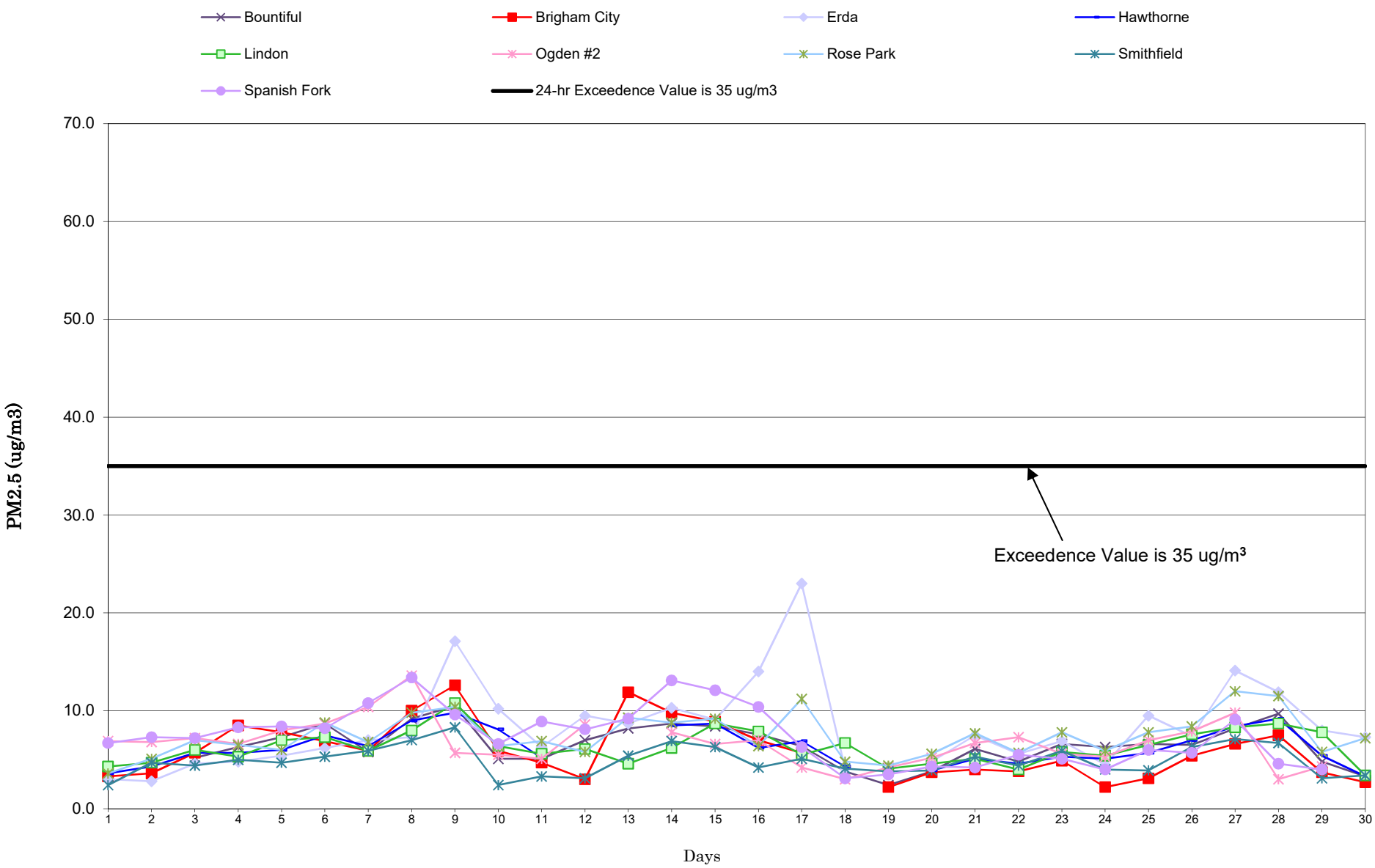
Air Monitoring

Utah 24-Hr PM2.5 Data May 2018



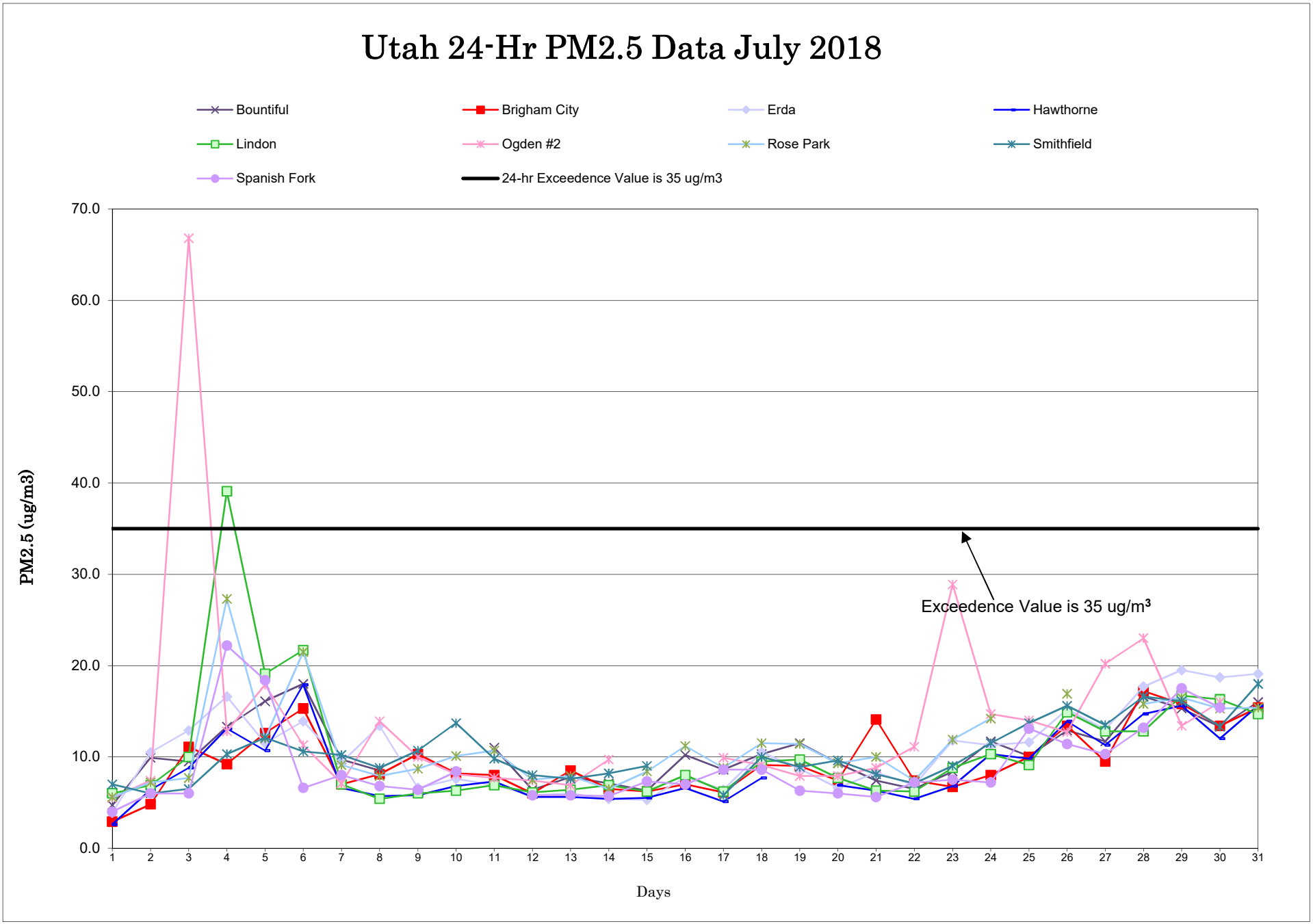
Utah Division of Air Quality

Utah 24-Hr PM2.5 Data June 2018



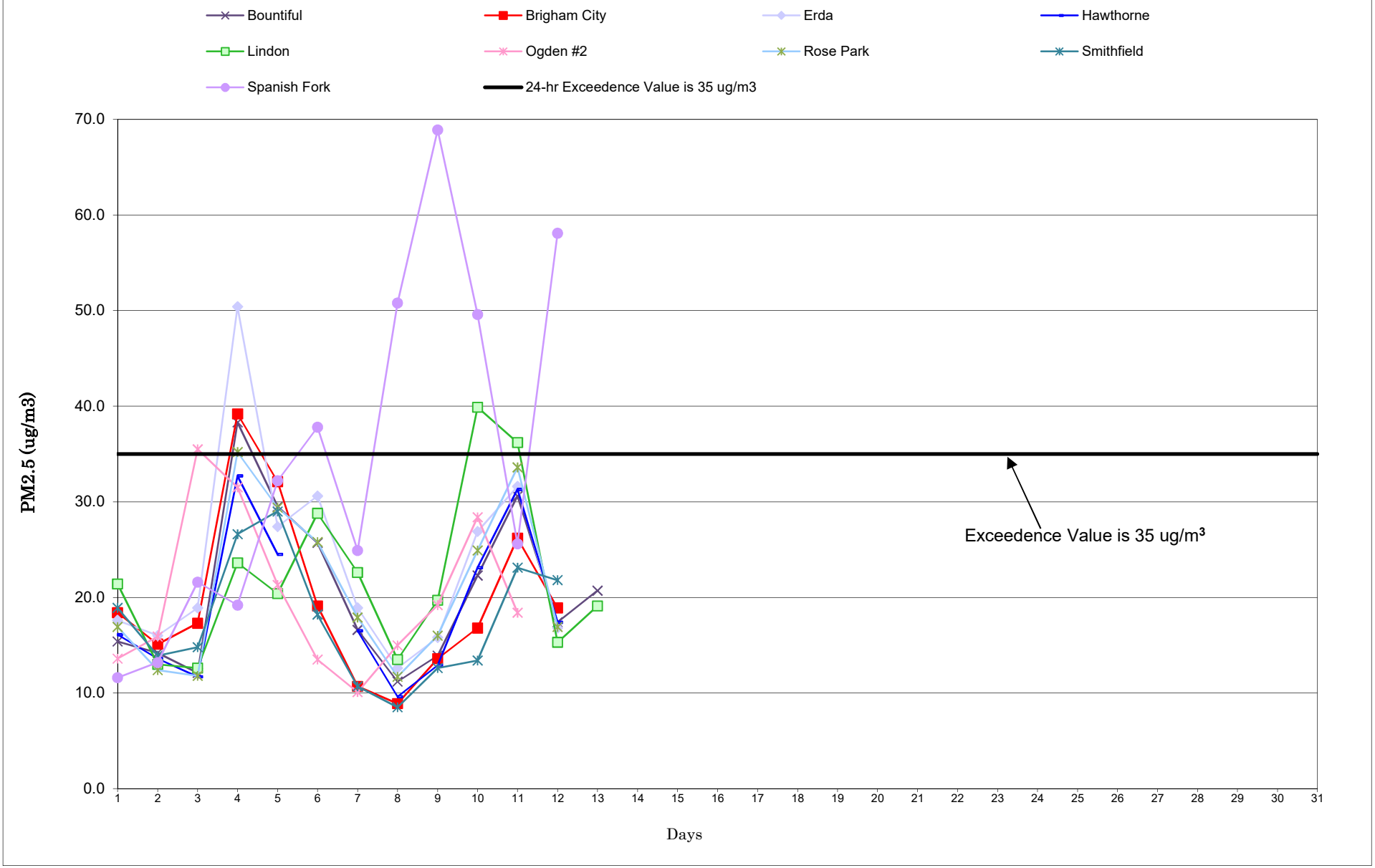
Utah Division of Air Quality

Utah 24-Hr PM2.5 Data July 2018



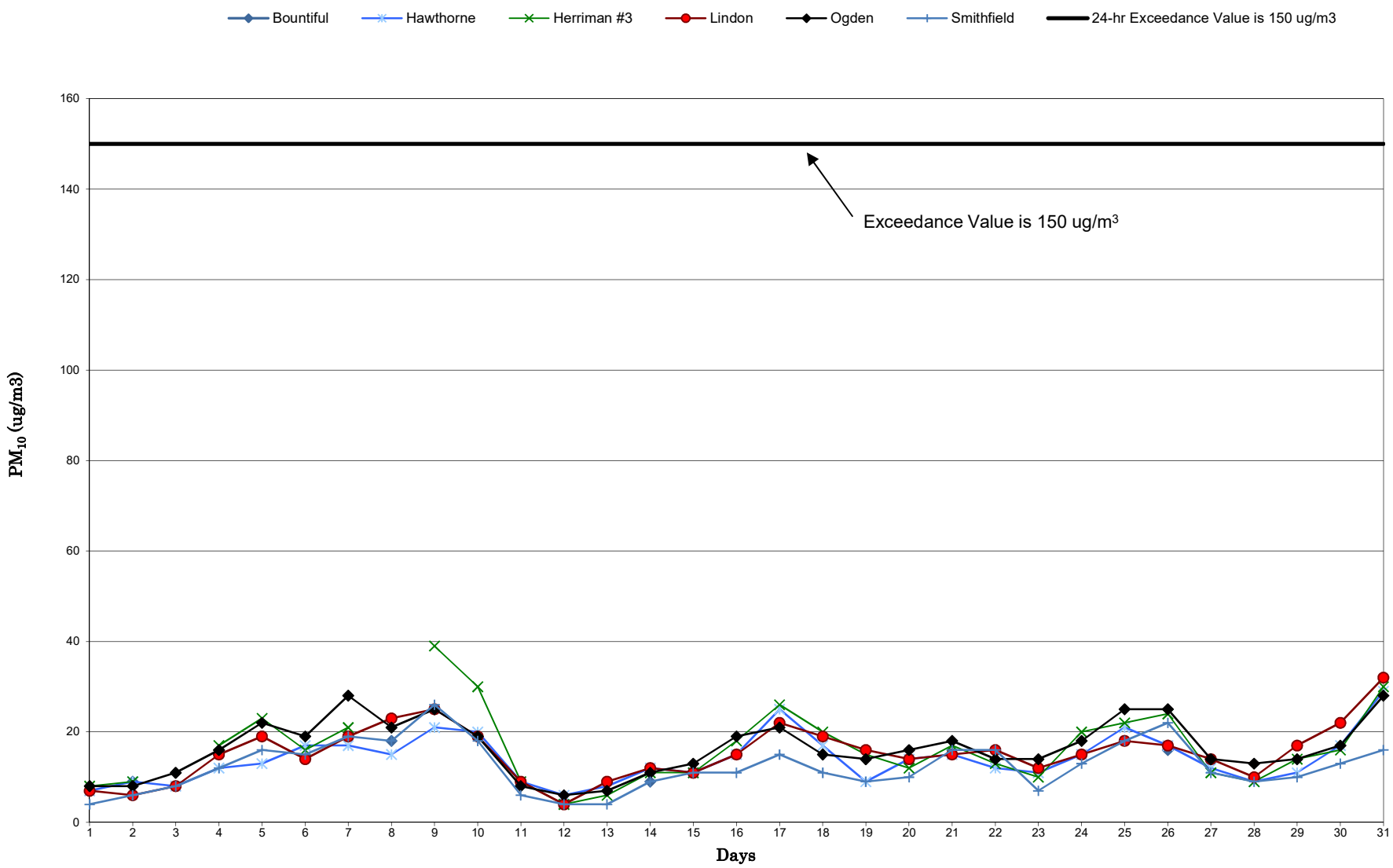
Utah Division of Air Quality

Utah 24-Hr PM2.5 Data August 2018



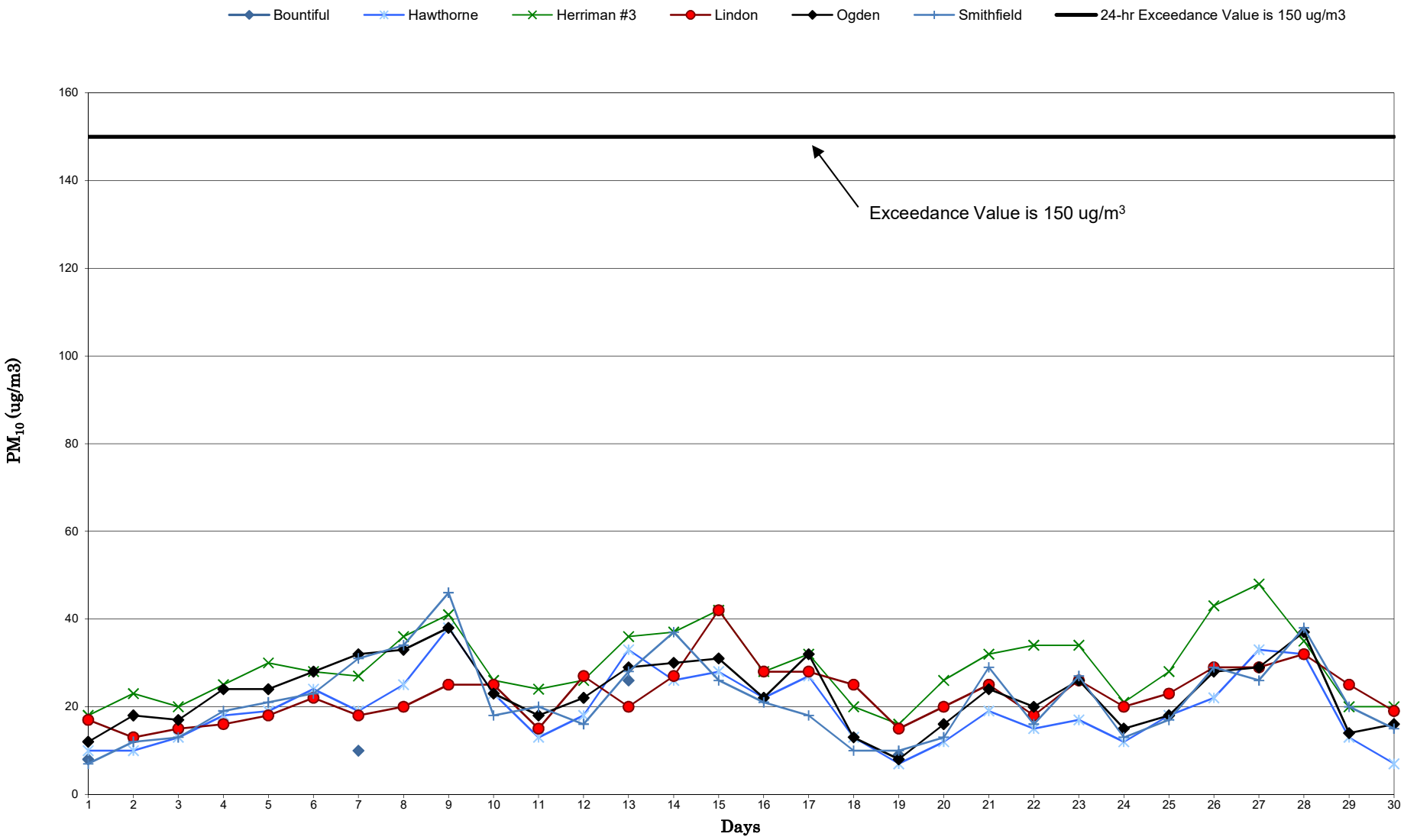
Utah Division of Air Quality

Utah 24-hr PM_{10} Data May 2018



