AIR QUALITY ON THE BISHOP PAIUTE RESERVATION
SOURCE AND EMISSIONS INVENTORY

BISHOP PAIUTE TRIBE
THE ENVIRONMENTAL MANAGEMENT OFFICE

revision
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ACKNOWLEDGEMENTS

The previous revisions of the Air Quality on the Bishop Paiute Reservation - Source & Emissions Inventory (EI) for Bishop Paiute Tribe (BPT or the Tribe) were completed by the former Air Quality Specialist, Toni Richards, Ph.D. This included extensive data survey and compilation from neighboring jurisdictions such as criteria pollutant and IMPROVE data, traffic data, permit data, utility data, local meteorological data, and performing on-reservation area and household surveys.

Technical support for BPT's EI reporting efforts was provided by Dave Bush from T&B Systems who performed all of the emission calculations.

We want to thank Thomas Gustie III, from our Environmental Management (EMO) staff who completed the survey of dirt roads, barren areas and sparse shrublands for the 2012 revised EI. We also want to thank BryAnna Vaughan, and EMO staff who developed the map of the Bishop Reservation.

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AIR QUALITY ON THE BISHOP PAIUTE RESERVATION
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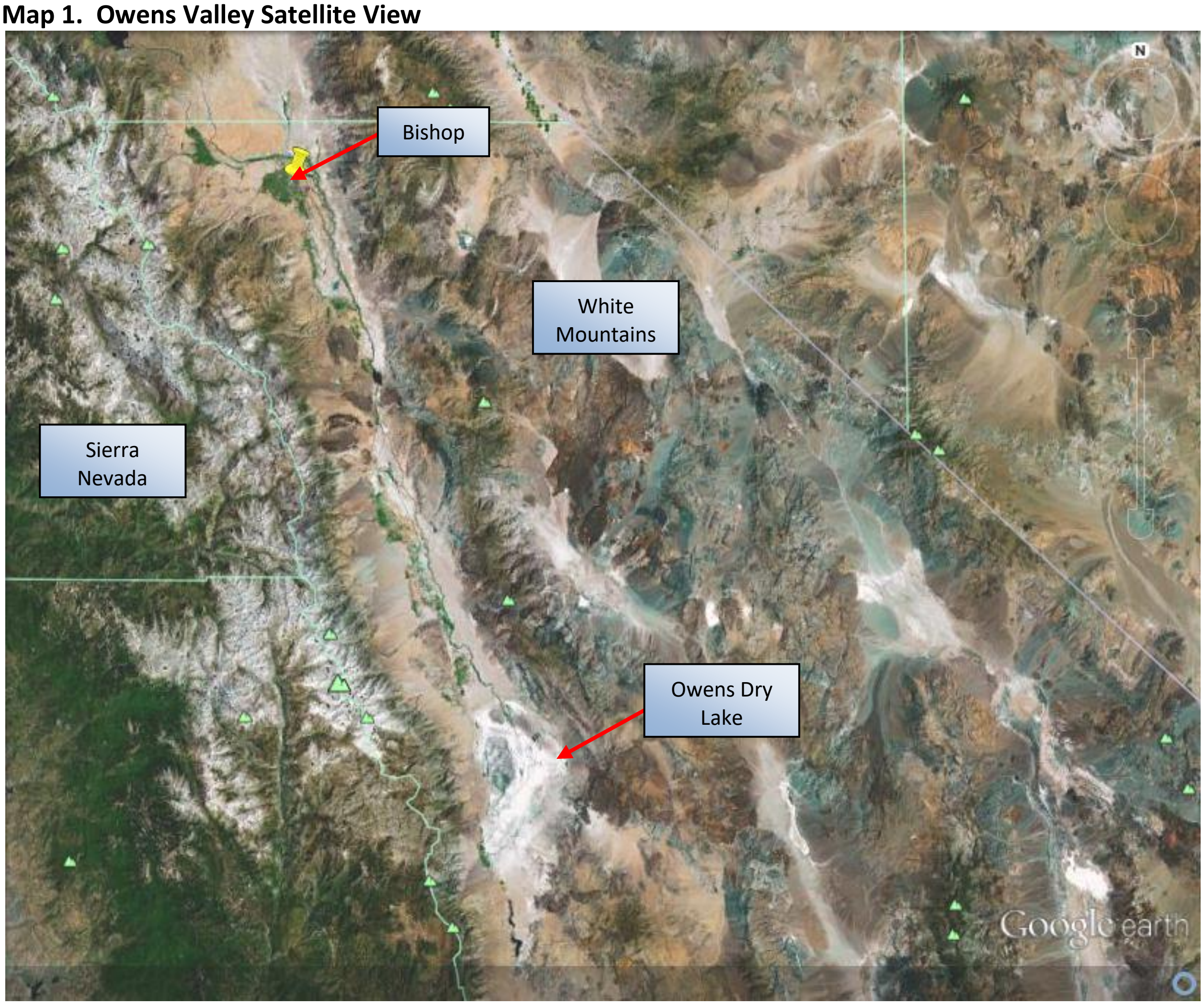
I. BACKGROUND, LOCATION AND HISTORY

A. Location of Bishop Reservation

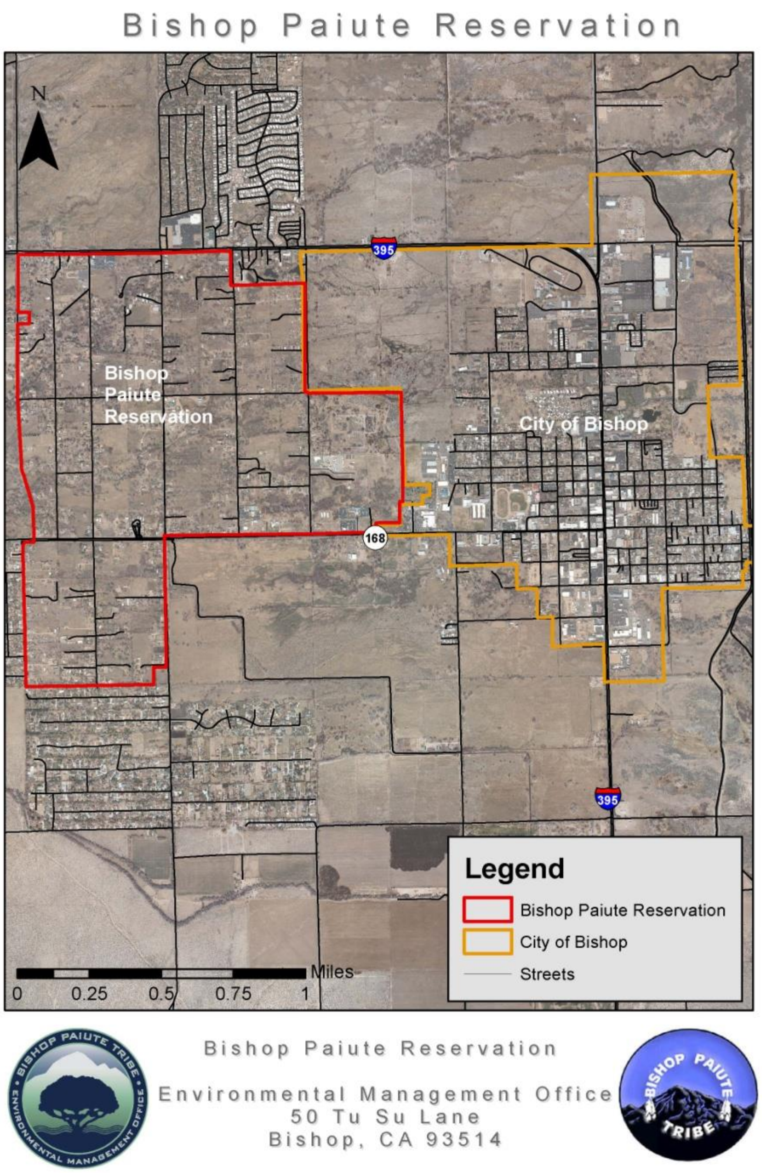
The Bishop Paiute Reservation is located in the Owens Valley in eastern California, near the Nevada border. The area is sometimes known as “the deepest valley” it is flanked by two 14,000-foot ranges – the Sierra Nevada to the west and the White Mountains to the east, and sometimes as Payahuunadü, ‘the land of flowing water’. The region includes some of the most spectacular scenery in the United States. Both mountain ranges are comprised of National Forest and National Park lands that include substantial wilderness areas and multiple Class I air-sheds (areas designated under the Federal Clean Air Act for Protection from Significant Deterioration). From time immemorial, the Paiute People have been shepherds of the Valley from crest to crest. The Bishop Paiute Tribe continues to maintain that interest by helping protect the air quality in this magnificent landscape. Map 1 depicts the Owens Valley.

Map 1. Owens Valley Satellite View



The Reservation is flanked by the City of Bishop to the east, and surrounded by private lands and by lands owned by the Los Angeles Department of Water and Power. The Bishop Paiute Reservation comprises 879 contiguous acres, with over 600 registered households, roughly 92% being native households. Nearly all of the land on the Reservation is assigned to individual families, with a limited number of acres set aside for public and commercial facilities. Despite substantial population growth since the creation of the Reservation in 1939, many of the assigned lands are in agriculture (pasture or alfalfa, primarily) or are open lands, and residential assignments may be densely populated. Map 2 shows the Reservation.

Map 2. Bishop Paiute Reservation



B. Meteorology

The Owens Valley is at the western edge of the Great Basin, and western basin and range province. The climate is high desert, and precipitation can vary widely from one year to the next, and the annual total can be dependent on as little as a single storm. Winter is the wettest season and is storm-driven. January typically has the most precipitation that may be in the form of snow. Summer precipitation is dependent on monsoonal flow. Fall precipitation is highly variable.

Due to the desert climate, daily temperatures can vary by 40 to 50 degrees. Typically, July is the hottest month with maximum temperatures reaching or exceeding 100°F. January is the coldest month with minimum temperatures in the single digits or teens. Historical data from Bishop Airport show the record high as 110 degrees F and the record low as - 8 degrees F
(*https://www.wrh.noaa.gov/vef/climate/BishopClimateBook/ClimateofBishop.pdf 2016*.)

Winds are the driving force behind much of the air pollution in the Owens Valley. On the Bishop Reservation, our data demonstrates that wind gusts in excess of 35mph may generate episodic high dust conditions resulting in high levels of PM-10. Winds can also drive wild fires or can bring smoke from distant fires into the valley, impacting PM-2.5 levels. Winds can also transport ozone from the Central Valley. In any month maximum wind gusts can exceed 40mph and in most months, particularly in the winter and spring. Average winds are around 20mph. Average winds do not vary substantially from year to year, and high gusts are observed in all years.

