Klamath Falls 2020 Exceptional Event EPA Concurrence Request

Submitted to: EPA, Region 10
By: Margaret Miller and Anthony Barnack
July 2021

Oregon DEQ
Air Quality Planning
700 NE Multnomah St.,
Suite #600
Portland, OR 97232
Phone: 503.347.5028
Fax: 503 229-6762

Contact: Margaret Miller
www.oregon.gov/DEQ

DEQ is a leader in restoring, maintaining and enhancing the quality of Oregon's air, land and water.

State of Oregon
Department of Environmental Quality

This report prepared by:

Oregon Department of Environmental Quality
700 NE Multnomah St., Suite #600
Portland, OR 97232
1-800-452-4011
www.oregon.gov/deq

Contact:
Margaret Miller
Margaret.miller@deq.state.or.us
503-347-5028

Alternative formats (Braille, large type) of this document can be made available. Contact DEQ, Portland, at 503-229-5696, or toll-free in Oregon at 1-800-452-4011, ext. 5696.

Contents

Tables

Figures

Appendices[1]

[1] Do to file size, appendices are included as stand alone documents.

Executive Summary

To address high monitor values resulting from exceptional events not reasonably controllable or preventable, the U.S. Environmental Protection Agency promulgated the Exceptional Events Rule (EER) pursuant to Section 319 of the Clean Air Act. Major changes to the 2007 EER contained in the Code of Federal Regulations, Title 40, Parts 50 and 51 (40 CFR 50 and 51) were promulgated on October 3, 2016 (72 FR 13560) to clarify the scope of the rules, analyses, content, and organization for exceptional events demonstrations, and fire related definitions and demonstration components. The EER allows states to flag air quality data as exceptional and exclude those data from use in determining compliance with the National Ambient Air Quality Standards if EPA concurs with the state's demonstration that it satisfies the rule requirements.

Following the EER procedures, Oregon Department of Environmental Quality flagged values at the Klamath Falls Peterson School monitor and is requesting concurrence that certain flagged values (***Table 1***) are exceptional events. The PM2.5 flagged values close to or over 35 micrograms per cubic meter ($\mu g/m^3$) affect Oregon's compliance with the 2006 24-hour PM2.5 NAAQS. DEQ demonstrates in this report and requests EPA concurrence that these exceptional concentration values occurred as a result of wildfires, they were not reasonably controllable or preventable by the State of Oregon, not likely to reoccur, and they fully meet the EER criteria for excluding monitor values from the data used to determine compliance with NAAQS. At this point, we are only requesting concurrence for days that are of regulatory significance, and are providing information for days that may become regulatorily significant in the future. A measurement is considered regulatory significant when it could impact the designation of the non-attaintment area. Regulatory significance is based on a three-year rolling annual average of the 98th percentile of PM2.5 measurements. Therefore a measurement may become regulatorily significant in the future when more data is collected.

Table 1 below shows the key fires or fire complexes causing event days in Klamath Falls, associated with our request of EPA to concur with our findings. In the demonstration, we are showing the data from both the FRM and the FEM Teledyne T640x. We are doing this because the T640x was our primary sampler in 2020 but it was biased high by thirty to fifty percent compared to the FRM filter sampler. The bias was 30% higher until August 31st, 2020 when the T640x was recalibrated. After that the bias was close to 50% high. We feel strongly that the T640x was inaccurate and we are in the process of downgrading this data. We have asked EPA to accept the FRM data as the primary. Until this is resolved, we are presenting both data sets.

Table 1. Monitor Values at Klamath Falls for which DEQ is Requesting EPA Concurrence
Sorted by Maximum Value[2]

Date	24-Hour Average PM2.5 (µg/m3) EPA # 41-035-0004, POC 1		Flag	Source(s)
	T640x	FRM		
9/12/2020	457.6	300	RT/RT	Multi-Fire Smoke Event (Lionshead, Beachie Creek, Etc.)
9/13/2020	285.6	-	RT	Multi-Fire Smoke Event (Lionshead, Beachie Creek, Etc.)
9/11/2020	214.9	-	RT	Multi-Fire Smoke Event (Lionshead, Beachie Creek, Etc.)
8/24/2020	97.9	-	RT	Red Salmon Complex, Spring Fire, Elkhorn Fire, CA

[2] *Please note that RT means days with wildfire smoke impacts that do have regulatory significance and IT means days with wildfire smoke impacts that are being flagged for information purposes only.*

10/8/2020	95.6	-	RT	Red Salmon Complex, Fox Fire, August Complex, Bear Fire, CA
9/23/2020	94.1	-	RT	Red Salmon Complex Fire & August Complex Fire
8/23/2020	89.3	-	RT	Red Salmon Complex Fire
9/5/2020	88.4	-	RT	Red Salmon Complex Fire
7/28/2020	77.1	-	RT	July Complex Fire
9/14/2020	75.3	-	RT	Multi-Fire Smoke Event (Lionshead, Beachie Creek, Etc.)
8/25/2020	71.8	45.8	RT/RT	Red Salmon Complex Fire
9/6/2020	70	41.5	RT/IT	Red Salmon Complex Fire
10/7/2020	68.7	-	RT	Red Salmon Complex, Fox Fire, August Complex, Bear Fire, CA
9/22/2020	67.1	-	RT	Red Salmon Fire, August Complex Fire
7/27/2020	66.3	-	RT	July Complex Fire
9/15/2020	64.4	-	RT	Multi-Fire Smoke Event (Lionshead, Beachie Creek, Etc.)
10/9/2020	63.6	-	RT	Red Salmon Complex, Fox Fire, August Complex, Bear Fire, CA
9/21/2020	63.1	-	RT	Red Salmon Fire, August Complex Fire
9/17/2020	56.5	-	RT	Multi-Fire Smoke Event (Lionshead, Beachie Creek, Etc.)
9/16/2020	56.1	-	RT	Multi-Fire Smoke Event (Lionshead, Beachie Creek, Etc.)
9/30/2020	54.2	27.9	RT/IT	Red Salmon, August Complex, Slater & return of plume fromNW
9/4/2020	50.7	-	RT	Spring Fire, Elkhorn Fire, CA
10/1/2020	47.4	-	IT	Red Salmon, August Complex, Slater
10/6/2020	47.4	-	IT	Red Salmon Complex, Fox Fire, August Complex, Bear Fire, CA
9/7/2020	47.3	-	IT	Multi-Fire Smoke Event (Lionshead, Beachie Creek, Etc.)
9/18/2020	41.6	-	IT	Multi-Fire Smoke Event (Lionshead, Beachie Creek, Etc.)
9/10/2020	40.2	-	IT	Multi-Fire Smoke Event (Lionshead, Beachie Creek, Etc.)
9/19/2020	35.9	-	IT	Multi-Fire Smoke Event (Lionshead, Beachie Creek, Etc.)
10/4/2020	35.5	-	IT	Red Salmon, August Complex, Slater
8/26/2020	35.1	-	IT	Red Salmon Complex Fire
8/22/2020	34.1	-	IT	Red Salmon Complex Fire
9/8/2020	30.4	-	IT	Multi-Fire Smoke Event (Lionshead, Beachie Creek, Etc.)
8/27/2020	27.2	-	IT	Red Salmon Complex Fire
9/24/2020	27	-	IT	Red Salmon Complex Fire, August Complex Fire

In addition, ***Table 2A*** and ***Table 2B*** shows that the requested values are the highest values recorded at the respective monitors for summer days (July 22 to October 9) from 2012-2020. ***Table 2A*** includes the data from the T640x for 2019 and 2020. ***Table 2B*** shows the same data for 2012 to 2018 but uses the FRM for 2019 and 2020. Exceptional events days from prior years, with the exception of 2018[3], that have been concurred by EPA are included in this table.

Table 2A. Rank Percent of Requested Values, 2012-2020; July 22 - October 9; Klamath Falls Monitor. FRM 2012 to 2018 and T640x 2019 to 2020

Monitor	Date	Year	PM2.5 (µg/m3)	Flag	Rank (N=450)	PCTL
KFP	9/12/2020	2020	458	RT	566	100%
KFP	9/13/2020	2020	286	RT	565	62%
KFP	9/11/2020	2020	215	RT	564	47%
KFP	8/3/2018	2018	156	IT	563	34%
KFP	8/6/2018	2018	156	IT	562	34%

[3] *A 2018 Exceptional Events Demonostration is being developed and will be submitted. Prenotification has already been received by the EPA.*

KFP	7/31/2018	2018	146	IT	561	32%
KFP	8/9/2018	2018	125	IT	560	27%
KFP	8/21/2018	2018	116	IT	559	25%
KFP	7/28/2018	2018	111	IT	558	24%
KFP	9/4/2017	2017	102	RT	557	22%
KFP	7/25/2018	2018	98	IT	556	21%
KFP	8/24/2020	2020	98	RT	555	21%
KFP	10/8/2020	2020	96	RT	554	21%
KFP	9/23/2020	2020	94	RT	553	21%
KFP	8/15/2018	2018	93	IT	552	20%
KFP	8/23/2020	2020	89	RT	551	20%
KFP	9/5/2020	2020	88	RT	550	19%
KFP	8/1/2015	2015	85	RT	549	19%
KFP	7/30/2013	2013	80	RT	548	17%
KFP	7/28/2020	2020	77	RT	547	17%
KFP	9/14/2020	2020	75	RT	546	16%
KFP	8/5/2013	2013	75	RT	545	16%
KFP	8/25/2020	2020	72	RT	544	16%
KFP	9/6/2020	2020	70	RT	543	15%
KFP	8/29/2017	2017	69	RT	542	15%
KFP	10/7/2020	2020	69	RT	541	15%
KFP	9/22/2020	2020	67	RT	540	15%
KFP	7/27/2020	2020	66	RT	539	14%
KFP	9/15/2020	2020	64	RT	538	14%
KFP	10/9/2020	2020	64	RT	537	14%
KFP	9/21/2020	2020	63	RT	536	14%
KFP	9/17/2020	2020	56	RT	535	12%
KFP	9/16/2020	2020	56	RT	534	12%
KFP	8/24/2018	2018	56	IT	533	12%
KFP	8/20/2017	2017	55	IT	532	12%
KFP	9/30/2020	2020	54	RT	531	12%
KFP	9/4/2020	2020	51	RT	530	11%
KFP	9/1/2017	2017	51	IT	529	11%
KFP	10/5/2020	2020	49	IT	528	11%
KFP	7/22/2018	2018	48	IT	527	10%
KFP	10/1/2020	2020	47	IT	526	10%
KFP	10/6/2020	2020	47	IT	525	10%
KFP	9/7/2020	2020	47	IT	524	10%
KFP	8/18/2018	2018	46	IT	523	10%
KFP	8/26/2017	2017	45	IT	522	10%
KFP	8/4/2015	2015	44	RT	521	10%
KFP	8/19/2015	2015	44	IT	520	10%
KFP	8/28/2012	2012	43	RT	519	9%
KFP	9/18/2020	2020	42	IT	518	9%

KFP	9/10/2020	2020	40	IT	517	9%
KFP	7/28/2019	2019	38	IT	516	8%
KFP	7/27/2019	2019	37	IT	515	8%
KFP	9/8/2018	2018	37	IT	514	8%
KFP	7/29/2019	2019	37	IT	513	8%
KFP	7/30/2019	2019	37	IT	512	8%
KFP	9/19/2020	2020	36	IT	511	8%
KFP	10/4/2020	2020	35	IT	510	8%
KFP	8/26/2020	2020	35	IT	509	8%
KFP	8/17/2017	2017	35	IT	508	8%
KFP	8/31/2012	2012	34	RT	507	7%
KFP	8/22/2020	2020	34	IT	506	7%

Table 2B. Rank Percent of Requested Values, 2012-2020; July 22 - October 9; Klamath Falls FRM Monitor

Monitor FRM	Date	Year	PM2.5 (µg/m3)	Flag	Rank (N=450)	PCTL
KFP	9/12/2020	2020	300	RT	212	100%
KFP	8/3/2018	2018	156	RT	211	52%
KFP	8/6/2018	2018	156	RT	210	52%
KFP	7/31/2018	2018	146	RT	209	49%
KFP	8/9/2018	2018	125	RT	208	42%
KFP	8/21/2018	2018	116	RT	207	39%
KFP	7/28/2018	2018	111	RT	206	37%
KFP	9/4/2017	2017	102	RT	205	34%
KFP	7/25/2018	2018	98	RT	204	33%
KFP	8/15/2018	2018	92.6	RT	203	31%
KFP	8/1/2015	2015	84.8	RT	202	28%
KFP	7/30/2013	2013	79.8	RT	201	27%
KFP	8/5/2013	2013	74.8	RT	200	25%
KFP	8/29/2017	2017	69.3	RT	199	23%
KFP	8/24/2018	2018	55.5	IT	198	19%
KFP	8/20/2017	2017	55.1	IT	197	18%
KFP	9/1/2017	2017	50.6	IT	196	17%
KFP	7/22/2018	2018	47.6	IT	195	16%
KFP	8/18/2018	2018	46.3	IT	194	15%
KFP	8/25/2020	2020	45.8	IT	193	15%
KFP	8/26/2017	2017	44.7	IT	192	15%
KFP	8/4/2015	2015	44.4	RT	191	15%
KFP	8/19/2015	2015	44.2	IT	190	15%
KFP	8/28/2012	2012	43.2	RT	189	14%
KFP	9/6/2020	2020	41.5	IT	188	14%
KFP	9/8/2018	2018	37	IT	187	12%
KFP	8/17/2017	2017	34.6	IT	186	12%

KFP	8/31/2012	2012	34.1	RT	185	11%
KFP	8/2/2013	2013	33.6	IT	184	11%
KFP	8/30/2018	2018	33.5	IT	183	11%
KFP	8/23/2017	2017	32.7	IT	182	11%
KFP	8/3/2014	2014	31.4	IT	181	10%
KFP	9/16/2017	2017	30.3	IT	180	10%
KFP	8/28/2015	2015	29.5	IT	179	10%
KFP	8/25/2012	2012	28.1	RT	178	9%
KFP	9/30/2020	2020	27.9	IT	177	9%
KFP	9/8/2014	2014	26.3	IT	176	9%
KFP	8/14/2013	2013	25.2	IT	175	8%
KFP	8/25/2015	2015	25.2	IT	174	8%
KFP	8/17/2013	2013	25	IT	173	8%

Required Elements of the Exceptional Event Rule

The EER requires that demonstrations justifying data exclusion as exceptional event must include the following:

(a) A narrative conceptual model that describes the event(s) causing the exceedance of violation and a discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s);
(b) A demonstration that the event affected air quality in such a way that there exists a clear causal relationship between the specific event and the monitored exceedance or violation;
(c) Analyses comparing the claimed event-influenced concentration(s) to concentrations at the same monitoring site at other times to support the clear causal relationship requirement;
(d) A demonstration that the event was both not reasonably controllable and not reasonably preventable;
(e) A demonstration that the event was a human activity that is unlikely to recur at a particular location or was a natural event; and
(f) Documentation that the State followed the public comment process and conducted at least a 30-day comment period.

In addition, a state must submit the public comments with the demonstration and address in the demonstration those comments disputing or contradicting factual evidence provided in the demonstration (40 CFR 50.14). We organized the demonstrations by sections that address each element of the EER (***Table 3***).

Table 3. Summary of Elements Included in this Demonstration.

EER Element	Section	Summary
Conceptual Model	1	The conceptual model describes the affected area, meteorological conditions of the region, and the source causing the violation. It includes a discussion of how emissions from the wildfire event led to the violation at the Klamath Falls monitor.
Clear Causal Relationship	2	Data are presented to demonstrate that the event affected air quality and that there is a clear causal relationship between the event and the exceedances: (1) Meteorological evidence: transport of emissions to monitor

		(2) Satellite and back trajectory evidence: spatial relationship between source and monitor (3) Time series evidence: temporal description of event days Alternative sources
Historical Concentrations	3	Analyses are provided comparing the event-influenced concentrations at Klamath Falls to historical concentrations.
Not Reasonably Controllable or Preventable	4	A wildfire event meets the EER for this element (40 CFR 50.14(b)(4))
Human Activity Unlikely to Recur at a Particular Location or a Natural Event	5	The criterion meets the EER definition that wildfires predominantly occurring on wildland are natural events.
Mitigation	6	DEQ presents evidence of prompt public notification of the event, public education so that individuals could make behavioral changes to reduce exposure to unhealthy air, and implementation of appropriate measures to protect public health from the impacts of exceptional events.
Initial Notification	7	Demonstration of initial notification to EPA.
Public Comments	8	Documentation of the public comment process, public comments received and DEQ response to comments.

Introduction

The Oregon Department of Environmental Quality requests an exclusion of the fire measured exceedances of the 24-hour PM2.5 (fine particulate matter) National Ambient Air Quality Standards at Klamath Falls, Oregon, on the days outlined in ***Table 1*** above. This demonstration provides evidence and narrative satisfying all the requirements set forth in the Exceptional Events Rule. The exceedances were the direct result of wildfire events that affected air quality at the respective monitors.

