

2012 Alaska Wildfire Emissions Inventory

Prepared by
Department of Environmental Conservation
Division of Air Quality
for the Air Quality & Smoke Management Committee
of the Alaska Wildland Fire Coordinating Group

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2012 Alaska Wildfire Emissions Inventory

Summary

The Department of Environmental Conservation (DEC) in coordination with the Alaska Wildland Fire Coordinating Group (AWFCG) developed the Alaska Enhanced Smoke Management Plan (ESMP) to reduce wildfire smoke impacts in Alaska. The ESMP and accompanying volume of appendices were adopted by the AWFCG in June 2009. According to the ESMP, DEC is responsible for collecting, reviewing, tracking, and summarizing statewide pre- and post-burn data for annual ESMP emissions inventory reports to be distributed to the AWFCG, the U.S. Environmental Protection Agency and the Western Regional Air Partnership (WRAP).¹

The ESMP helps fulfill Alaska's responsibilities for protection of air quality and human health under federal and state law and reflects the Clean Air Act requirement to improve regional haze in Alaska's Class I areas. The ESMP is an important component of Alaska's Regional Haze State Implementation Plan.

This report accomplishes the Department of Environmental Conservation's responsibility for reporting 2012 prescribed fire emissions as required by the Enhanced Smoke Management Plan. It also reports on the statewide wildfire emissions occurring in 2012.

In 2012, 27 prescribed fires were conducted, burning a total of 12,095 acres. The largest number of prescribed acres burned occurred in May and October and were conducted by or for the military. The same fire season 413 wildfires burned a total of 286,888 acres. The wildfire acreage burned was the second lowest of the past 10 years. One wildfire was reported in January and 18 were reported in April, but the majority of wildfires occurred in May, June, and July in the northern half of the state.

The ten wildfires producing the most PM_{2.5} emissions created approximately 67,792 tons of PM_{2.5}, which was close to 75.7% of the total tons of PM_{2.5} produced by all 413 wildfires. Those same ten wildfires burned approximately 222,110.8 acres which was about 77.4% of the total acres burned.

The Alaska Interagency Coordination Center (AICC) is the Geographic Area Coordination Center for Alaska. Located on Ft. Wainwright, near Fairbanks, the AICC serves as the focal point for initial attack resource coordination, logistics support, and predictive services for all state and federal agencies involved in wildfire management and suppression in Alaska.²

The AICC operates on an interagency basis - cooperators include the Bureau of Land Management, State of Alaska Department of Natural Resources (including the Division of Forestry), USDA Forest Service, National Park Service, Bureau of Indian Affairs, and the Fish and Wildlife Service.³ The AICC collects most wildfire related data into daily situation reports, available on their website: <http://fire.ak.blm.gov/predsvcs/intel.php>

Fire management planning, preparedness, suppression operations, prescribed fire, and related activities are coordinated on an interagency basis (i.e., the AICC). The Division of Forestry, Bureau of Land Management, and the U.S. Forest Service fight fires within their protection areas on all land ownerships which reduces the duplication of facilities and services. The state and federal agencies routinely utilize each other's personnel and resources to both manage and fight fires for efficiency and cost effectiveness.⁴

¹ Alaska Enhanced Smoke Management Plan for Planned Fire, Procedures Manual, Executive summary, June 2009