The Air Program published a study *Weather History on the Bishop Paiute Reservation 1925 – 2011*, found at: http://www.bishoptribeemo.com/Library/Air%20Quality%20Studies/Weather%20History%201925-2011%202.5.14.pdf.

The Bishop Paiute Tribe's weather station collects and publishes online real time data, going back to 2005. The tribal data is currently available for analysis at:
http://www.bishoptribeemo.com/monitoring.htm,
https://aqs.epa.gov/aqsweb/documents/data_mart_welcome.html
AQS direct client (for AQS users)
http://trexwww55.ucc.nau.edu/cgi-bin/yearly_summary.pl where meteorological data for Big Pine Paiute Tribe's weather station, Lone Pine Paiute-Shoshone Tribe's weather station, and Fort Independence Reservation's weather station can also be accessed.

Additionally, meteorological monitoring data and resources in the Owens Valley can also be found at:
https://www.gbuapcd.org/cgi-bin/downloadData for Great Basin Unified Air District monitoring in Owens Valley locations, validate data sets;
https://www.wrh.noaa.gov/vef/climate/BishopClimateBook/index.php Bishop Airport station Climate Book;
https://www.wmrc.edu/weather/default.html for White Mountain Research Center Weather Page

II. AIR QUALITY

A. Measuring Air Quality

Air pollution is of concern because of its impacts on human health. Two aspects of air quality are typically measured. The first concerns five criteria pollutants: particulate matter (PM), carbon monoxide (CO), ozone (OZ), sulfur dioxide (SOX) and nitrogen dioxide (NOX). Federal and state standards have been established for each of these five pollutants. These standards are based on the health impacts of each pollutant. Federal standards apply to all lands, including Indian reservations. In addition, states may establish their own standards, but state standards do not apply to Indian reservations. California state standards are typically more stringent than the federal standard. In 2006, the Tribal Council adopted air quality standards for PM-10, PM-2.5, Ozone (O_3), and carbon monoxide (CO). These standards largely follow existing California standards. The second aspect of air quality that is often measured is Hazardous Air Pollutants. These refer to pollutants that are unhealthy in any amount.

In 2003, the Tribe initiated monitoring for particulate matter less than 10 microns in aerodynamic diameter (PM-10). Monitoring for particulate matter less than 2.5 microns in aerodynamic diameter (PM-2.5) began in 2004. O_3 monitoring began in 2007. The Bishop Tribe's monitors are continuous FEM, and are all located at the Environmental Management Office-A building, shown in Map 2 above.

B. Air Quality on the Bishop Paiute Reservation

Summary information is shown in Table 1 below. Exceedances of the Tribal and State 24-hour standard for PM-10 (50 µg/m³) have been observed in all years since the inception of monitoring. 2008, 2015, and 2018 have had either 1 or multiple exceedances of the Tribal and state 24-hour standard for PM-2.5 (35 µg/m³). The exceeding PM-2.5 values in these years were all associated with wildfires. 2008 also saw exceedances of the O_3 standards (90ppb for 1 hour and 70ppb for 8 hours); however, these were attributed to stratospheric intrusion associated with frontal passage.

Table 1. Air Quality Monitoring Data Summary Bishop Paiute Reservation 2005-2018

	PM-10 micrograms per cubic meter		**PM-2.5** micrograms per cubic meter		**Ozone** parts per billion	
Year	**24-hour max**	**Hourly max**	**24-hour max**	**Hourly max**	**8-hour max**	**Hourly max**
2005	54.9	553.0	30.9	98.3		
2006	112.9	376.8	29.4	96.5		
2007	70.0	710.5	27.4	157.3	56	67
2008	90.5	1,076.9	39.2	95.1	82	93
2009	120.5	901.6	31.5	86.6	69	72
2010	71.2	939.5	28.2	123.0	64	70
2011	122.05	1,426.40	25.25	175.44	54	60
2012	81	698	30	85	49	53
2013	106	424	26	75	44	48
2014	87	421	37	141	47	61
2015	128	430	85	252	42	47
2016	64	388	32	101	56	62
2017	86	771	27	87	55	63
2018	197	743	138	210	52	75

NOTE: The Bishop Tribe's air quality standards (and state standards) for particulate matter for PM and ozone are:
PM-10 24-hour 50 µg/m³
PM-2.5 24-hour 35 µg/m³
Ozone 1-hour 90ppb 8-hour 70ppb

1. <u>Particulate Matter less than 10 microns</u>

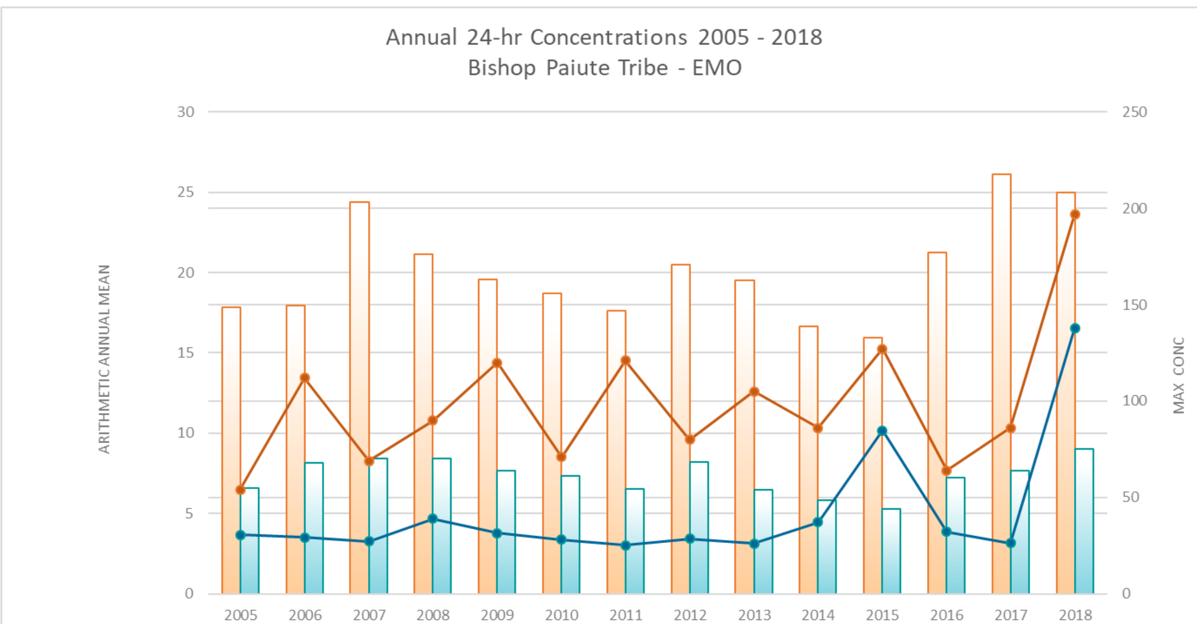
The Bishop Paiute Reservation is located only 60 miles north of the largest source of PM-10 in the nation, the Owens Dry Lake. Historically PM-10 has been the primary pollutant of concern for the surrounding Great Basin Unified Air Pollution Control District. Studies by the Tribe's Air Program have shown the impact of the dry lake on reservation air quality. ("Where does the dust come from?" This study can be found on the Air Program website http://www.bishoptribeemo.com/index_air.htm under "library.") Other sources include dirt roads and barren lands on an off the Reservation.

2. <u>Particulate Matter less than 2.5 microns</u>

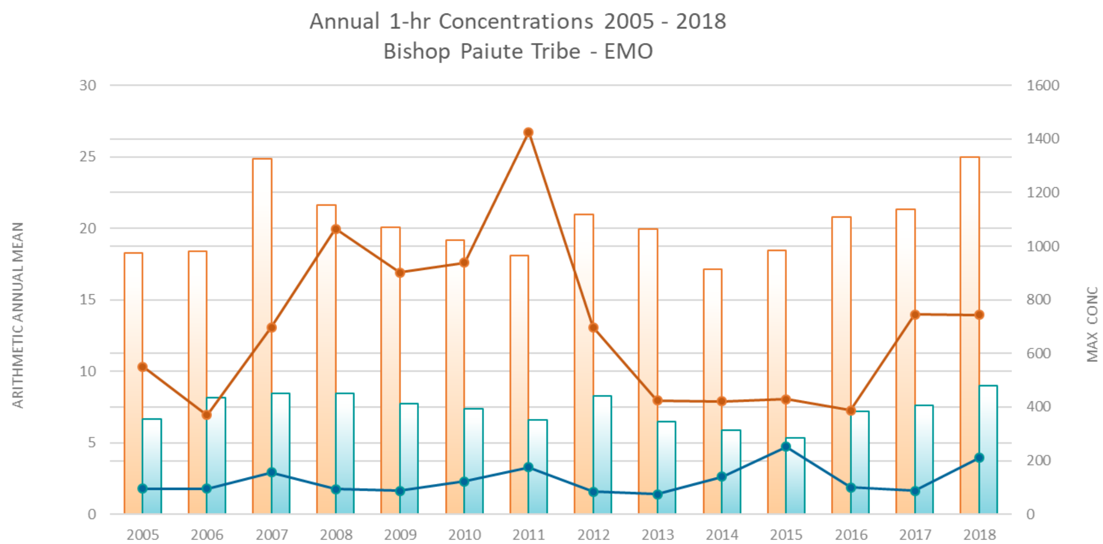
In the winter, wood burning for home heating is the primary source of particulate matter less than 2.5 microns. In the summer, off-reservation wild fires are the primary source. 24-hour average PM-2.5 concentrations are generally low during the observation period, although in every year hourly values have reached or exceeded 75 µg/m³. The seasonal patterns reflect the two sources mentioned above.

As the graph below shows, high PM-10 concentrations have been observed in all years, with at least one exceedance of the Tribal 24-hour standard in every year. Hourly maxima have exceeded 400 µg/m³ in all years except 2006 and 2016. The highest 24-hour concentrations recorded are associated with wind and/or dust storms, usually with frontal passage, and can be observed outside of the summer months, notably November and February.