The conceptual model describes the event and how the emissions from the events led to the exceedances at each monitor on each day. It demonstrates that a clear causal relationship exists between the event and the monitored exceedance. We compared the historical concentrations at the Klamath Falls monitor to the exceedance concentrations to support the clear causal relationship requirement. The wildfire event was both not reasonably controllable and not reasonably preventable, and it was a natural event. DEQ provided prompt public notification of the event, provided for public education concerning actions that individuals may take to reduce exposures to unhealthy levels of air quality during the event, and provided for the implementation of appropriate measures to protect public health from the exceedances caused by the event. Public comments on the demonstration and DEQ's responses can be found in ***Section 8.***

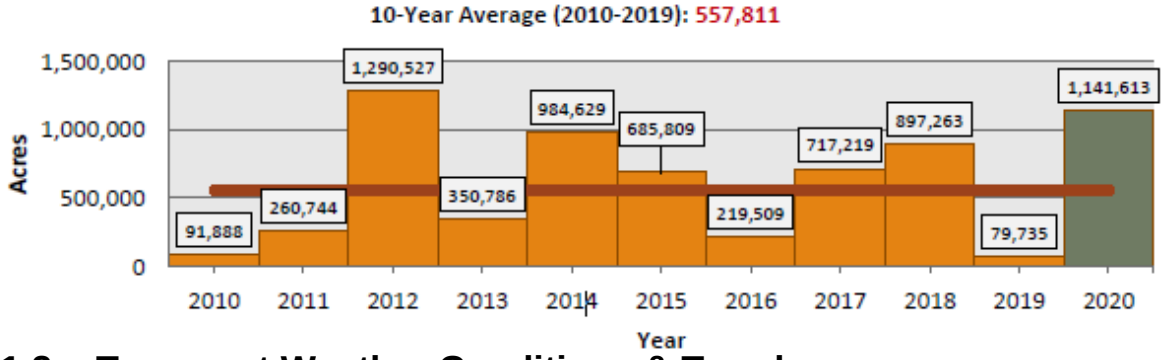
1 Conceptual Model

In July, August, September and October of 2020, smoke from regional wildfires was transported to the Klamath Falls monitors. The Klamath Falls monitor recorded exceedances of the 24-hour PM2.5 NAAQS; twenty-two days from the T640x and 2 days of FRM (identified in ***Table 1*** of this report and flagged as RT) have regulatory significance, twelve additional days on the T640x (2 days on the FRM) have been identified for informational purposes, because they have the potential of becoming regulatorily significant. All of these occurances are of results of wildfires. The conceptual model describes the source of the fine particulate matter that impacted the monitor, the transport weather conditions that brought aerosols to the monitor, the estimated emissions of the wildfire sources, and the timing and magnitude of the events' impacts on the respective monitors.

1.1 Overview

Wildfires occur every year in the western United States during summer and fall. The 2020 wildfire season was, like most years, hot, dry, and smoky. Over 1.98 million acres burned in Oregon, Washington, and Idaho during the 2020 wildfire seaason. Oregon alone saw over 1.14 million acres burn[4]. From September 7th through the 18th, smoke from many of these fires was trapped in a multiday stagnation event. Smoke accumulated during that 12-day period and negatively affected the air quality throughout the northwestern United States. As has happened in the past, smoke from California wildfires also impacted Oregon's southern border communities including Klamath Falls, OR. Many of the larger wildfires that burned in 2020 were closer to human habitation than in previous years.

Figure 1. Total Wildfire Acres Burned in Oregon vs. 10-year Average, 2010-2020.

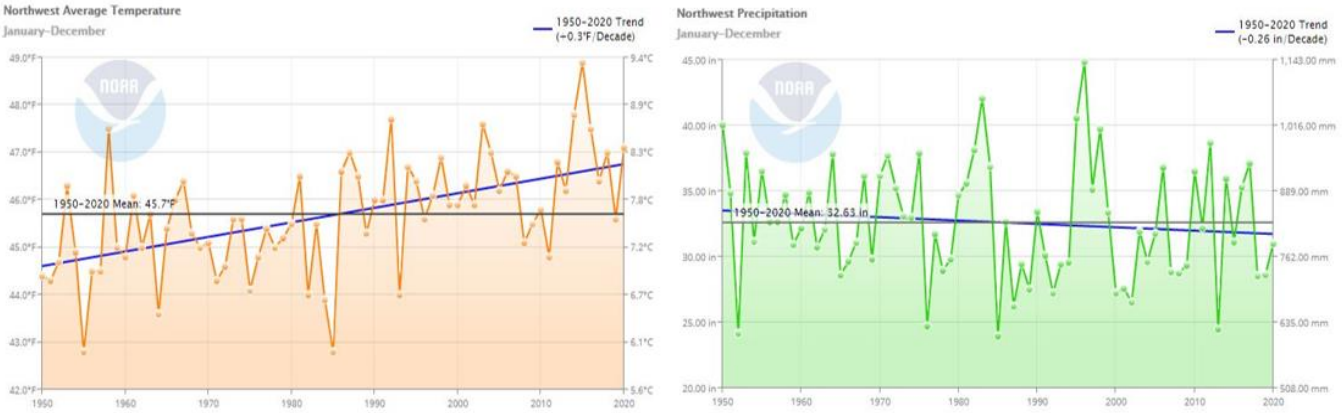


1.2 Transport Weather Conditions & Trends

According to the 2020 Northwest Annual Fire Report, despite cool and wet periods early in fire season 2020, persistent warmth and very low rainfall in the second half of the summer boosted fire danger sufficiently to make many areas more susceptible to fires by late August and early September. While lightning was much less than average during fire season 2020, wide-spread lightning ignited significant fires along the Cascades, in Eastern Oregon, and a few lightning-caused large fires helped set the stage for the fire outbreak that accompanied a historic windstorm in early September.

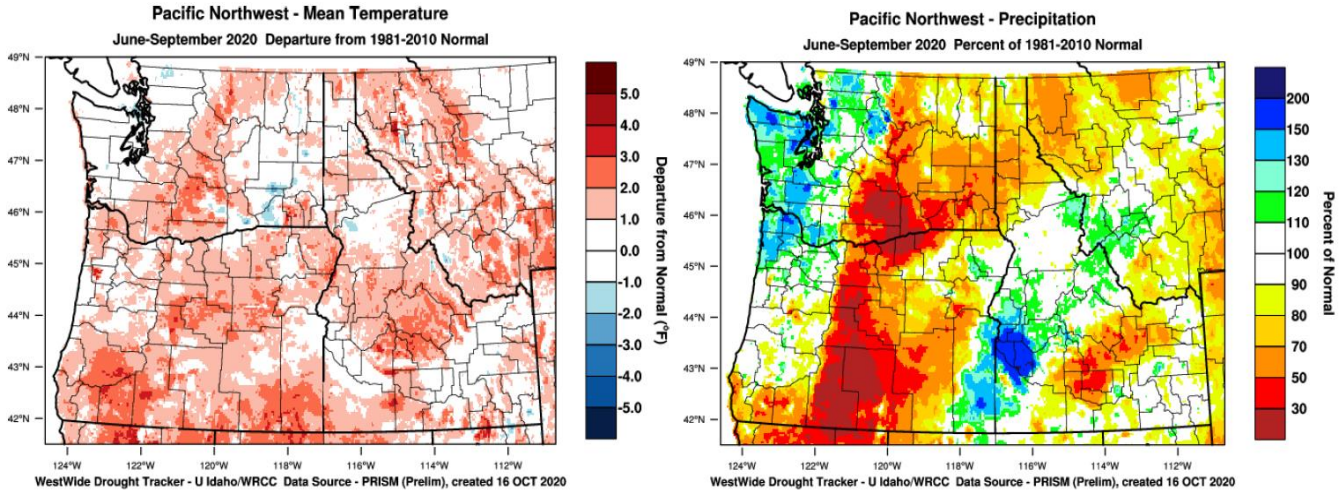
Overall, temperature was slightly above average for most of the Pacific Northwest. Rain in western Washington and northwest Oregon eased drought late in fire season but southwest Oregon and much of eastern Oregon and eastern Washington remained quite dry.

Figure 2. Northwest Average Temperatures and Precipitation



[4] Northwest Interagency Coordination Center. April 9, 2020. Northwest Annual Fire Report 2020. Portland, OR. https://gacc.nifc.gov/nwcc/content/pdfs/archives/2020_NWCC_Annual_Fire_Report.pdf (Accessed April 2020).

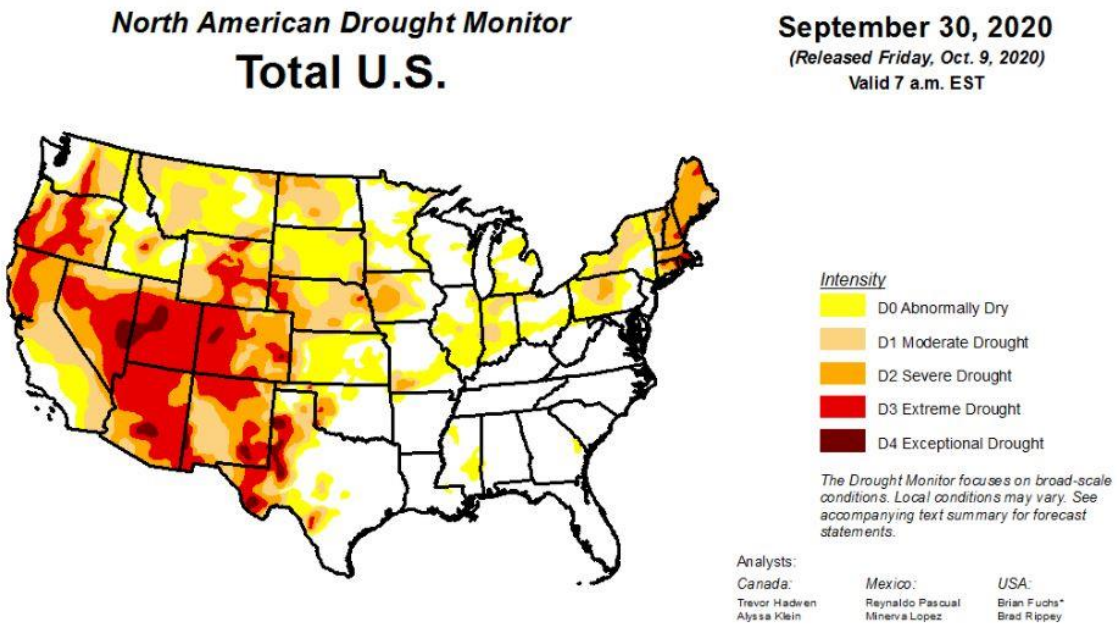
Figure 3. Pacific Northwest Mean Temperatures Departure from Normal and Precipitation Percent of Normal from June – Septmeber 2020.



Weather Trends

The very dry trend observed in July and August 2020 across the region continued for the first half of September (***Figure 4***, below). Daily values of minimum relative humidity and corresponding overnight recoveries maintained a worsening trend from late August through mid-September, falling steadily below average.

Figure 4. North American Drought Monitor Map as for Sept. 30, 2020



Historic Windstorm on September 7th and 8th

On September 7th and 8th, a strong dry cold front moving south from Canada pushed across the geographic area bringing record breaking strong winds and low relative humidity to much of the region. As winds calmed behind the front, smoke from multiple large fires settled into western Oregon and

Washington creating unhealthy air quality and poor visibility that spread over the next ten days and covered regions on both sides of the Cascades.

Strong winds diminished in the aftermath of the cold front, but the dry air and heavy smoke lingered until several Pacific frontal systems brought rain on September 18th, and again on the 24th. It was concentrated mainly in western Washington and most of northwest Oregon, where rainfall totals went well above normal for the month. However, eastern Washington, eastern Oregon, and southwest Oregon did not accumulate as much precipitation and rainfall totals remained below average for the month.

Air quality improved considerably with the arrival of the Pacific frontal systems. Despite the arrival of cold fronts, temperatures were above normal for September over the entire northwest geographic area.

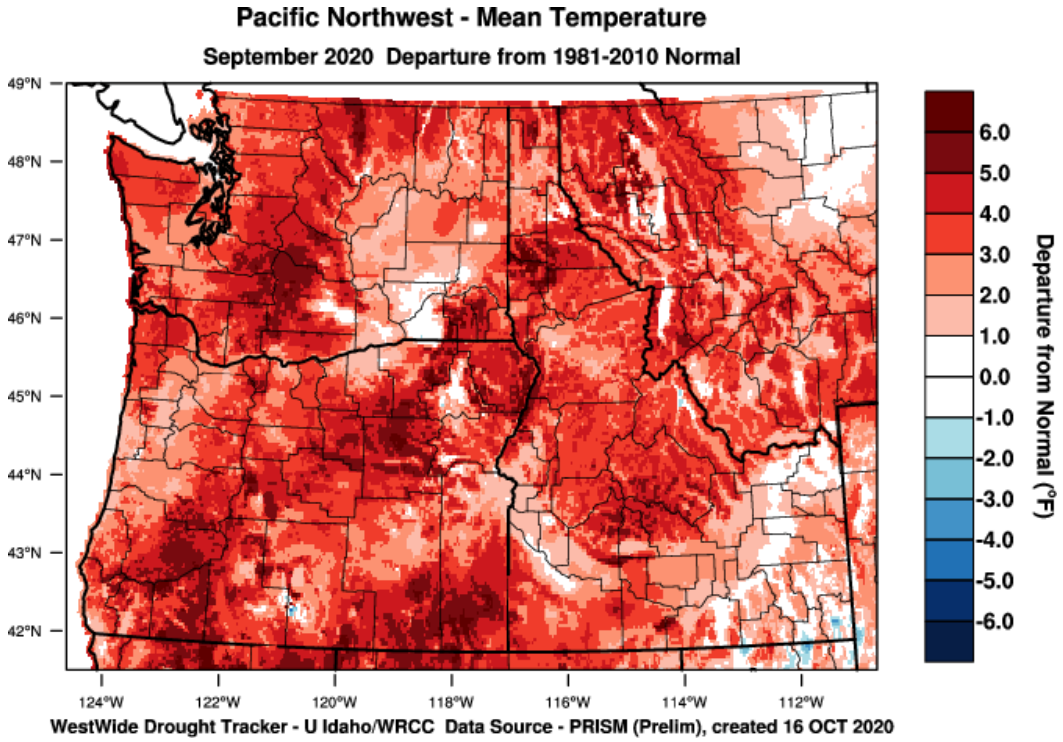
September Fire Activity

The northwest geographic area was already busy at Preparedness Level 4 in early September 2020 with a dozen large incidents receiving support, including Type I, Type II, and Type III IMTs in both Oregon and Washington. On September 7th and 8th, a dry cold front swept in from Canada with strong winds that accelerated the already busy fire activity in the northwest. Eastern Washington and the Cascades of western and southern Oregon saw the greatest impacts from this cold front.

The resulting fast-moving firestorms in timber, brush, and grasses burned over 1.76 million acres on new and existing large fires across the geographic area from September 7th through 13th, during and shortly after the wind event. The event proved to be an unprecedented disaster for communities and there was significant resource loss in and near the Oregon Cascades. Fire activity was well above average for the region for September both in terms of numbers of fires and acreage burned; 90% of acres burned in the geographic area in 2020 occurred during September. [5]

Figure 5. PNW Mean Temperatures Depature from Normal for September, 2020.

[5] Northwest Interagency Coordination Center. April 9, 2020. Northwest Annual Fire Report 2020. Portland, OR. https://gacc.nifc.gov/nwcc/content/pdfs/archives/2020_NWCC_Annual_Fire_Report.pdf (Accessed April 2020).



1.3 Source Area and Affected Region

Klamath Falls is located in south central Oregon at an elevation of 4,105 feet. The City of Klamath Falls serves as an important commercial center for south central Oregon. The Klamath Basin is a relatively flat area of an old high elevation lakebed that is drained by the Klamath River. Occasional hills and a system of elongated ridges confine the basin and the greater Klamath Falls area to the east and west. Most of the Klamath Falls residential area, especially the south suburban area, is located on the lower elevation area. Because of these features, Klamath Falls can experience very strong and shallow nighttime inversions that break up with daytime solar heating. In the wintertime, frigid arctic air masses frequently move down Upper Klamath Lake and invade the Klamath Basin. Temperatures can remain well below freezing for several weeks at a time. Under these conditions, these strong inversions occur over the Klamath Basin concentrating emissions in the south suburban area of Klamath Falls.

In 1987, Klamath Falls was designated a nonattainment area by the Environmental Protection Agency for PM10 – particulate matter 10 microns and smaller. A PM10 attainment plan was developed for the Klamath Falls Urban Growth Boundary by 1991, however, at that time the area still had not met the standard. DEQ subsequently revised the PM10 plan and submitted an addendum to EPA in 1995. EPA approved both the attainment plan and the addendum on April 14, 1997. In 2002, DEQ submitted a maintenance plan for PM10. EPA approved the PM10 maintenance plan and Klamath Falls was redesignated to attainment for PM10 on October 21, 2003. Both the attainment plan and maintenance plan included a key strategy of a mandatory woodstove curtailment program and a large woodstove change-out program. This was accomplished through citizen involvement in Klamath Falls and the citizenry addressing it at a local level through both ordinance and education of neighbor-to-neighbor. As a result, the area met and continues to meet the PM10 standards.