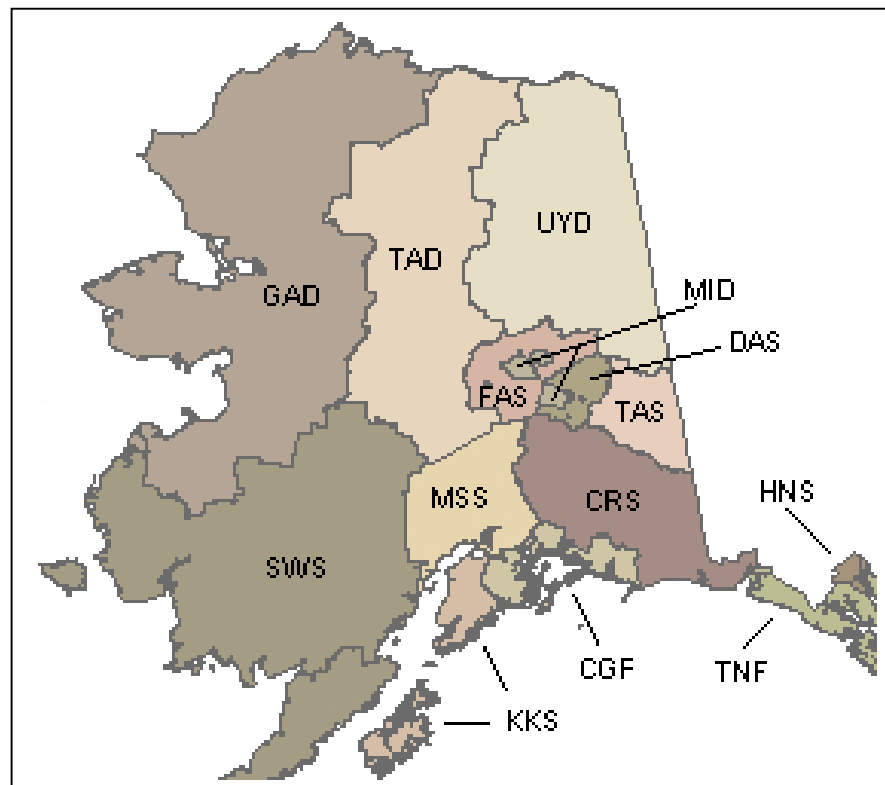
² Alaska Interagency Coordination Center website: <http://fire.ak.blm.gov/aicc.php>

³ ibid

⁴ Division of Forestry Fire Program website: <http://forestry.alaska.gov/fire/>

The 14 Alaska Fire Management Zones are shown on the map below. These zones are as follows:

- Chugach National Forest (CGF)
- Valdez/Copper River Area Forestry (CRS)
- Delta Area Forestry (DAS)
- Fairbanks Area Forestry (FAS)
- Galena Fire Management Zone (GAD)
- Haines/Northern Southeast Area Forestry (HNS)
- Kenai-Kodiak Area Forestry (KKS)
- Military Fire Management Zone (MID)
- Mat-Su/Southwest Area Forestry (MSS)
- Southwest District Forestry (SWS)
- Tanana Fire Management Zone (TAD)
- Tok Area Forestry (TAS)
- Tongass National Forest (TNF)
- Upper Yukon Fire Management Zone (UYD)



Method for 2012 Alaska Wildfire Emissions Inventory

The Wildland Fire Emission Template prepared in 2006 by Air Sciences, Inc. for the Department of Environmental Conservation (DEC) was used to prepare the 2012 wildfire inventory. The template, after input of appropriate data, graphs and summarizes the fire and emissions data. Using the template provides a consistent analysis of fire data from year to year. This year the Air Quality and Smoke Management Committee approved using LANDFIRE vegetative types, provided by the Department of Natural Resources, Division of Forestry, for the 12 largest fires. This data provided greater detail of the vegetation within the fire perimeter, compared to the vegetation type noted at the fire start. These 12 fires burned approximately 82% of the total acreage burned in 2012. Additional information about the use of LANDFIRE data for 2012 can be found in the Appendix, Section A, Emission Factors Used section.

A summary of the 2012 fires, their type, start and end dates, 'owner', locations, and acreages was provided to DEC by the Division of Forestry. The data was copied into the template. The dates were re-entered to conform to the template requirements. The 'emission factor' for each fire, as determined by the vegetative type listed in the electronic version of the AICC daily situation report, the description in the pdf version of the daily situation report or the LANDFIRE vegetation types, was also input. The majority of fires which did not have a vegetation type listed were 0.1 – 0.2 acre in size. Since most of the other fires of those sizes were grass fires, those unknown vegetation type fires were given the grass emission factor.

The wildfire acreage and numbers received from the Division of Forestry almost matched the acreage and numbers in the AICC Report for the 2012 wildfires. There were 3 additional wildfires in the AICC report, all less than 0.25 acre.

The fires in the emission inventory are categorized into two groups: Prescribed Fires and Wildfires. The category of "Wildland Fire Use" is now obsolete and has not been used by agencies since the 2008 fire season in describing and tracking fires. In the past, this category described the management of either wildfire or prescribed fire to meet resource objectives or benefits. The National Wildfire Coordinating Group ceased to use this term because a wildland fire may be concurrently managed for one or more objectives and objectives can change as fire moves across the landscape. As a result, this category is no longer recorded as a separate category.⁵

The following definitions are taken from the 2009 Alaska Enhanced Smoke Management Plan for Planned Fire.