Figure 1. Particulate Matter - Bishop Paiute Reservation 2005-2018

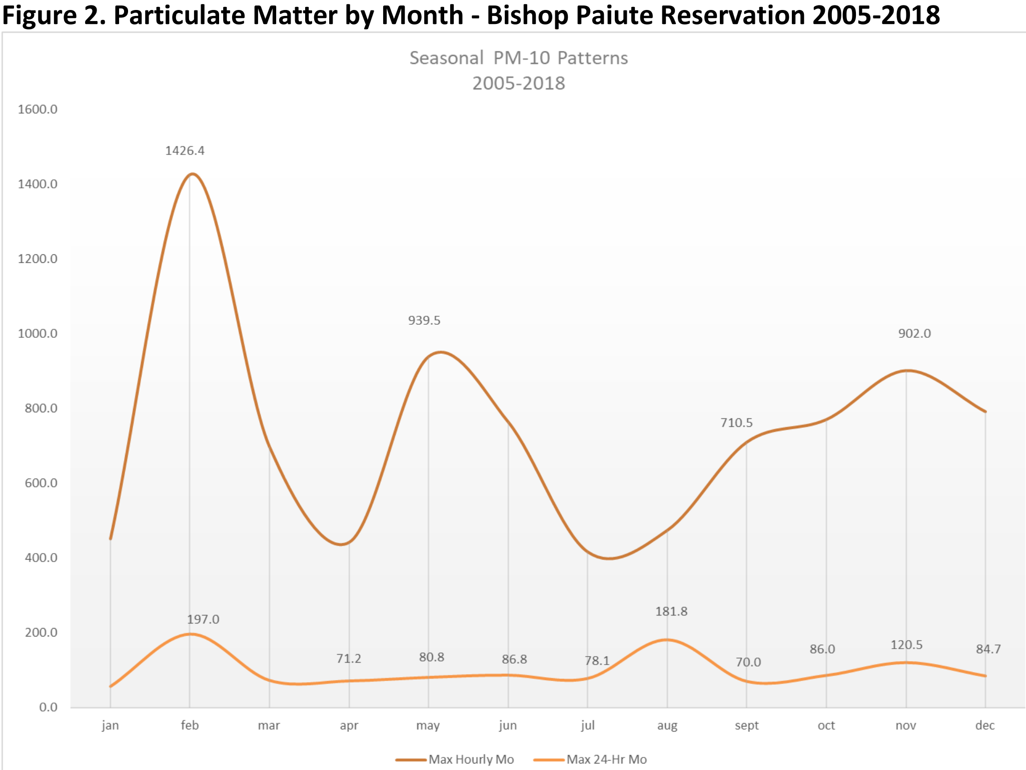


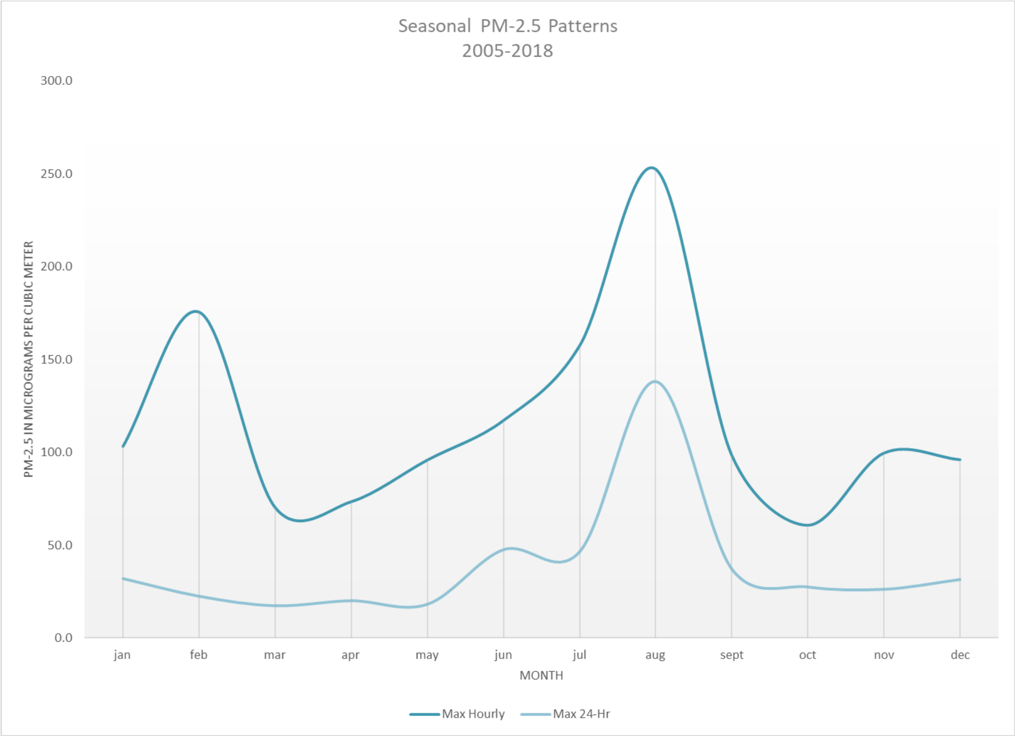
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
PM10 24 hr mean	18	18	24	21	20	19	18	20	19	17	16	21	26	25
PM2.5 24 hr mean	7	8	8	8	8	7	7	8	6	6	5	7	8	9
PM10 24 hr max conc	54	112	69	90	120	71	121	80	105	86	127	64	86	197
PM2.5 24 hr max conc	31	29	27	39	32	28	25	29	26	37	85	32	26	138



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
PM10 1 hr mean	18	18	25	22	20	19	18	21	20	17	18	21	21	25
PM2.5 1 hr mean	7	8	8	8	8	7	7	8	6	6	5	7	8	9
PM10 1 hr max conc	550	370	698	1064	902	939	1426	698	424	421	429	388	745	743
PM2.5 1 hr max conc	96	96	156	94	87	123	175	85	75	141	252	100	87	210

Figure 2. Particulate Matter by Month - Bishop Paiute Reservation 2005-2018

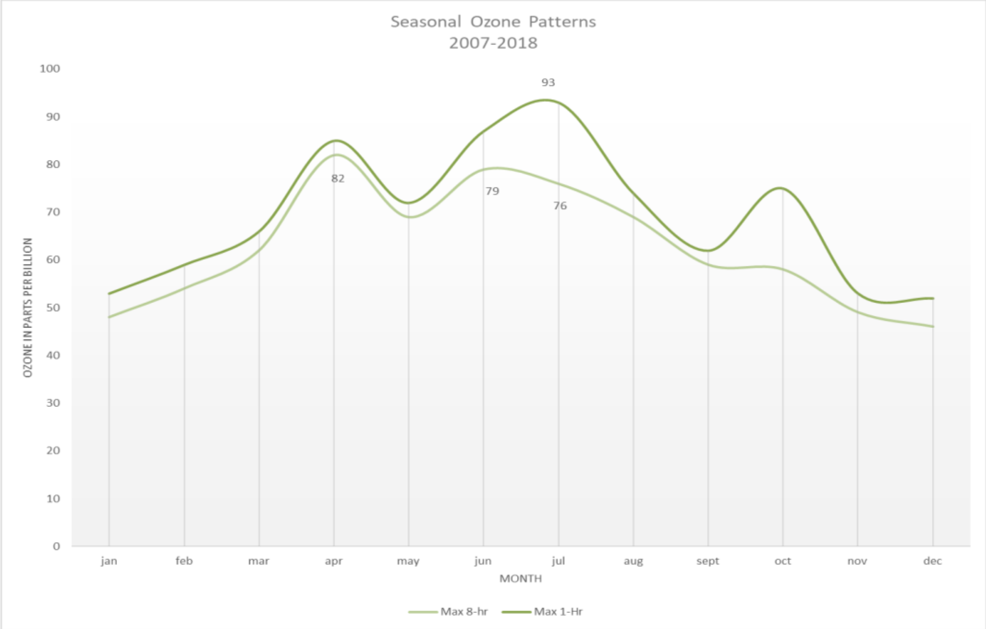




3. <u>Ozone</u>

Ozone levels have exceeded standards only in one year since the start of Tribal monitoring. The exceedances, which occurred in 2008, were attributed to stratospheric intrusion during a spring frontal passage in April ("Whose ozone is this?") and wildfires in June and July ("High ozone episodes June and July 2008?" These studies can be found on the Air Program website http://www.bishoptribeemo.com/index_air.htm under "library."). The seasonal pattern reflects the usual one of high concentrations in the summer months. The aberrations all occurred in 2008.

