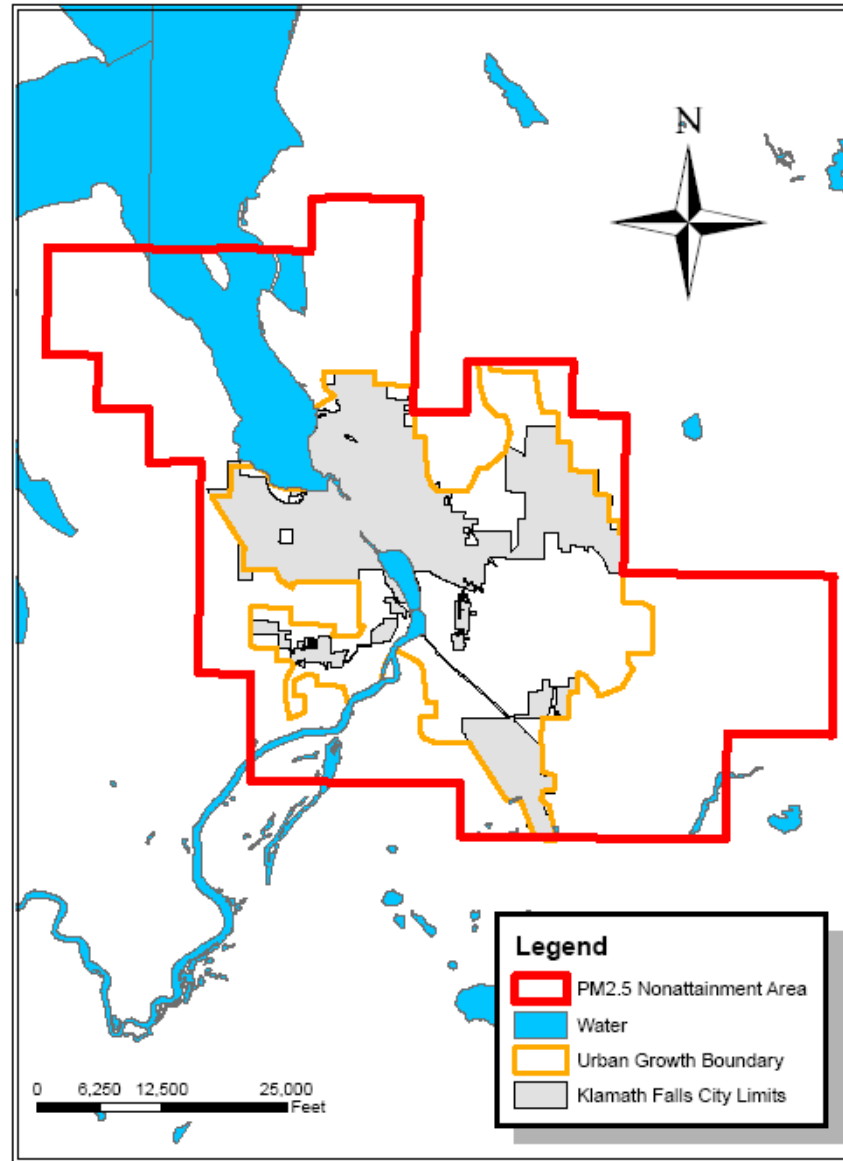# Klamath Air Quality Advisory Committee

Air Quality Planning

Jan. 12, 2022
Remotely held

DEQ

Klamath Falls PM2.5 Nonattainment Area

Klamath Falls Nonattainment Area Boundary Set by EPA on December 18, 2008
Klamath Falls Urban Growth Boundary and City Limits based on Oregon's Land Use Planning Laws.

Discussion Questions

- In your perception, has air quality gotten better or worse in Klamath County over the last 10 years?
- What do you think is responsible for the change in air quality over this time period?

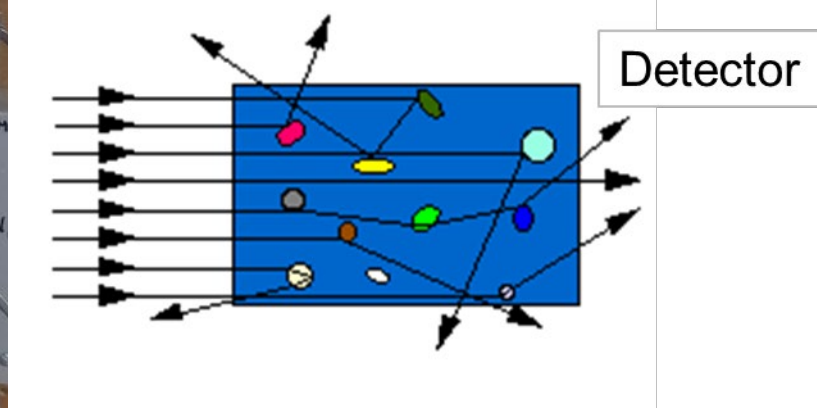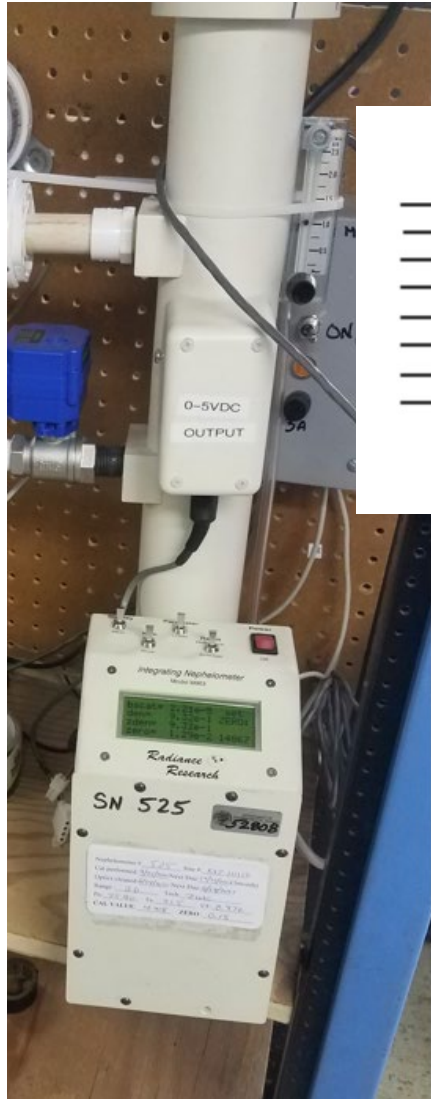# PM2.5 Monitoring at Peterson Elementary School

Started site up in 1985

PM2.5 Monitoring at Peterson Elementary School

-Nephelometer: 1985 to present

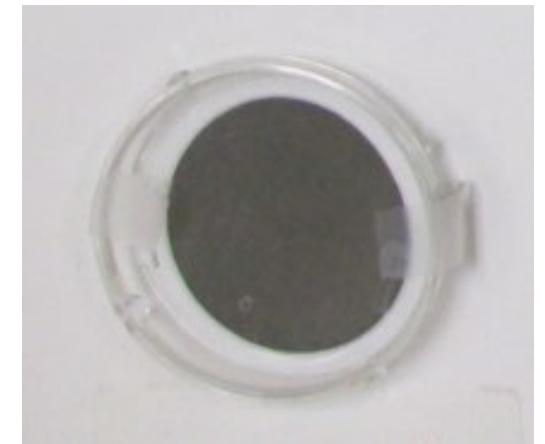- PM2.5 Federal Reference Method Sampler 1999 to present

Detector

Clean filter

Loaded filter
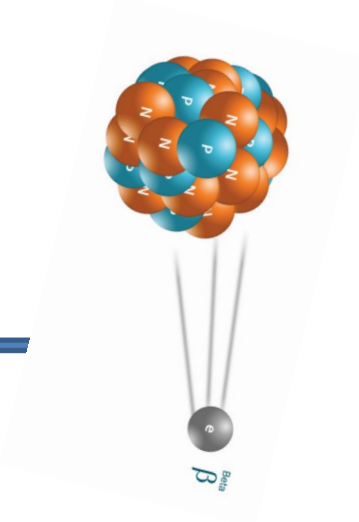
PM2.5 Monitoring at Peterson Elementary School

Federal Equivalent Methods

-Light Scattering w/ T640x 2019 to 2021   - Beta Attenuation 2021 to present
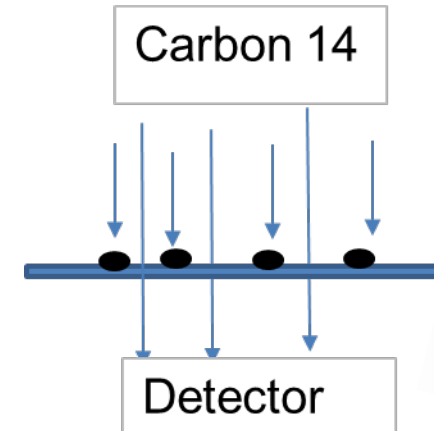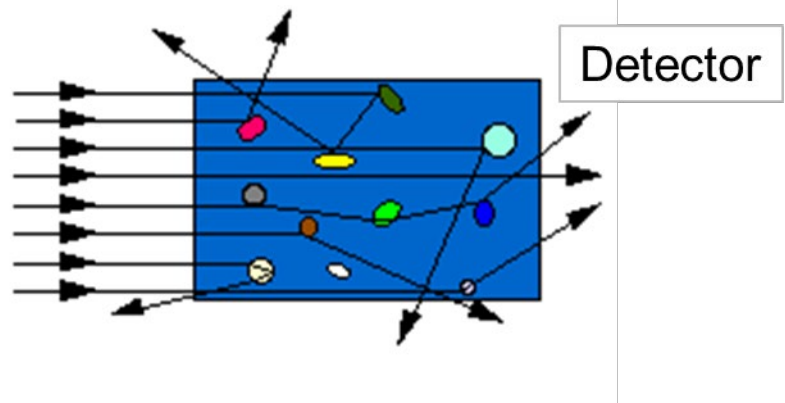
Klamath Falls PM2.5 Trend Comparison to the NAAQS