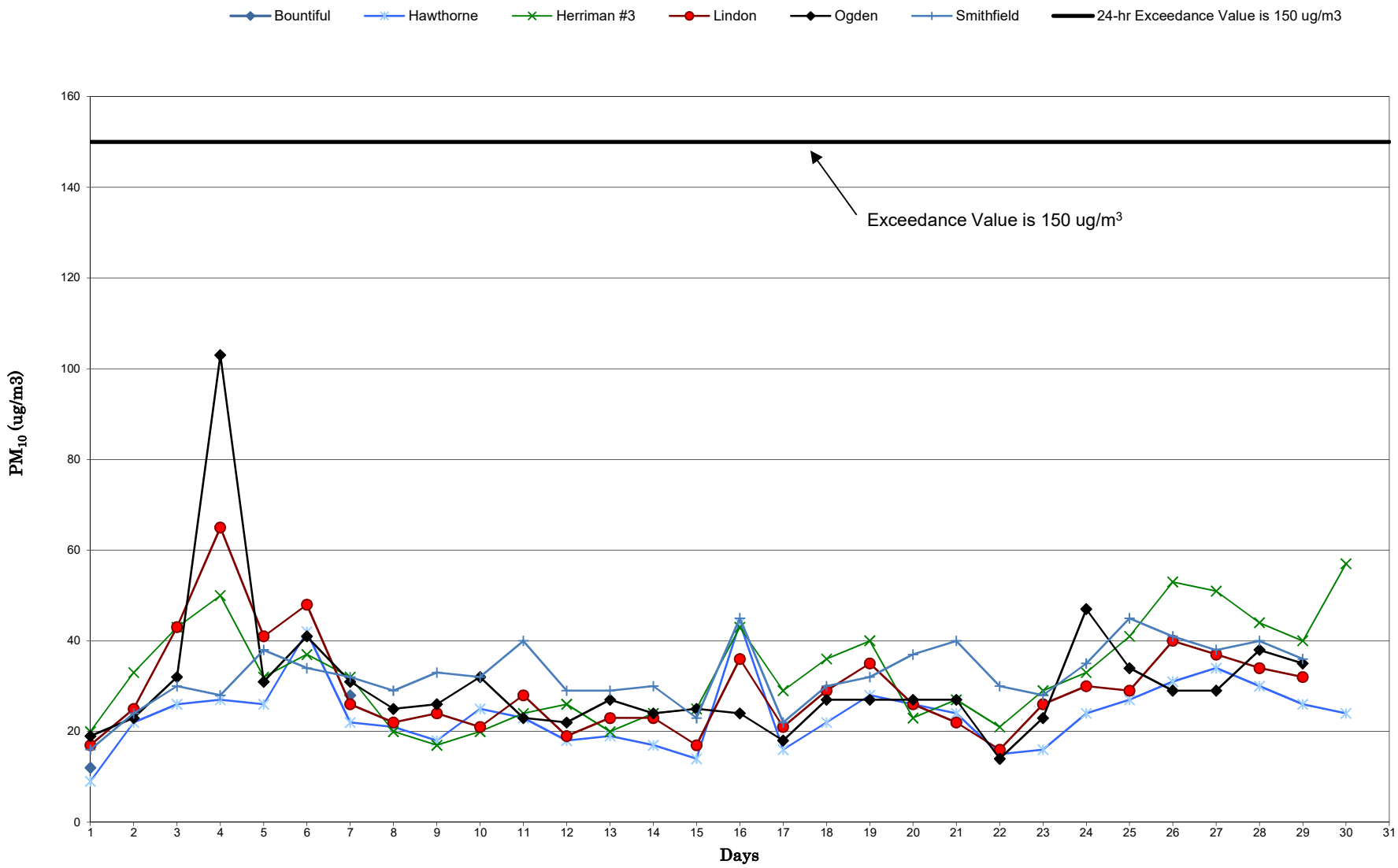
Utah Division of Air Quality

Utah 24-hr PM_{10} Data June 2018



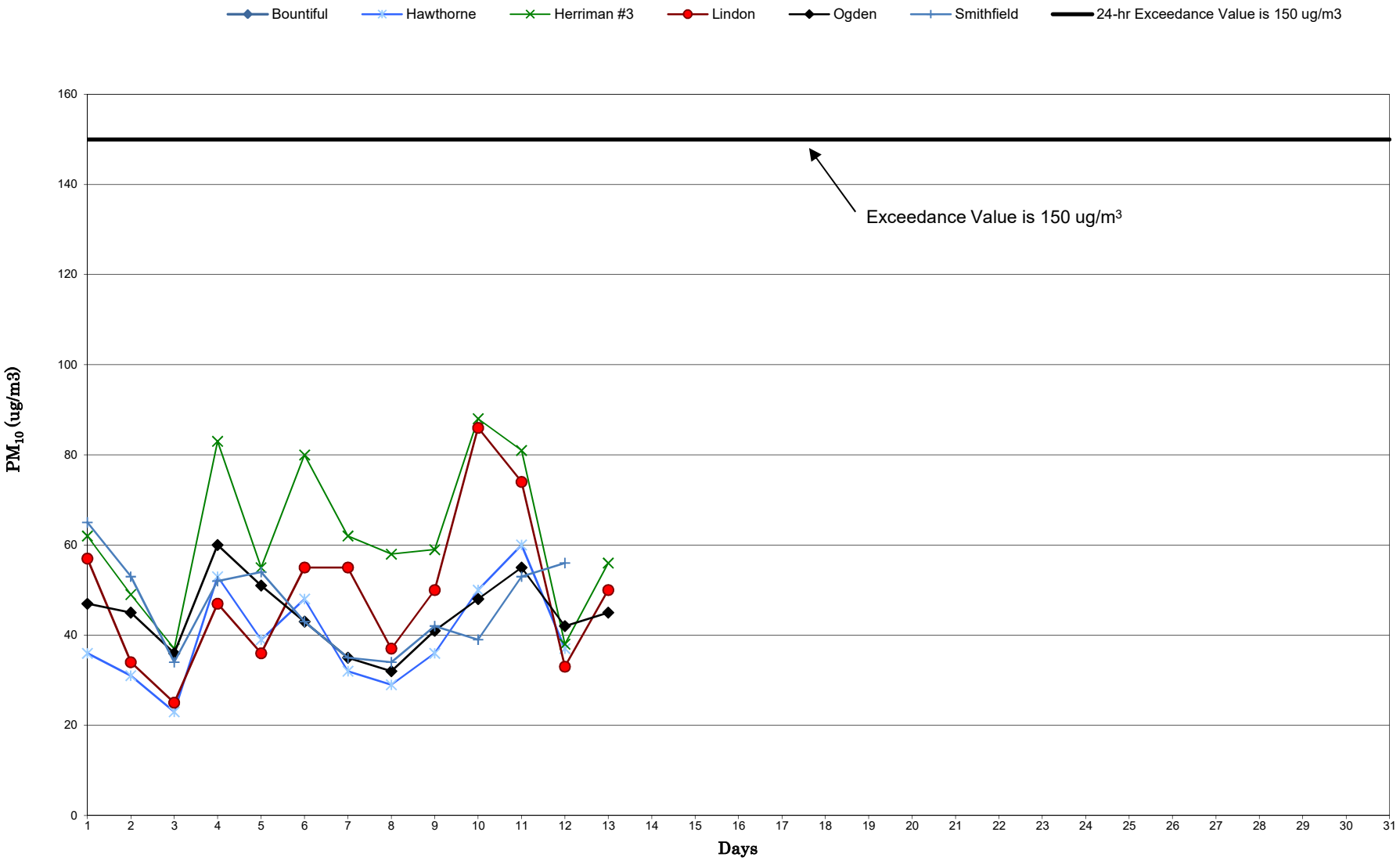
Utah Division of Air Quality

Utah 24-hr PM_{10} Data July 2018

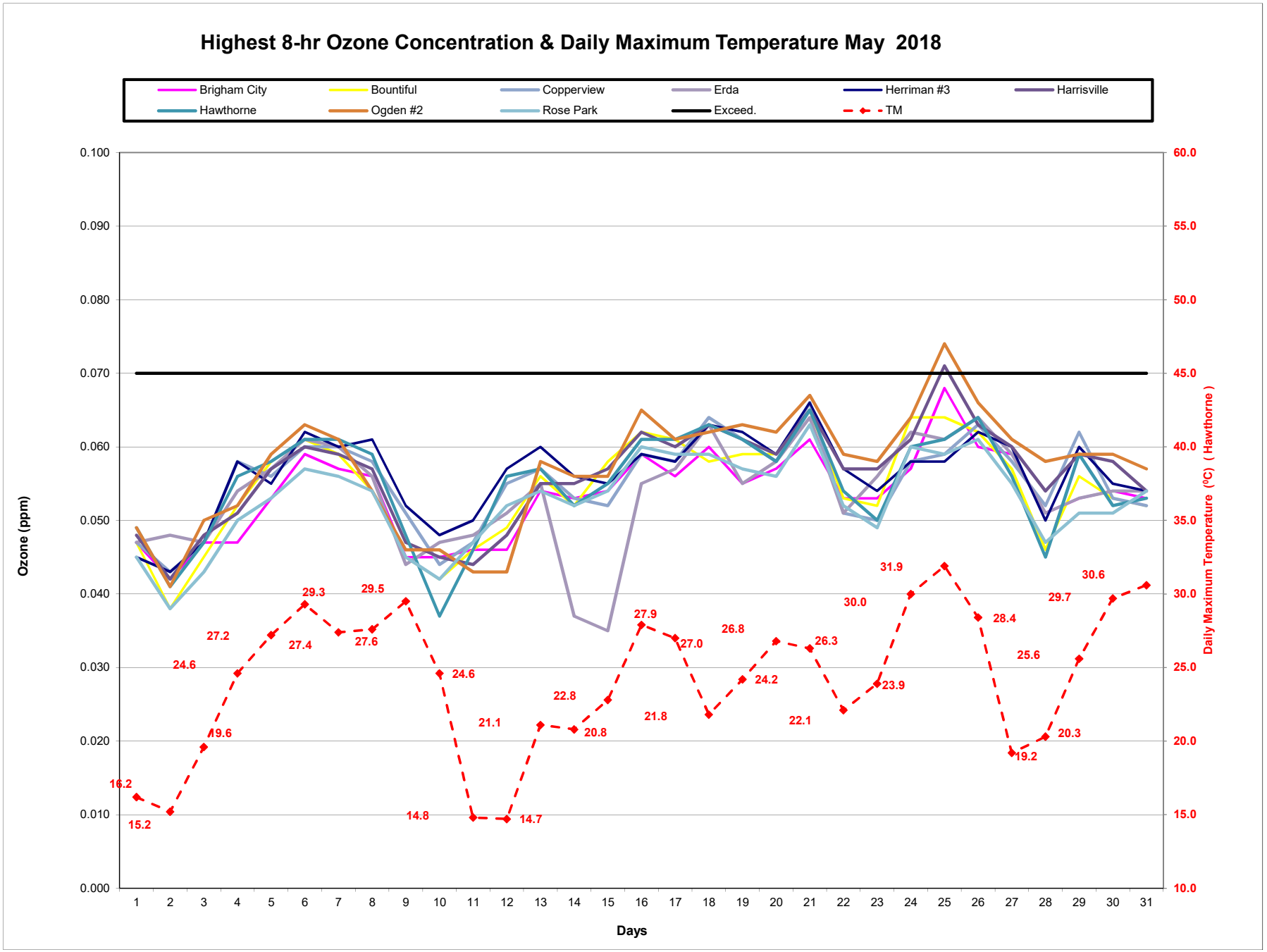


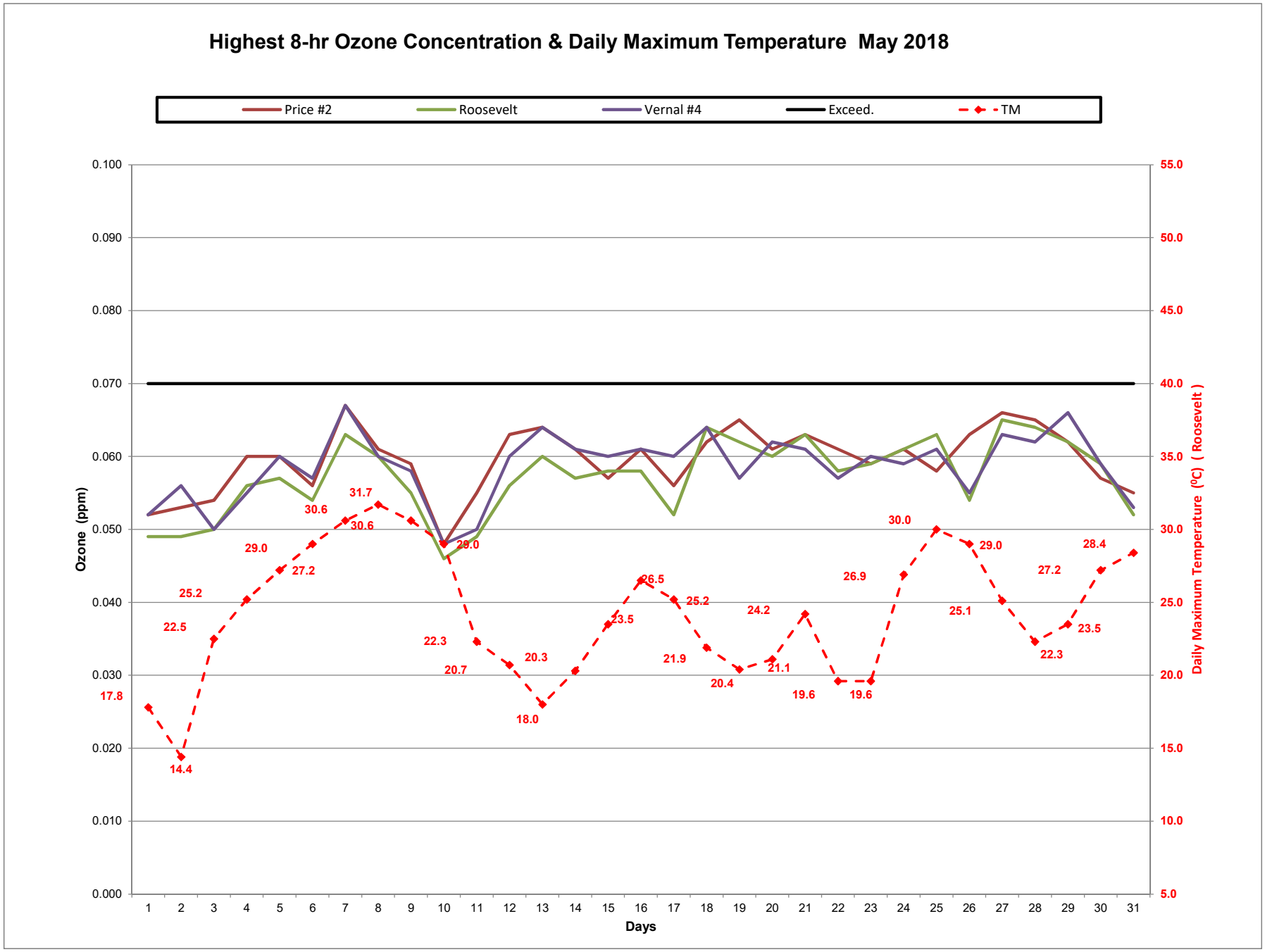
Utah Division of Air Quality

Utah 24-hr PM_{10} Data August 2018

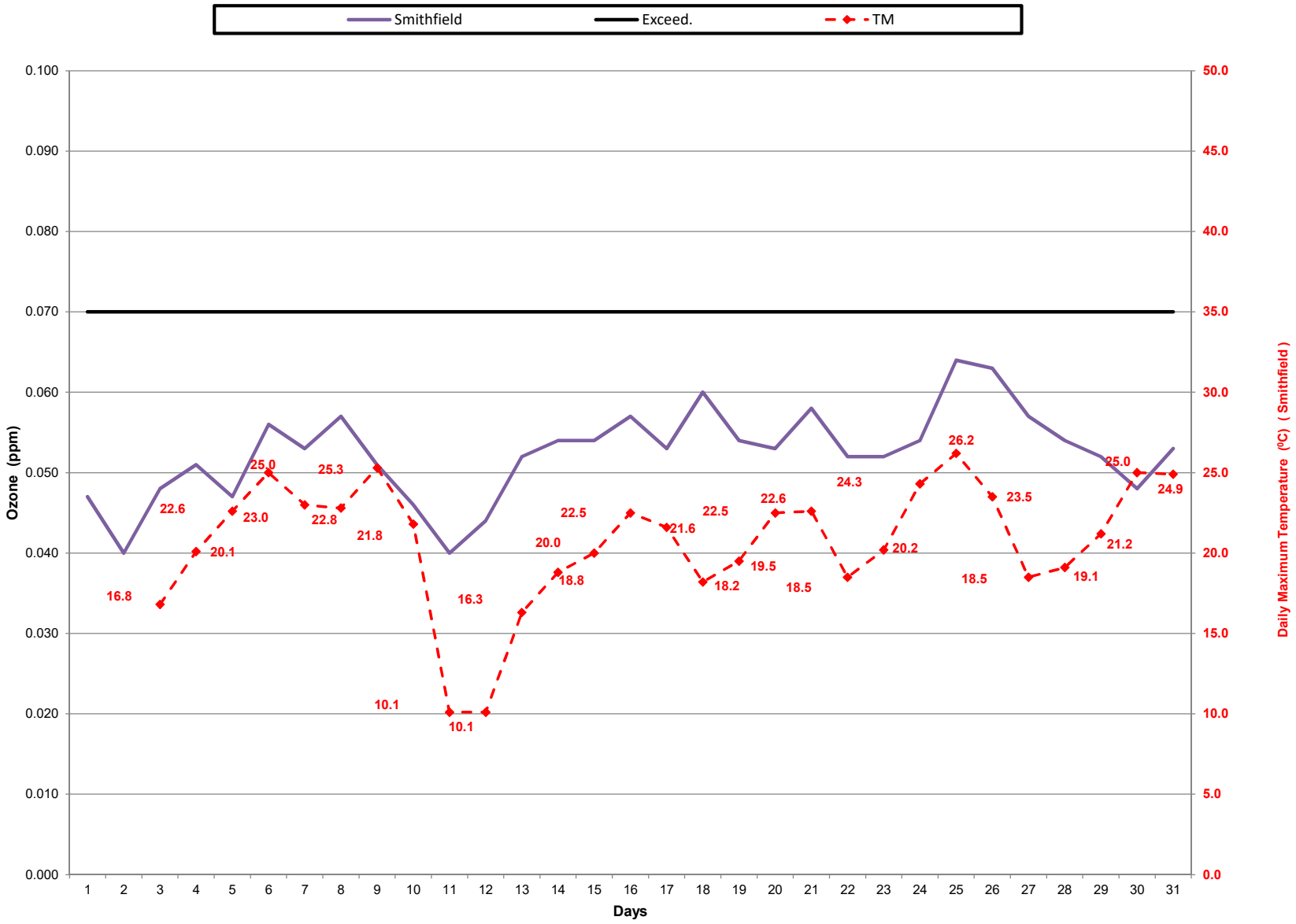


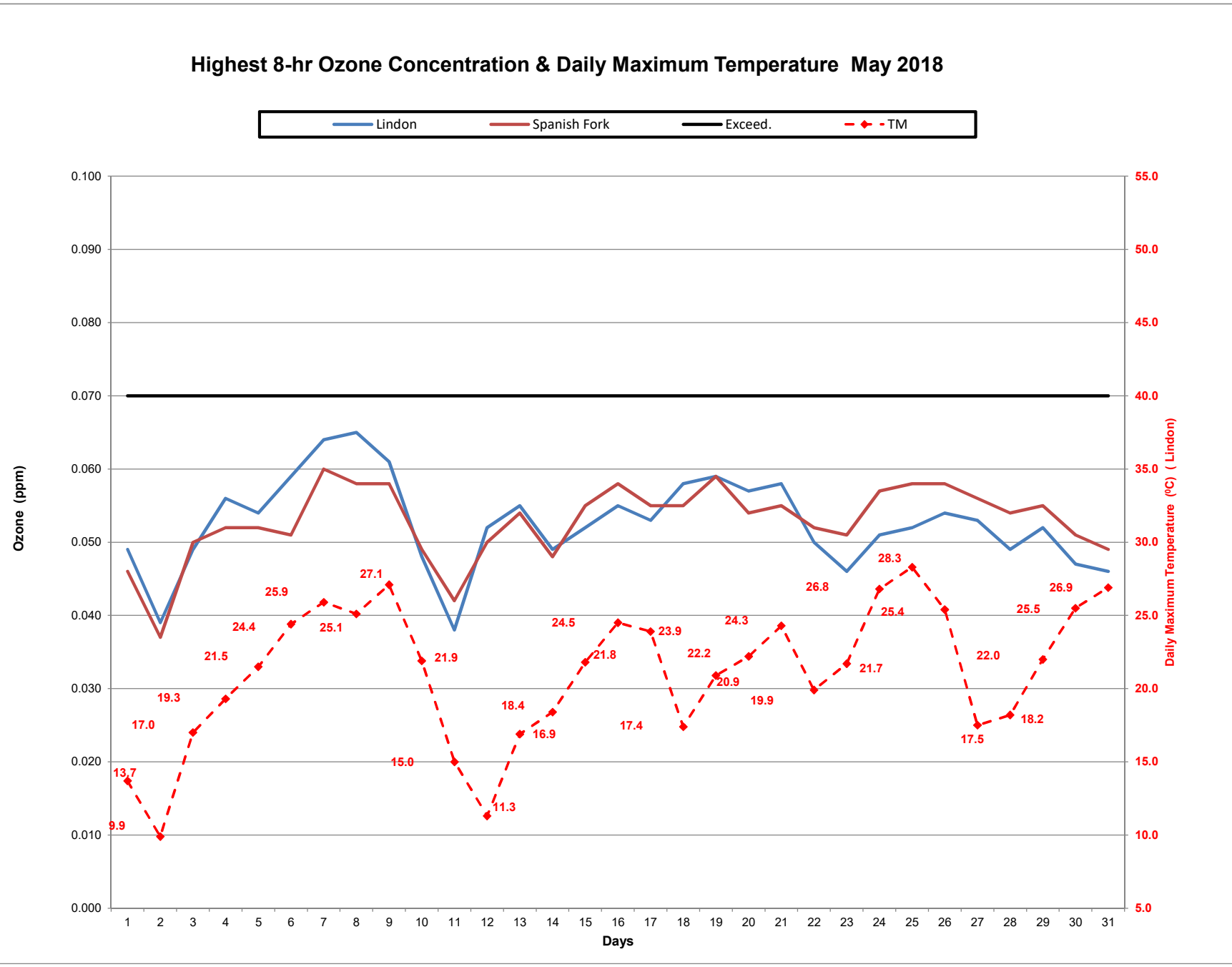
Utah Division of Air Quality

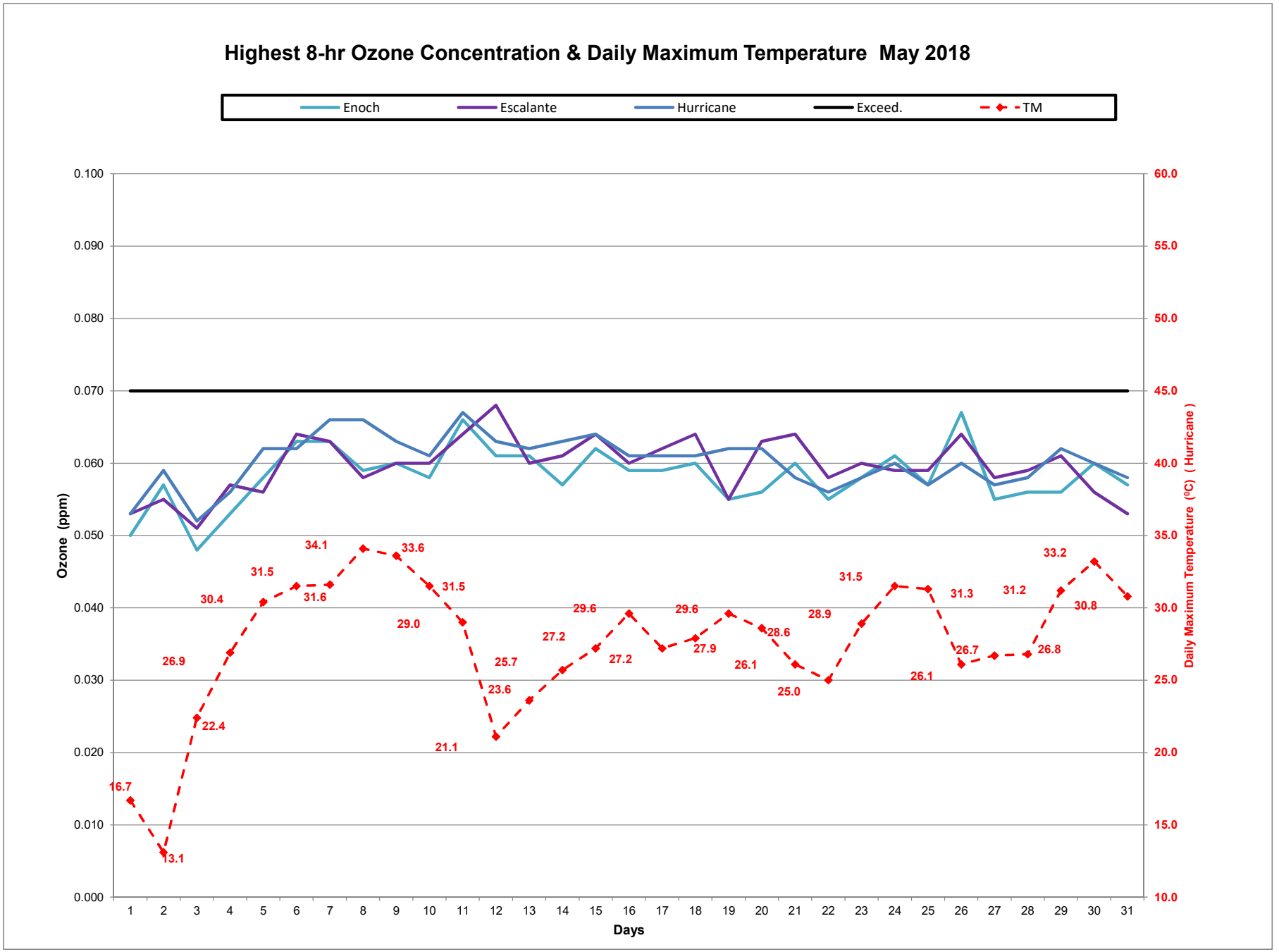