Figure 3. Ozone by Month - Bishop Paiute Reservation 2007-2018

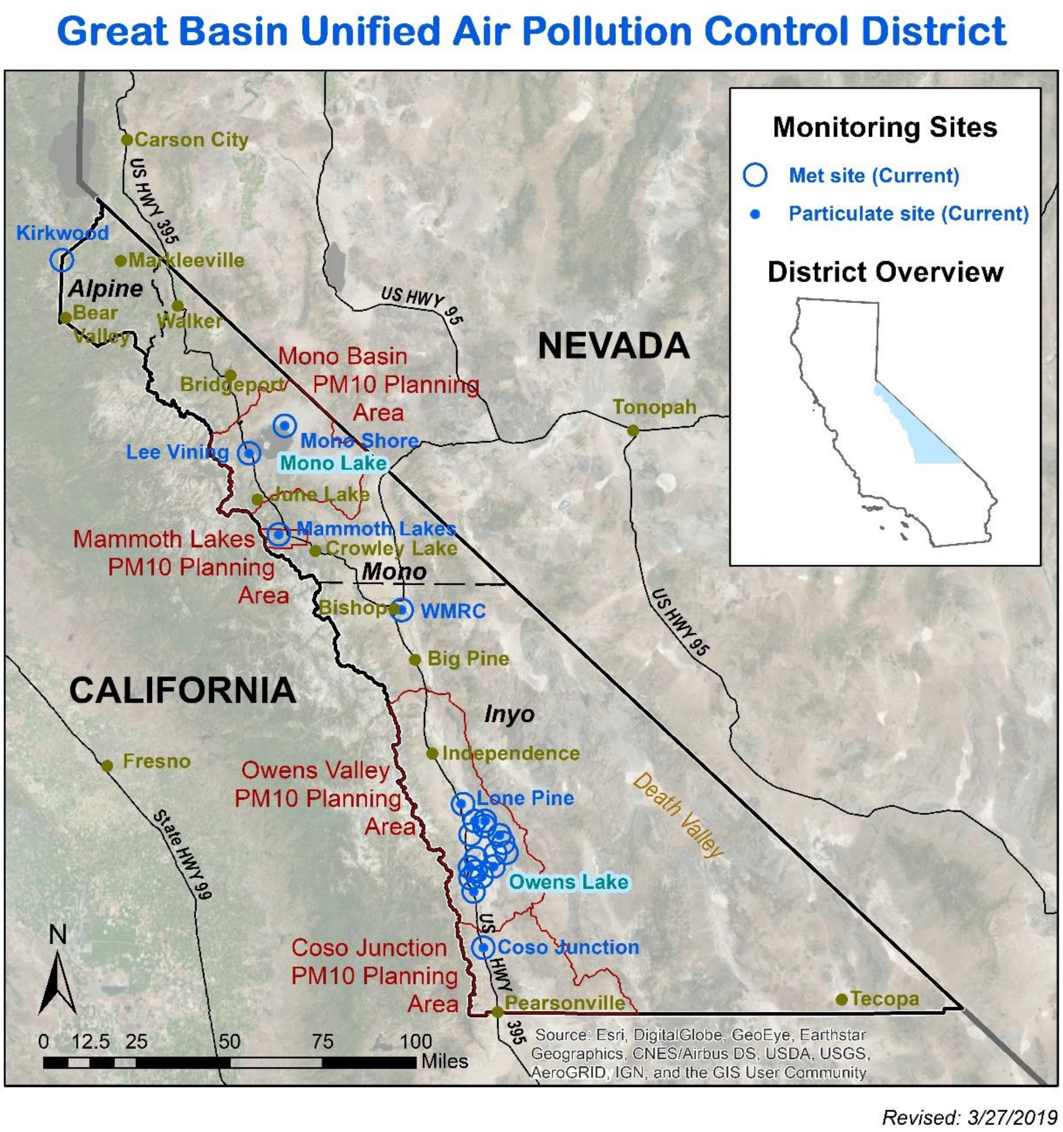


C. Regional Air Quality

1. Monitoring

Additional monitoring is carried out by the Great Basin Unified Air Pollution Control District (GBUAPCD) which includes all of Inyo, Mono and Alpine Counties and by the state of California. The principal pollutant of concern for GBUAPCD is PM-10, although monitoring for PM-2.5 is also ongoing. A map of the District and their (currently 14) air quality monitoring sites is shown below.

Map 3. Great Basin Unified Air Pollution Control District Monitoring



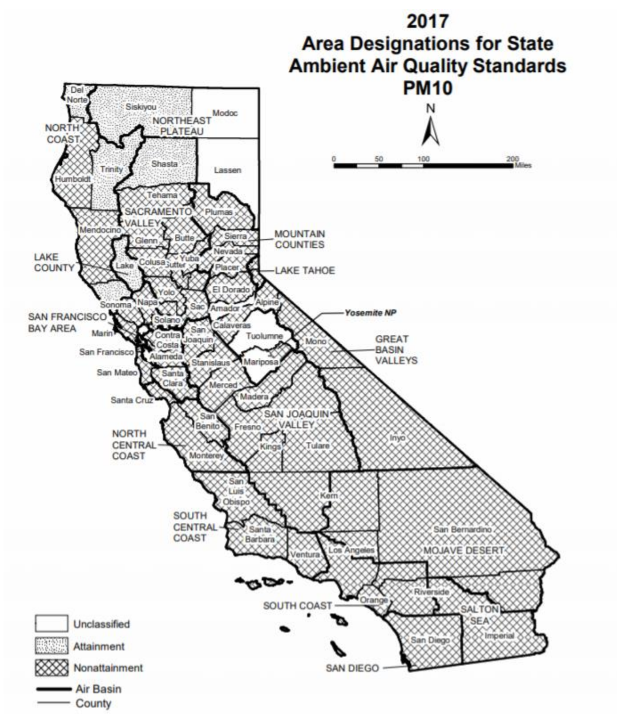
Map Source: Great Basin Unified Air District, Jul 2019.

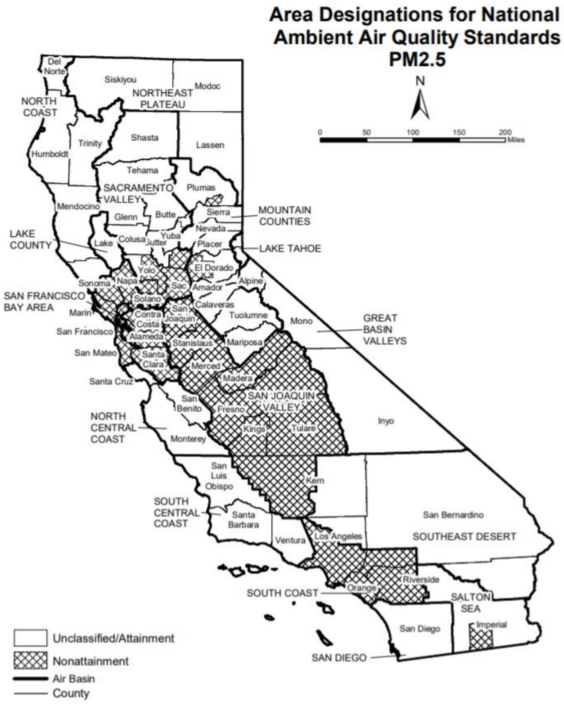
2. <u>California Area Designations</u>

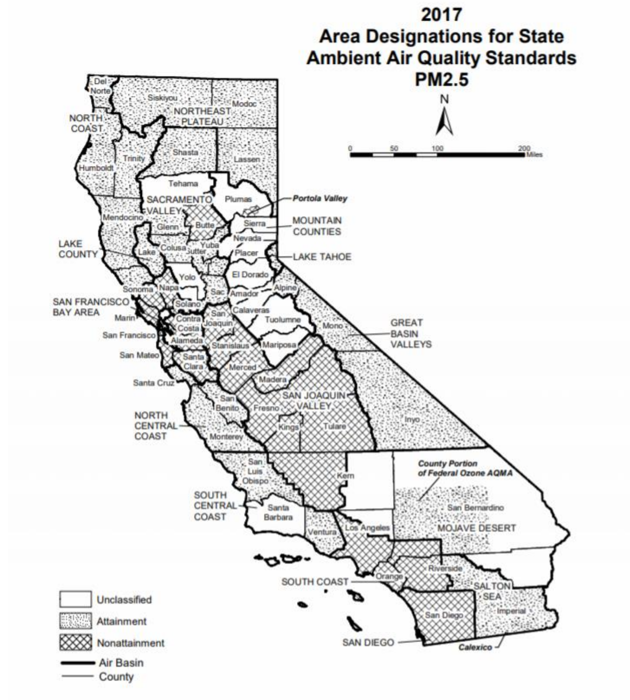
The potential impact of regional air quality is illustrated by the most recent Area Designation maps for the state of California. Currently for some pollutants, designations differ in terms of attainment of the State standards v. national standards. National standards (within California) are less stringent than state standards and therefore may be more likely to indicate the impact of transport. Map 4 shows both current State designation and national designation maps (from The US EPA “Green Book”) for California or the Inyo County area. Results only for the three pollutants of primary interest: PM-10, PM-2.5 and ozone.

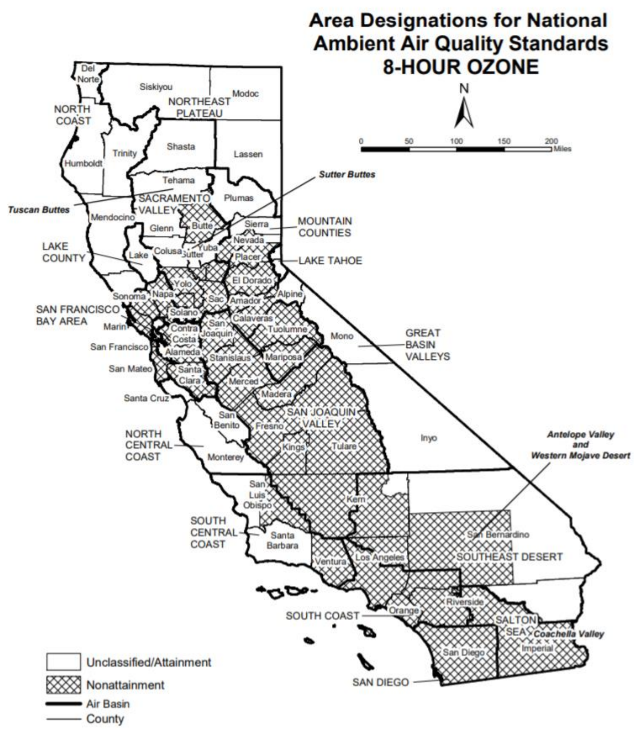
The North-South corridor through the Owens Valley is probably the most important channel for transport of PM-10 and the two PM-10 national non-attainment areas to the North and South of Bishop are clearly apparent. PM-2.5 can be transported longer distances and trans-Sierra transport from the San Joaquin Valley to the West is possible, particularly during wild fires. Ozone transport is most likely from the West.

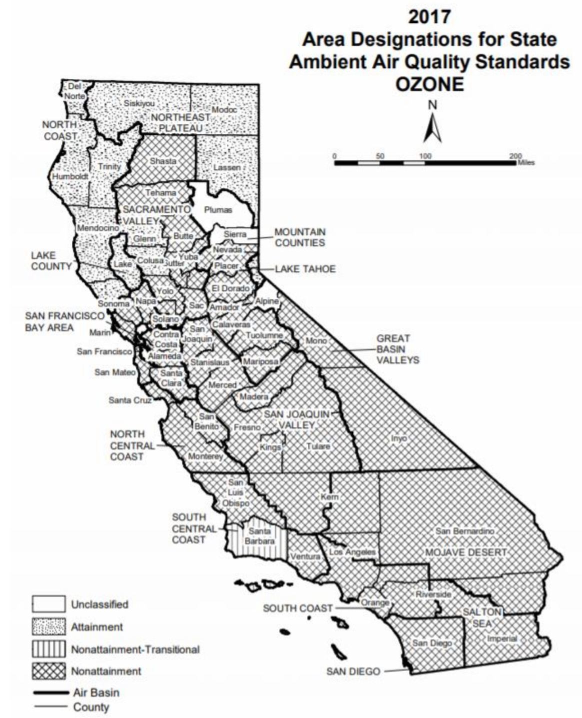
Map 4. Californian National (*updated Oct 2018*) v. State Standard (*updated Nov 2017*) Area Designations for PM-10, PM-2.5 and Ozone.











Maps Source: California Air Resources Board, Jul 2019. https://ww3.arb.ca.gov/desig/adm/adm.htm

3. Inyo County Emissions

The Bishop Paiute Reservation is located in Inyo County where only 2 percent of the land is privately owned, the remainder being held by the National Forest, Bureau of Land Management or Los Angeles Department of Water and Power. Consequently, there is very little industrial development. This is demonstrated by the county emission inventory in Table 2 below. Emissions categories reflect partial NEI 2014 pollutant categories (acrolein, ammonia, chromium VI compounds, formaldehyde, lead, and theylene oxide are omitted). NEI sector 1 categories are reflected in the table.