Legend:
- 98th Excluding WF (red line)
- 98th Including WF (red dot)
- Annual Excluding WF (blue line)
- Annual Including WF (blue dot)

Daily NAAQS 65 ug/m³

35 ug/m³

Annual Average NAAQS 15 ug/m³

12 ug/m³
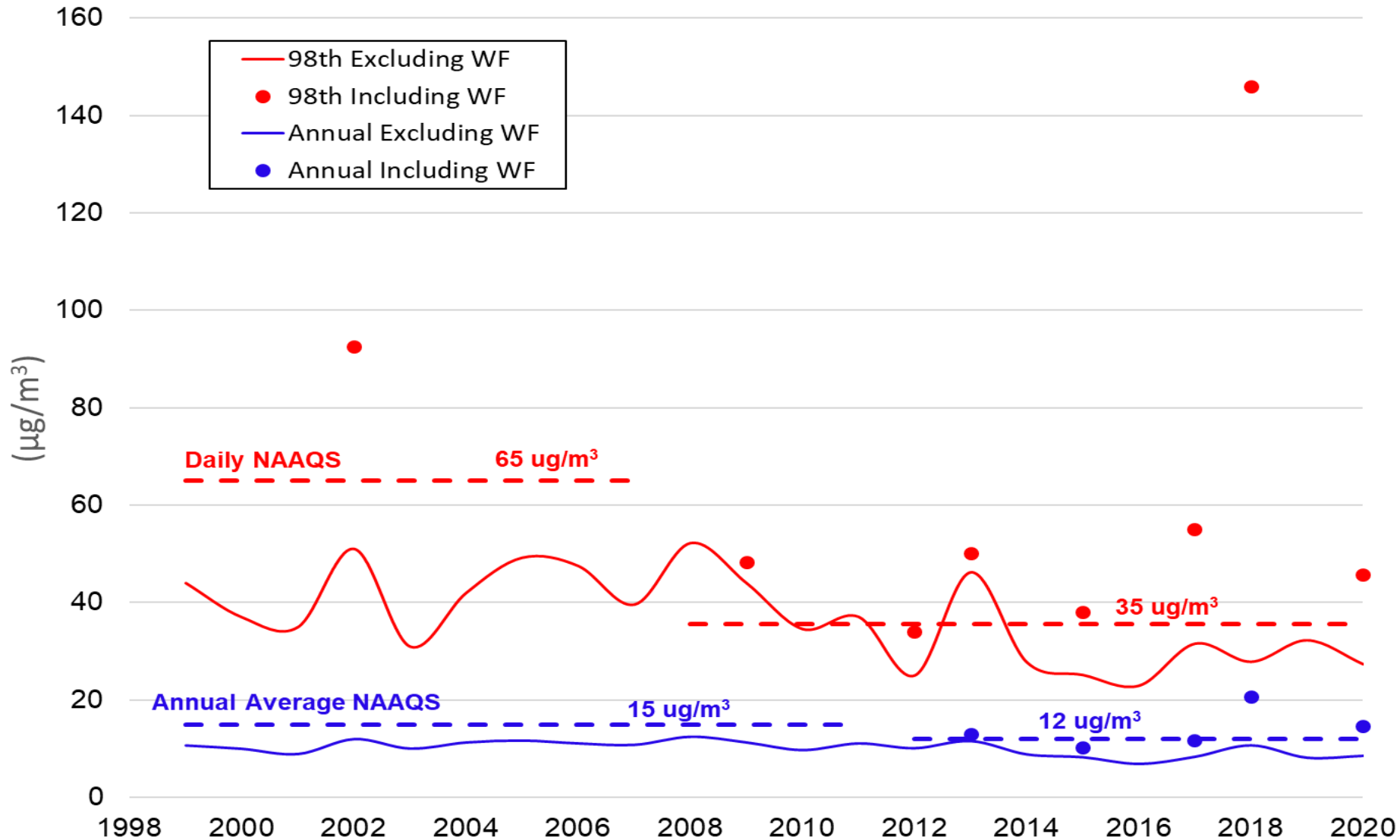
Daily Std = 3yr average of annual 98th percentile.