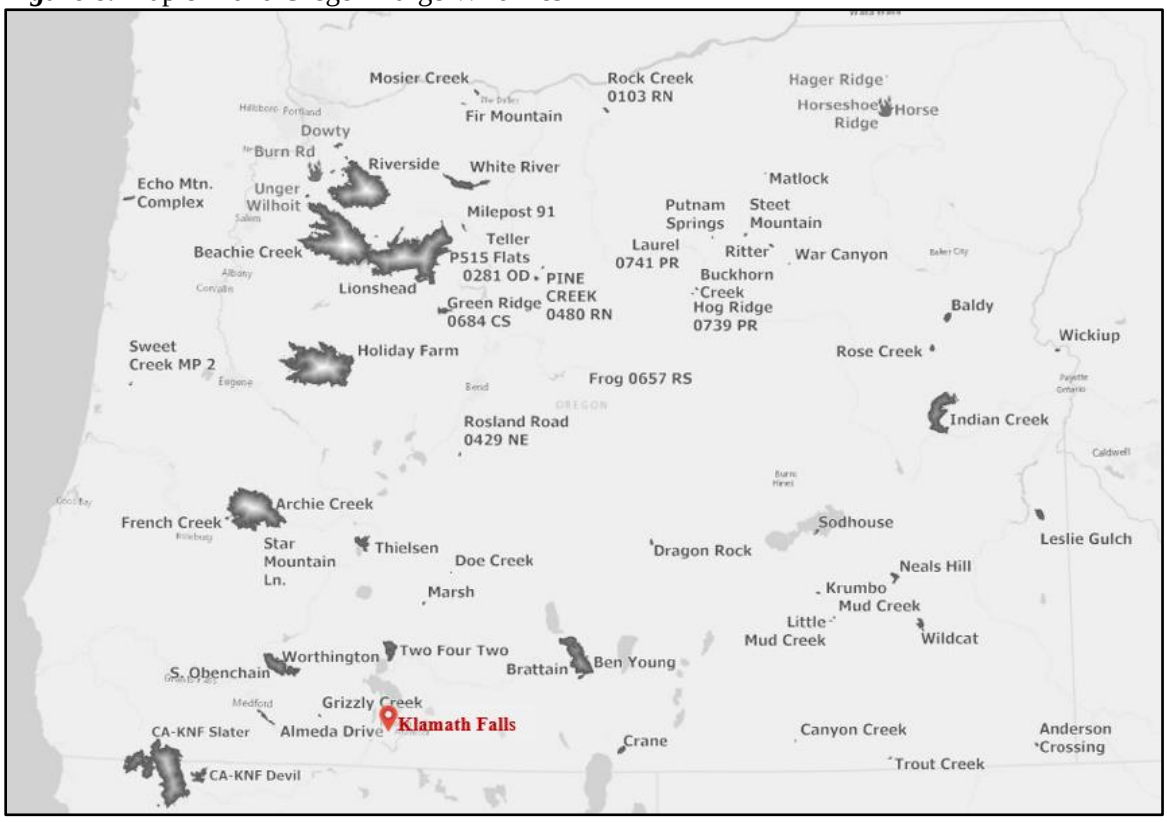
In 1997, EPA revised the particulate standard to include PM2.5 and established a daily standard of 65 µg/m3. The original PM10 strategies included in the Klamath Falls PM10 attainment plan were so successful in maintaining clean air that Klamath Falls met the 1997 fine particulate (PM2.5) standard. By 2006, however, EPA modified the PM2.5 standard again based on the latest health effects data, lowering

it to 35 µg/m3. Klamath Falls has faced challenges in meeting the 2006 daily PM2.5 standard. DEQ has measured particulate at the same location in the Klamath Falls UGB (Peterson School on Clinton Street) since 1996 and conducted numerous saturation surveys to confirm Peterson School is still the appropriate location for the monitor.

Portions of Klamath Falls in Klamath County were designated as the Klamath Falls PM2.5 nonattainment area in 2009 with an attainment date on December 31, 2015. Klamath Falls was classified as moderate for PM2.5 on June 2, 2014 (79 FR 31566). In June 2016, EPA approved a finding of attainment and clean data determination for Klamath Falls, based on data from 2012-2014. In 2017, an exceptional events demonstration was submitted to and approved by the EPA on May 21, 2020. In 2018 wildfire smoke did impact monitors and an exceptional events demonstration is currently being prepared for the thirteen days that were impacted during the 2018 wildfire season. These 2018 and 2020 monitor values that meet the criteria for exceptional events must be excluded for Klamath Falls to be redesignated as an attainment area and demonstrate continued ability to meet the NAAQS for PM2.5.

For Klamath Falls, 2020 wildfire smoke events happened throughout the summer with events in July, August, September and October. Smoke not only resulted from Oregon's 2020 wildfires (***Figure 6***) but also as a result of complex wildfires in northern California.

Figure 6. Map of 2020 Oregon Large Wildfires



1.3.1 Key Wildfires or Multi-Source Smoke Events

The primary contributors to smoke in the Klamath Falls area were a result of several different wildfires including:

July Complex
The July Complex fire began on July 24, 2020 in the Modoc National Forest near the Siskiyou Modoc County line in California. According to the Modoc National Forest, a series of fires, thought to be ignited by lighting strikes, burned tall, dry grass, brush and timber. This July Complex fire was finally extinguished on August, 20, 2020 after burning a total of 83,261 acres.

Red Salmon Complex
The Red Salmon Complex was a fire that was first reported on July 27, 2020 and was burning in Humboldt, Trinity and Siskiyou Counties in California. This fire consists of two fires, the Salmon Fire, and the Red Fire, which merged together creating the Red Salom Complex. Both fires were caused by lighting strikes and burned mature timber with heavy duff, litter, shrubs, and grass. Steep rugged terrain with parallel ridges and drainages hampered direct line construction so containment was difficult. By the time this fire was contained on November, 17, 2020 a total of 144,698 acres had burned.[6]

August Complex Fire - North Zone (Elkhorn Fire)
The August Complex was a massive wildfire that burned in Glenn, Lake, Mendocino, Tehama, Trinity, and Shasta Counties in northern Califorina. The complex originated as 38 separate fires started by lightning strikes on August 16–17, 2020. On September 10, the this fire merged with the Elkhorn Fire (originally a separate incident) and the Hopkins Fire, growing substantially in size. By the time it was extinguished on November 12, the August Complex fire had burned a total of 1,032,648 acres and was considered the largest complex fire recorded in California history.[7]

Lionshead Fire
Lightning sparked the Lionshead Fire on August 16, 2020 at 10:45 pm in Lionshead Canyon on the Confederated Tribes of Warm Springs Reservation approximately 14 miles west of the Warm Springs community. An historic windstorm on Monday, September 7, caused rapid fire spread west onto the Willamette, Deschutes, and Mt. Hood National Forests. The fire (as of 10/10/2020) encompassed 204,469 acres.

Holiday Farm Fire
The Holiday Farm Fire began on September 7, 2020 at approximately 7:45 p.m. during a strong east wind event that passed through the area. The fire started approximately 3 miles west of McKenzie Bridge, OR. Pushed westward by strong winds, the fire moved through the communities of Blue River, Finn Rock, Nimrod, Vida and Leaburg, damaging and destroying homes, businesses and facilities in its path. The fire (as of 10/12/2020) encompassed 173,439 acres primarily in a mixed conifer forest. The fire burned a mosaic pattern through most of the area, and the majority burned with low and moderate severity.

Thielsen Fire
The Thielsen Fire was detected on September 8, 2020 at approximately 8:30 a.m. after lightning passed through the area. The fire was on the Diamond Ranger District of the Umpqua National Forest, approximately 5 miles north of Crater Lake National Park. It burned within one mile of the Diamond Lake Resort, along both sides of Oregon Highway 138, and a small portion of the Mount Thielsen Wilderness. The fire (as of 10/6/2020) encompassed 9,951 acres primarily in a mixed conifer forest. The fire burned a mosaic pattern through most of the area, and the majority burned with low and moderate severity.

[6] "Red Salmon Complex - InciWeb the Incident Information System". *InciWeb*. July 27, 2020. Retrieved May 4, 2021
[7] *"Top 20 Largest California Wildfires" (PDF). CAL FIRE. November 3, 2020. Retrieved May 4, 2021.*

Slater/Devil Fires
The Slater Fire started on September 8, near Slater Butte Fire Lookout on the Klamath National Forest. This fire burned on the Klamath, Six Rivers, and Rogue-Siskiyou National Forests in Siskiyou and Del Norte Counties in California and Josephine County in Oregon. In total this fire burned 157,270 acres of mixed conifer forest. The Devil Fire, which was detected on September 9, 2020, is located north of Upper Devil's Peak on the Klamath National Forest. Burning concurrently the Devil Fire comsumed a total of 8,857 acres. With the arrival of cool moist weather, fire managers declared these fires contained on November 16, 2020.

Multiple Fires Smoke Event
Starting on 9/10/2020 and continuing through 9/18/2020, smoke from the Holiday Farm, Lionshead, and Thielsen fires, combined with multiple other fires in Oregon (see Figure 6) to inundate the western half of the state, including the Klamath Falls area, with wildfire smoke. Smoke from the fires caused air quality levels in the region to climb to hazardous levels, at points going beyond the limits of the AQI scale and well above the 2006 PM2.5 NAAQS.

1.3.2 Methodology

Wind speed, wind direction and hourly PM2.5 readings were taken from monitors and plotted against the time of day for the previous evening and 24 hour period of the impacted day. Satellite smoke images from MODIS Terra and MODIS Aqua satellites were examined for the day of the impacted monitor reading, for the central and southern Oregon region. These satellites tend to pass over the area that covers Klamath Falls from 10 am to 1 pm of each day.

HYSPLIT back trajectories were calculated in AirNow-Tech, using the PM2.5-88502 parameter and 1-hour duration. The date and time was set to the time of day where the monitor reading was at its peak. Heights were set at 50 m, 500m, and 1000 m to capture near ground and higher altitude wind transport, and the model was usually run for 8-24 hours. Our data show approximately a one to three-hour delay for Klamath Falls monitor from the forest fire complexes in question for 2020. See ***Appendix A*** for more details on how the HYSPLIT trajectories are calculated.

1.3.3 Klamath Falls Monitor Impacted Days & Emmission Source

The following section is broken down by event. There is a July event, August event, September event and October event. Within each event you will find a description of days impacted, the emission source(s), a time series of the PM2.5 readings at the Klamath Falls monitor, satellite smoke images from either MODIS Terra or MODIS Aqua satellites and an examination of wind speed, wind direction, and smoke sources using the HYSPLIT back (and at time forward) trajectory analysis. Due to the sheer number of days within certain events not all daily satellite smoke images and HYSPLIT trajectory modeling results are included in the main body of this document, but are available in the appendices included and made part of this demonstration.

July Event | July 27, 2020 – July 28, 2020

The July event was predominantly caused by smoke from the July Complex (Modoc Lightning Fires). The July Complex fire began on July 24, 2020 in the Modoc National Forest in Siskiyou County California a total of 83,261 acres burned. On July 27, 2020 at 3:00pm wind directions shifted from W to NE bringing smoke in from the July Complex fire. Observed PM 2.5 levels elevated quickly picked up also at 3:00pm and stayed elevated above the 2006 PM2.5 standard until 2:00 pm on July 28, 2020. Diurnal wind speeds ranged from 0 MPH to approximately 6 MPH.

In the information provided below, ***Figure 7A*** shows the time series (wind speed, wind direction, and hourly PM2.5 readings) at the Klamath Falls Peterson School monitor, while ***Figure 7B*** shows the MODIS satellite data and ***Figure 7C*** the aerosol optical depth of smoke over Klamath Falls. ***Figure 7D*** and ***Figure 7E*** show the HYSPLIT back trajectory for July 27th and July 28th, respectively. Both of these impacted days have regulatory significance.

Figure 7 Ai-E. Including time series, satellite smoke images, and modeling results for Klamath Falls Peterson School monitors for July 27 and July 28

Figure 7A. Klamath Falls July 27-28, 2020 PM2.5 and Wind Time Series

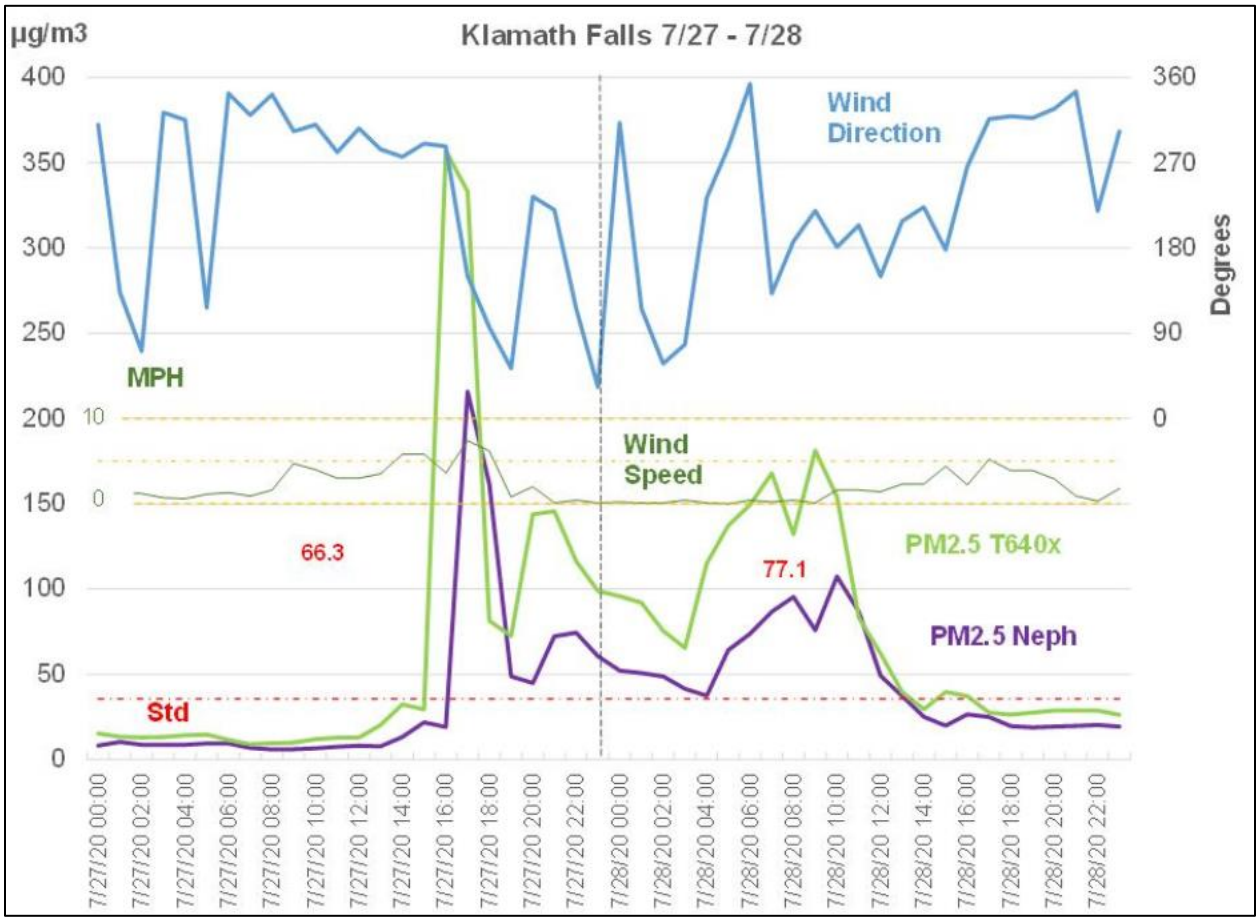


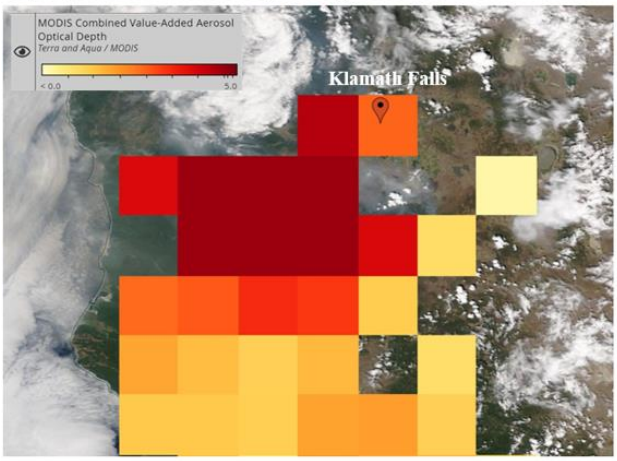
Figure 7B. Satellite Photos of Smoke Over Klamath Falls on July 27 - 28, 2020

July 27, 2020 Satellite Photo of Smoke Over Klamath Falls

July 28, 2020 Satellite Photo of Smoke Over Klamath Falls

Figure 7C. Satellite Aerosol Optical Depth Readings Over Klamath Falls July 27 – 28, 2020