Highest 8-hr Ozone Concentration & Daily Maximum Temperature May 2018
Brigham City
Bountiful
Copperview
Erda
Herriman #3
Harrisville
Hawthorne
Ogden #2
Rose Park
Exceed.
TM
Ozone (ppm)
Daily Maximum Temperature (°C) (Hawthorne)
Days
0.100
0.090
0.080
0.070
0.060
0.050
0.040
0.030
0.020
0.010
0.000
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
16.2
15.2
19.6
24.6
27.2
27.4
29.3
27.6
29.5
14.8
24.6
21.1
14.7
22.8
20.8
27.9
21.8
27.0
26.8
24.2
26.3
22.1
30.0
23.9
31.9
28.4
25.6
19.2
20.3
29.7
30.6


Highest 8-hr Ozone Concentration & Daily Maximum Temperature May 2018
Price #2
Roosevelt
Vernal #4
Exceed.
TM
Ozone (ppm)
Daily Maximum Temperature (ºC) (Roosevelt)
Days
0.100
0.090
0.080
0.070
0.060
0.050
0.040
0.030
0.020
0.010
0.000
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
17.8
14.4
25.2
22.5
29.0
27.2
30.6
30.6
31.7
28.0
22.3
20.7
20.3
18.0
23.5
26.5
25.2
21.9
24.2
20.4
21.1
19.6
26.9
19.6
30.0
25.1
29.0
22.3
27.2
23.5
28.4

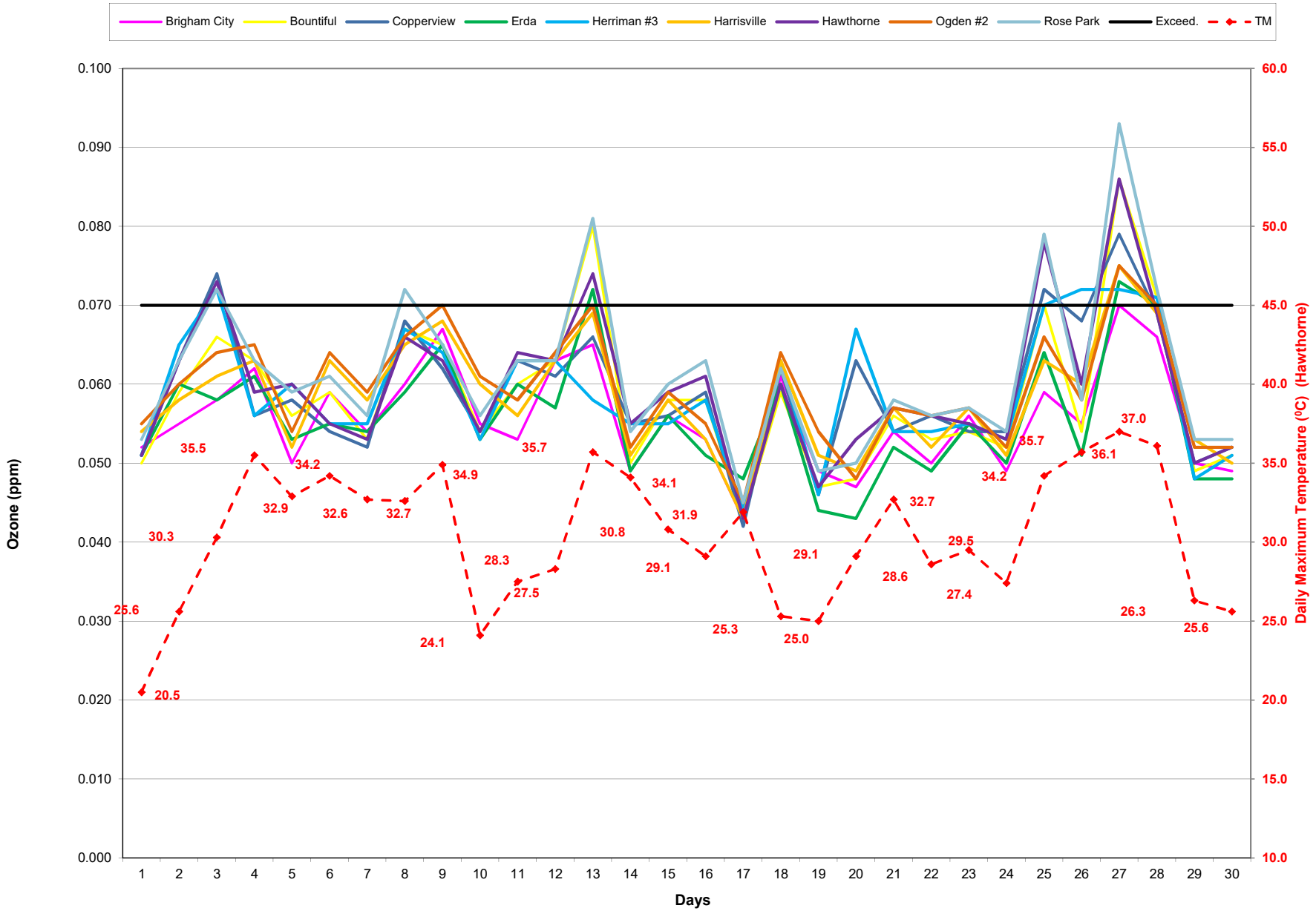
Highest 8-hr Ozone Concentration & Daily Maximum Temperature May 2018