- **Prescribed Fire**, or controlled burn, is any fire ignited by management actions to meet specific objectives. A written, approved prescribed fire plan must exist. In a federal action, National Environmental Policy Act requirements must be met prior to ignition. Prescribed fire is a type of open burning.
- **Wildfire** is any non-structure fire, other than prescribed fire, that occurs in the wildland. Wildland is an area where development is generally limited to roads, railroads, power lines, and widely scattered structures. The land may be neglected altogether or managed for such purposes as wood or forage production, wildlife, recreation, wetlands or protective plant cover.

⁵ NWCG Memorandum Ref# NWCG024-2010, Terminology Updated Resulting from Release of the *Guidance for the Implementation of Federal Wildland Fire Management Policy (2009)*, April 30, 2010.

Discussion of Results

The Fire Emission Template presents results through 10 graphs. Figures 1 through 10 are discussed on this and the following pages. A listing of the emission factors used for vegetation groups is provided after Figure 10.

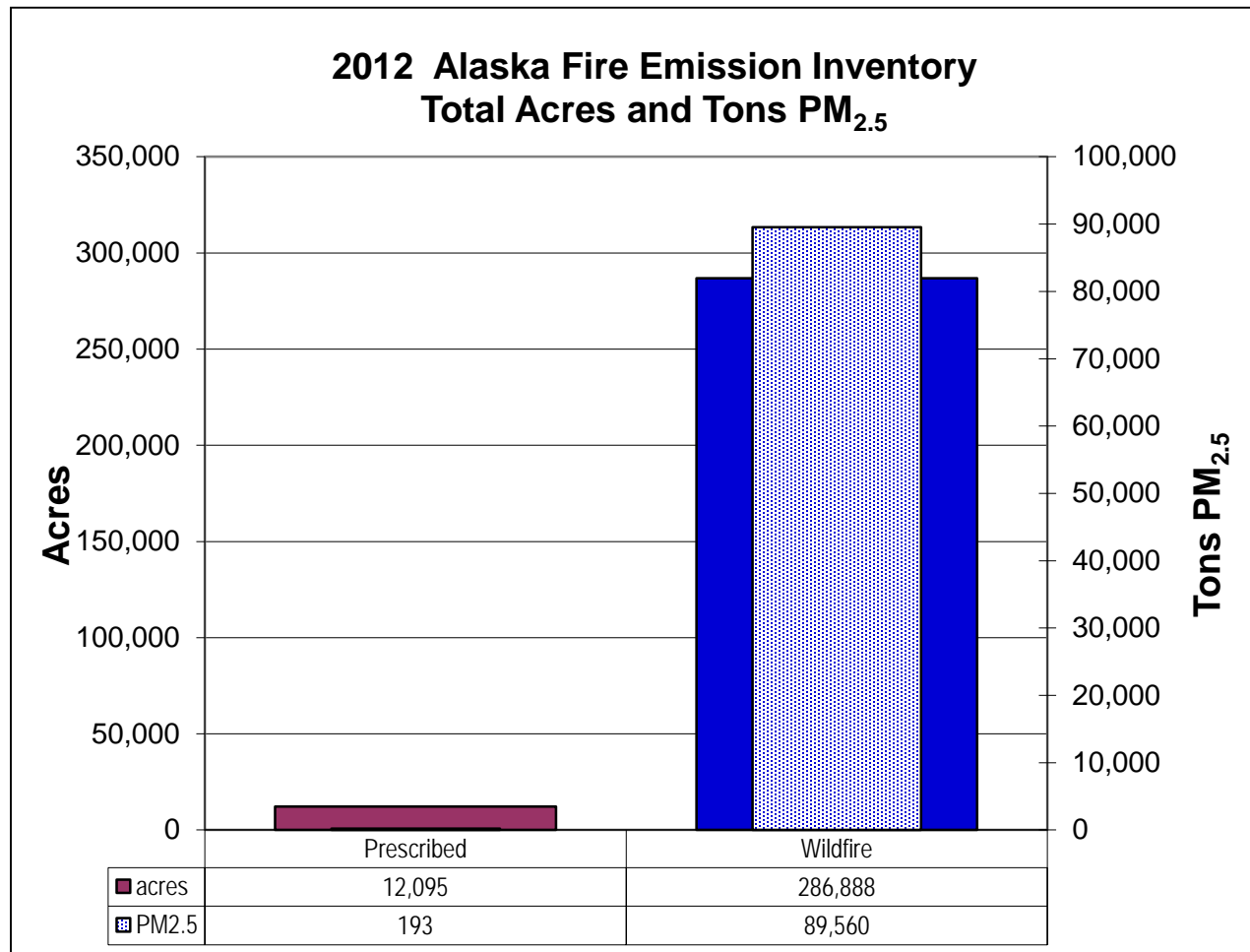


FIGURE 1

Figure 1 shows the number of acres burned and the tons of PM_{2.5} produced for both fire types (prescribed and wildfire) during the 2012 season.

- Prescribed fires were approximately 4.0% (12,095 acres) of the total 2012 Alaskan fires, producing 193 tons of PM_{2.5} (approximately 0.2%) of the total PM_{2.5}.
- Wildfires were approximately 96.0% (286,888 acres) of the total 2012 Alaskan fires, producing 89,560 tons of PM_{2.5} (approximately 99.8%) of the total PM_{2.5}.

2012 Alaska Fire Emission Inventory Number of Events by Month and Source Type

Events are assigned a month by the average of the event start and end dates.

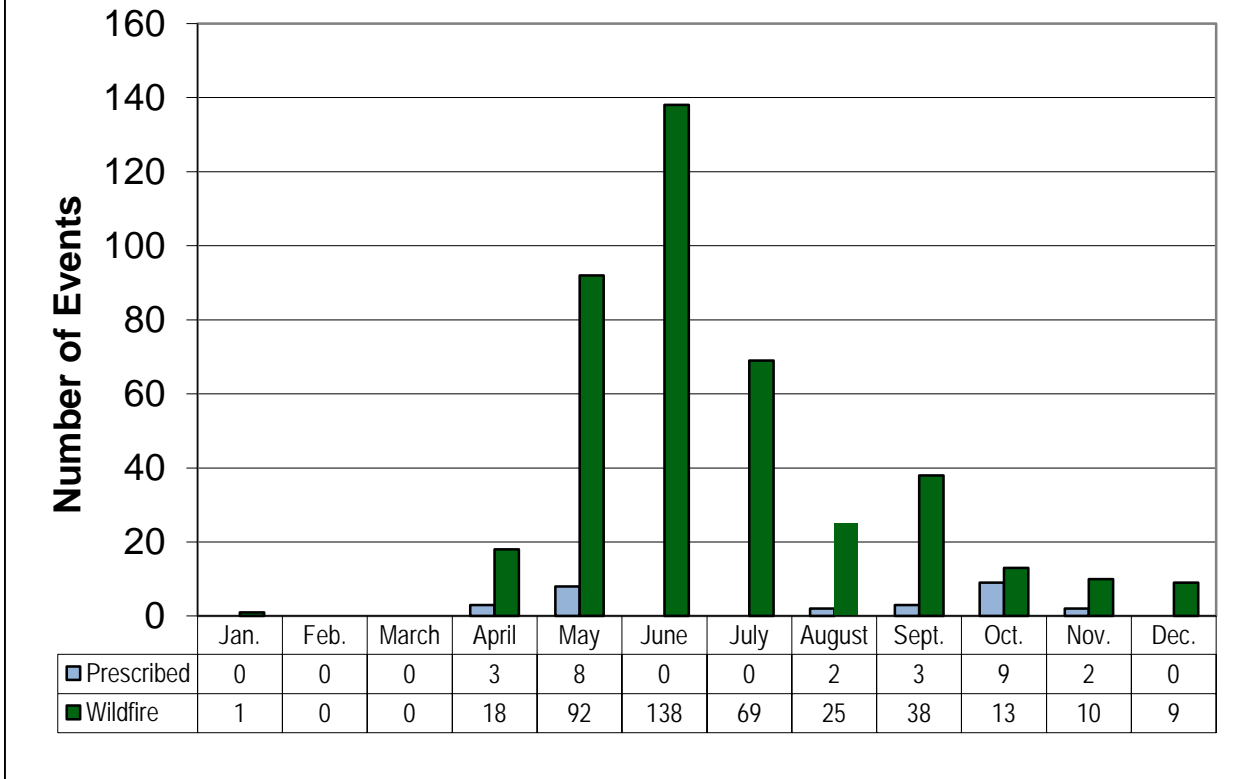


FIGURE 2

Figure 2 shows the total number of wildfires in 2012, by month and type of fire, prescribed or wildfire.