July 27, 2020 Satellite Aerosol Optical Depth of Smoke Over Klamath Falls



July 28, 2020 Satellite Aerosol Optical Depth of Smoke Over Klamath Falls

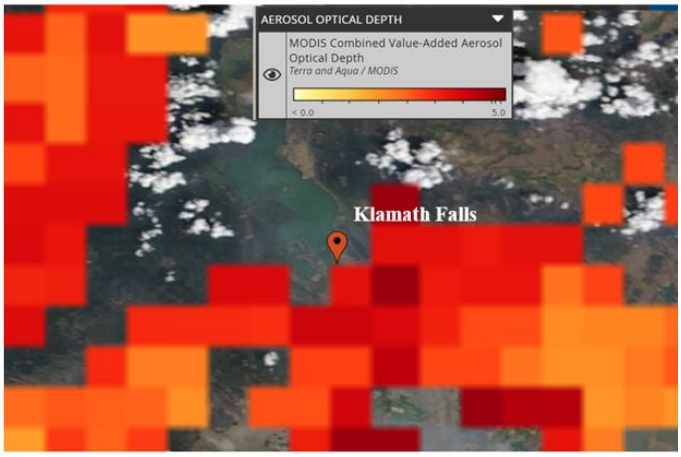


Figure 7D. July 27, 2020 HYSPLIT 12 Hour Back Trajectory from Klamath Falls

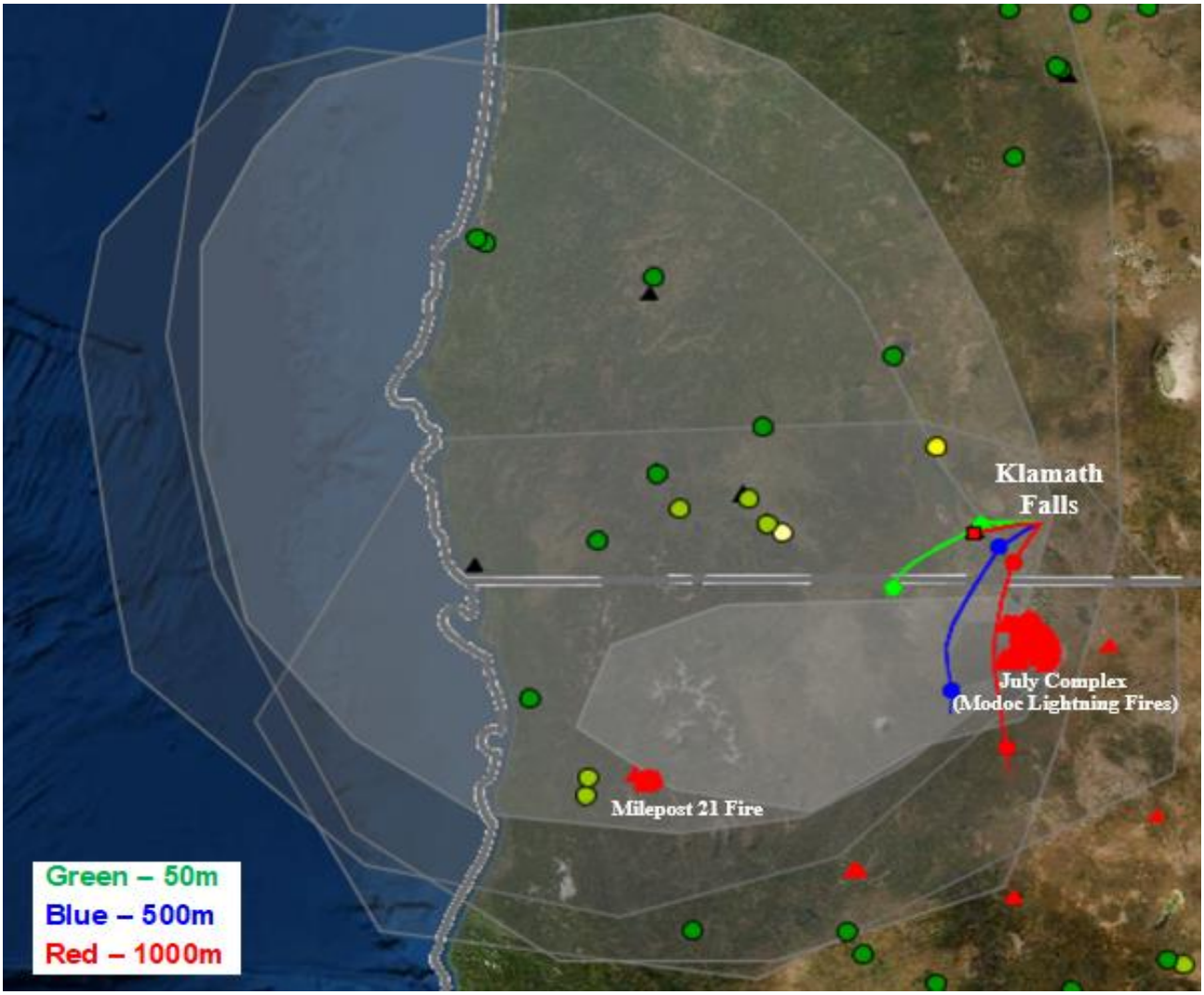
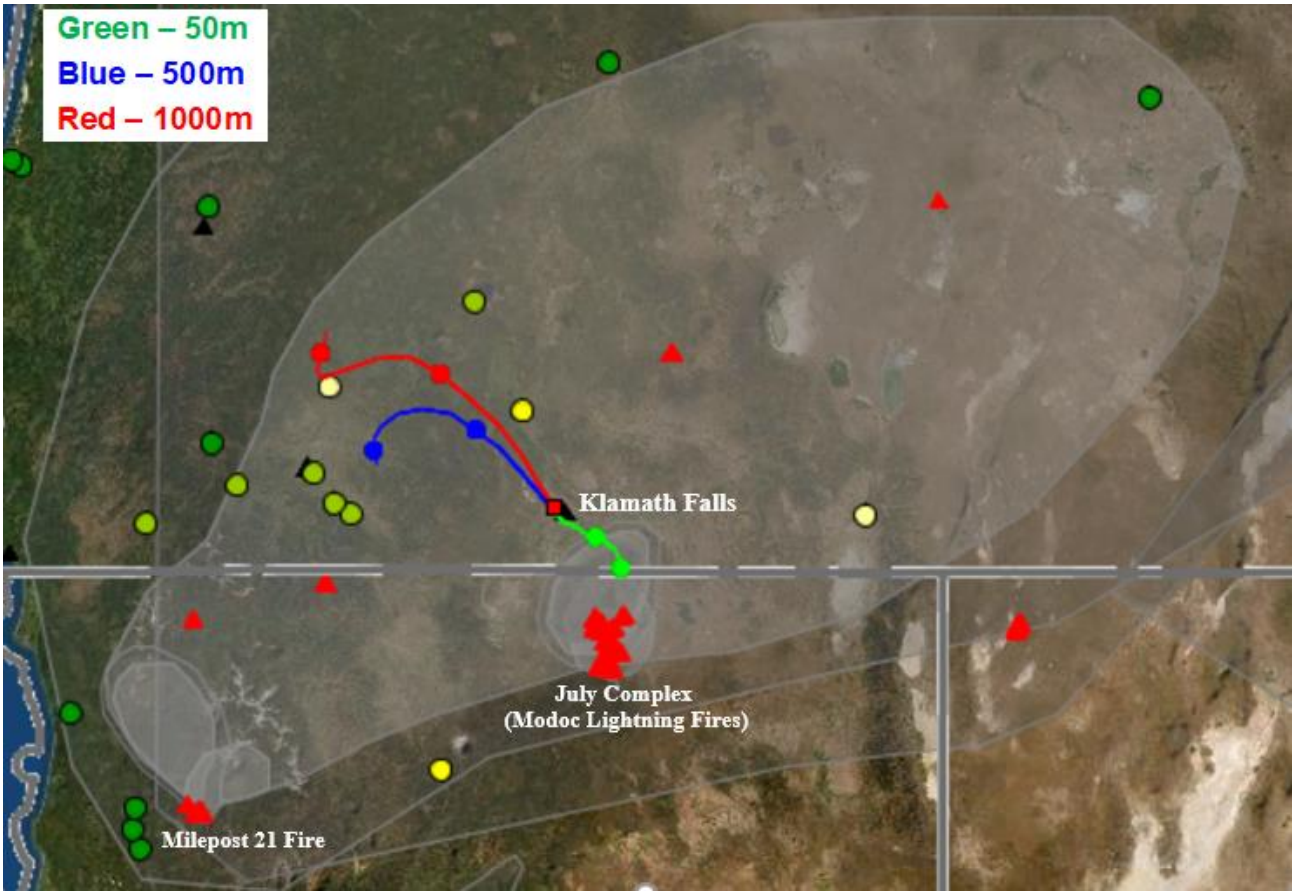


Figure 7E. July 28, 2020 HYSPLIT 12 Hour Back Trajectory from Klamath Falls



August Event | August 22, 2020 – August 27, 2020

Table 4: August Event Details (IT & RT)

Date	PM 2.5 ug/m3		Flag
	T640x	FRM	
8/22/2020	34.1		IT
8/23/2020	89.3		RT
8/24/2020	97.9		RT
8/25/2020	71.8	45.8	RT/RT
8/26/2020	35.1		IT
8/27/2020	27.2		IT

During the August event there were three regulatorily significant days (8/23/2020, 8/24/2020, and 8/25/2020) and there were three days (8/22/2020, 8/26/2020, and 8/27/2020) that PM 2.5 levels were high, due to the same event, but they don't currently have regulatory significance. ODEQ is flagging these days since they have potential for future impact on NAAQS compliance in the community. We have included the PM2.5 values for all of the event days in ***Table 4.*** Please note that RT means days with wildfire smoke impacts that do have regulatory significance and IT means days with wildfire smoke impacts that are being flagged for information purposes only.

The August event was predominantly caused by smoke from the Red Salmon Complex fire which was burning in Humboldt, Trinity and Siskiyou Counties in California. This fire consists of two fires, the Salmon Fire, and the Red Fire, which merged together creating the Red Salom Complex. Both fires were caused by lighting strikes and burned mature timber with heavy duff, litter, shrubs, and grass. All fuel types that have potential to create lots of smoke. Smoke from this fire was impacting communities across northern California and southern Oregon, including Klamath Fall, OR.

On August 22, 2020 at around noon wind directions were shifting bringing smoke in from the Red Salmon Complex fire located SW of Klamath Falls, OR in northern California. Observed PM 2.5 levels were elevated on August 22nd and stayed high until August 27th. PM 2.5 observations were the highest when South/SWesternly winds occurred. Diurnal wind speeds ranged from 0 MPH to approximately 7 MPH. In the information provided below, ***Figure 8A*** shows the time series (wind speed, wind direction, and hourly PM2.5 readings) at the Klamath Falls Peterson School monitor for between August 22 – 27. ***Figure 8B*** shows the MODIS satellite data for August 24 (the date with the highest daily average) and the aerosol optical depth of smoke over Klamath Falls on August 24th. ***Figure 8C*** show the HYSPLIT back trajectory and forwards trajectory for August 24th.

Daily satellite smoke images and reverse/forward HYSPLIT trajectory modeling results are available for all August event dates and can be found in ***Appendix B***.

Figure 8 A-D. Time Series for Event, Satellite Smoke Image, and Modeling Results for Klamath Falls Peterson School Monitor, 8/24/2020

Figure 8A Klamath Falls August 22-27, 2020 PM2.5 and Wind Time Series

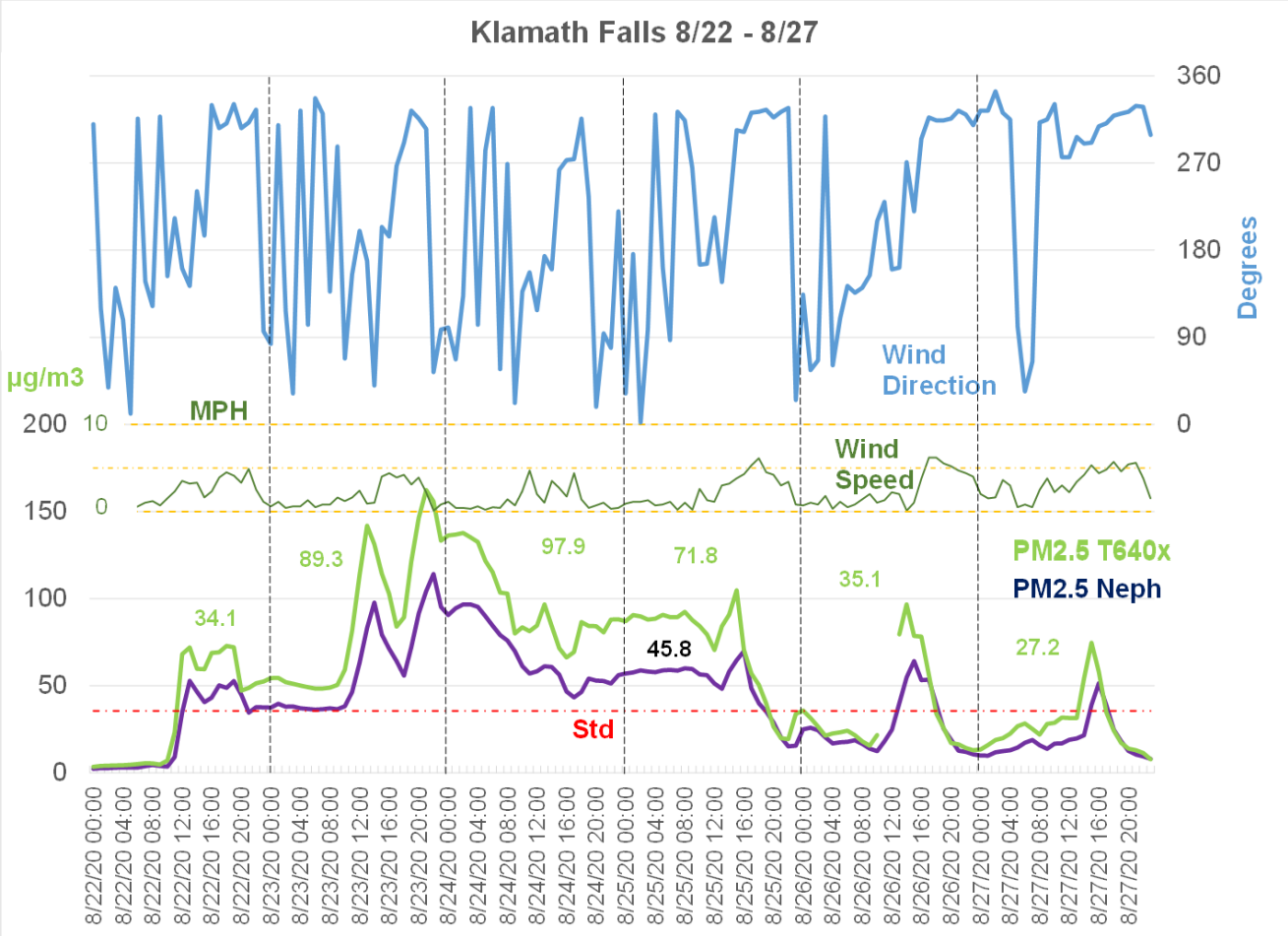


Figure 8B. August 24, 2020 Satellite Photo of Smoke Over Klamath Falls and Satellite Aerosol Optical Depth of Smoke Over Klamath Falls