98th percentile example: 365 days*0.98 = 7th highest day of year

Annual Std = 3yr average of annual average

WF = Wildfire smoke

2021 Klamath Falls PM2.5 FEMs vs. Neph estimate
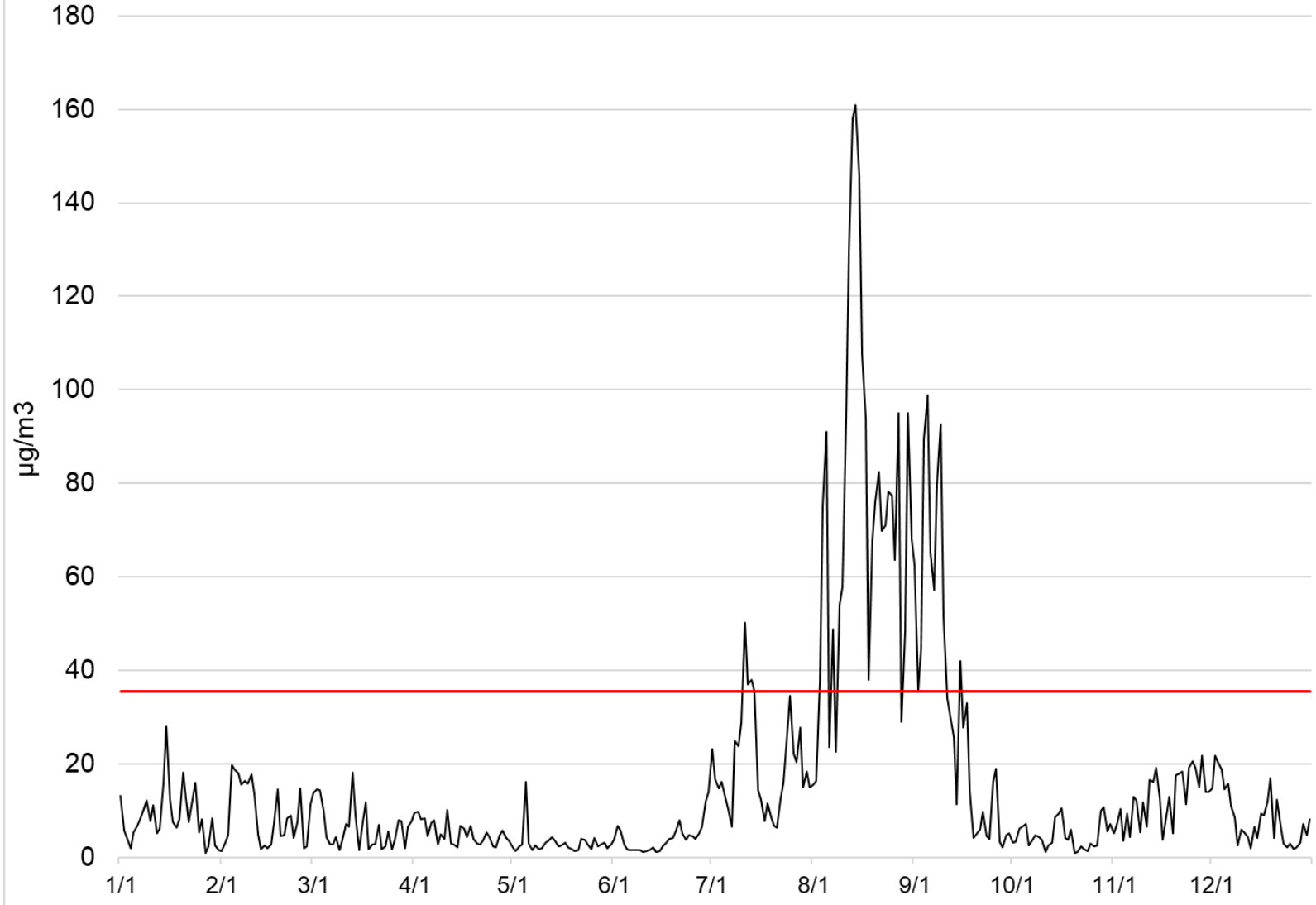
Klamath Falls PM2.5 AQI
Number of Days with USG or Greater
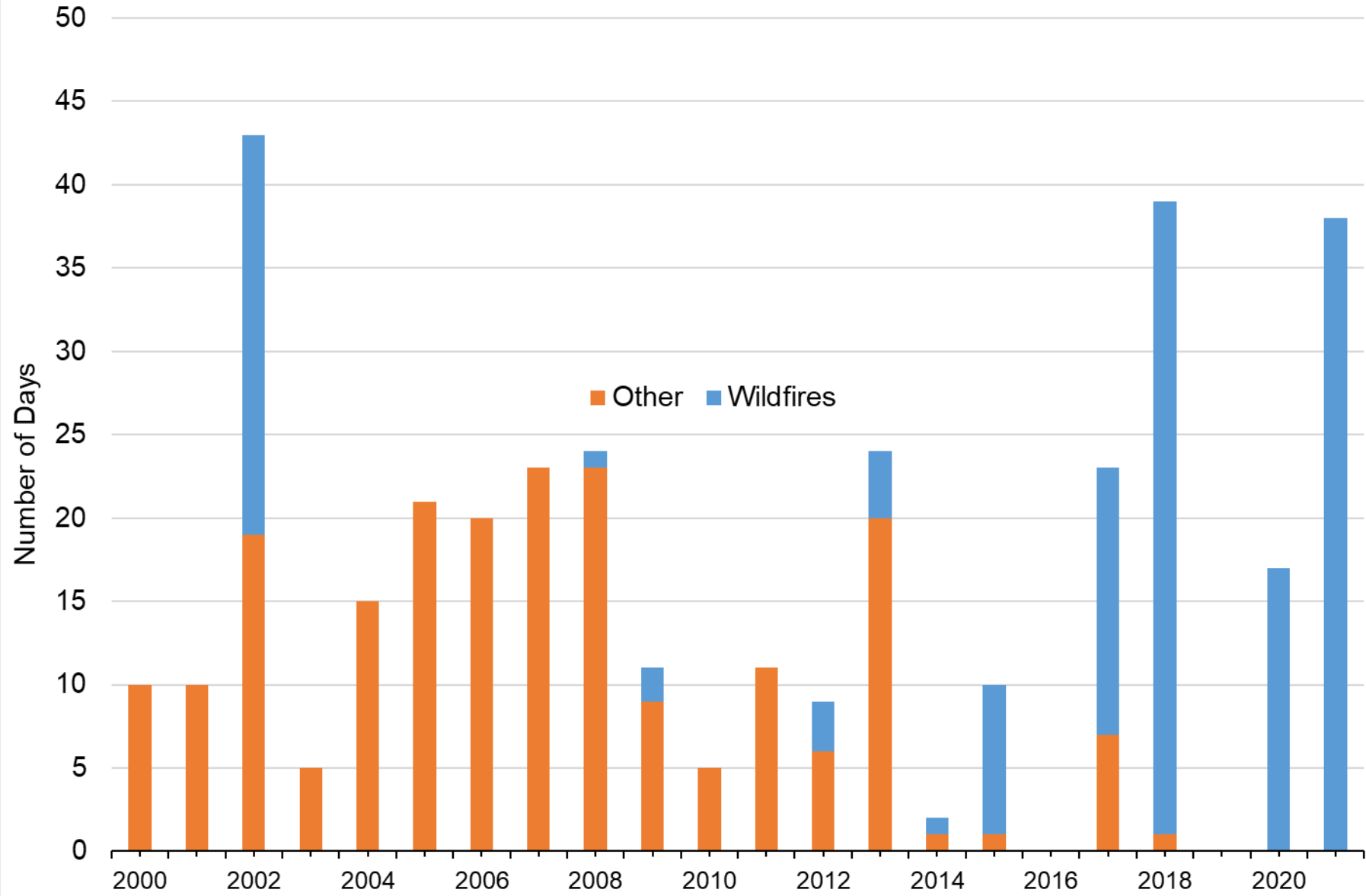
December and January Source Apportionment
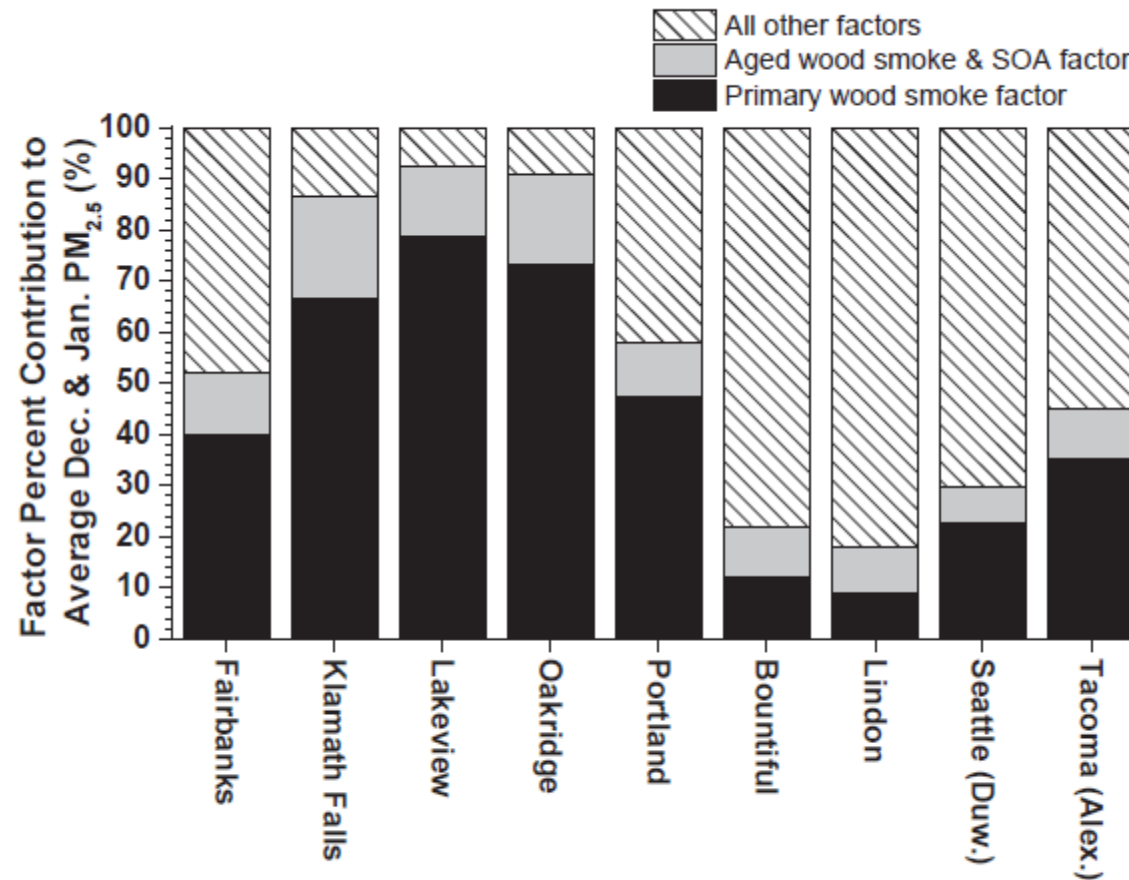
Fig. 5. Factor percent contribution to average December and January PM₂.₅ for sites where two wood smoke factors were identified.

SOA = Secondary organic aerosol

December and January Source Apportionment

	Primary wood smoke factor mass (%)	Aged wood smoke & SOA factor mass (%)	Total primary & aged wood smoke
Klamath Falls	**67%**	**19.7%**	**86.4%**
Lakeview	79%	14.1%	92.7%
Oakridge	73%	17.7%	90.7%
Portland	47%	10.6%	57.9%

Questions?

Discussion Questions

What do you think is the biggest source of fine particulate pollution in Klamath County?

- wildfires
- industry
- woodstoves
- trash and yard debris burning
- prescribed forestry burning
- cars and trucks

Emissions Inventory 101

What are emission inventories?

An accounting of emission quantities discharged into the atmosphere by various emission sources, in a particular geographical location for a specified period of time.

Why do we need them?

Emission inventories help identify:

- Pollutants of concern

- Emission sources of concern

- Geographical areas of concern

We need inventories to:

- Inform policy and program development

- Develop emission reduction strategies and track progress of those strategies locally, regionally and nationally for various environmental programs.

Emission Categories Inventoried

Emissions Categories	Description
Point	Major stationary sources that emit greater than 100 tpy of criteria or 10-25 tpy of hazardous air pollutants
Nonpoint	Minor stationary sources that emit less than 100 tpy of criteria or 10-25 tpy of hazardous air pollutants. Reported at county level by industry category or sector activity rather than individual facilities.
Mobile	Onroad vehicles and nonroad equipment that use gasoline, diesel, liquid petroleum gas, and other types of fuels.
Events	Prescribed burns, wildfires, structure fires and biogenic emissions sources. These are exceptional events.

What information is used to develop point emissions and where does it come from?

Emission Basis

1. List of permitted emission sources at facility
2. Estimation methodologies for each emission source
3. All derived from Air Permits

Activity Data

1. Activity or production rates
2. Material balance
3. CEMS
4. All derived from Annual Reports

What information and tools are used to develop Nonpoint, Mobile, and Events emissions?