Table 2. Inyo County 2012 Estimated Emissions (tons/year)

Major Source Type	Sector 1 Category/s	CO	NOX	SOX	PM-10	PM-2.5	Black Carbon	Benzene	VOCs
STATIONARY	Fuel Combustion - Non-res.	29.77	141.65	161.78	165.65	104.20	9.98	0.07	5.32
	Fuel Combustion - Residential	115.28	16.9	2.10	18.68	17.99	1.04	0.51	15.86
	Dust	-	-	-	4,642.75	470.58	0.616	-	-
	Agriculture	-	-	-	154.19	31.47	1.54	-	115.19
	Solvent	-	-	-	-	-	-	0.08	457.85
	Industrial Processes	0.90	14.37	17.54	245.31	91.16	1.47	0.04	64.73
	Miscellaneous*	98.52	5.05	0.91	28.08	24.90	2.01	0.98	24.04
	Subtotal Stationary	**244.49**	**177.98**	**182.34**	**5,245.68**	**740.30**	**16.65**	**1.70**	
FIRE SOURCES	Prescribed Fires	36.34	1.01	0.43	4.16	3.52	0.35	.10	8.72
	Wildfires	91.39	1.84	0.86	9.82	8.33	0.79	.20	21.72
	Subtotal Fire Sources	**127.73**	**2.85**	**1.30**	**13.99**	**11.85**	**1.17**	**0.30**	**30.44**
MOBILE	On-road Vehicles	2,361.70	614.53	3.10	39.73	20.12	5.10	8.0	327.05
	Non-road**	803.48	52.26	2.37	9.75	8.11	4.45	3.71	326.21
	Subtotal Mobile	**3,165.19**	**688.79**	**5.47**	**49.50**	**28.23**	**9.55**	**11.71**	**653.26**
BIOGENICS	**Subtotal Biogenics**	**34,361.0**	**606.20**	-	-	-	-	-	**156,395**
TOTAL	**All Sources**	**37,898.42**	**1,475.83**	**189.11**	**5,318.16**	**780.39**	**27.39**	**13.71**	**157,761**

NOTES: *Miscelleaneous includes bulk fuel stations and waste disposal
**Non-road includes aircrafts

DEFINITIONS: VOCs: Volatile Organic Compounds; CO: carbon monoxide; NOX: nitrogen oxides; SOX: sulfur oxides; PM: particulate matter; PM-10: particulate matter less than 10 microns in diameter.

SOURCE: California Air Resources Board, Jul 2019. https://ww3.arb.ca.gov/ei/maps/2017statemap/cntymap.htm

4. Permitted Sources near the Bishop Reservation

As of the most recent database year (2017), there were only 3 active threshold permitted sources near the Bishop Reservation, all are relatively small. The largest source is the Granite Construction aggregate facility, located approximately 4 miles North of the Reservation.

Table 3. Permitted Sources Near the Bishop Reservation 2017 (tons/year)

Facility Name	TOG	ROG	CO	NOX	SOX	PM	PM-10
7/11 MATERIALS, INC	0	0	0	0	0	1.4	0.6
7/11 MATERIALS COYOTE VALLEY	0	0	0	0	0	7.8	0.8
GRANITE CONSTRUCTION 5 BRIDGES	0.8	0.6	2.3	0.5	0.1	1	0.7

SOURCE: California Air Resources Board, Jul 2019. https://www.arb.ca.gov/app/emsinv/facinfo/facinfo.php

III. SOURCE AND EMISSION INVENTORY FOR THE BISHOP PAIUTE RESERVATION

A. Inventory of Sources within the Bishop Tribe's Jurisdiction and Prioritization for Future Regulation

The following sources have been identified within the Bishop Paiute Reservation. They are listed from highest to lowest priority, which has remained consistent since the 2012 revised EI. The emissions from these sources have been estimated below.

1. Emissions from residential trash burning
2. Smoke from residential wood burning for home heating

3. Fugitive dust from dirt roads
4. Fugitive dust form wind erosion of open spaces
5. Emissions from open burning of vegetative waste
6. Fugitive dust from paved roads
7. Vehicle emissions
8. Gaseous emissions – non-mobile sources

Among the sources of air pollution on the reservation, residential trash burning has been identified as the highest priority source for reducing on-reservation emissions. Trash burning is also a source of dioxins, a toxic air contaminant and has is regulated by the California Air Resources Board. Residential wood burning for home heating is the next highest priority source for reducing on-reservation emissions.

The emission calculations focus on PM-10 and PM-2.5 because these are the primary pollutants of interest on the Reservation. A summary of PM-10 emissions from on-reservation sources is given in Table 4a below. Table 4b gives PM-2.5 emissions. The largest source of PM-10 is from fugitive dust from dirt roads, which is estimated to have decreased since 2012 from 13,740 kg/year. Residential wood burning for home heating, for which revised estimates were not made for this report (discussed in section 3) is estimated to be closely next. Wood burning for home heating is by far the largest source of PM-2.5. Burning of vegetative waste is not a current target for pollution prevention because of the large quantity of hazardous fuels on the Reservation.

A small number of boilers now operate on the Reservation, and may generate some NOx, CO, and PM. The BPT Air Program has historically only monitored for ozone and particulate matter and these amounts are not determinable other than via the discussion herein.

Table 4a. PM-10 From On-Reservation Sources

SOURCE	**PM-10** (Kg/year)	**PM-10** (tons/year)
Residential Trash Burning	780	.86
Backyard (Vegetation) Burning	472	.52
Smoke from Residential Wood Burning for Home Heating	12,345	13.61
Open Area Wind Erosion – barren parcels	452	.50
Open Area Wind Erosion – sparse vegetation	590	.650
Fugitive Dust from Dirt Roads	12,532	13.81
Entrained Paved Road Dust	141.7	0.156
Other Vehicle PM-10 including Service Station	6.1	0.007

Table 4b. PM-2.5 From On-Reservation Sources

SOURCE	**PM-2.5** (Kg/year)	**PM-2.5** (tons/year)
Residential Trash Burning	714	.77
Backyard (Vegetation) Burning	364	.40
Smoke from Residential Wood Burning for Home Heating	12,345	13.61
Open Area Wind Erosion – barren parcels	68	.075
Open Area Wind Erosion – sparse vegetation	88	0.10
Fugitive Dust from Dirt Roads	1,247	1.37
Entrained Paved Road Dust	44.16	0.049
Other Vehicle PM-2.5 including Service Station	3.91	0.004

B. Emissions Inventory

This emissions inventory has been calculated from a variety of sources. All calculations are in grams or kilograms, with the exception of tons per year where sourced from PTE calculations. Summary measures for PM-10 and PM-2.5 in the preceding tables are presented in both kilograms/year and tons/year. Unless stated, emissions factors are based on current EPA AP-42 guidance.

1. Residential Trash and Vegetative Waste Burning: PM-10 and PM-2.5

Trash incineration on the reservation is important because it is a source of dioxins and other toxic air pollutants, as well as PM-10 and PM-2.5. Trash incineration is also a potential nuisance due to the unpleasant odors that may be emitted. The US Environmental Protection Agency and the California Air Resources Board have identified dioxins as an important air toxic due to its potential carcinogenicity and wide-ranging impacts on a variety of biological processes. The California Air Resources Board has adopted a rule banning all backyard trash incineration, indicating the importance of this problem. However, this rule does not apply to the Bishop Reservation, although permits for open burning specify that only cardboard and non-glossy paper is to be burned in trash barrels. Despite these regulations, some residents continue to burn trash.

a. *Data*

In 2009, the Tribe conducted a general survey. The goal was to personally interview all households on the Reservation to get results as close to a census as possible for use in planning and funding applications. A total of 525 households were surveyed, representing 1,232 Reservation residents. Households were asked about back yard trash incineration, open burning of vegetative waste and wood burning for home heating.

b. Methods

In the 2009 survey, residents could indicate that they burned household trash, paper/cardboard, and/or yard waste. Multiple responses were allowed. 87 households (17%) reported burning trash/paper/cardboard, down from the 2002 inventory when 23% of the households reported burning trash. For the 2009 survey, 38 households reported burning trash, 49 households reported burning paper/cardboard, and 197 households reported burning yard waste. Analysis of burn permit records maintained by the Air Program in 2019 revealed 193 addresses with at least 1 permit for yard waste or paper/cardboard burns during the 2016-2018 period. As some addresses support more than 1 household or permit-holder, and not every address is permitted every year, the 2009 estimate for yard waste is still deemed a viable estimate. Estimates for trash and paper/cardboard burning were not revised in 2019, as the survey was not repeated.

Since the survey did not include information on the quantity burned, an average per household amount was used. The current EPA factsheet on municipal solid waste (MSW) states that each person in the US generates 4.48 lbs, or 2.03 kg, of MSW per day (*https://www.epa.gov/sites/production/files/2018-07/documents/2015_smm_msw_factsheet_07242018_fnl_508_002.pdf* 2015). Previous revisions indicated that approximately 60% of this is residential waste (with the remainder accounting for per capita commercial waste). Furthermore, the 2018 EPA factsheet states that 13.3% of MSW is yard waste, 25.9% of MSW is paper (assumed to include cardboard). Of the remainder, 13.5% was non-combustible glass and metal, leaving 47.3% of the residential MSW classified as combustible household waste other than paper/cardboard and yard waste.

The 2009 general survey results averaged 2.3 residents per household, based on a high number of respondents reporting 1-person households. In the prior EI report, an average of 2 people per household was assumed for purpose of these emissions calculations. In 2016, the Air Program interviewed the Tribe's Community Development (Housing) Director to complete the NTAA's 2016 Indoor Air Quality Needs Assessment, in which an estimate of 6 people per household was made. In 2019, the Air Quality

Specialist investigated the average and total of 1-person households with some other Tribal departments' staff, and a new estimate of 3 people was made. It is then calculated that:

(4.48 lbs/day x 3 people/household x 365 days/year / 2.2 lbs/kg) x .60 = 1337.89 kg/year of combined burnable material were available for burning at each residence. Thus, the total mass burned per category is calculated as:

annual mass burned = 1337.9 kg x percent of MSW x residences

For "Vegetative Waste", this amounts to an estimated mass of 35,054 kg. Alternately, the annual mass can be calculated based on data from the 2009 general survey regarding the frequency that residents burned 4' x 4' (permitted size) burn piles. Based on the survey data, 805 piles were burned annually. Assuming a total volume of each pile of 15 $ft^3$and an average density of common vegetation (leaves and brush) of 33 lbs/ft^3, and assuming that 75% of the pile is empty space, the expected annual mass burned can be calculated as:

mass of 4' x 4' yard waste pile = 805 piles x 15 ft^3x 33 lb/ft^3 x 0.25
= 99,618 lbs or 45,281 kg

This mass is notably higher than that calculated as a percentage of the average MSW, which seems consistent with the more rural environment and relatively large estimated range of household size on the Reservation relative to the average American household, and is therefore used in the emissions calculations below.

c. Emissions

No specific emissions factor was available for paper/cardboard, but the PM-10 emission factor is assumed to be similar to that for trash. For yard waste, it is assumed that the mass burned was split between leaf and brush, since they have different emissions factors. The remaining emission factors are given in Table 5.