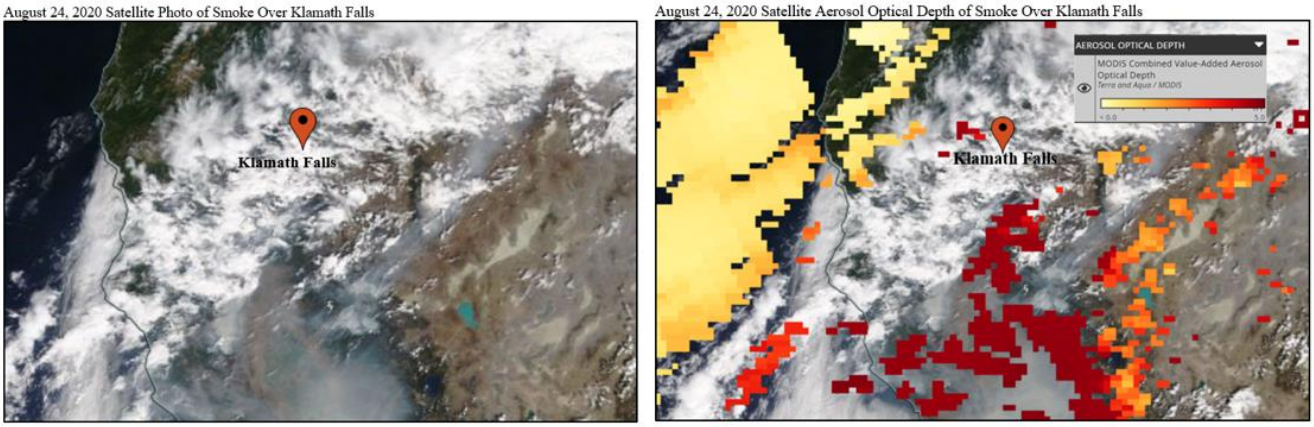
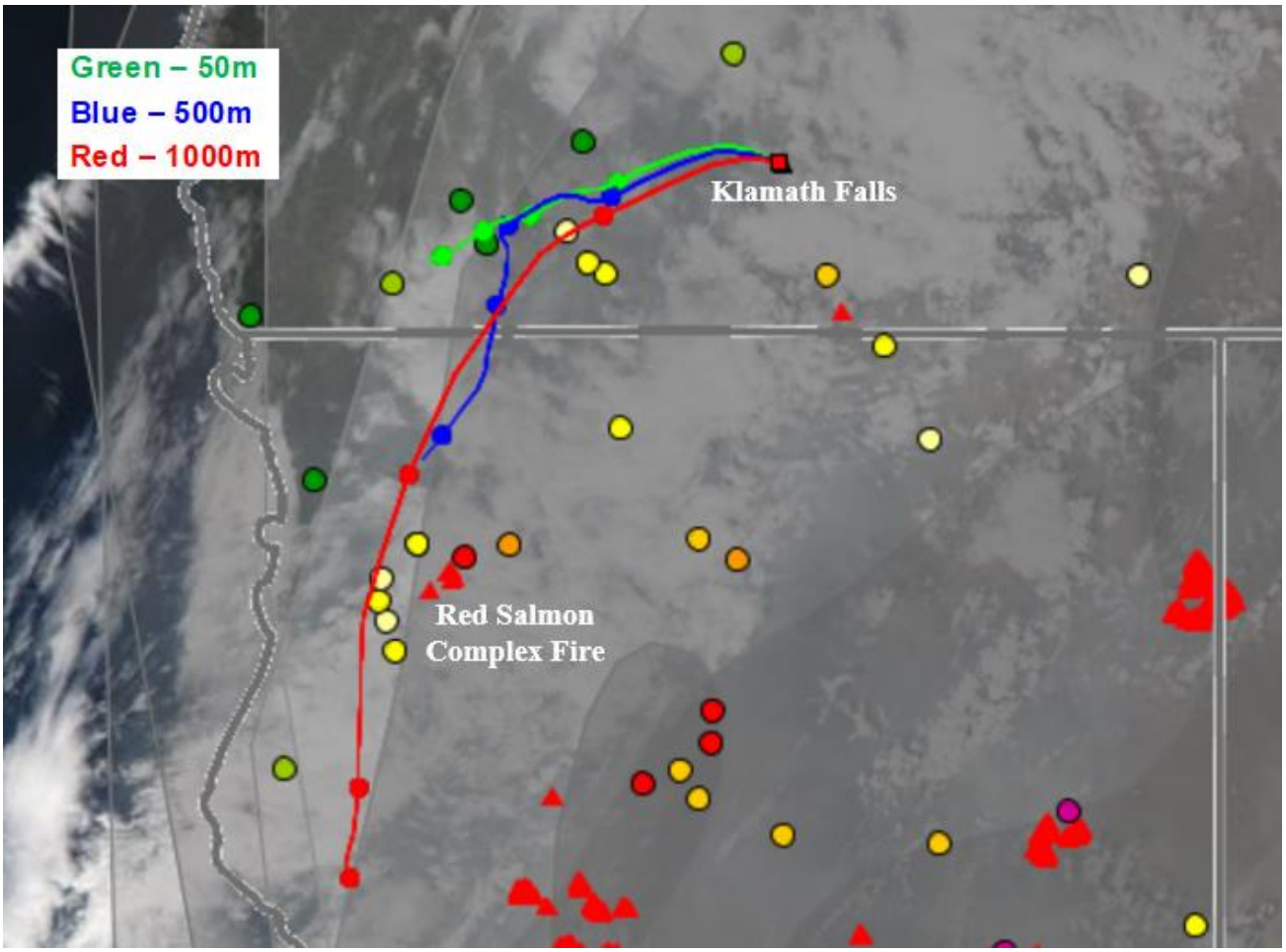


Figure 8C. August 24, 2020 HYSPLIT 24 Hour Back Trajectory from Klamath Falls



September Event | September 4, 2020 – September 8, 2020; September 10, 2020 – September 19, 2020; and September 21, 2020 – September 24, 2020

Table 5. September Event Details (IT & RT)

Date	PM 2.5 ug/m3		Flag
	T640x	FRM	
9/4/2020	50.7		RT
9/5/2020	88.4		RT
9/6/2020	70	41.5	RT/IT
9/7/2020	47.3		IT
9/8/2020	30.4		IT
9/10/2020	40.2		IT
9/11/2020	214.9		RT
9/12/2020	457.6	300.0	RT/RT
9/13/2020	285.6		RT
9/14/2020	75.3		RT
9/15/2020	64.4		RT
9/16/2020	56.1		RT
9/17/2020	56.5		RT
9/18/2020	41.6	20.2	IT/none
9/19/2020	35.9		IT
9/21/2020	63.1		RT
9/22/2020	67.1		RT
9/23/2020	94.1		RT
9/24/2020	27	11	IT/none

During the September event there were thirteen regulatorily significant days (9/4/2020, 9/5/2020, 9/6/2020, 9/11/2020, 9/12/2020, 9/13/2020, 9/14/2020, 9/15/2020, 9/16/2020, 9/17/2020, 9/21/2020, 9/22/2020, and 9/23/2020) and there were six days (9/7/2020, 9/8/2020, 9/10/2020, 9/18/2020, 9/19/2020 and 9/24/2020) that PM 2.5 levels were high, due to the same event, but they don't currently have regulatory significance.

ODEQ is flagging these days since they have potential for future impact on NAAQS compliance in the community. We have included the PM2.5 values for all of the event days in ***Table 5***. Please note that RT means days with wildfire smoke impacts that do have regulatory significance and IT means days with wildfire smoke impacts that are being flagged for information purposes only.

In early September, smoke from the Red Salmon Complex, Spring and Elkhorn Fires were impacting the community of Klamath Falls. Monitor readings ranged between 47.3 ug/m3 to 88 ug/m3. On September 8th, a strong dry cold front pushed across the area bringing strong winds and low relative humidity to much of the region. As Oregon's major wildfires (Lionshead, Beachie Creek, Archie Creek, and Holiday Farm) rapidly increased in size, residual smoke from the Northern California fires continued to impact Klamath Falls. By September 12th a think blanket of smoke lingered across all of the PNW. At peak impact Klamath Falls had PM2.5 readings of 457.6 ug/m3. Any respite was short lived for the Klamath Falls area because smoke from the Red Salmon, Fox, and Slater fires continued to impact the area until Setempter 24th.

In the information provided below, ***Figure 9A*** shows the time series (wind speed, wind direction, and hourly PM2.5 readings) at the Klamath Falls Peterson School monitor from September 4 - 19, 2020[8], ***Figure 9B*** shows the MODIS satellite data the aerosol optical depth of smoke over Klamath Falls for September 12th (the date with the highest daily average) and ***Figure 9C*** shows the HYSPLIT back trajectory and forwards trajectory for September 12th. ***Figure 9D*** shows the time series from September 21 - 24, 2020, ***Figure 9E*** shows the MODIS satellite data the aerosol optical depth of smoke over Klamath Falls on August 23th and ***Figure 9F*** show the HYSPLIT back trajectory and forwards trajectory for September 23rd.. Daily satellite smoke images and reverse/forward HYSPLIT trajectory modeling results are available for all September event dates and can be found in ***Appendix C.***.

Figure 9 A-F. Time Series for Event, Satellite Smoke Image, and Modeling Results for Klamath Falls Peterson School Monitor, for 9/12/2020 and 9/23/2020

[8] Please note red labels denote PM 2.5 levels for the day's with regulatory significance (RT) and green labels denote PM 2.5 levels for the days being flagged for informational (IT) reasons only.

Figure 9A. Klamath Falls September 4 -19, 2020 PM2.5 and Wind Time Series

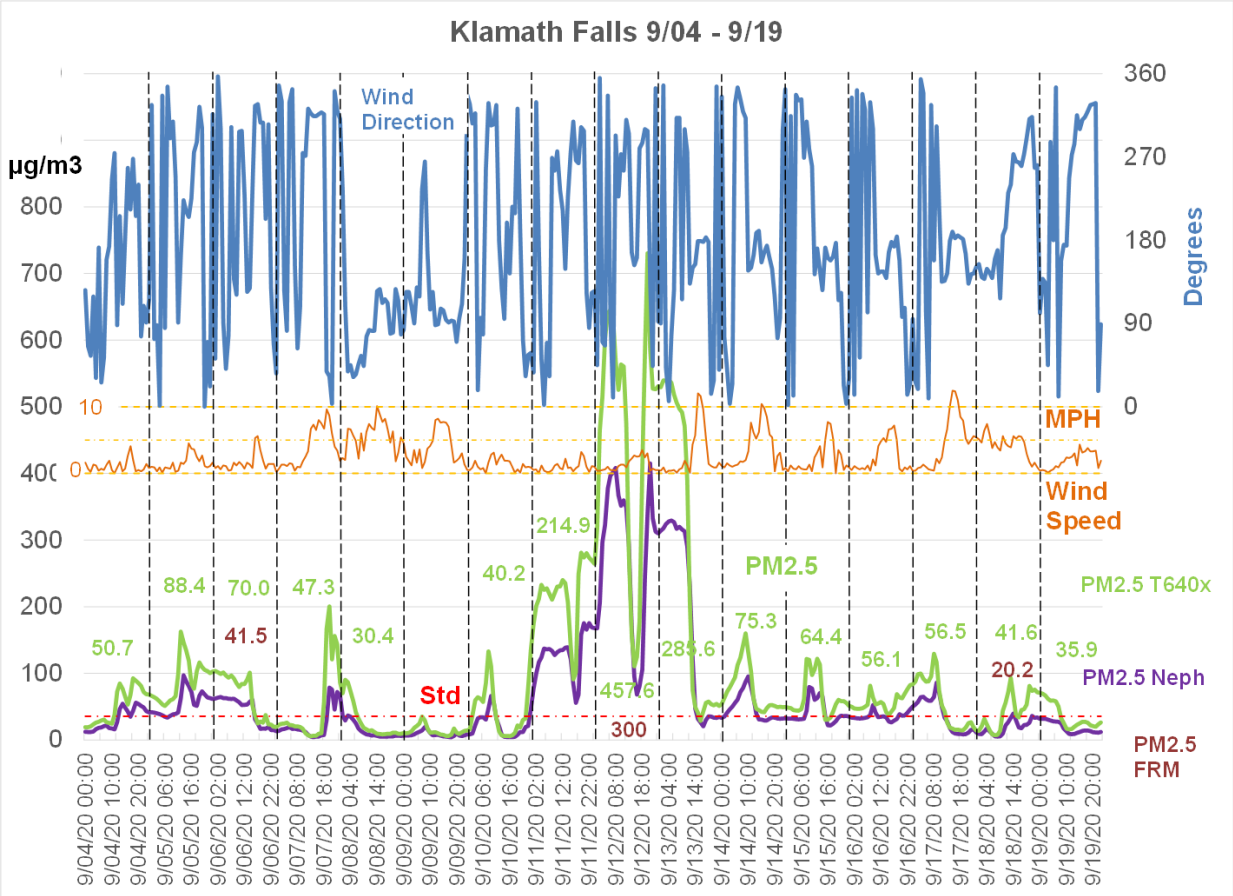


Figure 9B. September 12, 2020 Satellite Photo with Aerosol Optical Depth of Smoke Over Klamath Falls

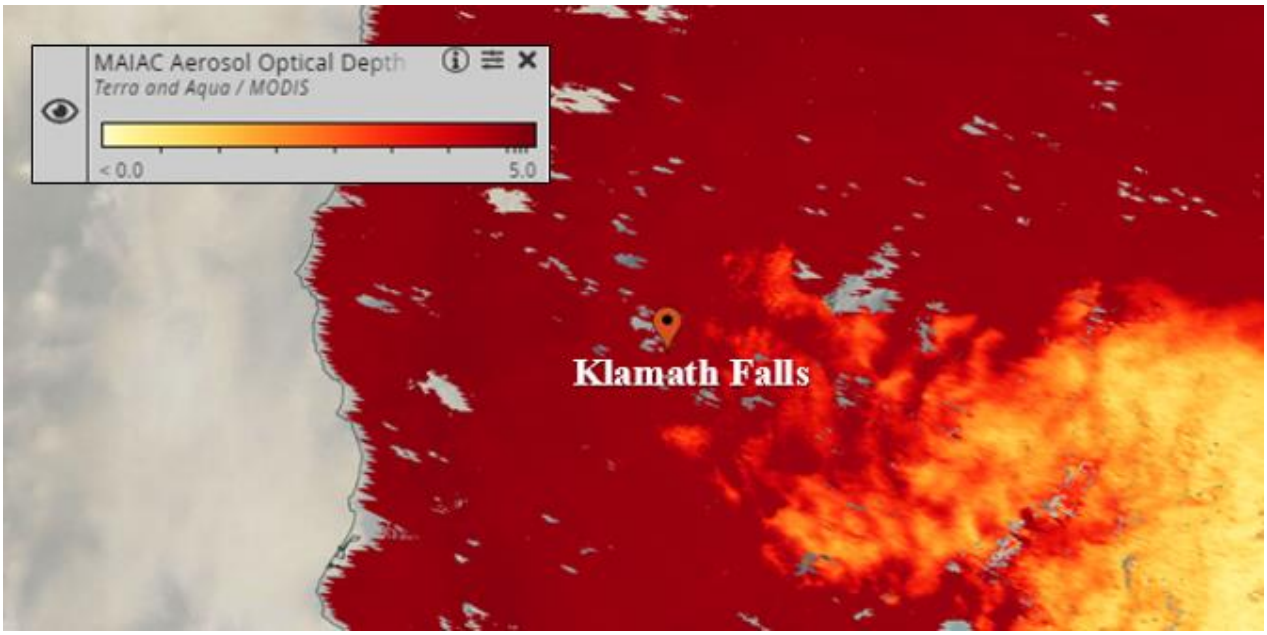


Figure 9C. September 12, 2020 HYSPLIT 24 Hour Backwards & Forwards Trajectory from Klamath Falls (Please note "KFP" identifies the monitoring location in Klamath Falls)