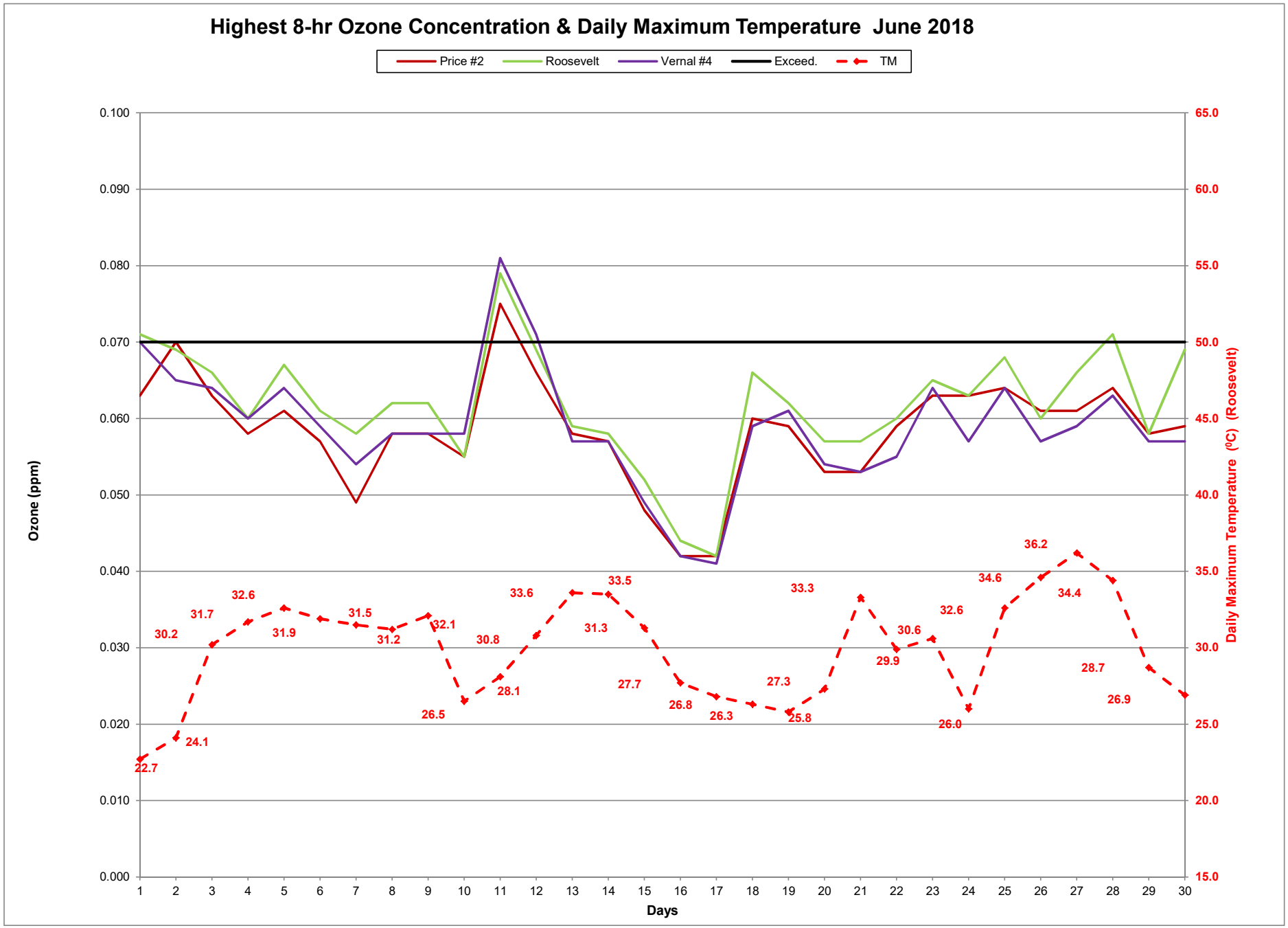


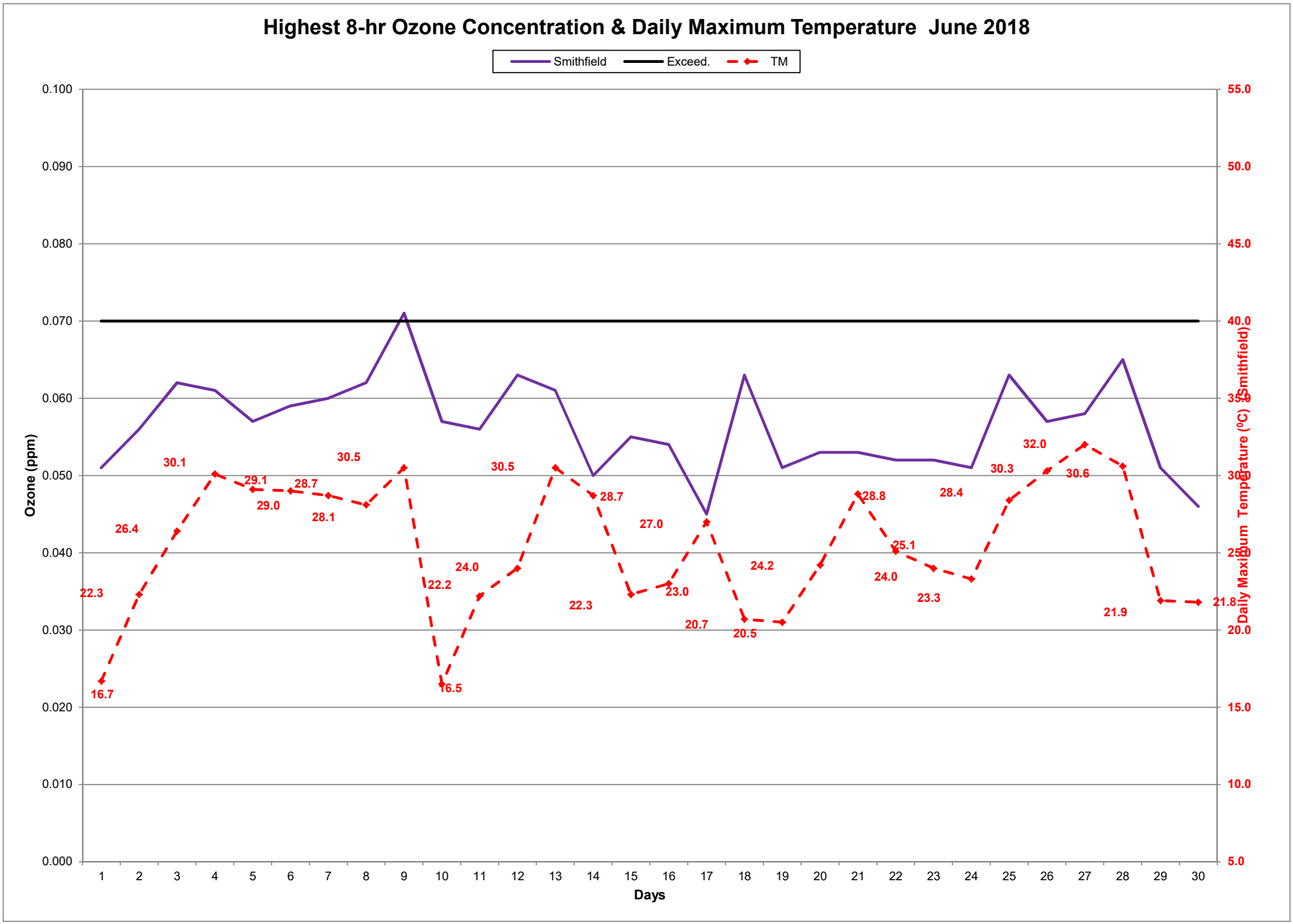

Highest 8-hr Ozone Concentration & Daily Maximum Temperature May 2018
Lindon
Spanish Fork
Exceed.
TM
Ozone (ppm)
Daily Maximum Temperature (ºC) (Lindon)
Days
0.100
0.090
0.080
0.070
0.060
0.050
0.040
0.030
0.020
0.010
0.000
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
9.9
13.7
17.0
19.3
21.5
24.4
25.9
25.1
27.1
21.9
15.0
11.3
18.4
16.9
24.5
21.8
23.9
17.4
22.2
20.9
24.3
19.9
26.8
21.7
28.3
25.4
22.0
17.5
25.5
18.2
26.9

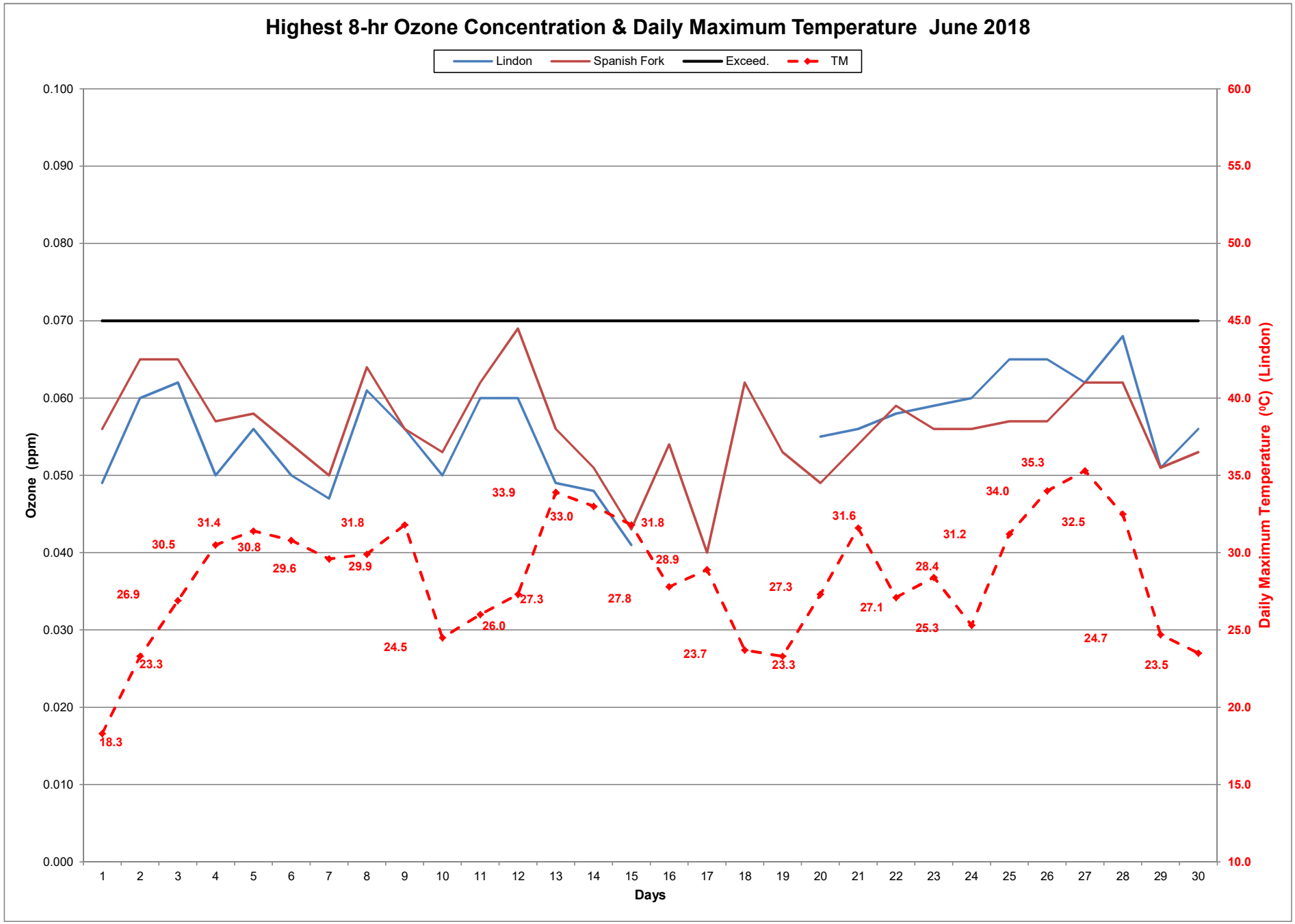

Highest 8-hr Ozone Concentration & Daily Maximum Temperature May 2018
Enoch
Escalante
Hurricane
Exceed.
TM
Ozone (ppm)
Daily Maximum Temperature (ºC) (Hurricane)
Days
0.100
0.090
0.080
0.070
0.060
0.050
0.040
0.030
0.020
0.010
0.000
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
16.7
13.1
22.4
26.9
30.4
31.5
31.6
34.1
33.6
29.0
31.5
21.1
25.7
23.6
27.2
29.6
27.2
29.6
27.9
26.1
28.6
25.0
28.9
31.5
26.1
31.3
26.7
31.2
26.8
33.2
30.8

Highest 8-hr Ozone Concentration & Daily Maximum Temperature June 2018




Highest 8-hr Ozone Concentration & Daily Maximum Temperature June 2018
Price #2
Roosevelt
Vernal #4
Exceed.
TM
Ozone (ppm)
Daily Maximum Temperature (°C) (Roosevelt)
Days
0.100
0.090
0.080
0.070
0.060
0.050
0.040
0.030
0.020
0.010
0.000
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
22.7
24.1
30.2
31.7
32.6
31.9
31.5
31.2
32.1
26.5
30.8
28.1
33.6
33.5
31.3
27.7
26.8
26.3
27.3
25.8
33.3
29.9
30.6
32.6
26.0
34.6
36.2
34.4
28.7
26.9


Highest 8-hr Ozone Concentration & Daily Maximum Temperature June 2018
Smithfield
Exceed.
TM
Ozone (ppm)
Daily Maximum Temperature (°C) (Smithfield)
Days
0.100
0.090
0.080
0.070
0.060
0.050
0.040
0.030
0.020
0.010
0.000
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
22.3
26.4
30.1
16.7
29.1
29.0
28.7
28.1
30.5
22.2
16.5
24.0
30.5
22.3
28.7
27.0
23.0
20.7
24.2
20.5
28.8
24.0
25.1
23.3
28.4
30.3
32.0
30.6
21.9
21.8