Table 5. PM Emissions for Residential Trash and Vegetative Waste Burning

MSW component	Annual mass (kg)	PM-10 Emission factor	PM-10 Emissions (kg)	PM-2.5 Emission Factor	PM-2.5 Emissions (kg)
Trash	24,047.3	19 g/kg	456.9	17.4 g/kg	418.4
Paper/Cardboard	16,979.2	19 g/kg	322.6	17.4 g/kg	295.4
Total Residential Trash Burning			**779.5**		**713.9**
Leaf Burning	22,640.5	11 g/kg	249	8.48 g/kg	192
Brush Burning	22,640.5	9.865 g/kg	223	7.605 g/kg	172
Total Yard Waste Burning			**472**		**364**

NOTE: Emissions factors (from EPA, 1992, AP-42 Chapter 2, Section 5 or from the 2008 NEI website if update factors are available)

2. Residential Trash Burning: Air Toxics

Emissions factors for toxics from residential trash burning from the Tribe's 2002 Emissions Inventory are retained through updated revisions to this report, as the original emissions factors were from California Air Resource Board's 2002 Initial Statement of Reasons for the Proposed Airborne Toxic Control Measure to Reduce Emissions of Toxic Air Contaminants from Outdoor Residential Waste Burning, and the ATCM has not been updated since 2003. Emissions factors are applied to the "trash" (both combustible and non-combustible) portion of the MSW (24,047.3 kg/yr). Emissions are therefore calculated as:

24,047.3 kg / year x emissions factor (mg / kg burned)

The results are shown in Table 6 below. Due to the small numbers involved, emissions are shown in grams.

Table 6. Toxic Emissions from Residential Trash Burning

Pollutant	**Average Emission Factor** (mg/kg burned)	**Total Emissions** (g)
Dioxins (EPA Series 1, 1997 Testing)	0.16	4.95
Dioxins (EPA Series 2, 2000 Testing)	0.005	0.15
1,3-Butadiene	141.2	4,364.58
Benzene	979.7	30,283.15
PAHs4	45.0	1,390.98
PCBs	0.13	4.02

3. Emissions from Residential Home Heating: PM-10 and PM-2.5

a. *Data*

Information on residential home heating is taken from the 2009 general household survey described earlier. Based on that survey, 330 households used standard wood stoves or fireplace inserts, 13 used an EPA rated stove with a catalytic converter, and 51 used pellet stoves. The survey also showed that standard wood stoves and fireplace inserts used 967.5 cords of wood, the EPA fireplaces used 43 cords of wood, and the pellet stoves burnt 72,160 kilograms of pellets. This data source is carried through to the current EI revision, as the survey has not been repeated.

b. *Methods*

Calculations for emissions from wood burning for home heating are based on factors from EPA AP-42, Chapter 1, Section 10. The methodology is also carried through

The majority of wood burned is pinon or jeff pine, and the mass assumptions are taken from emission inventory for the nearby Town of Mammoth Lakes 1990 Air Quality Management Plan.

mass = # cords x 800 kg/cord

PM-10 emission factors

10.2 g/kg wood stoves with catalytic converter
15.3 g/kg conventional wood stoves
2.1 g/kg pellet stoves

Emissions are calculated as mass (kg) x emission factor (g/kg)

Though not specifically stated in AP-42, a search of the EPA website for the 2012 revised EI produced recommendations made at a 2001 Emission Inventory Improvement Plant (EIIP) Ch. 2, Residential Wood Combustion states that PM-10 emissions can be used as surrogate to PM-2.5 emissions. This assumption was used in the emission calculations below:

c. *Emissions*

As can be seen in Table 7 below, the majority of particulate emissions from home heating are contributed by standard wood stoves. This is not surprising since 63% of reservation residents report using a standard wood stove, with each household burning nearly 3 cords per year.

Table 7. Emissions from Home Heating

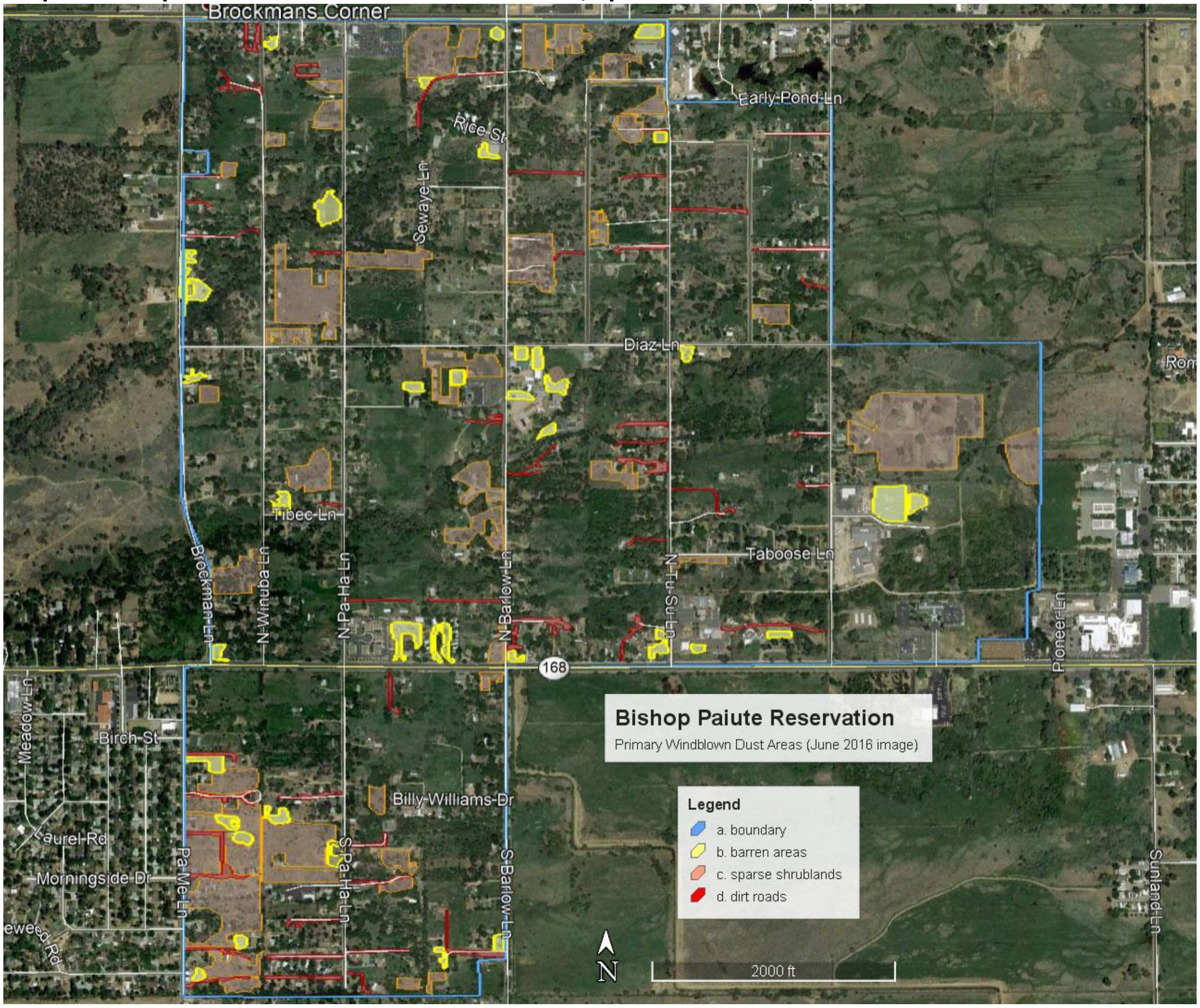
Type of stove	**Annual mass** (kg)	**PM-10 Emission factor**	**PM-10 Emissions** (kg)	**PM-2.5 Emissions** (kg)
Standard wood stove	774,000	15.3 g/kg	11,842	11,842
Wood stove with catalytic converter	34,400	10.2 g/kg	351	351
Pellet stove	72,160	2.1 g/kg	152	152
Total	**880,560**		**12,345**	**12,345**

NOTE: Mass is calculated assuming 800kg/cord
PM-2.5 emission factors are assumed to be the same as PM-10 factors

4. Particulate Emissions from Wind Erosion of Open Areas
   a. *Data*

Using June of 2016 satellite imagery (Google Earth), EMO staff conducted of land use on the Reservation. The results of this survey showed that 80.48 acres within the reservation can be classified as “sparse vegetation” and 14.07 acres can be classified as “barren space”. Both have the potential of producing particulate emissions due to wind erosion. These areas along with dirt roads are shown in Map 5. below.

Map 5. Bishop Paiute Reservation - Barren Areas, Sparse Shrublands, and Roads



b. Methods

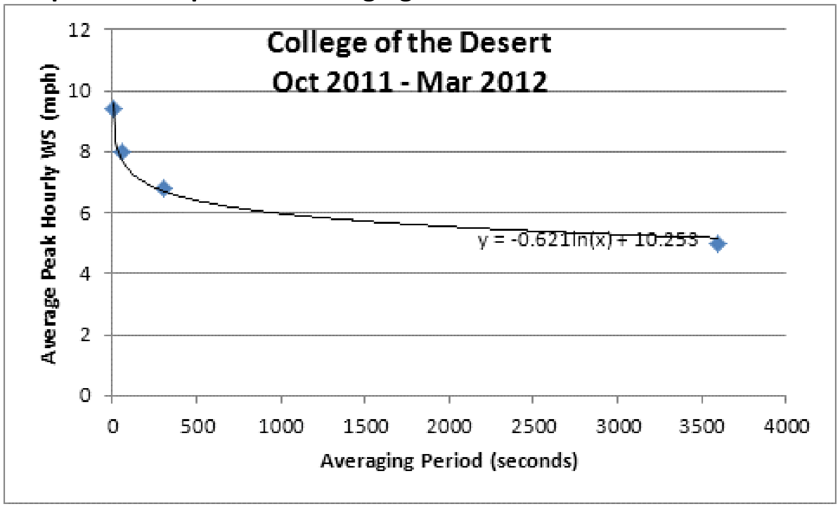
AP-42 does not deal directly the providing emission factors for these specific sources, though they do deal with particulate emissions off of industry-related material storage piles. The Western Regional Air Partnership's (WRAP) Fugitive Dust Handbook (2006) presents a much more detailed discussion of wind erosion emissions off of open desert areas, using the AP-42 Chapter 13, Section 2.5 as a basis. As part of the Handbook, they provide an emissions calculator in the form of an Excel spreadsheet, which was used for the following emissions calculations.