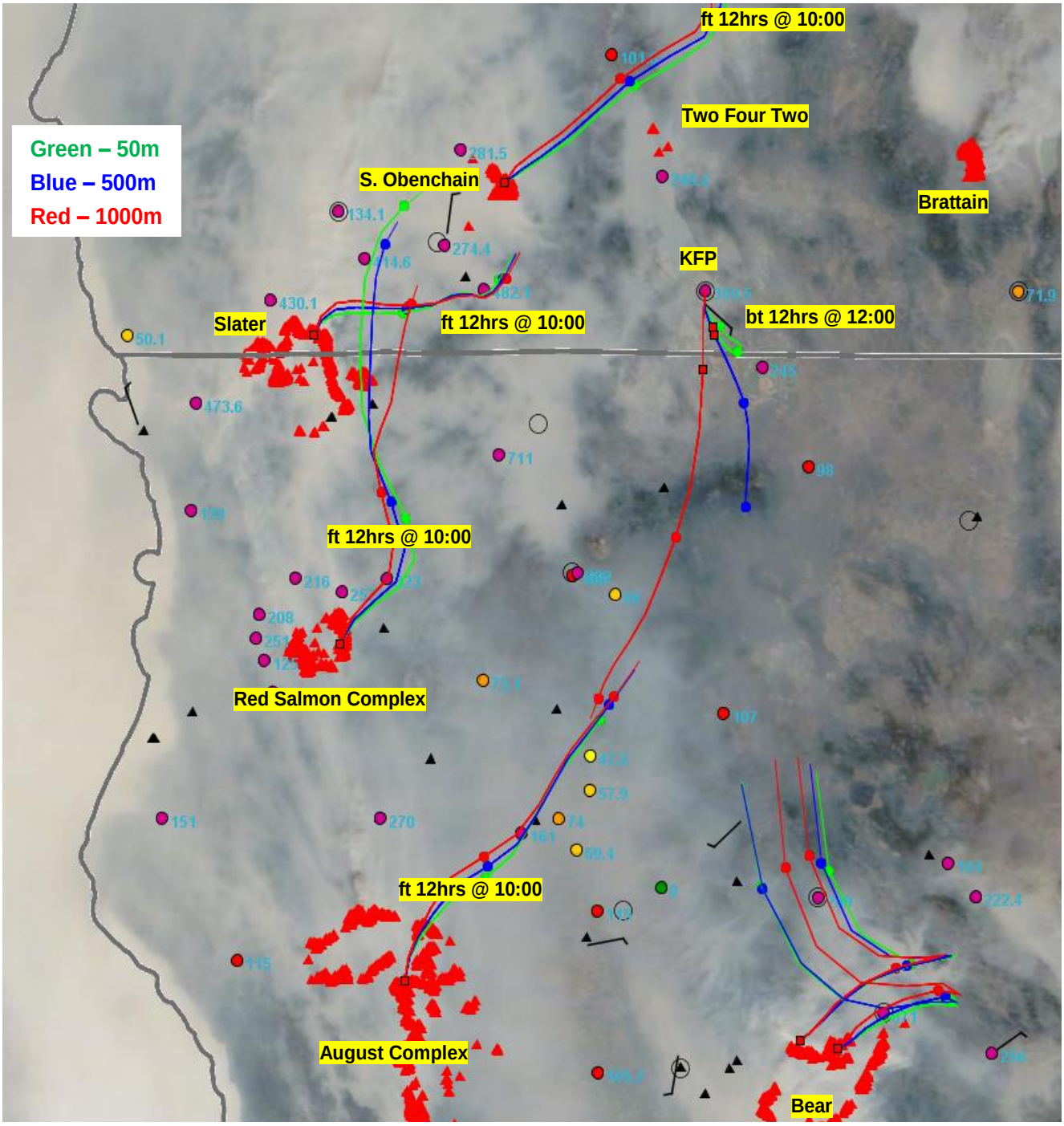


Figure 9D. Klamath Falls September 21 -24, 2020 PM2.5 and Wind Time Series

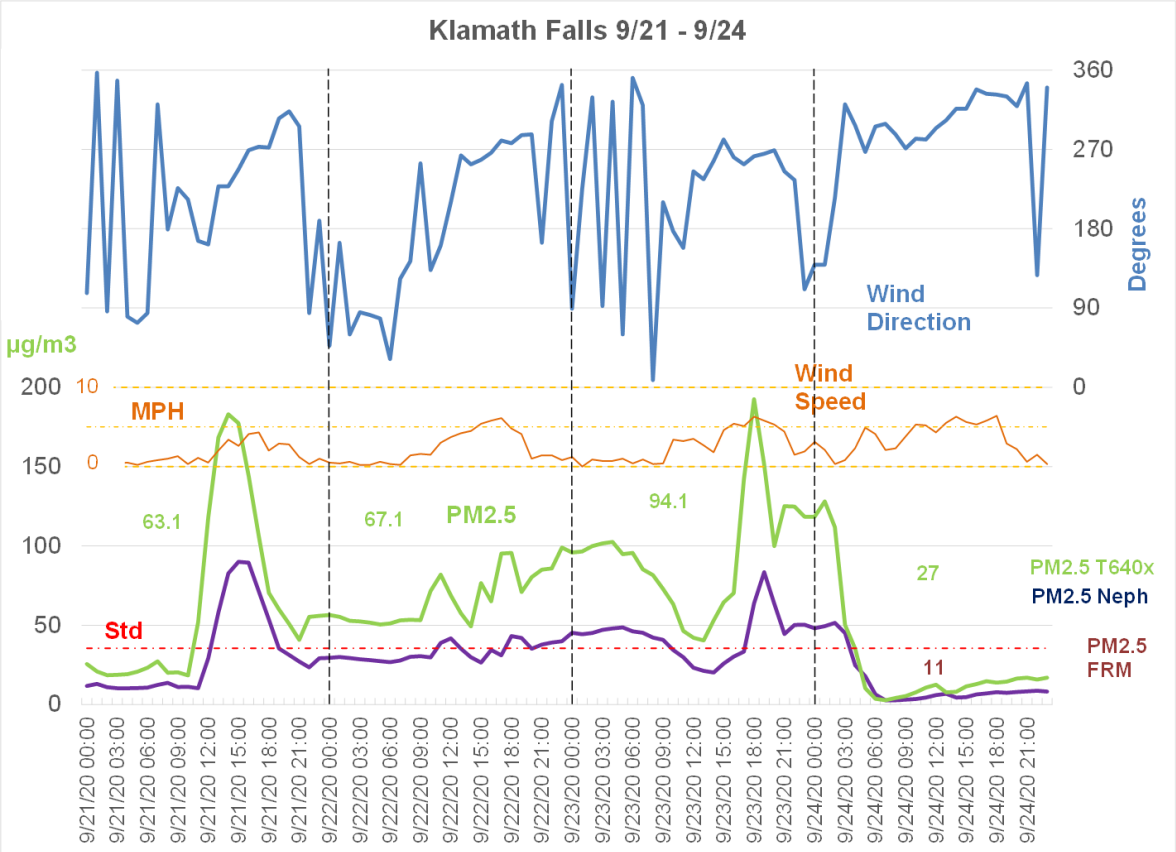


Figure 9E. September 23, 2020 Satellite Photo with Aerosol Optical Depth of Smoke Over Klamath Falls

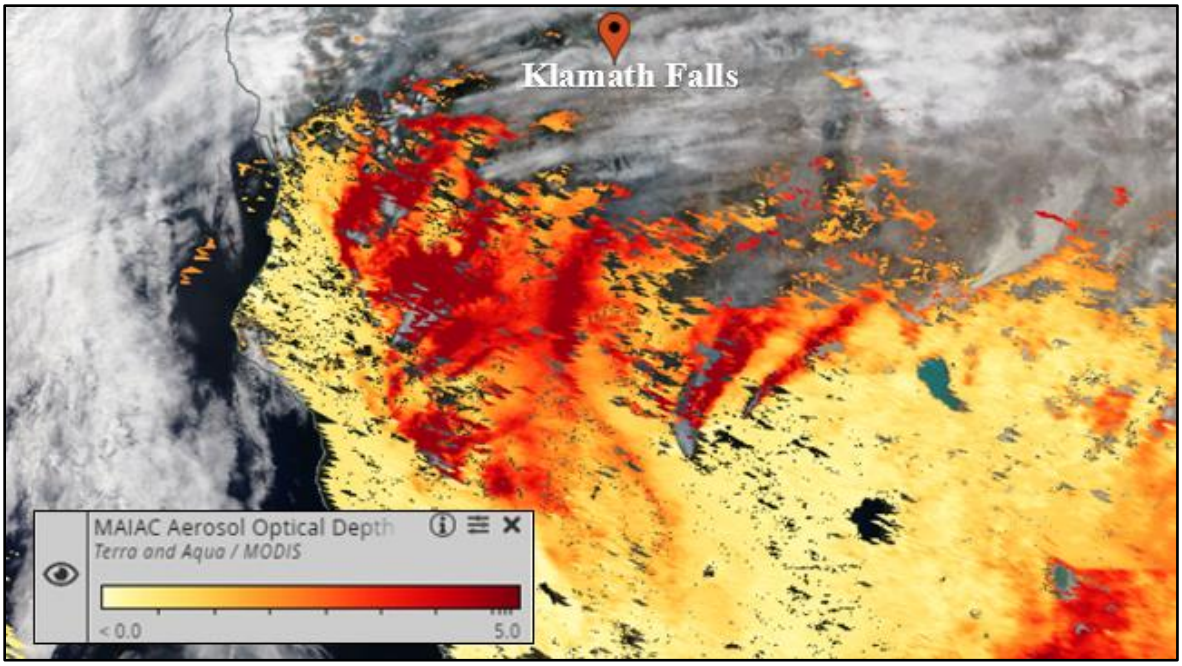
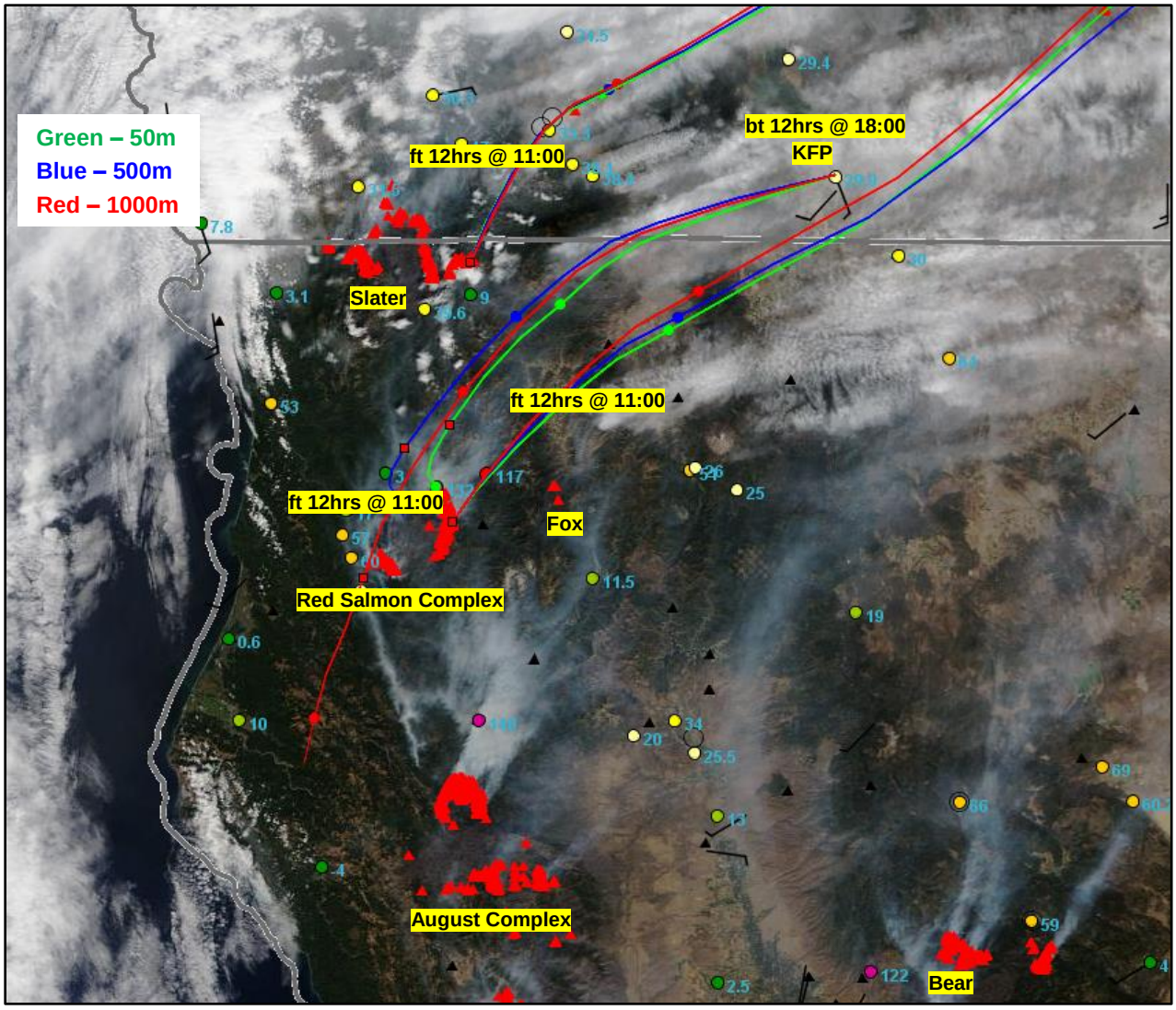


Figure 9F. September 23, 2020 HYSPLIT 24 Hour Backwards & Forwards Trajectory from Klamath Falls (Please note "KFP" identifies the monitoring location in Klamath Falls)



October Event – September 30, 2020 – October 1, 2020; October 4, 2020; and October 6 – October 9, 2020

Table 6. October Event Details (IT & RT)

Date	PM 2.5 ug/m3		Flag
	T640x	FRM	
9/30/2020	54.2	27.9	RT/IT
10/1/2020	47.4		IT
10/4/2020	35.5		IT
10/6/2020	47.4	24.8	IT/IT
10/7/2020	68.7		RT
10/8/2020	95.6		RT
10/9/2020	63.6		RT

During the October event there were four regulatorily significant days (9/30/2020, 10/7/2020, 10/8/2020, 10/9/2020) and there were three days (10/1/2020, 10/4/2020, and 10/6/2020) that PM 2.5 levels were high, due to the same event, but they don't currently have regulatory significance. ODEQ is flagging these days since they have potential for future impact on NAAQS compliance in the community.

We have included the PM2.5 values for all of the event days in ***Table 6***.

Please note that RT means days with wildfire smoke impacts that do have regulatory significance and IT means days with wildfire smoke impacts that are being flagged for information purposes only.
On September 30th at approximately noon smoke from the Slater fire entered into the Klamath Falls community causing poor air quality (PM2.5 = 54.2 ug/m3). The Slater Fire started on September 8th, near Slater Butte Fire Lookout on the Klamath National Forest. This fire burned on the Klamath, Six Rivers, and Rogue-Siskiyou National Forests in Siskiyou and Del Norte Counties in California and Josephine County in Oregon. Burning concurrently with the Devil Fire, fire managers did not declared these fires contained until November 16, 2020. Throughout the first week of October, PM2.5 concentrations remained high, although not elevated enough to have regulatory significance (RT) smoke continued to come into the airshed from the Slater/Devil's Fire as well as from California's large complex wildfires (Red Salmon Complex, August Complex). From Septemeber 7th – Septmeber 9th following a increase in wind speeds those same wildfires caused regulatorily significant (RT) impacts to the Klamath Falls monitors with PM2.5 levels ranging from 63.5 ug/m3 all the way to 95.6 ug/m3.

Figure 10A shows the time series (wind speed, wind direction, and hourly PM2.5 readings) at the Klamath Falls Peterson School monitor for between September 30, 2020 and October 9,2020. ***Figure 10B*** show the HYSPLIT back trajectory and forwards trajectory for October, 8th (the date with the highest daily average) and ***Figure 10C*** shows the aerosol optical depth of smoke over Klamath Falls on October, 8th.

Daily satellite smoke images and reverse/forward HYSPLIT trajectory modeling results are available for all October Event dates and can be found in ***Appendix D***.

Figure 10 A-D. Time Series for Event, Satellite Smoke Image, and Modeling Results for Klamath Falls Peterson School Monitor, 10/8/2020

Figure 10A. Klamath Falls September 30, 2020 – October 9, 2020 PM2.5 and Wind Time Series

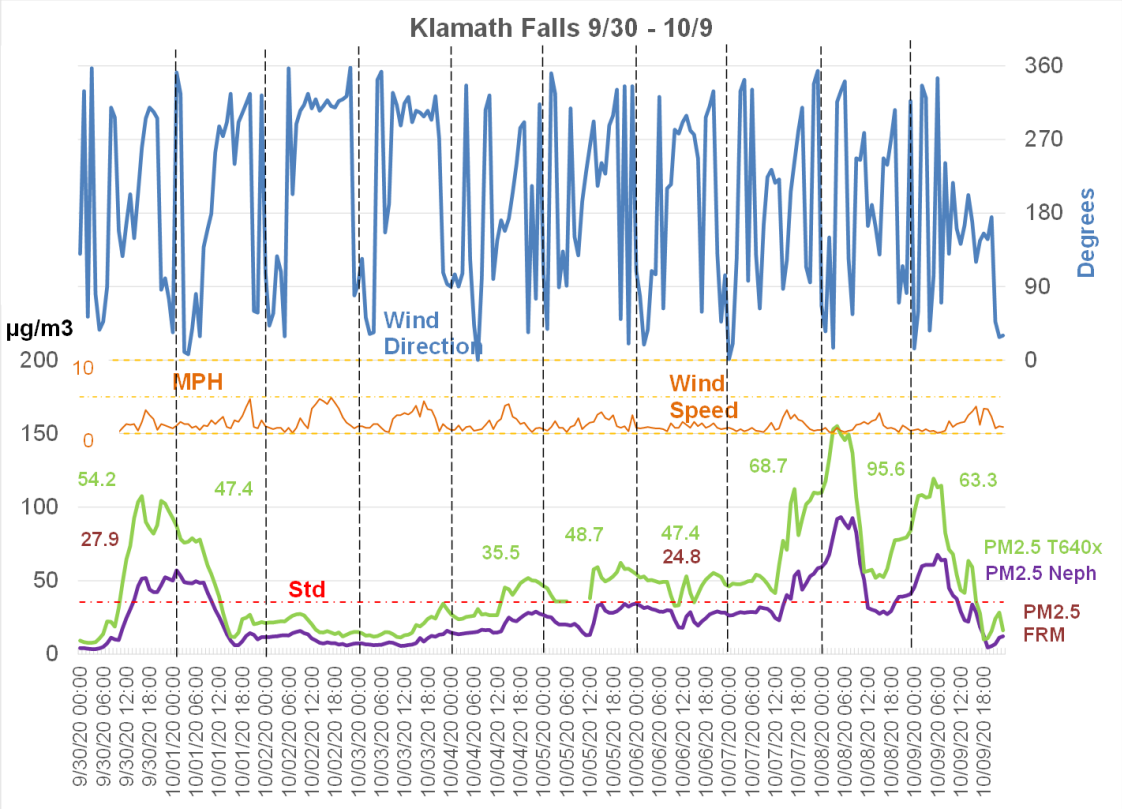


Figure 10B. October 8, 2020 HYSPLIT 24 Hour Backwards & Forwards Trajectory from Klamath Falls (Please note "KFP" identifies the monitoring location in Klamath Falls)