Highest 8-hr Ozone Concentration & Daily Maximum Temperature June 2018
Lindon
Spanish Fork
Exceed.
TM
Ozone (ppm)
Daily Maximum Temperature (°C) (Lindon)
Days
0.100
0.090
0.080
0.070
0.060
0.050
0.040
0.030
0.020
0.010
0.000
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
18.3
26.9
23.3
30.5
31.4
30.8
29.6
31.8
29.9
24.5
26.0
27.3
33.9
33.0
27.8
31.8
28.9
23.7
27.3
23.3
31.6
27.1
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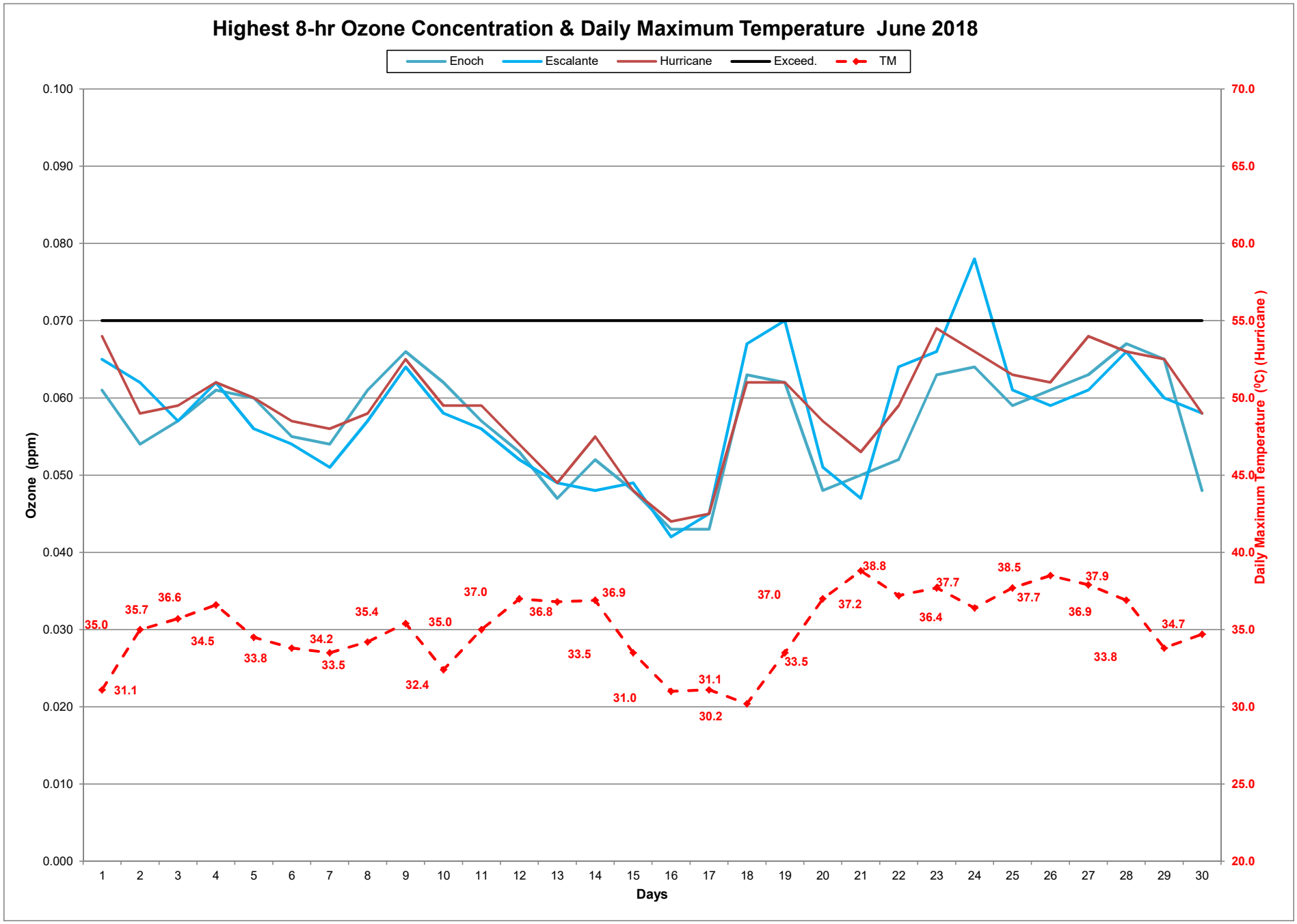
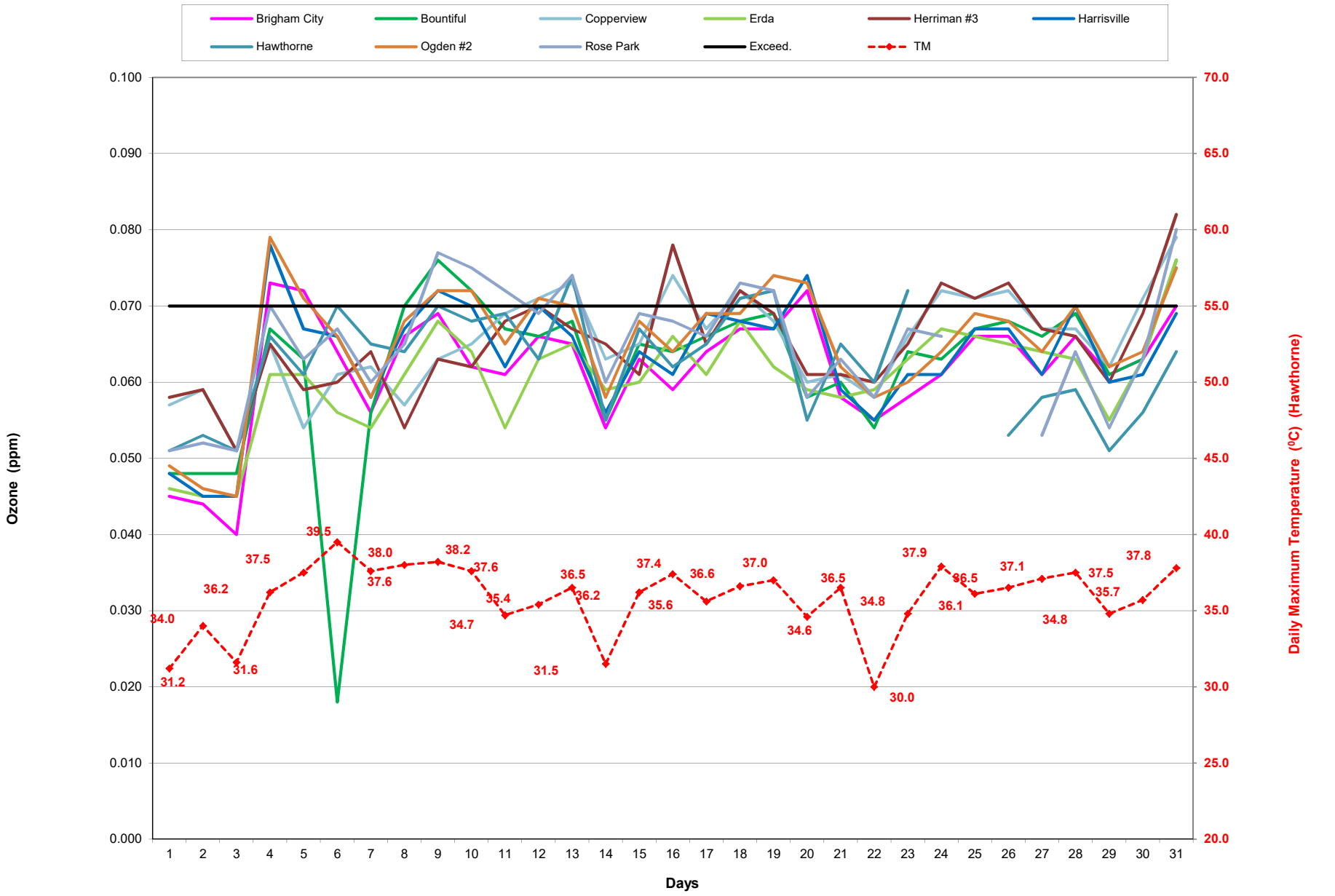
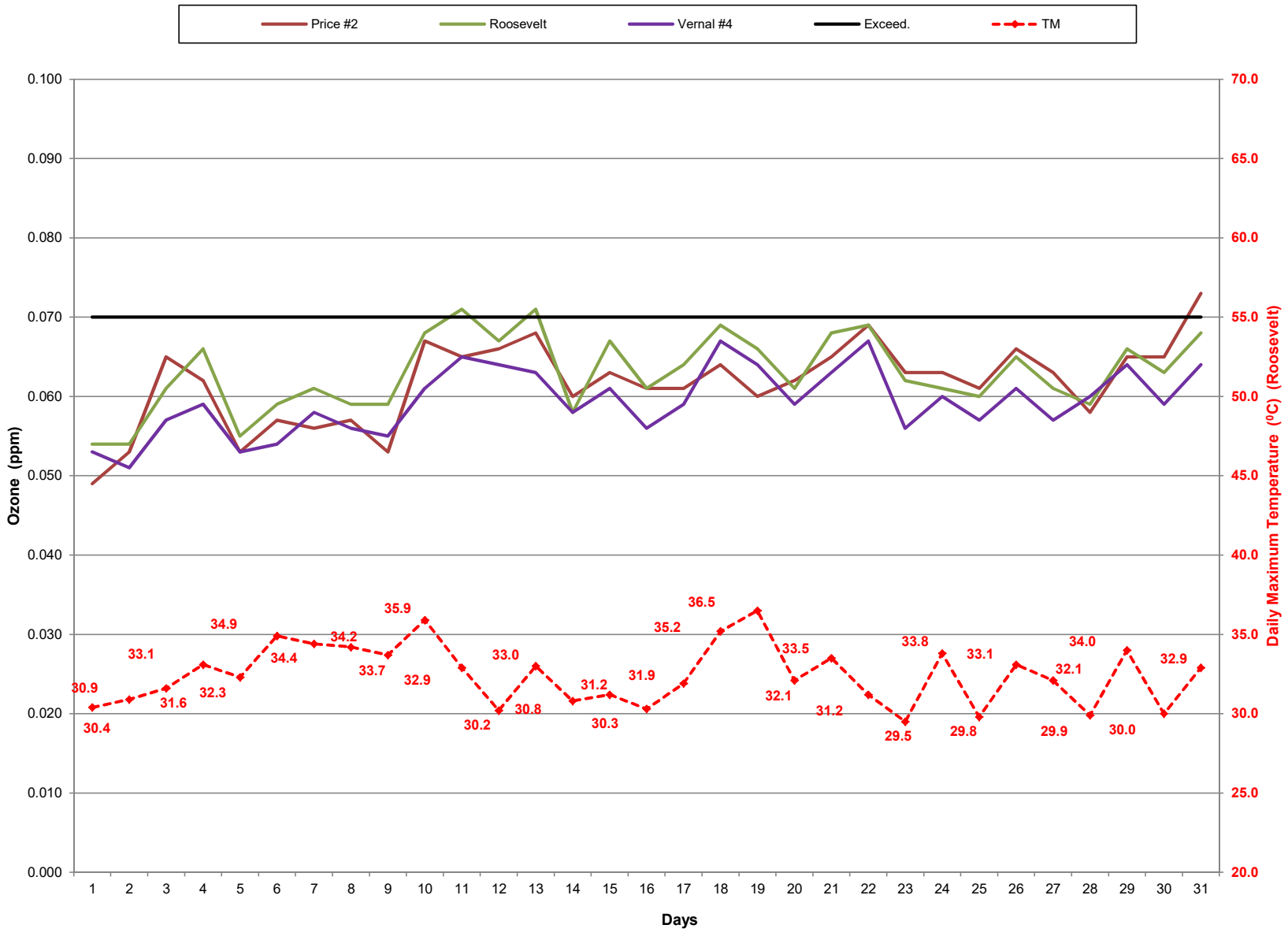
25.3
31.2
34.0
35.3
32.5
24.7
23.5


Highest 8-hr Ozone Concentration & Daily Maximum Temperature June 2018
Enoch
Escalante
Hurricane
Exceed.
TM
Ozone (ppm)
Daily Maximum Temperature (°C) (Hurricane)
Days
0.100
0.090
0.080
0.070
0.060
0.050
0.040
0.030
0.020
0.010
0.000
70.0
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
35.0 31.1 35.7 36.6 34.5 33.8 34.2 33.5 35.4 32.4 35.0 37.0 36.8 36.9 33.5 31.0 31.1 30.2 37.0 33.5 37.2 38.8 36.4 37.7 38.5 37.7 36.9 37.9 33.8 34.7

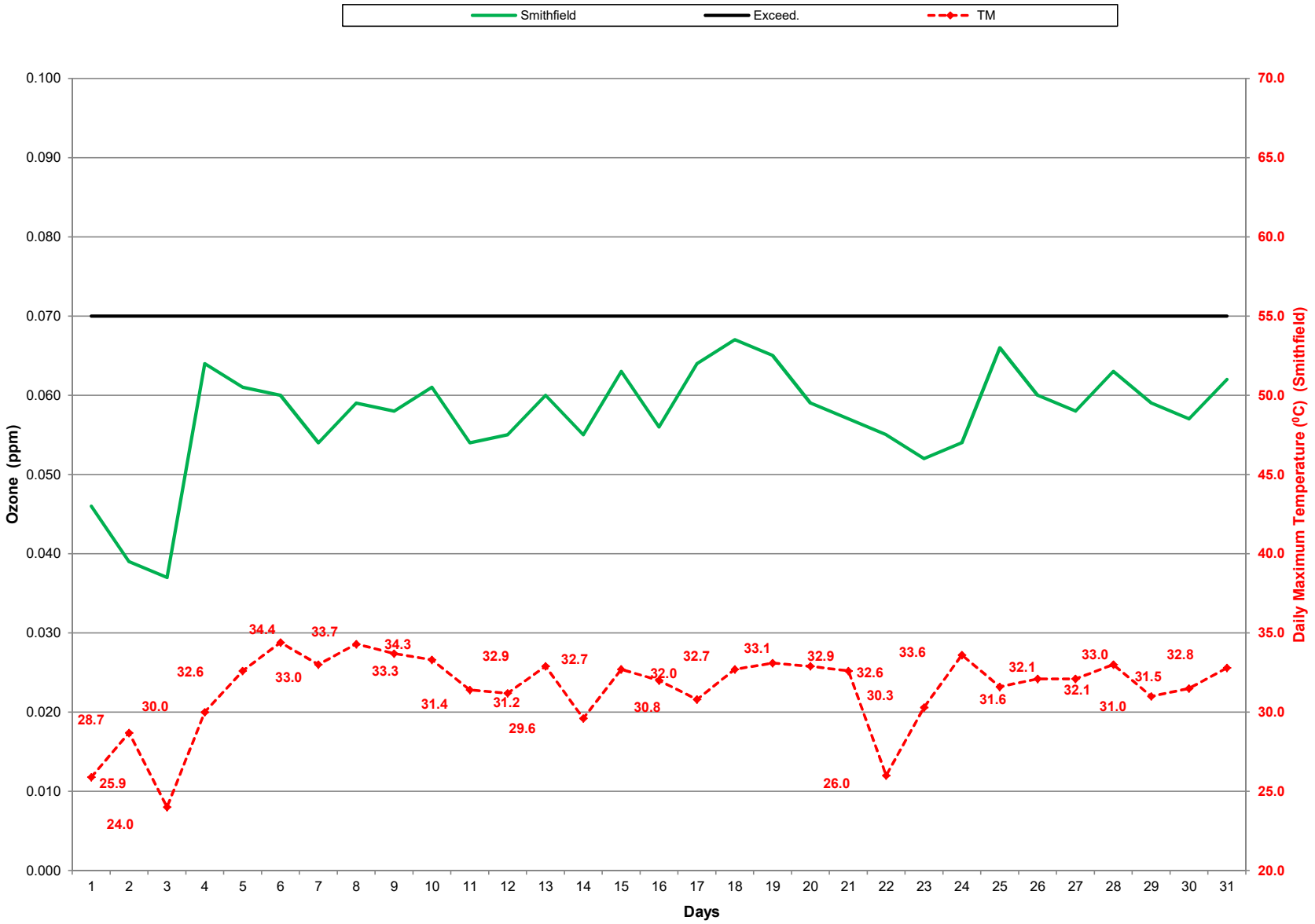
Highest 8-hr Ozone Concentration & Daily Maximum Temperature July 2018