An important first step in the emission calculations was to obtain an appropriate source of wind data. Peak 2-second gust and hourly average wind speed data are readily available from the Reservation's 10-m tower. However, neither of these metrics seemed appropriate, as the hourly average data provides no real information about high speed gusts that will lift the dust, while gust data fails account for the sustained winds that are needed to keep the dust aloft. AP-42 and the WRAP Handbook both discuss this issue, and instead recommend using a metric known as "the fastest mile" wind speed. The guidance goes on to state that a peak 2-minute average wind speed does a good job of approximating the fastest mile, since the wind speeds that are of interest are typically in the 30 mph range, which if sustained over a 2-minute period would travel about a mile.

Five-minute average data were also available from the Reservation met tower, but a review of these data showed them to be closer to the hourly average wind speed, and possibly significantly different from the fastest mile wind speed. To investigate this, data from two desert sites operated by the SCAQMD were analyzed – the White Water Wash site and College of the Desert site, both of which have gusty winds and PM episodes. In particular, the College of the Desert site, located north of the Salton Sea near Mecca, has very similar terrain and similar average and gust wind data as that from the Reservation. Both sites collect hourly average, peak 3-second gust, peak 1-minute sustained, and peak 5-minute average wind data for at least half a year.

Plotting the six-month average for each of these metrics produced a highly-correlated logarithmic equation. A plot of peak wind speed against the reporting period in seconds is shown in Figure 4 below. Using this relationship, the corresponding peak wind speed for a 2-minute (120-second) period was calculated. The results for both the White Water Wash and College of the Desert sites were essentially identical, with the peak 2-minute average located almost exactly midway between the hourly average and the peak 3-second gust (i.e. the average of the hourly average and the peak 3-second gust). This relationship (assuming that 2-second and 3-second gust data were similar) was then used to estimate the peak 2-minute average from the Reservation data as a surrogate for the fastest mile.

Figure 4. Relationship of Wind Speed to Averaging Period



Reservation wind and precipitation data were then reviewed for the three-year period from 2016 through 2018 to determine days when peak winds were greater than a given threshold velocity. Threshold velocities of 32.8 and 28.5 are stated in the Fugitive Dust Handbook for “shrubland” and “barren” land uses, respectively. In reviewing the data, the PM-10 data were also checked to provide verification that winds of this magnitude were indeed associated with elevated PM-10 readings. For these data years, at total of 16 dry days were identified when the calculated peak 2-minute average wind speed was greater than 28.5 mph, with peak 2-minute average wind speeds ranging from 28.6 to 39.7 mph. Of these days, 6 days had wind speeds greater than 32.8 mph. These statistics are an overall decrease from peak winds and dry days identified in the 2012 Emissions Inventory.

For each applicable day, the Erosion Potential for each type of area (P_t) was calculated using the following equation, taken from AP-42 Section 13.2.5.3:

$$P_t = 58\,(u^* - u^*_t)^2 + 25\,(u^* - u^*_t)$$

where:

P_t = erosion potential of the surface (g/m^2)
u^* = friction velocity based on the peak 2-minute average wind speed at 10 meters (m/s)
u^*_t = threshold friction velocity based on 12.74 m/s (28.5 mph) for barren areas and 14.66 m/s (32.8 mph) for sparsely vegetated areas

Note that friction velocities are calculated as 0.053 times the 10-meter wind speed, per AP-42 and the Fugitive Dust Handbook.

Both AP-42 and the Fugitive Dust Handbook discuss the importance of disturbance of the ground in order to provide an available source for wind-borne dust events. This loose layer is frequently depleted in a relatively short time, requiring re-disturbance before another event occurs. For barren areas, all twenty-two days were used in the calculations, since these areas were virtually all either corrals, overgrazed land, or parking and maintenance yards, where it is assumed that the area is being disturbed on an ongoing, likely daily basis. Additionally, all days were used for sparsely vegetated areas, as there were adequate periods of time between the wind event days.

The erosion potential for all days and for the 3 years was summed, Sum(P), then divided by 3 to obtain an annual average. The PM-10 emission factor, in g/m^2, was then calculated as E = 0.5 x Sum (P). This factor was then applied to the total surface area. For PM-2.5, the emissions factor is calculated as 15% of the PM-10 emissions factor, as per the Dust Handbook calculator.

c. Emissions

Tables 8a and 8b summarize the emission results for PM-10 and PM-2.5, respectively. Although the emission rates are higher for the barren spaces, the large number of sparsely vegetated acres means that they are a significant contributor to PM-10 emissions.

TABLE 8a. PM-10 EMISSIONS FROM WIND EROSION OF OPEN AREAS

Land Use	**Emission factor** (g/m^2)	**Acreage**	**Area** (m^2)	**Annual emissions** (kg)
Barren space	7.94	14.07	56,950	452
Sparse vegetation	1.81	80.48	325,692	590
Total				**1,042**

TABLE 8b. PM-2.5 EMISSIONS FROM WIND EROSION OF OPEN AREAS

Land Use	**Emission factor** (g/m^2)	**Acreage**	**Area** (m^2)	**Annual emissions** (kg)
Barren space	1.19	14.07	56,950	68
Sparse vegetation	0.27	80.48	325,692	88
Total				**156**

5. Particulate Emissions from Dirt Roads

a. *Data*

Using the same 2016 satellite images, EMO staff also identified dirt roads on the Reservation. Dirt roads were defined as roads over 150 feet long and serving more than one household. Inclusion of some dirt road segments which were shown as being surrounded by barren areas, into the updated barren areas polygon set, may result in some variation of total emissions, as these segments are then excluded from vehicle travel calculations, though they contribute to the size of areas subject to windblown dust calculations. Using this method, 4.34 miles of unpaved road were identified. The roads are comprised of 53 segments, ranging in length from 0.02 miles to 0.16 miles in length, servicing 166 residences. The

2009 survey also identified the number of residences were on each segment of dirt road. Residences served were updated for any new or removed road segments as of 2016 as defined above.

b. *Methods*

As discussed above, this study uses an average household size of 3 residents for the Reservation; however, for the methodology, 2 drivers per household are assumed. Assuming 2 roundtrips per day per resident, consistent with the methodology from the prior report revision, this equates to 4 round trips per household per day. Vehicle miles traveled (VMT) were calculated for each individual segment as:

Daily VMT = (4 trips) x (2 x segment length (miles)) x (number of residences on segment)

This amounted to 119.5 VMT daily or 43,601 VMT annually on the dirt roads.

Using equations presented in EPA AP-42 Chapter 13, Section 2.2 (2006) an emission factor for PM-10 for dirt roads dominated by light duty vehicles can be calculated as follows:

$E = (k (s / 12) (S / 30)^{0.5} / (M / 0.5)^{0.2}) - C$ lbs / VMT

= 0.6778 pounds/vehicle-mile traveled x 0.4536 kg/pound

= 0.3074 kg / vehicle-mile traveled

where

E = PM-10 emissions in pounds per vehicle mile traveled
k = size specific emissions factor (1.8 for PM-10, 0.18 for PM-2.5)
s = silt content of road surface material (5 percent)
S = mean vehicle speed (20 miles per hour)
M = surface moisture content (0.3 percent)
C = emission factor for 1980s vehicle fleet exhaust, break wear and tire wear (0.00047 lbs/VMT for PM-10, 0.00036 for PM-2.5)

The emissions are naturally mitigated by rain. Thus the emissions rate can be modified using the equation:

$E_{ext} = E [(365 - P)/365]$

= 0.3074 kg / vehicle-mile traveled [(365 – 24)/365]

= 0.2872 kg / vehicle-mile traveled

where

E_{ext} = PM-10 emission factor extrapolated for natural mitigation
P = number of days in a year with at least 0.01 inches of precipitation

P was obtained from the Tribal weather station's precipitation data for 2016 – 2018, which showed an annual average of 24 days with rainfall of at least 0.01 inches. P was confirmed also by cross checking station logs for the precipitation gauges operated by the Tribe's Air Program.

s

c. *Emissions*

The resulting particulate emissions from dirt roads are given below.

PM-10 emissions from dirt roads per year

= 119.5 vehicle-miles traveled x 0.2872 kg/mile traveled x 365 days/year

= 12,523 kg/year

PM-2.5 emissions from dirt roads per year

= 119.5 vehicle-miles traveled x 0.0286 kg/mile traveled x 365 days/year

= 1,247 kg/year

6. Entrained Dust from Paved Roads

a. *Data*

The majority of paved roads on the Reservation are maintained by other entities. Highway 395 which borders the Reservation to the north and Highway 168 which intersects the Reservation on the south are both maintained by California Department of Transportation (CalTrans). The remainder is maintained by the Inyo County Department of Public Works. The Inyo County roads include the majority of roads that cross the Reservation. Consequently there are only a total of 1.46 miles of paved roads on the Bishop Reservation that are not already included in the existing Inyo County emissions inventory.