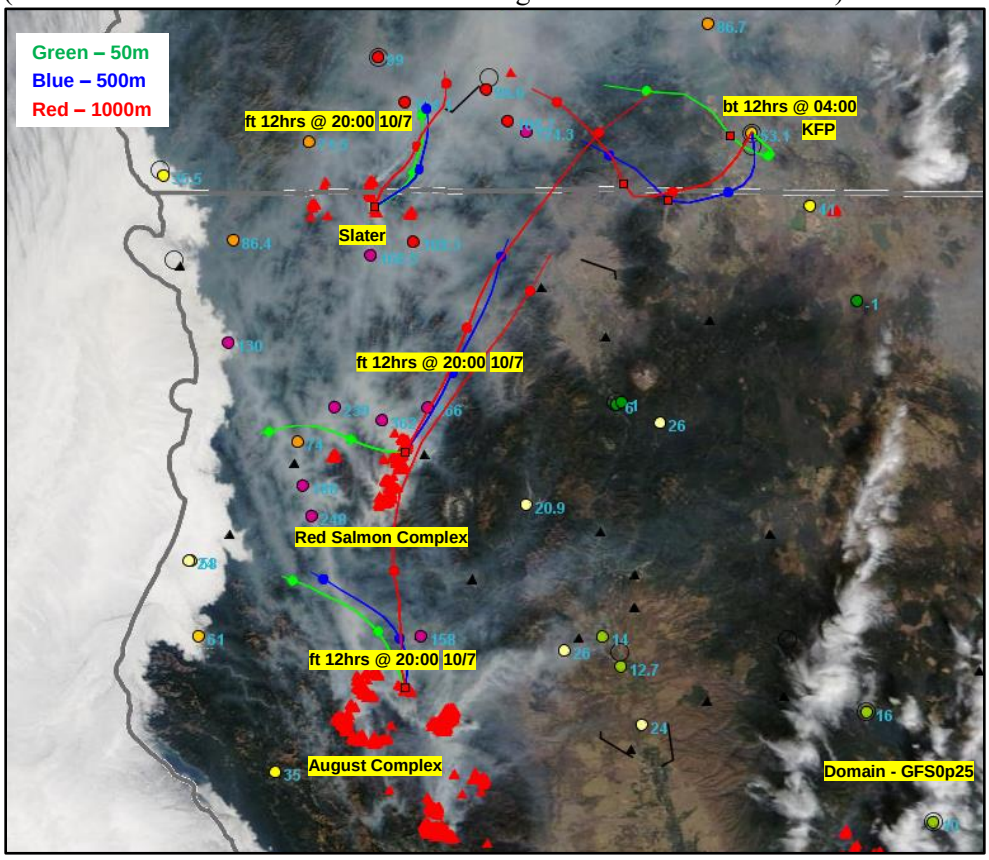
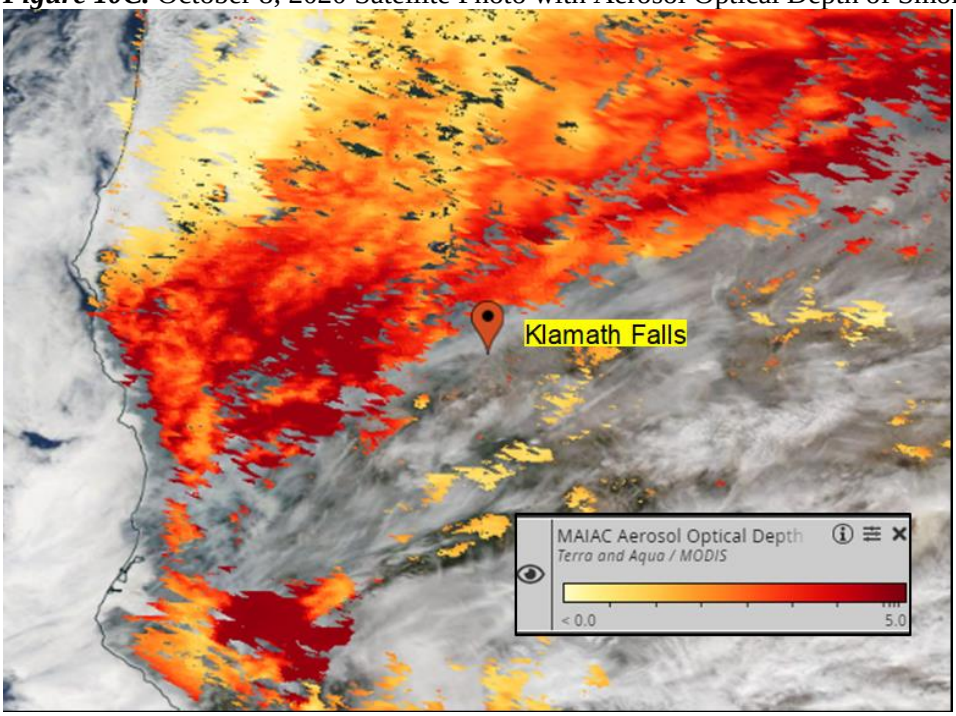


Figure 10C. October 8, 2020 Satellite Photo with Aerosol Optical Depth of Smoke Over Klamath Falls



2 Clear Causal Relationship

A clear causal relationship between a source and monitor is demonstrated with multiple strands of evidence linking the source of the event to the monitored exceedance. DEQ provides a concise description of how the evidence for each day demonstrates the clear causal relationship. In addition, alternative sources of PM2.5 and PM10 are explored. Specifically,

(1) Meteorological evidence (time series): transport of emissions to monitor

(2) Satellite, back trajectory, and/or wind rose evidence: spatial relationship between source and monitor

(3) Alternative sources

2.1 Meteorological Data and Time Series

Meteorological data was gathered and provided by our technical services and laboratory liaison, Anthony Barnack. He took wind speed and wind direction at the monitor as well as the hourly PM2.5 reading at the monitor to develop a three-tiered time series graph that shows the relationship of PM2.5 reading with wind speed and direction on the days of interest. We used that data to backtrack the wildfires that most likely contributed to the high readings of the days of interest.

2.2 Satellite Data, Back Trajectories and Forward Trajectories

We examined MODIS Terra and MODIS Aqua satellite photos provided through NASA's EOSDIS WorldView for smoke images related to monitor sites on the flagged wildfire days. MODIS satellite photos give visual evidence of the size and direction of the smoke plume on affected days. For a few days where smoke was not obviously coming from a fire to the monitor in question, we also examined Aerosol Optical Depth to identify the presence of wildfire smoke.

HYSPLIT back trajectory and forwards trajectories were conducted through EPA's AirNowTech website. The HYSPLIT model shows the back trajectory from the monitor to show that smoke traveled from the direction of the wildfires in questions to the monitor. The HYSPLIT model also shows the trajectory of smoke at varying heights. When necessary forwards trajectories were also used.

2.3 Alternative Source Hypotheses

An important element of the clear causal relationship demonstration is to explore alternative hypotheses for sources of PM2.5 and PM10. Anthropogenic sources include prescribed fires, crop residue burning (CRB), residential wood combustion (RWC), open burning, and vehicle emissions. These anthropogenic sources maintain relatively steady emissions from year to year and are included in historical monitor values.

2.3.1 Prescribed Burning

The Oregon Department of Forestry declared fire season on July 5, 2020 and no prescribed burns were authorized or reported in Klamath Falls area for the impacted monitor days. Although, some parts of the state remained in fire season longer, fire season for most of the state ended on October 17th, 2020.

2.3.2 Crop Residue & Agricultural Burning

Crop residue burning is regulated in Oregon by the Oregon Department of Agriculture in conjunction with multi-agency smoke management efforts, including the Oregon Department of Forestry, Oregon Department of Environmental Quality, and the Oregon State Fire Marshal. ODA's field burning rules are listed in OAR 603-077, "Field Burning Rules," for the Willamette Valley only. The open burning of all other agricultural waste is governed by OAR 340-264, "Rules for Open Burning." No open burning is allowed in Klamath Falls during the period in question.

2.3.3 Residential Wood Combustion

Residential wood combustion can be a significant source of PM2.5 emissions in Oregon communities during the winter months. The temperatures in Klamath Falls on the majorty of dates in question were well above the temperatures at which anyone would be burning wood for residential heating purposes.

Table 7. October Event - Average Tempatures

Date	Average Tempature °F	
	High	Low
9/30/2020	79.9	40.8
10/1/2020	85.6	42.4
10/4/2020	83.3	42.3
10/6/2020	82.0	43.2
10/7/2020	75.4	40.8
10/8/2020	77.4	37.2
10/9/2020	80.1	37.0

Although October average low tempatures may be cooler, the tempatures providided above may not correlate with the use of wood stoves. Additionally, the wildfire smoke present during the October event could have impacted local tempatures do to the attenuation of solar radition which could result in cooler air temperatures.

2.3.4 Open Burning

Open burning in Oregon is regulated by OAR 340-264.[9] Oregon

> "Classifies all open burning into one of seven classes: Agricultural; Commercial; Construction; Demolition (which includes land clearing); Domestic (which includes burning commonly called "backyard burning" and burning of yard debris); Industrial; or Slash. Except for field burning within the Willamette Valley regulated through OAR 340 division 266 and slash burning administered by the forest practices smoke management plan of the Oregon Department of Forestry, this division prescribes requirements for and prohibitions of open burning for every location in the state. Generally, if a class of open burning is not specifically prohibited in a given location, then it is authorized subject to OAR 340-264-0050 and 340-264-0060 and the requirements and prohibitions of local jurisdictions and the State Fire Marshal."

In addition, according to OAR 340-262-0900, "Materials Prohibited from Burning,"

> No person may cause or allow any of the following materials to be burned in a solid fuel burning device, fireplace, a trash burner or any other device described in ORS 468A.485(4)(b):
>
> (1)(a) Garbage; (b) Treated wood; (c) Plastic or plastic products; (d) Rubber or rubber products; (e) Animal carcasses; (f) Products that contain asphalt; (g) Waste petroleum products; (h) Paint; (i) Chemicals; (j) Products containing lead, mercury or other heavy or toxic metals; (k) Materials containing asbestos; and (l) Particleboard.
>
> (2) Paper or paper products, except for paper used to kindle a fire.

No open burning is allowed in Klamath Falls during the period in question and across the state a voluntary refrain from all outdoor burning was in affect. [10]

[9] Oregon Secretary of State website. "Rules for Open Burning." (Accessed 6/8/2020) https://secure.sos.state.or.us/oard/displayDivisionRules.action?selectedDivision=1568

[10] Details on the voluntary refrain for outdoor burning. https://deqblog.com/2020/04/08/state-agencies-ask-oregonians-to-voluntarily-refrain-from-outdoor-burning-while-communities-respond-to-covid-19/

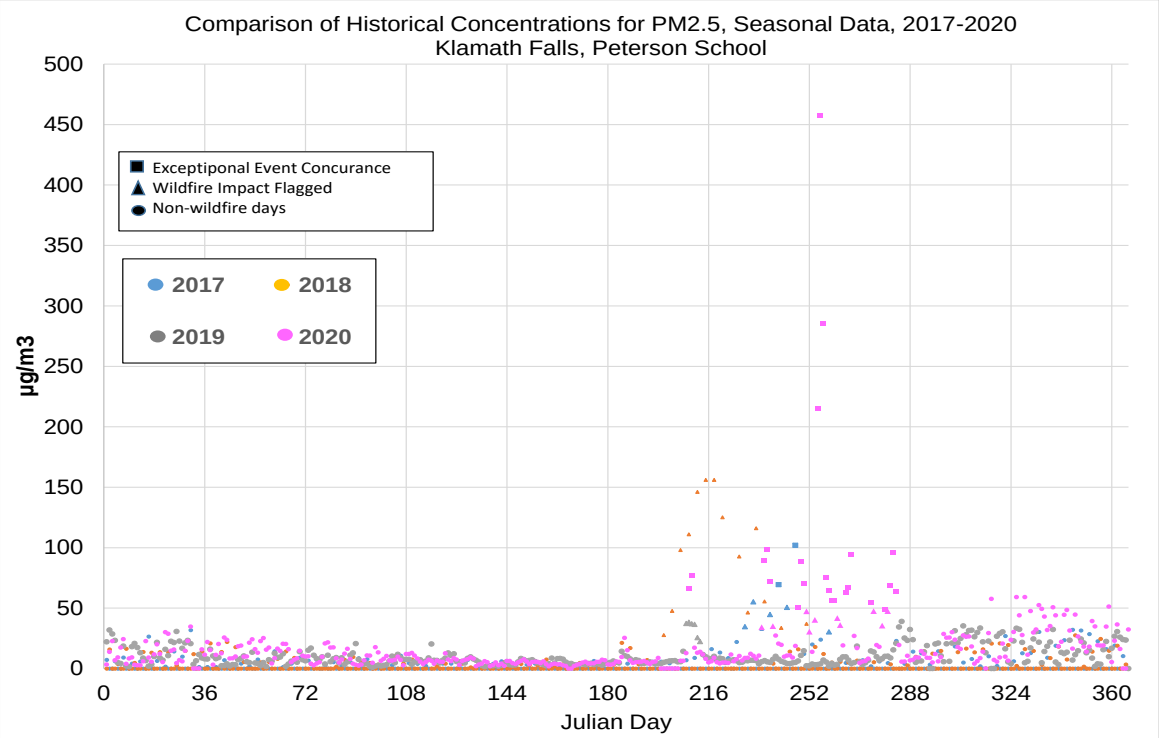
2.3.5 Vehicle Emissions

Vehicle emissions and road dust produce PM2.5 emissions and are included in the onroad mobile source category in the national emmissions inventory. The annual PM2.5 emissions in this category are a small fraction of the emissions produced by wildfires, especially in rural areas like Klamath Falls which has relatively few vehicles. The Klamath Falls Fine Particulate Matter (PM2.5) Attainment Plan (DEQ 2012)[11] also models onroad emissions contributions to PM2.5 levels as "minimal". Onroad mobile emissions did not likely contribute any significant PM2.5 to the elevated concentrations at the monitors in question on the impacted days.

3 Comparison to Historical Fluctuations

To support the clear causal relationship requirement of the EER, analyses are presented here comparing the event-influenced concentrations at Klamath Falls to historical concentrations. Evidence supports the conclusion that PM2.5 concentrations at this monitor on the flagged days were elevated due to wildfire smoke. ***Figures 11*** and ***Figure 12*** below shows the PM2.5 concentrations measured at Klamath Falls for 2017 through 2020. Exceptional event concurance days are shown in squares, wildfire impact days that have been flagged, but don't have regulatory significance, are shown in triangles and circles depict non-wildfire days.

Figure 11. Historical Comparison of PM2.5 Concentrations at Klamath Falls Peterson School Monitor using T640X



[11] Oregon Department of Environmental Quality. 2012. *Klamath Falls Fine Particulate Matter (PM2.5) Attainment Plan*. Portland, OR. https://www.oregon.gov/deq/FilterDocs/KFallsAttPlan2012.pdf

Figure 12. Historical Comparison of PM2.5 Concentrations at Klamath Falls Peterson School Monitor Zoomed in on Fire Season on T640X

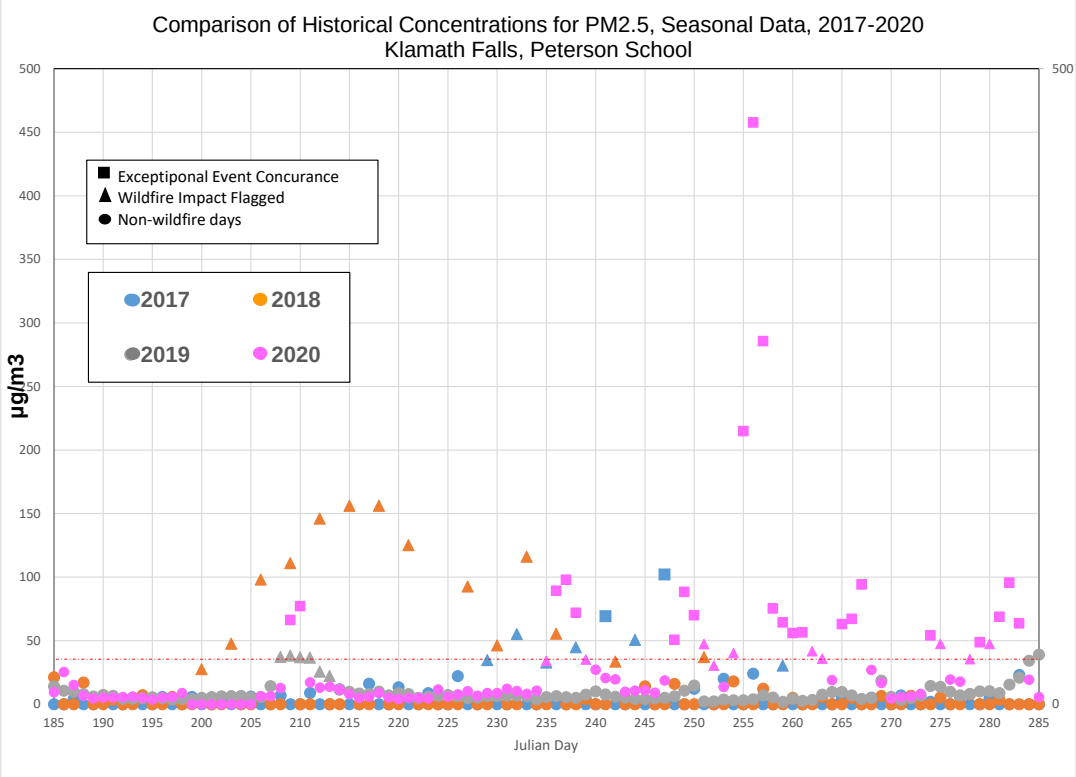


Figure 13. Historical Comparison of PM2.5 Concentrations at Klamath Falls Peterson School Monitor using FRM