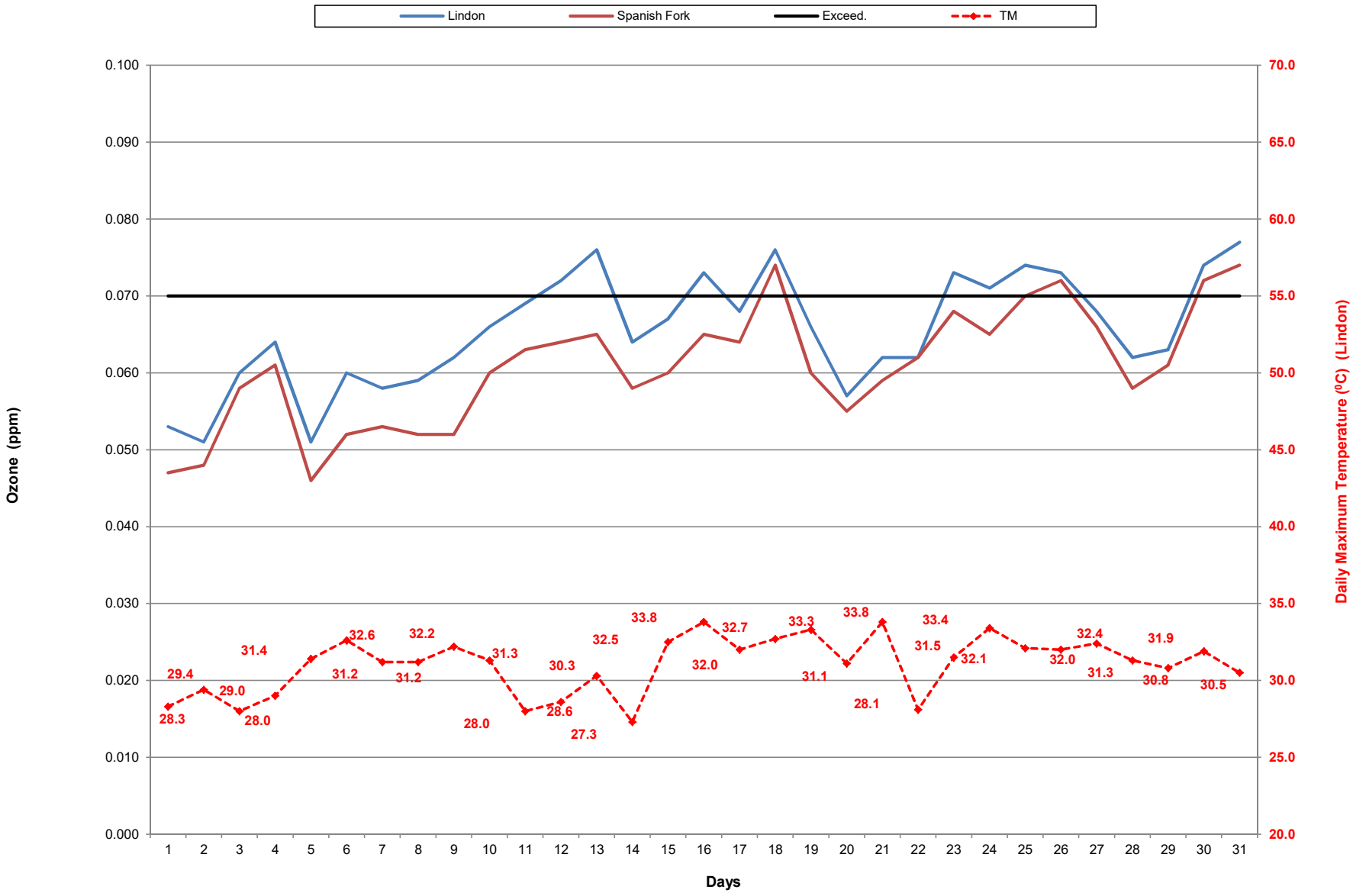
Highest 8-hr Ozone Concentration & Daily Maximum Temperature July 2018



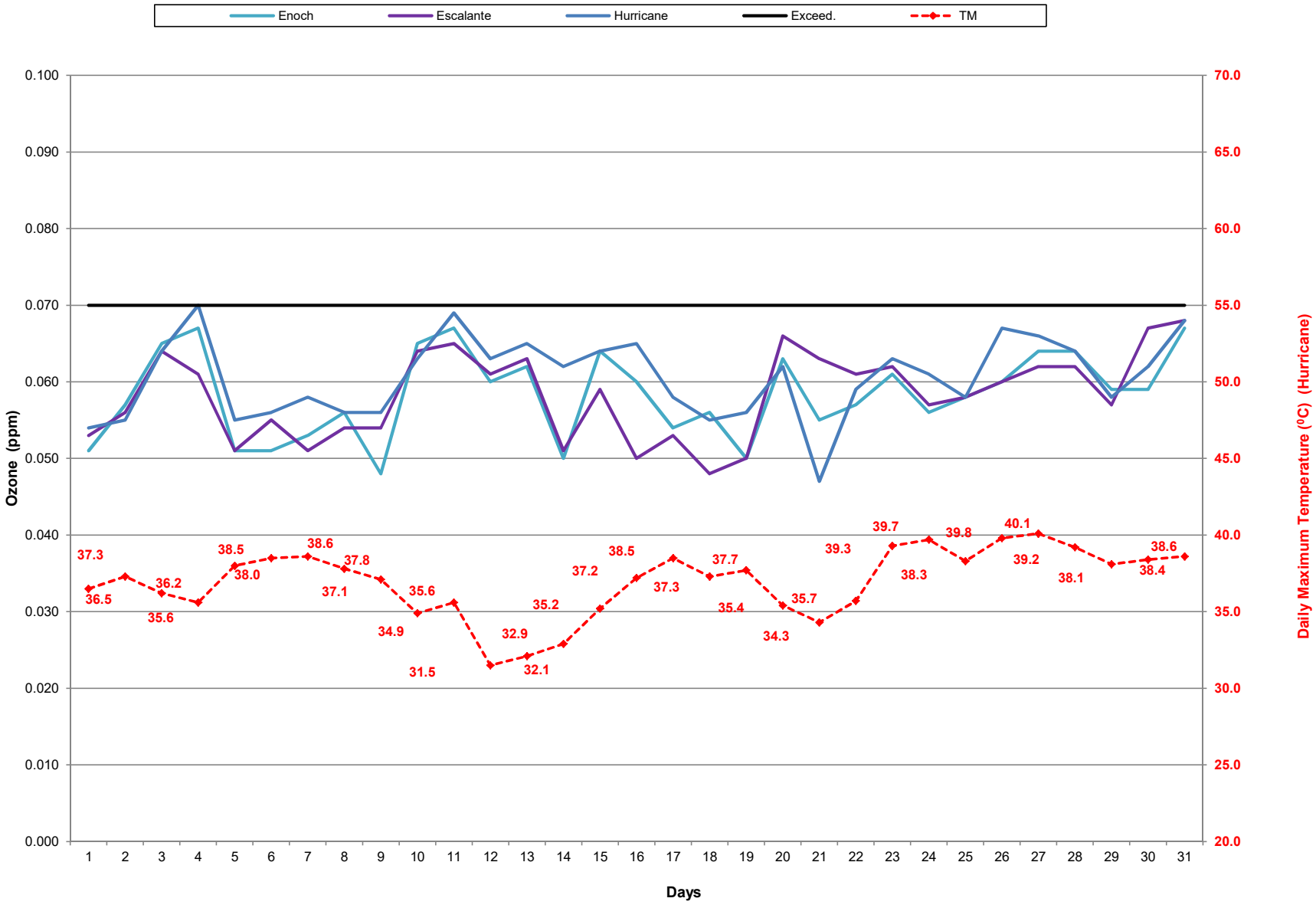
Highest 8-hr Ozone Concentration & Daily Maximum Temperature July 2018



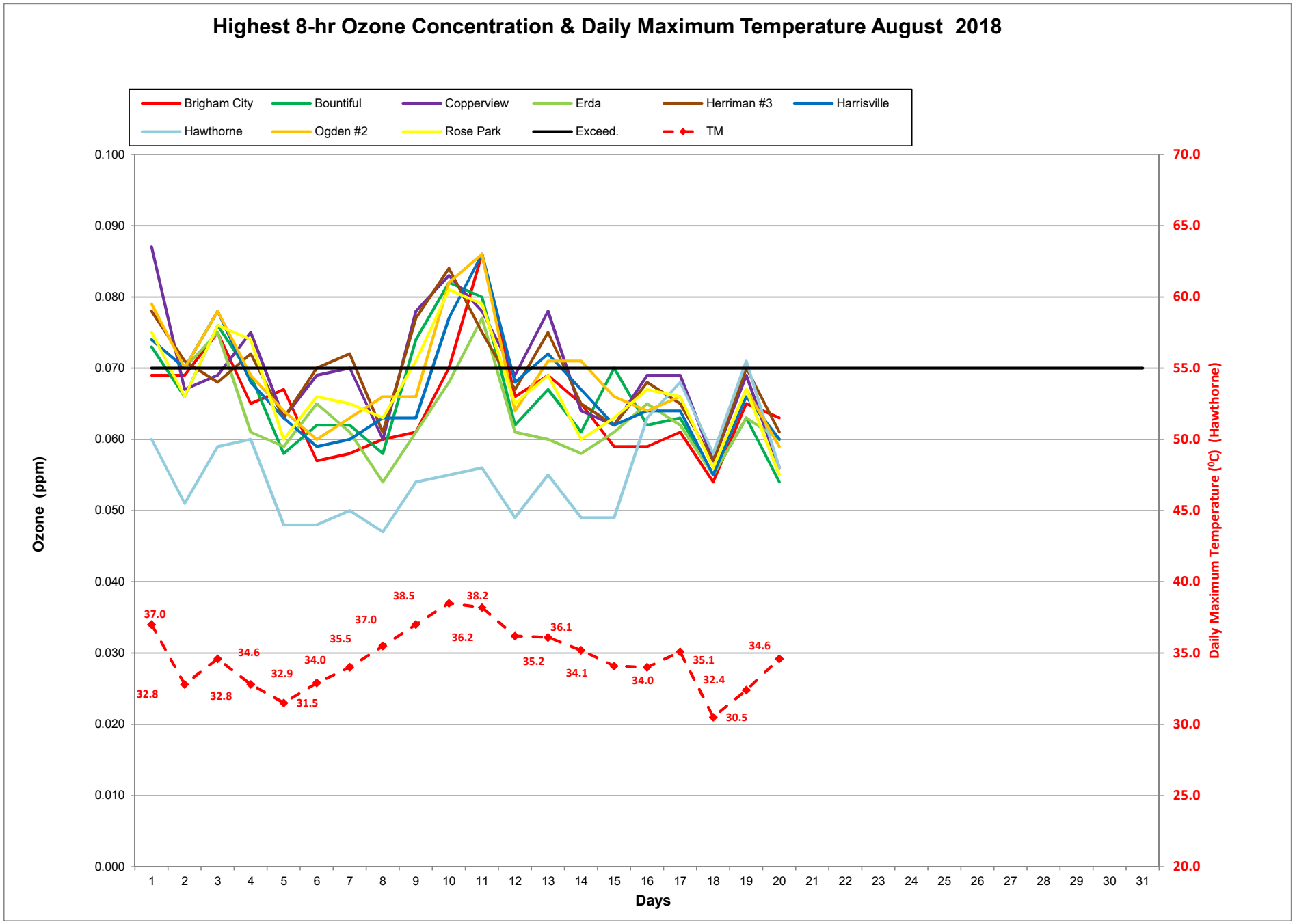
Highest 8-hr Ozone Concentration & Daily Maximum Temperature July 2018



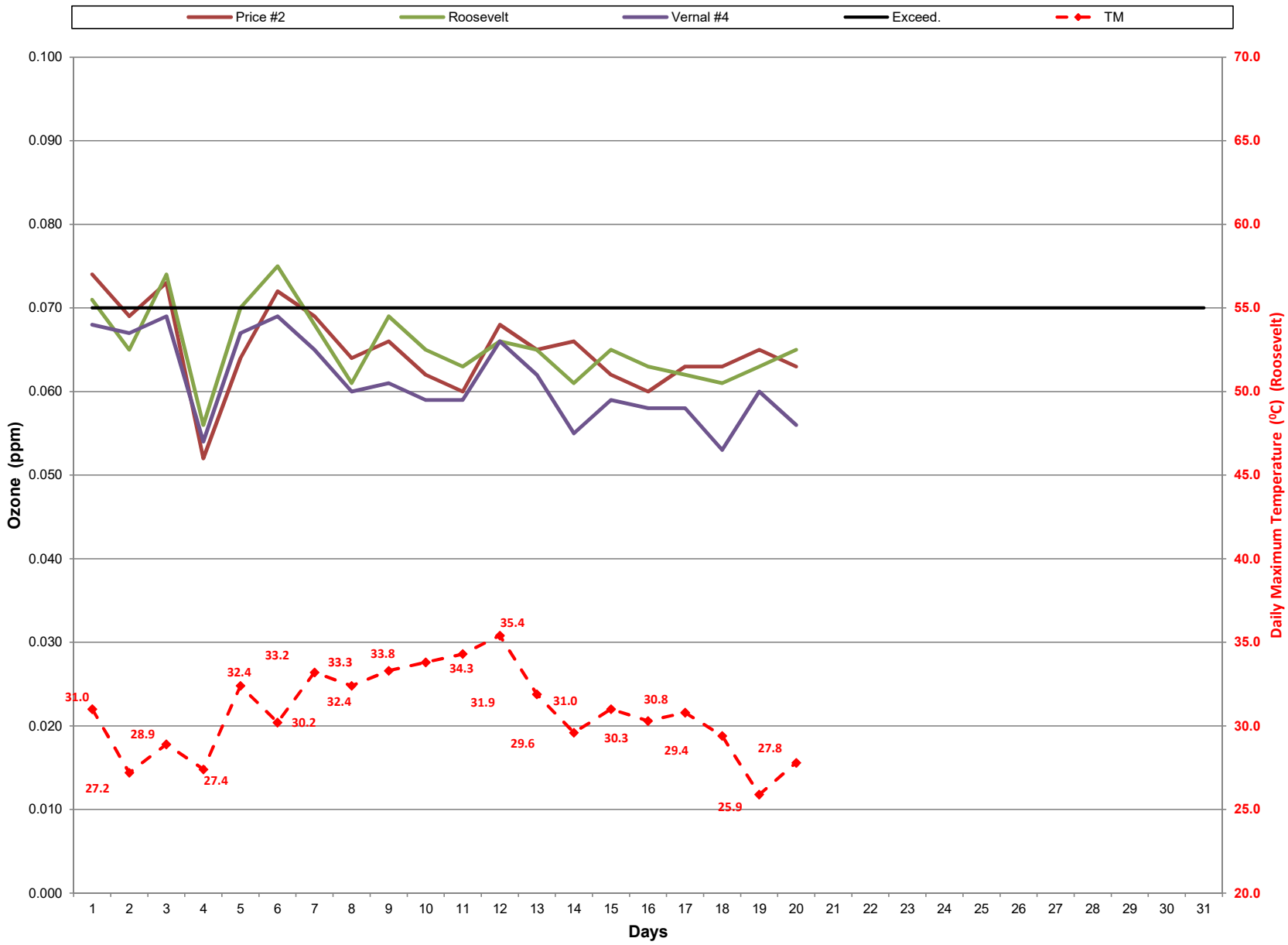
Highest 8-hr Ozone Concentration & Daily Maximum Temperature July 2018