Activity Data

- Census data
- Fuel, coating and solvent usage data
- Vehicle registration and vehicle miles-traveled data
- Residential Heating Survey data
- Fire activity data

Estimation Tools

- Wagon Wheel
- MOVES3.0
- SMARTFIRE2/Blue Sky

Klamath Falls Emissions Inventory

Klamath Falls Emissions Inventory Overview

- Pollutants inventoried: $PM_{2.5}$ and precursors of secondary formation of PM (e.g., NO_X, SO_2, VOC, NH_3)
- Emissions inventoried within Nonattainment Boundary (NAA)
- 2017 Annual and Typical Season Day emission estimates
- 2037 Future Year emission estimates
- Anthropogenic and Non-Anthropogenic emissions

2008
Klamath Falls
PM2.5 SIP

NAA, AQZ, and UGB
Boundaries

Legend
▭ Nonattainment Area
▭ Urban Growth Boundary
▭ Air Quality Zone
★ Peterson School Monitor

DEQ

Reference:
NAA Shapefile: EPA

CLS: 10/4/11   \\DEQHQ1\EI_FILES\2008_KFalls_PM25\GIS\FinalBoundary\2008_KFalls_FinalBoundary.mxd
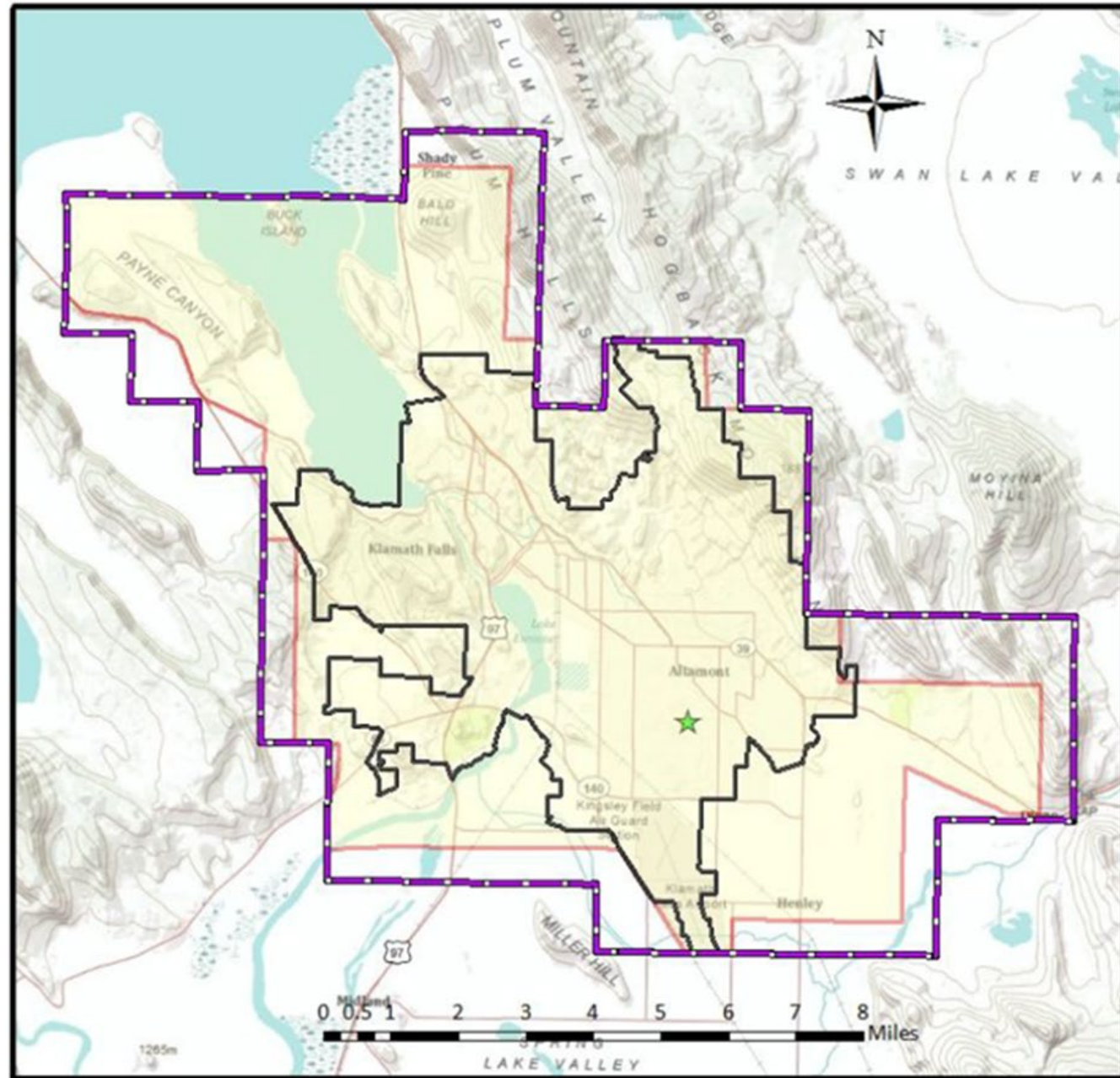
Emission Categories Inventoried

Emission Categories	Sectors
Events and Natural Sources	Biogenic Sources
	Prescribed Fires
	Structure Fires
	Wildfires
Mobile Sources	Aircraft and Airport Operations
	Locomotives
	Nonroad Mobile Sources
	Onroad Mobile Sources
	Re-Entrained Road Dust
Nonpoint Sources	Agriculture Sources
	Evaporative/Off-gassing Sources
	Fugitive Sources
	Miscellaneous Sources
	Stationary Fuel Combustion Sources
	Waste Disposal Sources
Point Sources	Permitted Sources

Klamath Falls Non-Attainment Area (NAA) 2008-2037 Annual Emissions Comparison

	2008		2017		2037	
Polllutant and Emission Category	AE (tpy)	AE Percent Distribution	AE (tpy)	AE Percent Distribution	AE (tpy)	AE Percent Distribution
Nonpoint Sources	296.0	45%	233.9	38%	251.8	41%
Events and Natural Sources	107.0	16%	163.5	27%	163.5	27%
Point Sources	143.4	22%	158.5	26%	137.0	22%
Mobile Sources	108.3	17%	57.1	9%	56.8	9%
PM2.5	654.7		613.0		609.1	
NH3	243.7		253.9		258.3	
NOX	2236.1		1483.2		843.3	
SO2	109.9		59.6		62.9	
VOC	2910.3		7541.0		7235.2	

Klamath Falls Non-Attainment Area (NAA)
2017 PM2.5 Emissions By Emissions Category
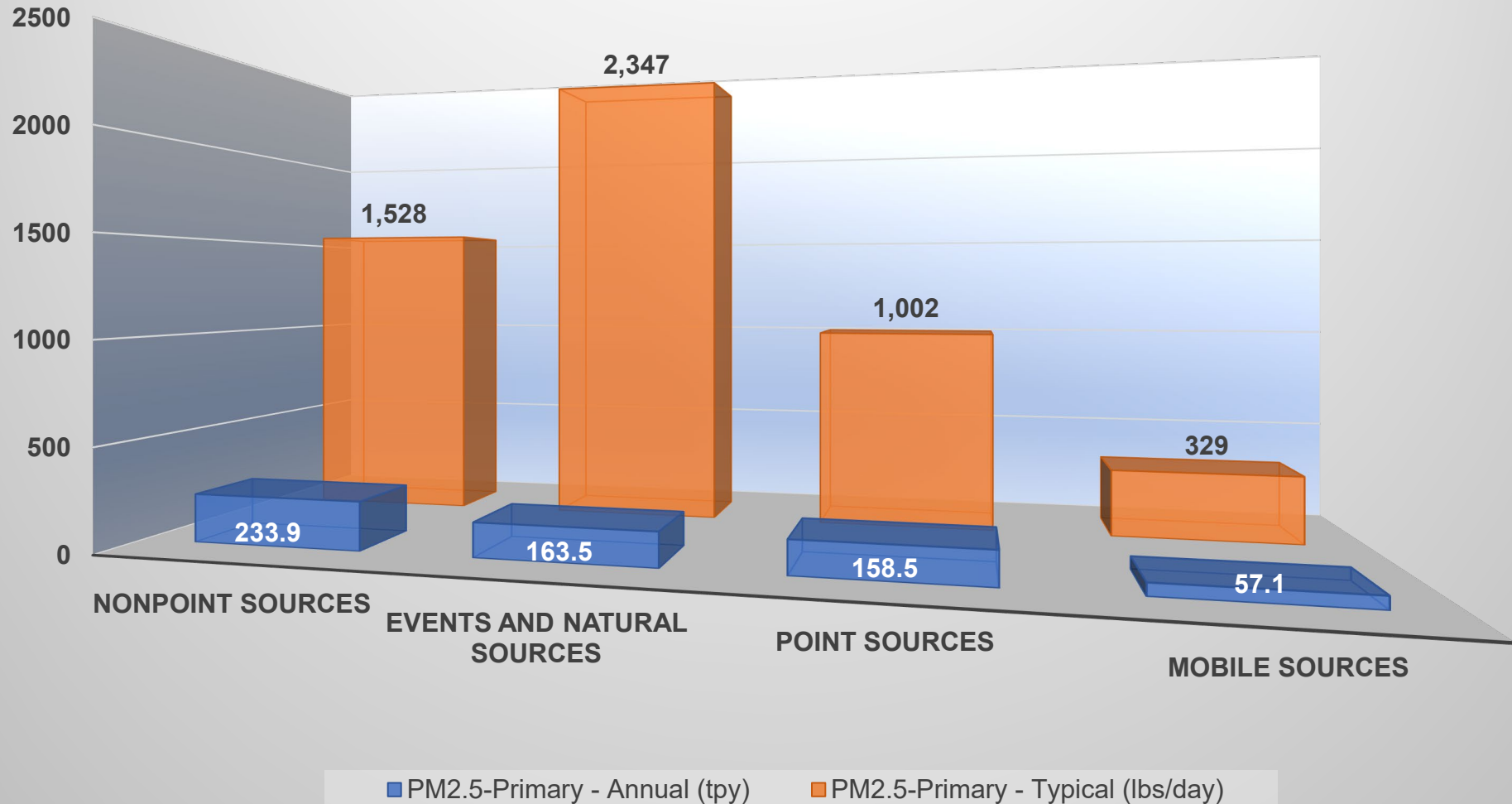
PM2.5 Emitting Sources