These roads are maintained by the Bureau of Indian Affairs and are identified in the Tribe's 1996 Transportation Plan. The vehicle count is based on the number of residences on each road segment that were identified by EMO staff using the 2009 aerial photos, and changes identified using the 2016 satellite photos. Contrary to the dirt roads, which dirt roads were treated as essentially long driveways where any round trip would result in the resident traveling the entire length of the road twice (coming and going). The Reservation paved roads are a set of N-S roads primarily used by residents to get to either Highway 395 or Highway 168, which lead out of the Reservation. Assuming the residences were evenly distributed along these Reservation roads, half of the residents would be closer to a given highway and half would be farther. Thus, the assumption was that on average only 1/2 of the road length would get traveled when headed to a highway. In addition, a resident might choose to head to the nearest of the two highways, in which case the distance traveled on the Reservation road is by definition less than 1/2 of the length. Thus, for the purpose of calculating the paved road emissions, the distance was cut in half (the equivalent of one round trip per resident) relative to how the dirt roads were treated (two round trips per resident).

b. *Methods*

Using equations presented in EPA "AP-42 Chapter 13, Section 2.1," (2006) an emission factor for PM-10 for paved roads can be calculated as follows:

$$E = (k\,(sL)^{0.91}\,W^{1.02})\ \text{g / VMT}$$
$$= 1.927\ \text{g/VMT}$$

where

- E = PM-10 emissions in grams per vehicle mile traveled
- k = size specific emissions factor (1.00 for PM-10, 0.25 for PM-2.5)
- sL = silt content of road surface material (0.6 g/m^2)
- W = average weight (tons) of the vehicles traveling the road (3 tons)

The emissions are naturally mitigated by rain. Thus the emissions rate can be modified using the equation

$$E_{ext} = E\,[1 - P/4N]$$
$$= 1.927\ \text{g / VMT}\ [1 - 24 / (4 \times 365)]$$
$$= 1.895\ \text{g / VMT}$$

where

- E_{ext} = PM-10 emission factor extrapolated for natural mitigation
- P = number of days in a year with at least 0.01 inches of precipitation
- N = number of days in the averaging period (365 for one year)

P was obtained from National Weather Service climate data, which showed an annual average of 24 days with rainfall of at least 0.01 inches, based on data from 2016-2018.

As discussed, there are about 2 drivers per household on the Reservation. Assuming 2 round trips per resident per day, this equates to 4 round trips per household per day. Vehicle miles traveled (VMT) were calculated for each individual segment as:

daily VMT = (4 trips) x (2 x (1/2 segment length (miles)) x (number of residences per segment)

Based on the survey data, this amounted

c. *Emissions*

Entrained dust emissions from paved roads are given in Table 9 below.

Table 9. Emissions Due to Entrained Dust From Paved Roads

Road	Length	Number of Vehicles per Day	Vehicle Miles Traveled (VMT)	Emissions factor (kg/1000VMT)	PM-10 (kg)/day	PM-10 per year (kg)
Tibec	0.10	24	2.4	1.895	0.005	1.7
Taboose	0.25	76	19.0	1.895	0.036	13.1
See Huvah	0.10	4	0.4	1.895	0.001	0.3
Winuba	0.92	192	176.6	1.895	0.335	122.17
Sewaye	0.10	32	3.2	1.895	0.006	2.2
Billy Williams	.16	20	3.2	1.895	.006	2.2
TOTAL	**1.30**		**176.64**		**0.388**	**141.7**

PM-2.5 emissions are 25% of the PM-10 emissions (AP42), or 44.16 kg/year.

7. <u>On-road Motor Vehicle Emissions</u>

a. *Data*

This section uses data from the most recent (2012) California Air Resources Board (CARB) Emissions Inventory, on estimated on-road motor vehicle emissions for Inyo County. These figures are given in tons per day and are used to apportion the CARB mobile source inventory based on the vehicle miles traveled on the Reservation.

b. *Methods*

Values from the CARB inventory published in 2012 for Inyo County are presented in Table 10, and have been converted in to kilograms/year for consistency. The Reservations share of these emissions is calculated using the ratio of Reservation VMT versus Inyo County VMT. Again this is based on the very low VMT that are specific for the five short Reservation roads that are not included in other inventories.

share of Inyo County VMT on the Bishop Reservation

= Reservation VMT/ Inyo County VMT
based on Reservation roads only

= 157.2/ 1,348,793

= 0.0001165

c. *Emissions*

The resulting motor vehicle emissions are shown in Table 10 below.

Table 10. Reservation Share of Motor Vehicle Emissions for the Bishop Paiute Reservation

Region / Roads	CO	NOX	SOX	PM-10	PM-2.5	VOCs
Inyo County (kg / year)	2,142,498.8	557,492.4	2,812.2	36,042.5	18,252.6	296,6945.9
Bishop Paiute Reservation – Tribal Roads Only (kg / year)	249.7	65.0	0.3	4.2	2.1	34.6

NOTES: See also Table 2

8. <u>Emissions from the Service Station</u>

a. *Data*

There is one gas station located on the Bishop Reservation. It is owned and operated by the Tribe. Information on 2017 fuel purchases by the station was obtained from the Tribe's fiscal records. The tanks are located above ground and have a full vapor recovery system, known as balanced submerged filling. The vehicle refueling operations are controlled using a vapor recovery system.

b. *Methods*

AP-42 Chapter 5, Section 2 (most recent revision – 2008) presents the following volatile organic compounds (VOC) emission source and rates regarding Service Station Operations for gasoline. The emission factors are only for underground tanks. The factor for balanced submerged filling is used in the calculations below.

Table 11. VOC Emission Rates For the Service Station

Emission Source	Emission Rate (lb/1000 gal throughput)
Filling underground tank	
Submerged filling	7.3
Splash filling	11.5
Balanced submerged filling	0.3
Underground tank breathing and emptying	1.0
Vehicle refueling operations	
Displacement losses (uncontrolled)	11.0
Displacement losses (controlled)	1.1
Spillage	0.7

c. *Emissions*

Based on the above, the total emission rate would be 0.3+1.0+1.1+0.7=3.1 lb/10^3 gal throughput. Note that even though the reservation service station utilizes above ground tanks, it is assumed that "underground" in the AP-42 is used as a convenient descriptor for specifying service station storage tanks, and that the above ground tanks would be subjected to the same sources as underground tanks. In 2017, the Reservation service station had a fuel throughput of 2,772,803.81 gallons of gasoline. Thus, annual VOC emissions are as follows:

Table 12. VOC Emissions from the Service Station

Process	Throughput (1000 gallons)	EF (lb/1000 gallons)	Emissions (lb)	Emissions (kg)
Balanced Submerged Filling	2,772.80	0.3	831.84	377.32
Tank Breathing and Emptying	2,772.80	1	2,772.80	1,257.72
Vehicle Refueling Displacement	2,772.80	1.1	3,050.08	1,383.49
Vehicle Refueling Spillage	2,772.80	0.7	1,940.96	880.40
Total		**3.1**	**8,595.68**	**3,898.93**

Additionally for the Service Station, the US EPA R9 CA GDF General Permit PTE Calculator was used to estimate emissions aside from VOCs, and includes emergency powering equipment at the Station and diesel fuel emissions. Based on AP42, this tool is not specific to equipment specifications such as model, year, capacities, etc. and may estimate the highest potential based on like equipment. The calculator generates units of *potential to* emit; however, because the values for VOCs were very close to the above calculations, the values for other pollutants are assumed to be adequate estimates and are included in the summary Tables 4a and 4b. Table 13 below summarizes the results or outputs of the calculator, based on the 80hp LPG genset at the Station, and the 12 fueling positions (8 standard gasoline only and 4 standard gasoline or diesel). Values are displayed in tons/year and rounded to 3 significant figures to reflect the original outputs.

Table 13. Other Emissions from the Service Station (tons/yr)

VOC	CO	NOX	SO2	PM	PM-10	PM-2.5
4.095	0.937	0.686	0.000	0.002	0.002	0.002
4.095	0.937	0.687	0.000	0.002	0.002	0.002

9. <u>Gaseous Non-Mobile Emissions</u>

a. *Data*

The Toiyabe Indian Health Project Clinic on the reservation operates 3 LPG water boilers, 2 1.26 MBtu units and 1 0.63 Btu unit. Technical specs on the units were obtained from the technicians retained by TIHP during a service in October 2019, as arranged via TIHP operations staff.

b. *Methods*

For the purposes of this report, the US EPA R9 TNSR Minor Source General Permit PTE Calculator was used to estimate potential emissions. Based on AP42, this tool is not specific to model years and may estimate the highest potential based on like equipment. Tables 14 and 15 below summarizes the results or outputs of the calculator, which reflect no genset on site. Values are displayed in tons/year and rounded to 3 significant figures to reflect the original outputs.

Table 14. Other Emissions from TIHP Clinic (tons/yr)

	PM10	PM2.5	SO2	NOX	CO	VOC	Combined HAP
Boilers	0.00	0.00	0.0	0.00	0.00	0.00	0.00
Auxiliary Heaters	0.11	0.11	0.00	1.96	1.13	0.15	0.01
Total PTE	0.11	0.11	0.00	1.96	1.13	0.15	0.01

IV. SUMMARY AND CONCLUSIONS

This inventory is an update of the source and emissions inventory (EI) originally complete by the Tribe's Air Quality Program in 2001, and revised in 2012. (That study can be found on the Air Program website http://www.bishoptribeemo.com/index_air.htm under "library."). Based on the original EI, the Tribe initiated particulate and ozone monitoring and these continue to be the principal pollutants of interest. The noteable changes on the reservation reflected in this revised EI are a detailed survey of dirt roads, barren areas and shrublands, all of which are major contributors to PM-10 pollution, and an updated evaluation of VOC and criteria pollutant potential to emit contributions from the Tribe's gas station. CARB and EPA data were updated and may reflect factors such as improved technology or changes in population and per capita consumption. Any and all measures enacted to reduce pollution on the reservation have helped and will help improve local and regional air quality.

In March 2012, The Tribe's Environmental Policy Ordinance was amended. This ordinance was originally created to establish the framework of governance by the Tribe concerning environmental resources. The ordinance comprehensively addresses potential actions that could be taken in regards to sources of pollution. The ordinance can be found at:

http://www.bishoppaiutetribe.com/assets/ordinances/Tribal%20Environmental%20Policy%20Ordinance.pdf

As demonstrated in the previous revision of the EI, the incidence of pollution from residential trash burning on the reservation remains a significant pollution source, because it is a source of toxic air pollutants as well as PM-10 and PM-2.5, and because there hasn't been a decrease in household size or significant reduction per capita generation of waste materials since the last revision. Trash burning is discouraged by the EMO through the burn permitting process. Currently, the Tribe may address certain occurrences of residential trash burning via the Tribe's Environmental Policy Ordinance (2012), Tribal Air Quality Standards (for PM-10, PM-2.5, and ozone, adopted in 2006 - Resolution T2006-08), and as per the Nuisance Ordinance. In 2018, the EMO began re-drafting a Solid Waste Ordinance, for which the Air Program contributed review and comments regarding coverage of trash burning; however, the TEPA has not adopted the ordinance as of this writing.

Smoke from residential wood burning continues to be another significant source of PM-10 and PM-2.5. Emissions from wood burning for home heating have been addressed over time through the replacement of older wood stoves by the Tribe's Community Development Department, when this assistance is available; however, without dedicated resources to replace woodstoves the emissions persist.

Supplemental funding was used since the last revised EI to pave the largest and busiest dirt parking lot on the Reservation, and this area along with an additional area at the Tribal HQ was repaved in 2019.