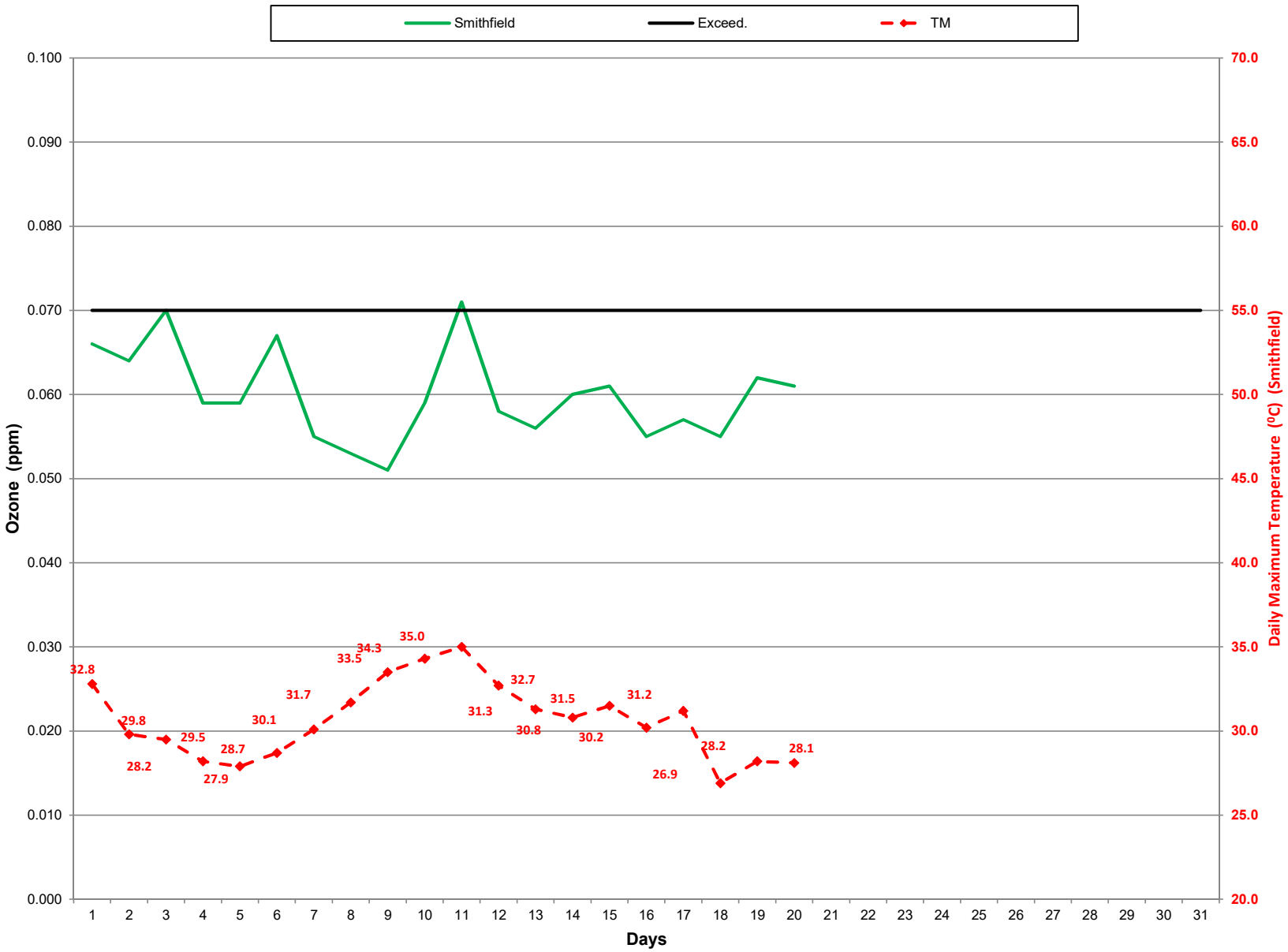
Highest 8-hr Ozone Concentration & Daily Maximum Temperature August 2018



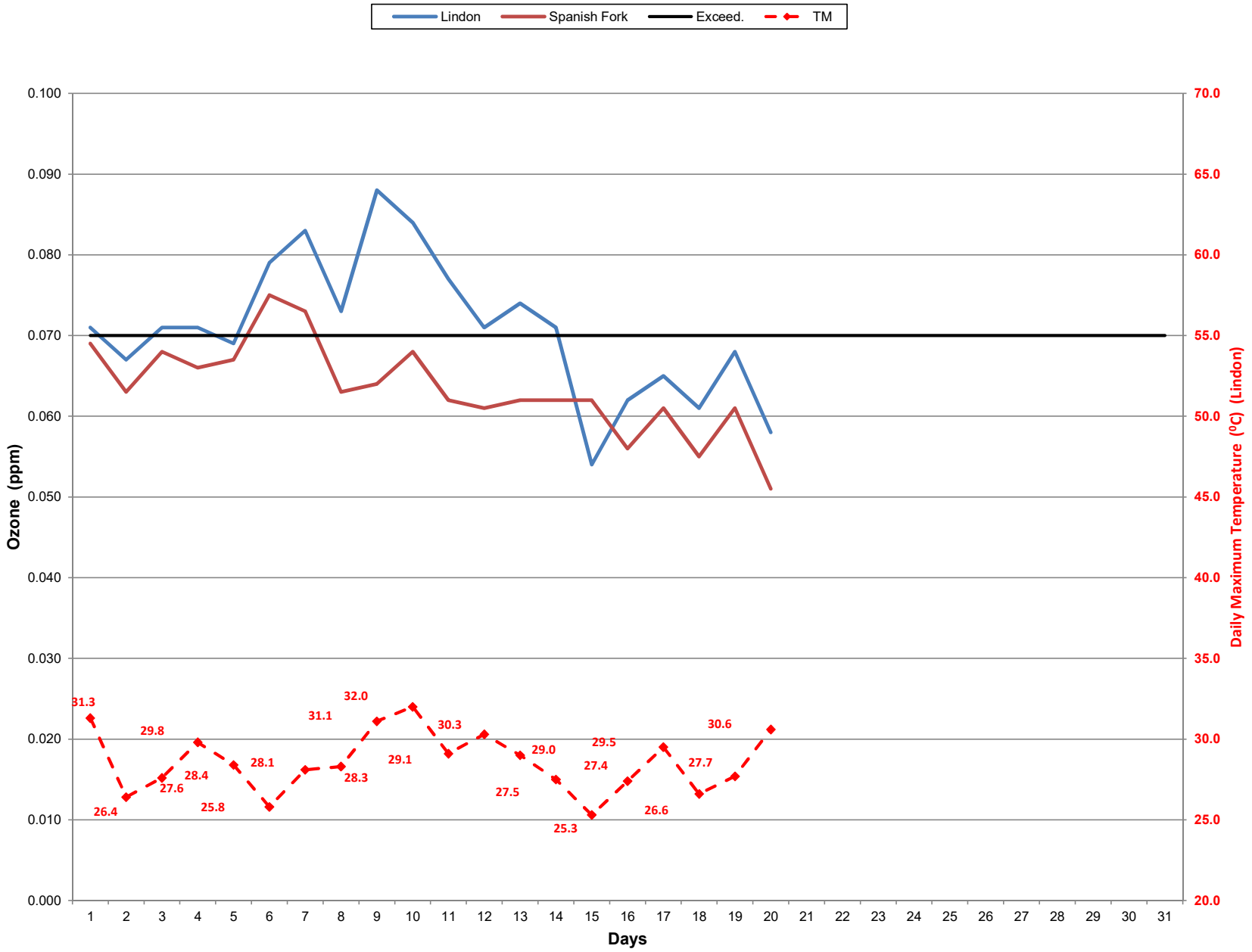
Highest 8-hr Ozone Concentration & Daily Maximum Temperature August 2018

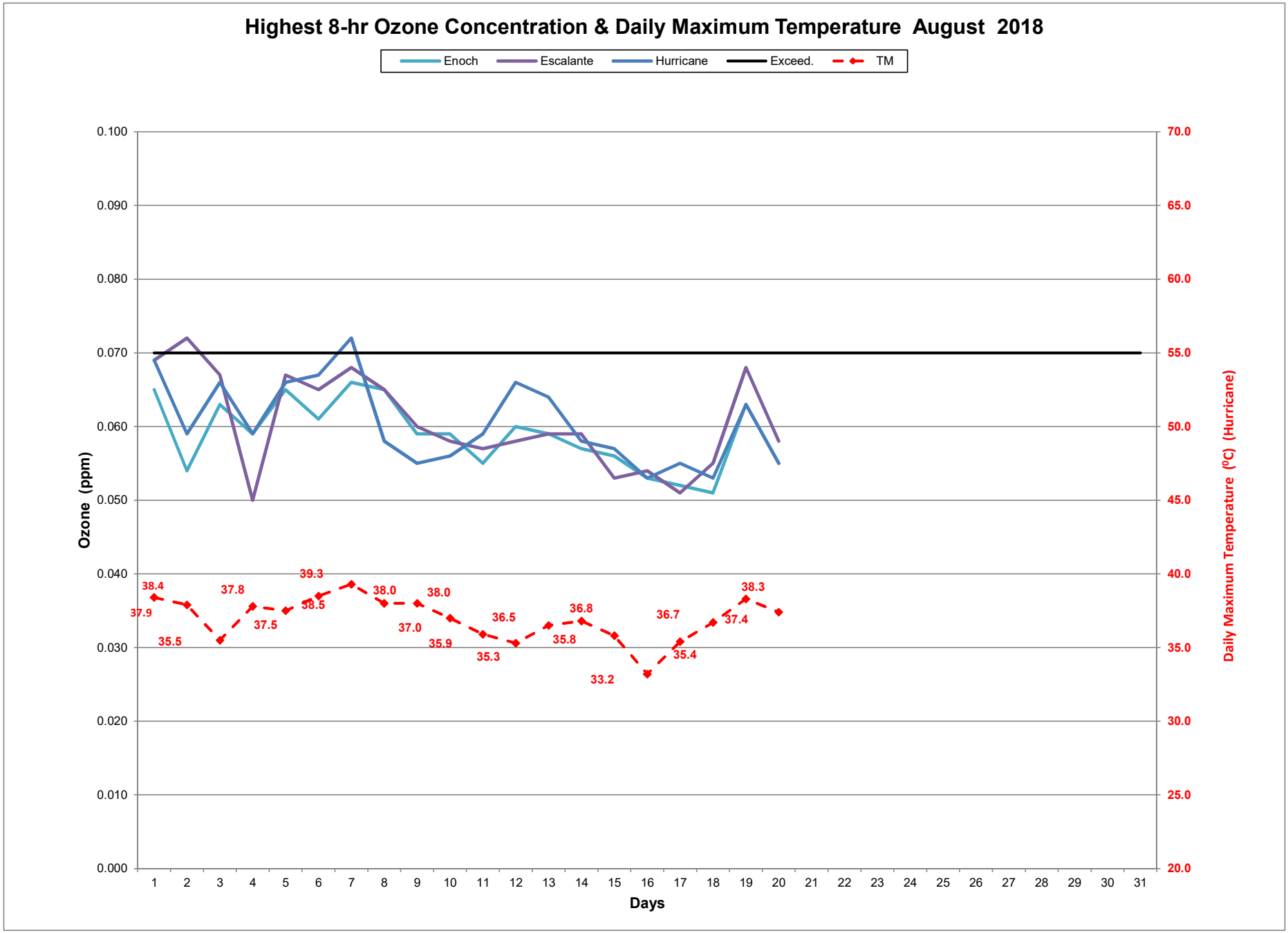


Highest 8-hr Ozone Concentration & Daily Maximum Temperature August 2018



Highest 8-hr Ozone Concentration & Daily Maximum Temperature August 2018




Highest 8-hr Ozone Concentration & Daily Maximum Temperature August 2018
Enoch
Escalante
Hurricane
Exceed.
TM
Ozone (ppm)
Daily Maximum Temperature (°C) (Hurricane)
Days
0.100
0.090
0.080
0.070
0.060
0.050
0.040
0.030
0.020
0.010
0.000
70.0
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
38.4
37.9
35.5
37.8
37.5
38.5
39.3
38.0
37.0
38.0
35.9
36.5
35.3
35.8
36.8
33.2
36.7
35.4
37.4
38.3