2017 PM2.5 Annual (AE) and Typical Season Day (TSD) Emissions by Sectors

Emission Sectors	Pollutant			
	PM2.5-Primary			
	AE (tpy)	AE Percent Distribution	TSD (lbs/day)	TSD Percent Distribution
Prescribed Fires	163.0	27%	2,346	45%
Permitted Point Sources	158.5	26%	1,002	19%
Stationary Fuel Combustion Sources	122.0	20%	1,191	23%
Waste Disposal Sources	44.6	7%	244	5%
Miscellaneous Sources	34.9	6%	66	1%
Re-Entrained Road Dust	32.1	5%	189	4%
Agriculture Sources	25.6	4%	27	1%
Onroad Mobile Sources	9.9	2%	66	1%
Aircraft and Airport Operations	8.0	1%	39	1%
Fugitive Sources	6.8	1%	0	0%
Nonroad Mobile Sources	4.1	1%	19	0%
Locomotives	2.9	0%	16	0%
Structure Fires	0.3	0%	1	0%
Wildfires	0.2	0%	0	0%
Grand Total	**613.0**	**100%**	**5,206**	**100%**

Stretch break!

Nonpoint Emission Sources

Top Nonpoint Sectors Contributing to PM2.5 Emissions:

Stationary Fuel Combustion Sources – 122 tons

- Wood Combustion-119.5 tons

Waste Disposal Sources- 42.6 tons

- Open Burning- 42.6 tons

Misc. Sources- 34.9 tons
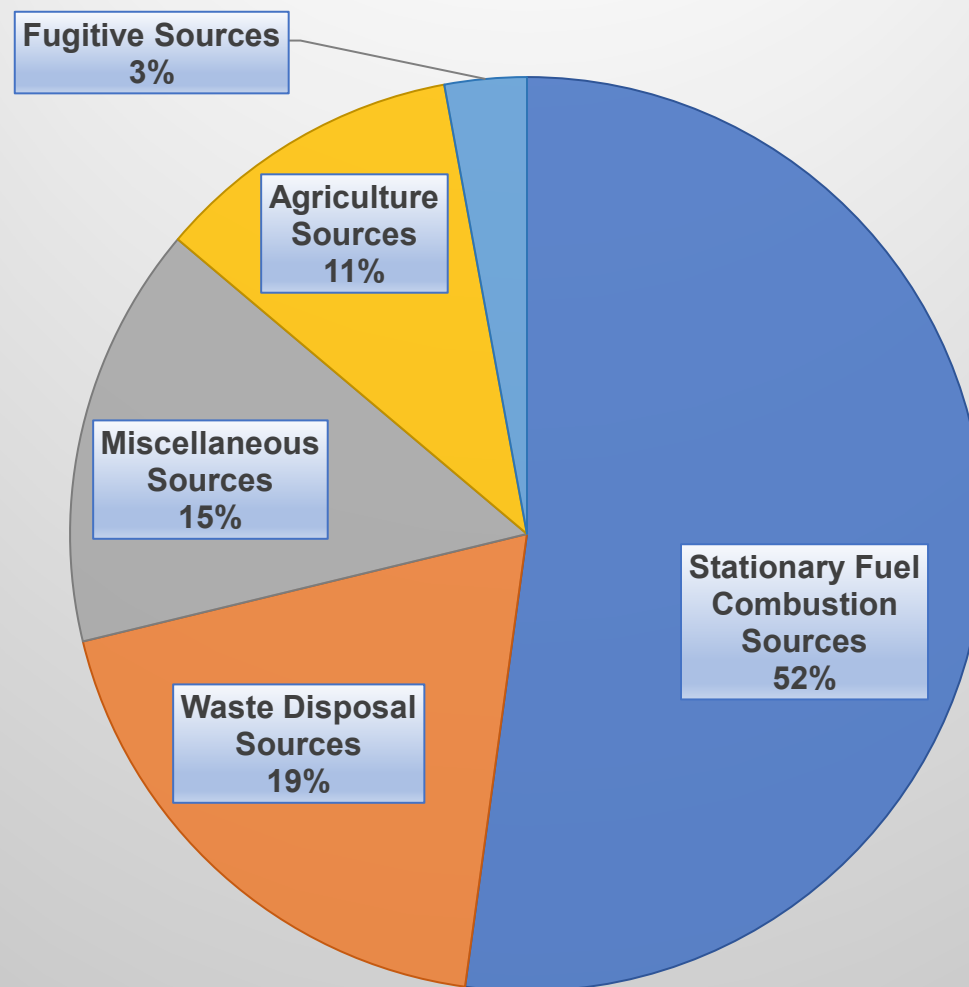
- Commercial Cooking- 29.7 tons

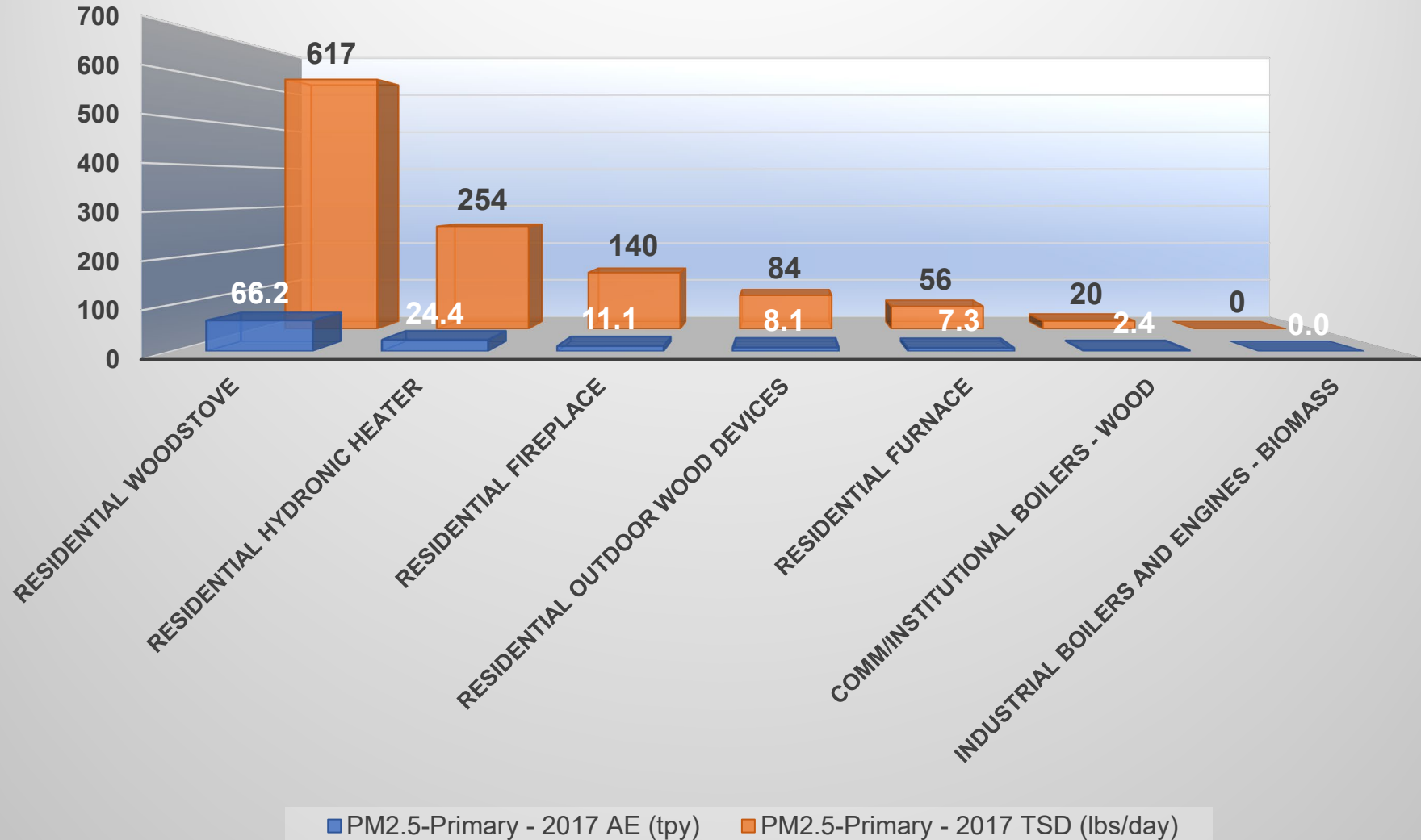**Agriculture Sources- 25.6 tons**

- Tilling- 12.9 tons

Fugitive Sources- 6.8 tons

- Construction Dust- 5.8 tons

Klamath Falls Non-Attainment Area (NAA) 2017 Annual PM2.5 Percent Distribution by Sector