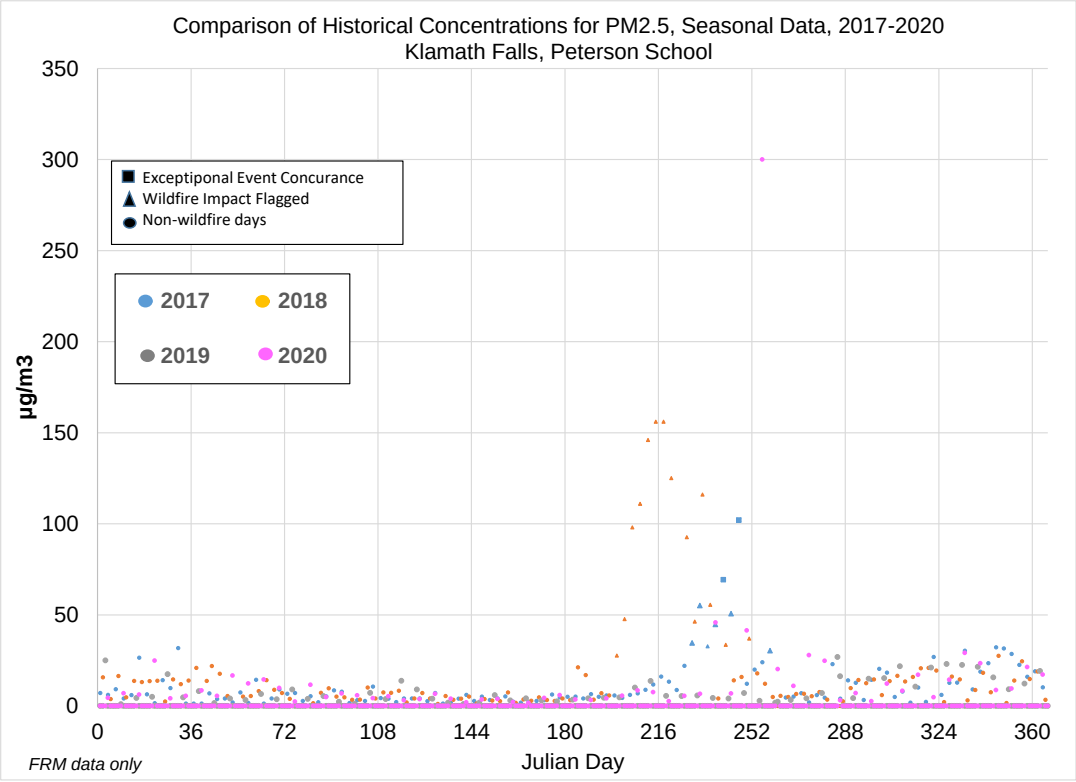
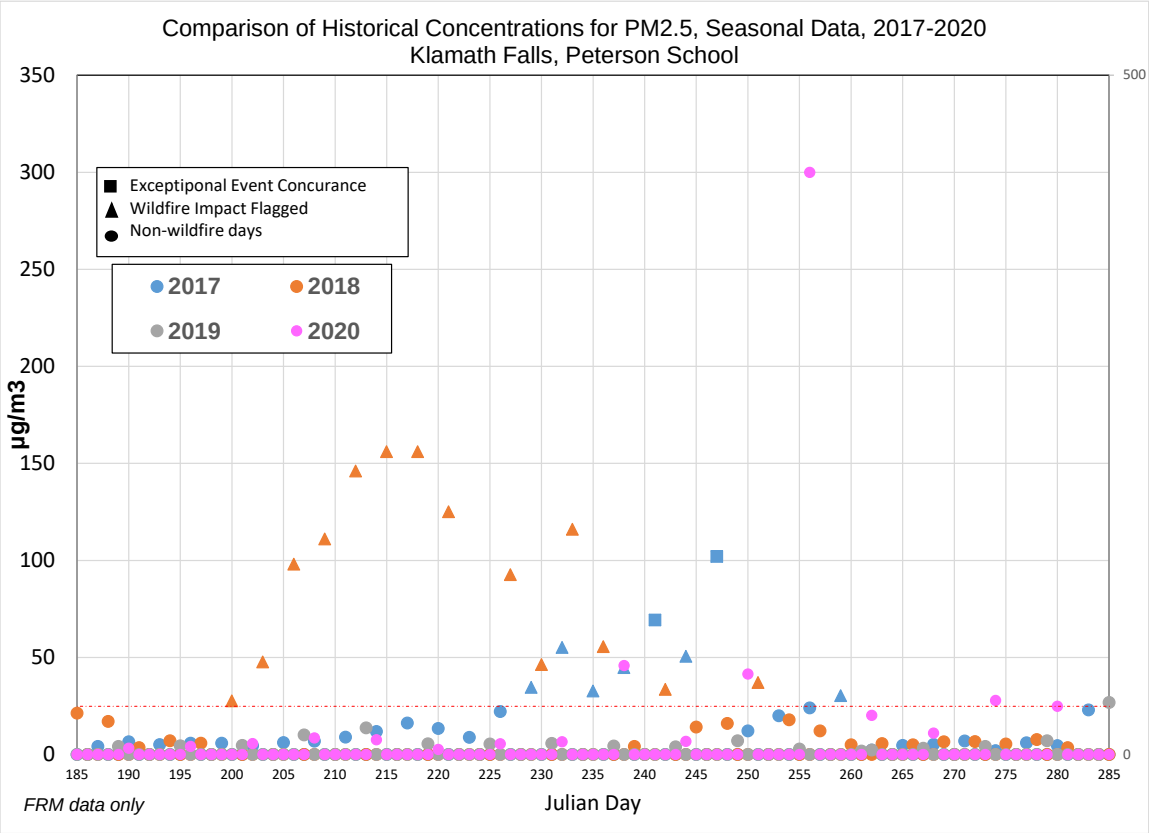


Figure 14. Historical Comparison of PM2.5 Concentrations at Klamath Falls Peterson School Monitor Zoomed in on Fire Season using FRM



This data shows that during wildfire season PM2.5 measurements typically remain below 35 ug/m3 with in Klamath Falls. Higher numbers in the wintertime are attributed to residential wood combustion and wintertime inversions in our mountain valleys.

The exception is when there are wildland fire smoke incursions during the summer months. In this section we show that the summer background PM2.5 levels are low on the vast majority of days. June through September data was analyzed for 2011 through 2019 to establish a background level. The FRM data was used when there was a sample day, otherwise PM2.5 estimates from the nephelometer were used.

Table 8 shows that 2020 PM2.5 readings were truly exceptional, even given wildfire years within the 2011-2019 years.

Table 8. Basic Descriptive Statistics for 24-hr PM2.5 Concentrations Recorded at Peterson School Monitor in Klamath Falls, OR from 2011 - 2020

	2011-2019 with wildfire *(ug/m^3)*		**2011-2019 with no wildfire** *(ug/m^3)*		**2020** *(ug/m^3)*	
	T640x	FRM	T640x	FRM	T640x	FRM
Minimum	0.6	0.6	0.6	0.6	1.7	1.7
Maximum	156	156	24	24	457.6	300
Median	5.4	5.1	5.0	4.7	8.8	6.3
Mean	11.1	12.0	6.0	5.8	27.9	24.7
Std.Dev	19.8	22.1	3.9	4.1	53.9	62.8
N	438	339	395	301	128	22

4 Not Reasonably Controllable or Preventable

This EER element requires a demonstration prove that the event(s) were neither reasonably controllable not preventable, and this requirement has been met for wildfire events (40 CFR 50.14(b)(4)). DEQ presents sufficient evidence in this demonstration showing the source of the event was indeed wildfires (***Section 1*** and ***Section 2***). DEQ contends that the events of July, August, September and October of 2020 at Klamath Falls were both not reasonably controllable or preventable.

5 Natural Event or Human Activity Unlikely to Recur (NE/HAUR)

The EER requires that agencies must document that the identified source of an exceptional event is either a natural event (NE) or a human activity unlikely to recur at the same location (HAURL) such as to affect the monitors in question again. EPA's 2016 Exceptional Events rule indicates that if an agency has adequately demonstrated that the source is a *natural event* or, if not natural, is a human activity unlikely recur at the same location and that there is a *clear causal relationship* between the identified source (s) and the affected monitor, then the HAURL/Natural Event criterion is also satisfied.

The fires in 2020 were largely due to lightning strikes that occured during a record-breaking hot and dry summer season. These lightning-caused wildfire events are considered natural events. The detailed data included in ***Section 1*** and ***Section 2*** demonstrate a clear causal relationship between source and monitor for each day that ODEQ requests concurrence. Thus, the NE/HAUR criterion is also satisfied.

6 Mitigation

The EER requires states to take appropriate and reasonable actions to protect public health from exceedances or violations of the NAAQS (40CFR 51.930). DEQ presents evidence of prompt public notification of the event, public education so that individuals could make behavioral changes to reduce exposure to unhealthy air, and implementation of appropriate measures to protect public health from the impacts of exceptional events.

Control of wildland fires is coordinated under the National Interagency Fire Center. Their fire control policy states:

> Five federal agencies, including the Depart of the Interior's Bureau of Land Management, Bureau of Indian Affairs, National Park Service, and U.S. Fish and Wildlife Service, along with the Department of Agriculture's Forest Service, manage and have primary fire program responsibilities on more than 676 million acres. The U.S. Fire Administration works with county and local fire departments; while the states are represented by the National Association of State Foresters. The state, county, and local jurisdictions provide primary fire protection on public and private lands covering additional hundreds of millions of acres across all 50 states.
>
> As partners, they work together on fire management issues covering the spectrum from safety and planning, to science, preparedness, operations, strategy development, logistics, intelligence, emergency response, and more. They also collaborate on interagency strategies to manage wildfires, not only for single incidents but as a matter of policy.

In addition to the total effort of the various natural resource agencies, the specific USFS districts prepare fire management plans.[12]

Oregon DEQ, Lane Regional Air Pollution Authority, Oregon Health Authority, Oregon OSHA, Oregon Emergency Management, Oregon Department of Forestry, and the US Forest Service developed a

[12] For more details for fire science reports and community outreach practices, see: USDA Forest Service – Fire Science and report page. *https://www.fs.usda.gov/detail/r6/fire-aviation/?cid=fseprd604078* (Accessed 6/8/21)

wildfire response protocol which outlines the state, federal, and local response to dangerous smoke levels impacting Oregon communities.[13] The protocol defines which agency is responsible for which activity and provides a guide for the coordination of emergency communication during extreme smoke events. The major areas of agency actions and the lead agencies responsible in the event of a severe smoke episode related to wildfire are presented in detail in ***Table 8***.

Table 9. Wildfire Response Protocol: Actions and Agencies Responsible.[9]

Action Needed	Lead Agency and Action Taken	Desired Outcome
1. Air Monitoring		
Measuring ambient air quality	Mostly DEQ as lead agency. Air Resource Advisors (ARA) may provide additional monitoring equipment via national cache resources and assist in deployment and data collection.	Ability to track ambient air quality levels in communities receiving the heaviest impact, and identify smoke-free areas where air quality is good.
Indoor air quality exposure	Oregon OSHA is lead agency to evaluate air quality concerns for workers. DEQ and OHA can provide advice to schools.	Ability to monitor indoor smoke levels in work environments and schools.
2. Smoke Forecasting and Modeling		
Smoke weather forecast	ODF is the lead agency, with back-up and assistance from NWS Meteorologists as requested. DEQ assists in coordination. National Weather Service can be contacted to provide "spot weather forecasts" for wildfire.	Provide advance notice of possible smoke movement and impacts, improve public notification, lower risk of public exposure to high smoke levels
Smoke modeling	ARAs can provide smoke modeling forecasts if requested.	Complementary to above
3. Issuing Health Warnings		
Provide public with frequent smoke updates on potential health risk and recommended public health actions via the web and media	Coordination between the Incident Management Team, DEQ, ARA, OHA, county health departments, local government, tribes and 211 info. Assistance from federal land managers on fire status, and from ODF wildfire forecasting.	Frequent coofdinated updates provided to the public via Oregon Smoke Blog, DEQ, OHA, local govermnet websites, press releases and media outreach. 211 info is provided with up-to-date health-related information.
4. Website management		
Updating the Oregon Smoke Blog and social media (see description under section 6)	Blog initiated by federal land managers or DEQ, and updated by DEQ Public Affairs who will act as a "gate keeper" to avoid duplicative messaging and crowding of the smoke blog.	Provide the public with comprehensive "one-stop" website/social media on wildfire status, air quality levels, leath risk, cleaner air spaces, press releases and other critical info.
Updating DEQ, OHA, ODF and local websites	Managed by respective agency. Supplements the Oregon Smoke Blog website.	Complements the above website.
5. Public Actions		

[13] Oregon DEQ et al. 2020. *Oregon Wildfire Response Protocol for Severe Smoke Episodes.* V7 June 10, 2020. https://www.oregon.gov/deq/FilterDocs/WFresponse.pdf (Accessed 6/8/21)

Cancel or modify public events, outdoor and business activities	Decision made within affected jurisdiction, by local or tribal health authorities in consultation with DEQ, ARA, local public health, OHA, federal land managers, and possibly or OR-OSHA as needed.	Prompt action taken, via notification of media, 211 info, and posting info on Oregon Smoke Blog and other websites
Consult with schools on limited hours or closure. Decisions about protecting schools or other public buildings from smoke intrusion	Decision made within affected jurisdiction, by local or tribal health authorities in consultation with DEQ, ARA, local public health, OHA, or OR-OSHA as needed.	Identification of measures to protect schools and users of public buildings from smoke
Set up general population shelters	Red Cross may support the setup and management of general population shelters based on decisions by local health officials.	When determined necessary, general population shelters will be established and opened in coordination with local public health and emergency management.
Establish or identify public cleaner air spaces	Decisions made within affected jurisdiction, by local or tribal health authorities in consultation with DEQ, ARA, OHA, or OR-OSHA as needed.	When determined necessary, prompt action taken to set up or identify cleaner air spaces, using guidance for "Identifcation of Cleaner Air Spaces for Protection from Wildfire Smoke"[1]
Recommended evacuation/relocation of sensitive populations	Decision made at local level, by health officials and tribal/local government (Sheriff or local emergency management), OEM, in consultation with DEQ, ARA, OHA, federal land managers and possibly OR-OSHA	Prompt action taken if dangerous smoke levels are expected to persis for a prolonged period. Requires close communication with DEQ, OHA, federal land managers, OEM, OR-OSHA, 211 info, and possibly Red Cross, State Fire Marshal and State Police.

7 Initial Notification

The EER establishes specific procedural requirements that an air agency must follow to request data exclusion. Those requirements and ODEQ's actions to meet them are summarized in the table below.

Table 10. Exceptional Event Rule Procedure Requirements

Exceptional Event Rule Procedural Requirement	ODEQ Action/Intended Action
A State shall notify EPA of its intent to exclude one or more measured exceedances of an applicable ambient air quality standard as being due to an exceptional event by placing a flag in the appropriate field for the data record of concern which has been submitted to the AQS database. 40 CFR § 50.14(c)(2)(i).	ODEQ notified EPA that it placed flags on numerous the monitor values originally thought to be affected by wildfires above the level of concern in Oregon for PM2.5 of 25μg/m3 and that we intended to request EPA concurrence to exclude some or all of them from the AQS database.

A State that has flagged data as being due to an exceptional event and is requesting exclusion of the affected measurement data shall, after notice and opportunity for public comment, submit a demonstration to justify data exclusion to EPA. EPA shall respond with a due date for demonstration submittal that considers the nature of the event and the anticipated timing of the associated regulatory decision. 40 CFR § (50.14(c)(3)(i)).	DEQ made this package available for public comment and subsequently submitted it to EPA by {TBD} so that it continues to demonstrate Klamath Falls is meeting the 24-hour PM2.5 standard.
With the submission of the demonstration, the air agency must document that the public comment process was followed. 40 CFR § (50.14(c)(3)(iv) and (v).	This document was available for a 30-day public comment from {Blank – Blank.}

DEQ posted notice of this exceptional events demonstration on {TBD} on the DEQ website. {BLANK} comments were received.

8 Public Comment

{To be completed after the public comment period}

9 Summary

With the weight of evidence discussed throughout this report, Oregon DEQ has shown that the smoke from the 2020 Oregon and California wildfires caused the PM2.5 concentration collected on the ODEQ Federal Reference Method air quality monitor in Klamath Falls in July, August, September and October of 2020. ODEQ requests EPA's concurrence and that these values not be used to calculate the relevant design values for the Klamath Falls State Implementation Plan. ODEQ is also submitting some dates for which EPA will not concur at the moment, but for which the information may become of regulatory significance in the future.