The month with the most prescribed burns was October (9 burns, 33.3%). The other prescribed burns occurred in April, May, August, September, and November for a total of 18 burns or 66.7%.

Most of the wildfires occurred during the summer months of May, June, and July (72.4%, 299 fires), with 1 fire in January, and 18 fires in April (19 fires total, 4.6%). There were 95 fires spread from August through December (23%). Most of the fires in April and the first couple weeks of May were small, escaped residential grass fires or small burn pile fires of 0.1 acre or less in size.

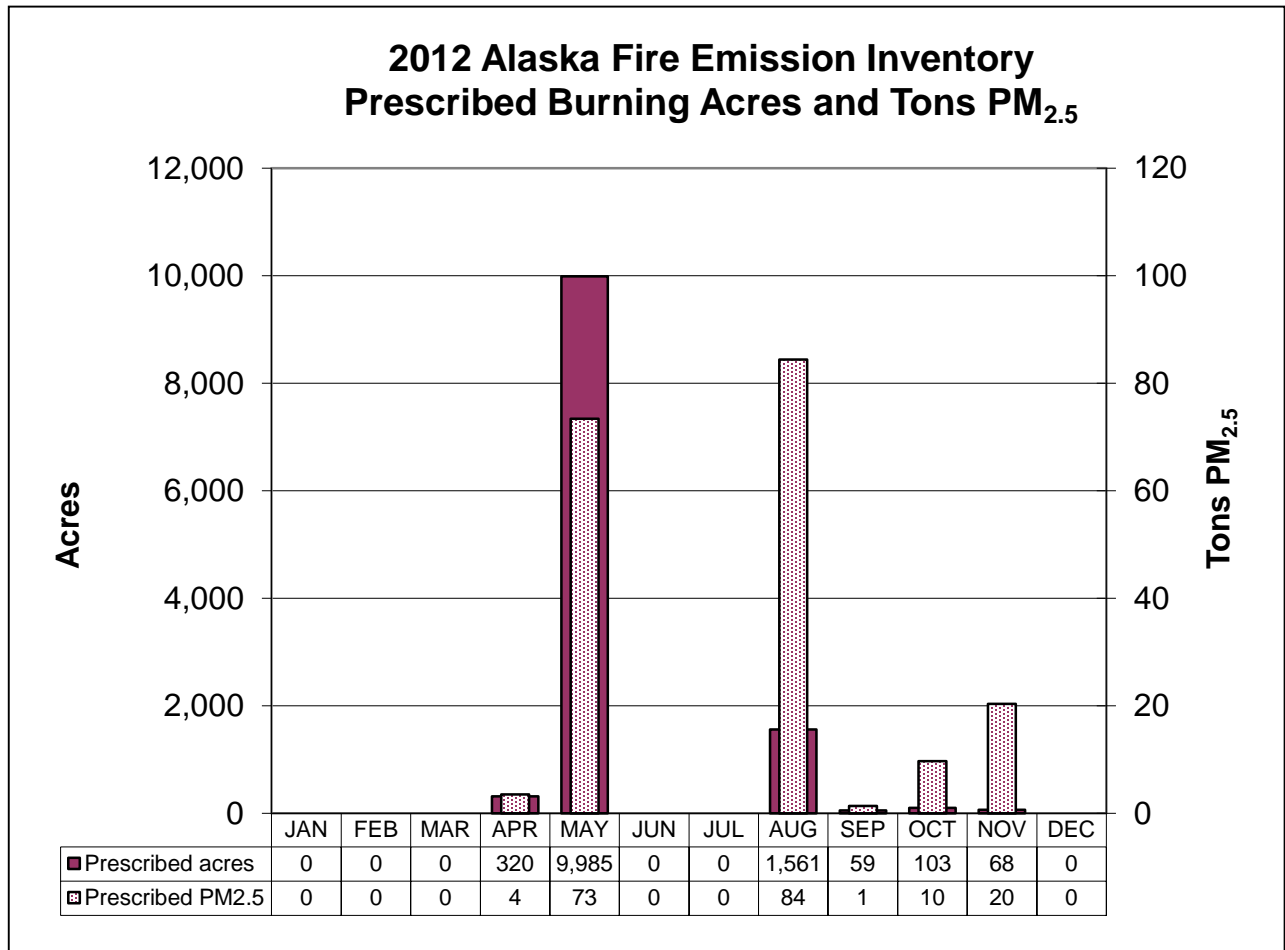


FIGURE 3

Figure 3 shows the acres of prescribed burns and tons of PM_{2.5} produced in 2012.