- Fugitive Sources 3%
- Agriculture Sources 11%
- Miscellaneous Sources 15%
- Waste Disposal Sources 19%
- Stationary Fuel Combustion Sources 52%

Klamath Falls Non-Attainment Area (NAA)
2017 PM2.5 Annual and Typical Season Day Emissions
Wood Combustion Sources

- PM2.5-Primary - 2017 AE (tpy)
- PM2.5-Primary - 2017 TSD (lbs/day)

Source	PM2.5-Primary - 2017 AE (tpy)	PM2.5-Primary - 2017 TSD (lbs/day)
RESIDENTIAL WOODSTOVE	66.2	617
RESIDENTIAL HYDRONIC HEATER	24.4	254
RESIDENTIAL FIREPLACE	11.1	140
RESIDENTIAL OUTDOOR WOOD DEVICES	8.1	84
RESIDENTIAL FURNACE	7.3	56
COMM/INSTITUTIONAL BOILERS - WOOD	2.4	20
INDUSTRIAL BOILERS AND ENGINES - BIOMASS	0.0	0

Events and Natural Emission Sources

PM2.5 and Precursor Emissions for Events and Natural Sources

Klamath Falls Non-Attainment Area (NAA) 2017 Annual and Typical Season Day Emissions from both Anthropogenic and Non-Anthropogenic Fires and Natural Sources

	1, 2, 3, 4									
Pollutants										
	PM2.5-Primary		**NH3**		**NOX**		**SO2**		**VOC**	
Emission Category	**NAA AE (tpy)**	**NAA TSD (lbs/day)**	**NAA AE (tpy)**	**NAA TSD (lbs/day)**	**NAA AE (tpy)**	**NAA TSD (lbs/day)**	**NAA AE (tpy)**	**NAA TSD (lbs/day)**	**NAA AE (tpy)**	**NAA TSD (lbs/day)**
Prescribed Fires	163.0	2,346	32.1	462	18.1	260	12.1	174	1,847.5	26,588
Structure Fires	0.3	1	0.0	0	0.0	0	0.0	0	0.3	1
Wildfires	0.2	0	0.0	0	0.1	0	0.0	0	2.2	0
Biogenic Sources	0.0	0	0.0	0	54.6	299	0.0	0	3,763.1	20,620
Grand Total	**163.5**	**2,347**	**32.2**	**462**	**72.8**	**559**	**12.1**	**174**	**5,613.1**	**47,209**

Notes

(1) EPA 2017 NEI, EIS event annual emissions data 4/30/2020. DEQ Ref.

(2) Structural Fires estimated by DEQ

(3) No wildfires occurred during the PM season.

(4) Anthropogenic emission sources are human caused while non-anthropogenic sources are not.
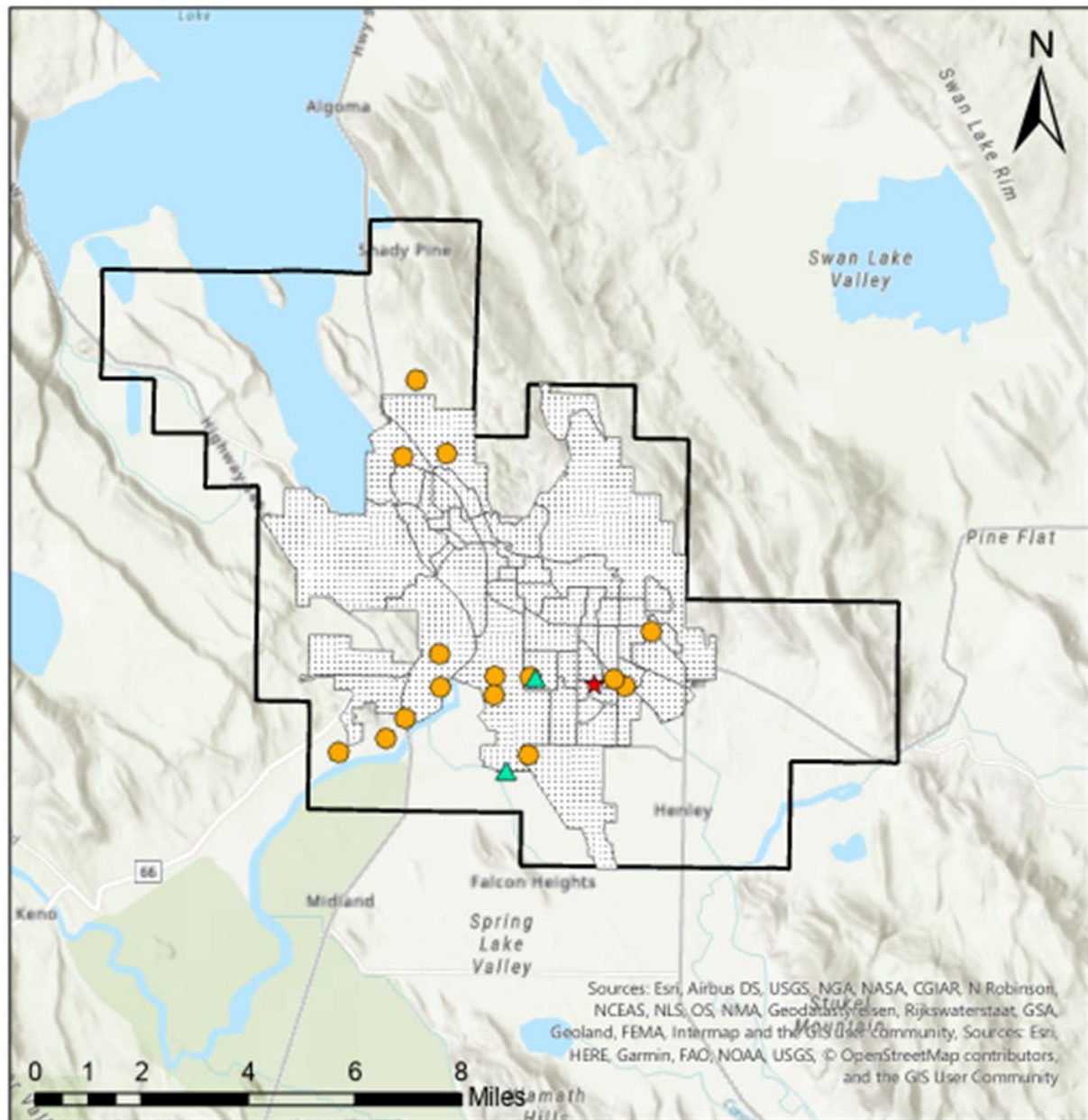
Point Emission Sources

Klamath Falls PM2.5 Emissions Inventory — Point Sources within NAA

Klamath Falls Non-Attainment Area (NAA) 2017 and 2037 PM2.5 Annual and Typical Season Day Emissions Broken Down by Permitted Industry

Emission Category	Point Sources
Emission Subcategory	Permitted Point Sources

	Pollutant			
	PM2.5-Primary			
Industry Type	2017 AE (tpy)	2017 TSD (lbs/day)	2037 AE (tpy)	2037 TSD (lbs/day)
Plywood Operations	92.2	554	92.2	554
Industrial Boilers and Engines - Biomass	23.3	198	1.8	11
Electric Generation Engine - Natural Gas	17.9	98	17.9	98
Sawmill Operations	11.9	79	11.9	79
Perlite Manufacturing	2.9	16	2.9	16
Electric Generation Engine - Distillate Oil	2.4	13	2.4	13
Bulk Handling and Storage - Wood/Bark	2.2	12	2.2	12
Industrial Boilers and Engines - Oil	1.4	7	1.4	7
Crematoriums	1.3	7	1.3	7
Industrial Boilers and Engines - Other	1.0	5	1.0	5
Electric Generation Boiler - Natural Gas	0.6	3	0.6	3
Concrete Batching	0.5	3	0.5	3
Stone Quarrying	0.3	2	0.3	2
Comm/Institutional Boilers - Natural Gas	0.2	2	0.2	2
Industrial Surface Coating & Solvent Use	0.2	1	0.2	1
Aircraft Engine Testing	0.1	0	0.1	0
Industrial Boilers and Engines - Natural Gas	0.0	0	0.0	0
Electric Generation Boiler - Oil	0.0	0	0.0	0
Electric Generation Engine - Oil	0.0	0	0.0	0
Grand Total	**158.5**	**1,002**	**137.0**	**815**

Mobile Emission Sources

Top Nonroad Sectors Contributing to PM2.5 Emissions:
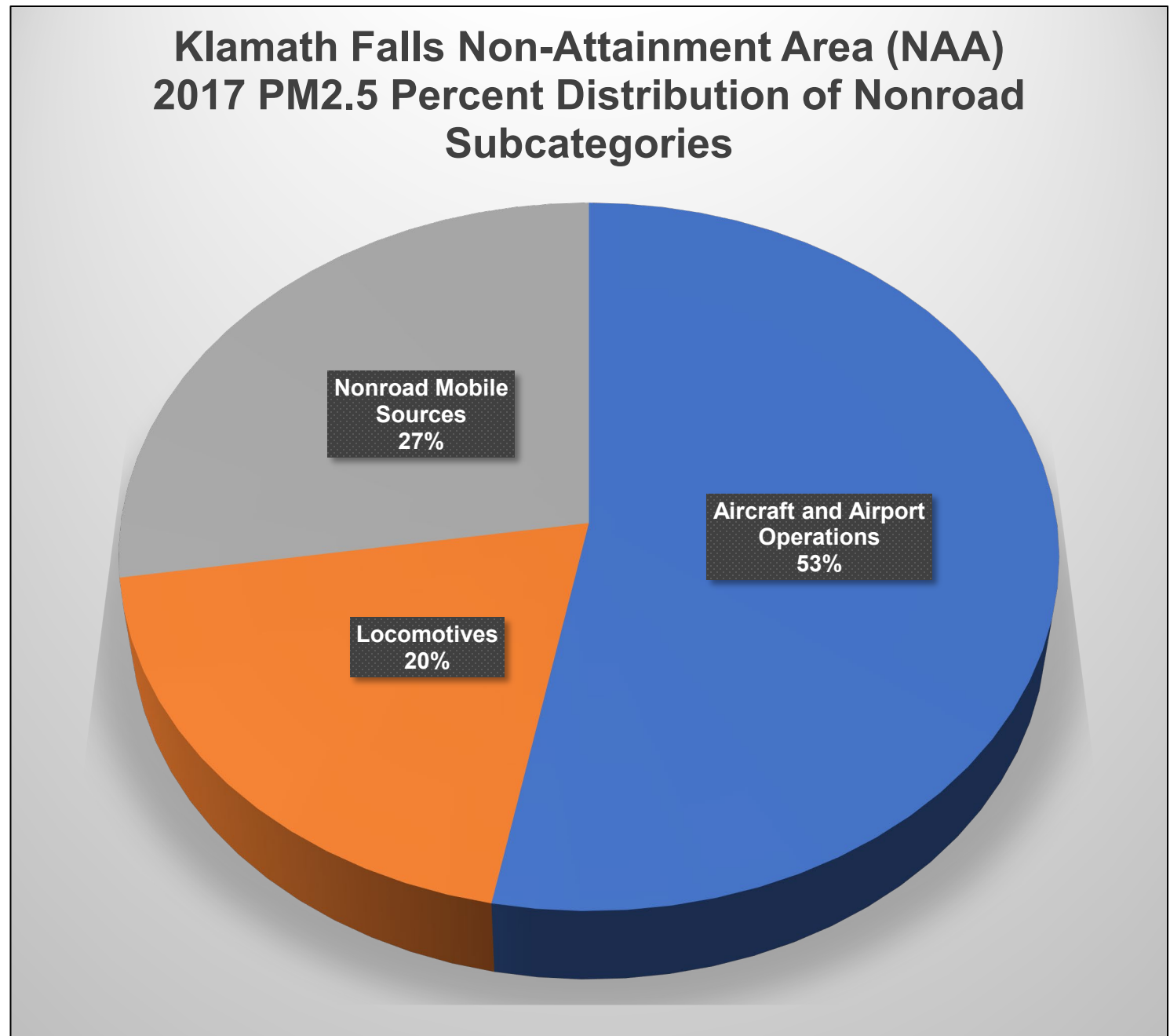
Aircraft and Airport Operations- 8.0 tons

Military Aircraft- 6.8 tons

Nonroad Mobile Sources- 4.1 tons

Nonroad Diesel Equipment- 2.5 tons

Locomotives- 2.9 tons

Line Haul Locomotives: Class I Operations- 2.6 tons

Klamath Falls Non-Attainment Area (NAA) 2017 PM2.5 Percent Distribution of Nonroad Subcategories

- Nonroad Mobile Sources 27%
- Aircraft and Airport Operations 53%
- Locomotives 20%

Nonroad Mobile Sources

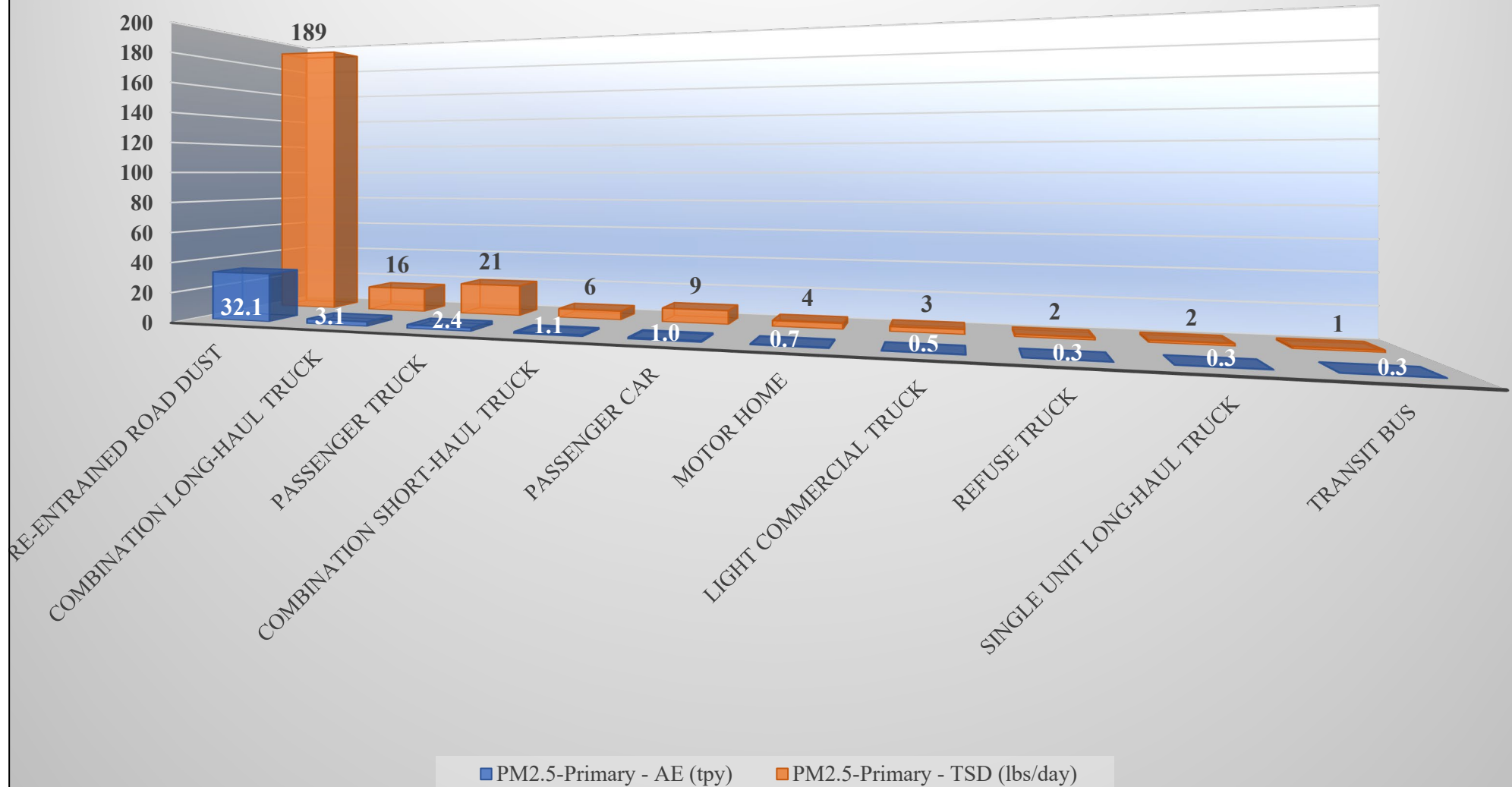*Breakdown Nonroad Equipment Categories Inventoried:*

- Agricultural Equipment
- Commercial Equipment
- Construction and Mining Equipment
- Industrial Equipment
- Lawn and Garden Equipment
- Logging Equipment
- Recreational Equipment

Klamath Falls Non-Attainment Area (NAA)
2017 PM2.5 Emissions by Fuel Type, Engine, and Nonroad Equipment
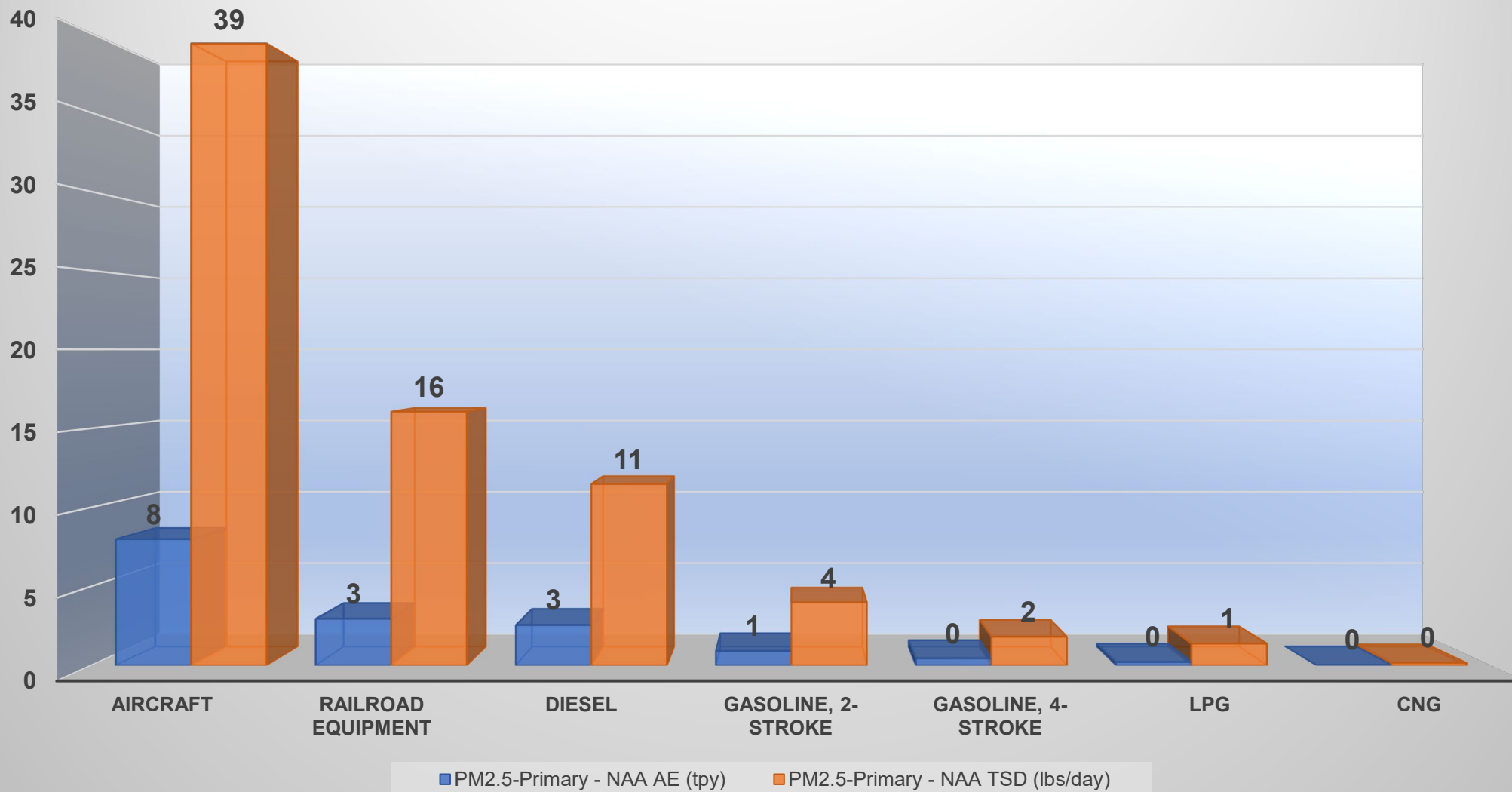
Klamath Falls Non-Attainment Area (NAA)
2017 PM2.5 Emissions from Onroad Emission Sources

PM2.5-Primary - AE (tpy)   PM2.5-Primary - TSD (lbs/day)

RE-ENTRAINED ROAD DUST: 32.1, 189
COMBINATION LONG-HAUL TRUCK: 3.1, 16
PASSENGER TRUCK: 2.4, 21
COMBINATION SHORT-HAUL TRUCK: 1.1, 6
PASSENGER CAR: 1.0, 9
MOTOR HOME: 0.7, 4
LIGHT COMMERCIAL TRUCK: 0.5, 3
REFUSE TRUCK: 0.3, 2
SINGLE UNIT LONG-HAUL TRUCK: 0.3, 2
TRANSIT BUS: 0.3, 1

Future Year Emissions

Klamath Falls Non-Attainment Area (NAA) 2037 PM2.5 Annual and Typical Season Day Emissions by Emission Subcategory

Emission Subcategory	Pollutant			
	PM2.5-Primary			
	AE (tpy)	AE % Distribution	TSD (lbs/day)	TSD % Distribution
Prescribed Fires	163.0	27%	2,346	46%
Permitted Point Sources	137.0	22%	815	16%
Stationary Fuel Combustion Sources	126.2	21%	1,230	24%
Waste Disposal Sources	49.1	8%	269	5%
Miscellaneous Sources	42.5	7%	80	2%
Re-Entrained Road Dust	38.2	6%	225	4%
Agriculture Sources	25.6	4%	78	2%
Fugitive Sources	8.3	1%	0	0%
Aircraft and Airport Operations	8.2	1%	41	1%
Onroad Mobile Sources	4.1	1%	23	0%
Locomotives	3.3	1%	18	0%
Nonroad Mobile Sources	3.0	0%	14	0%
Structure Fires	0.3	0%	1	0%
Wildfires	0.2	0%	3	0%
Grand Total	**609.1**	**100%**	**5,143**	**100%**

2017-2037 Comparison PM Winter Season Emissions
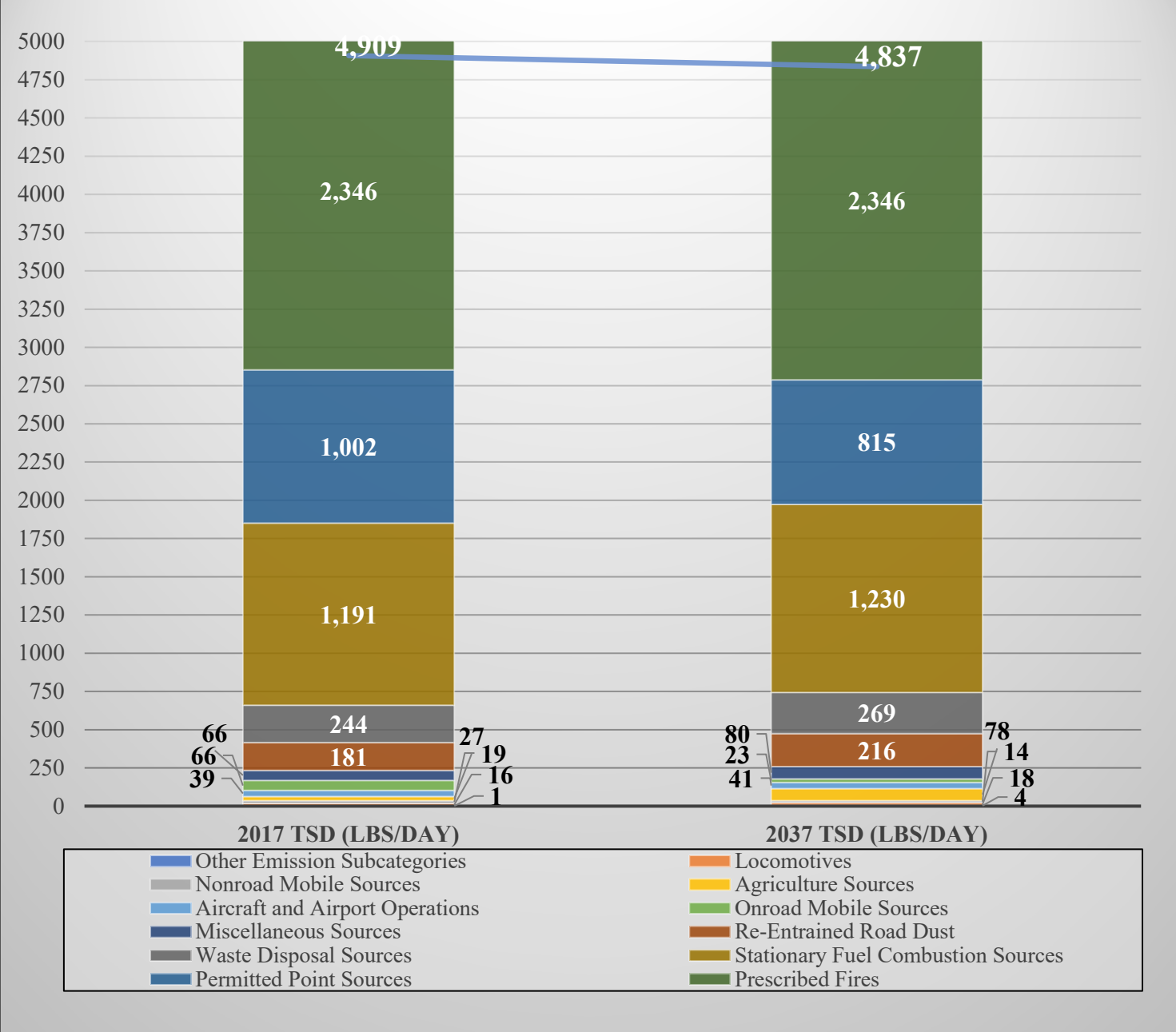
In Conclusion:

Klamath Falls EI identified emission sources driving PM2.5 Emission Levels within NAA:

- – Prescribed fires

- – Permitted plywood activities and fuel combustion

- – Residential Wood Combustion

- – Commercial/Institutional/Residential Open Burning

- – Commercial Cooking

- – Re-Entrained Road Dust

Questions?

Discussion Questions

- What did you learn today?
- What were you surprised by?
- How does this inform your perspective about what emissions we should be targeting for reductions?

Klamath Advisory Committee Meeting Schedule

Meeting	Date
Advisory Committee Meeting - **Review of Charge** - **Background on Clean Air Act, Regulatory Process** - **Review of Control Measures**	**November 22, 2021**
Advisory Committee Meeting - **Emissions Inventory (DEQ)** - **Monitoring Data: Then & Now (DEQ)**	**January 12, 2022**
Advisory Committee Meeting - **Clean Air Ordinance: Proposed Updates (Klamath Public Health)**	**February 2022**
Advisory Committee Meeting - **Discussion: Changes to Control & Contingency Measures**	**March 2022**
Final Report to DEQ and Klamath County Board of Commissioners	**April 2022**