Almost all of the prescribed fire burns were conducted during May and August (11,546 acres, 95.6%), producing the largest amounts of PM_{2.5} (157 tons, 81.8%). April was the third largest month for acreage (320 acres, 2.6%) and November was the third largest month for tons of PM_{2.5} produced (10.4%) for prescribed burns.

Prescribed burns conducted through August were primarily broadcast (fire burned in mostly grassland, areas with little or no forest stand present); those conducted September through December were primarily pile burns, only 3 of 18 burns conducted during that time period were broadcast.

2012 Alaska Fire Emission Inventory Prescribed Burning Acres and Tons PM_{2.5}

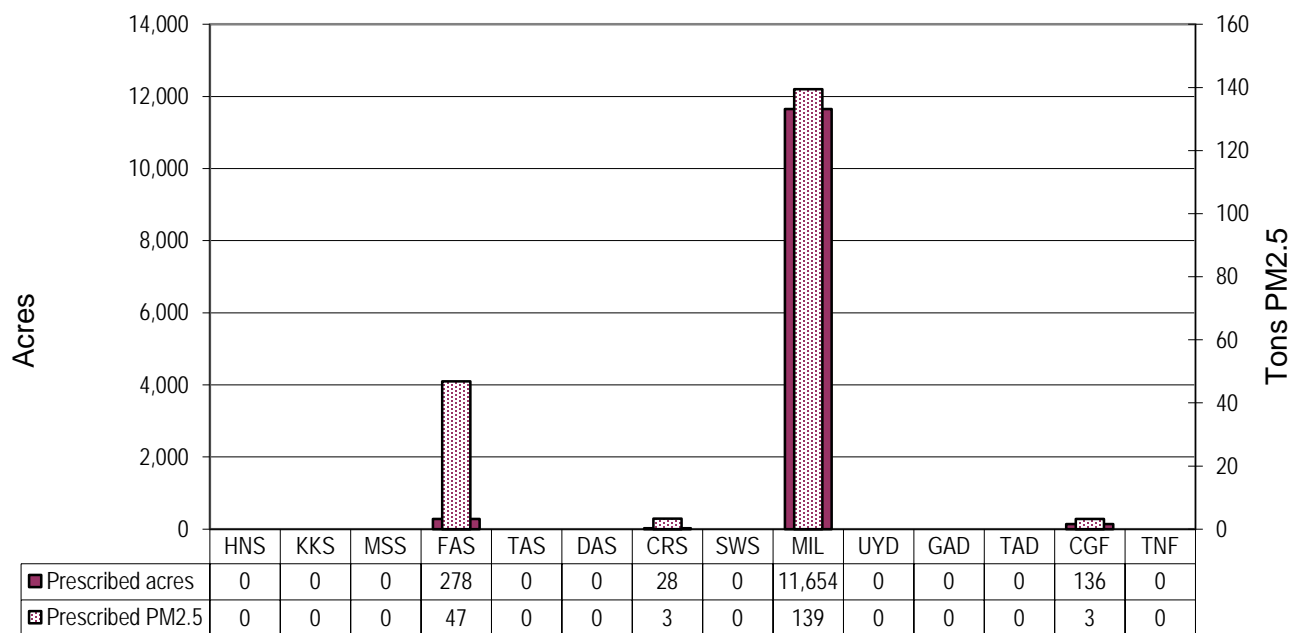


FIGURE 4

Figure 4 shows the acres of prescribed burns and the tons of PM_{2.5} produced by Fire Management Zone. A map of the Fire Management Zones is on Page 5.

The Military (MIL) burned most of the prescribed burn acres in 2012 (11,654 acres or 96.3%) and consequently produced most of the tons of PM_{2.5} (139 tons or 72.4%).

Fairbanks Area Forestry (FAS) had the 2nd highest prescribed burn acreage (278 acres or 2.3%) and PM_{2.5} tons (47 tons or 24.5%) produced in 2012.

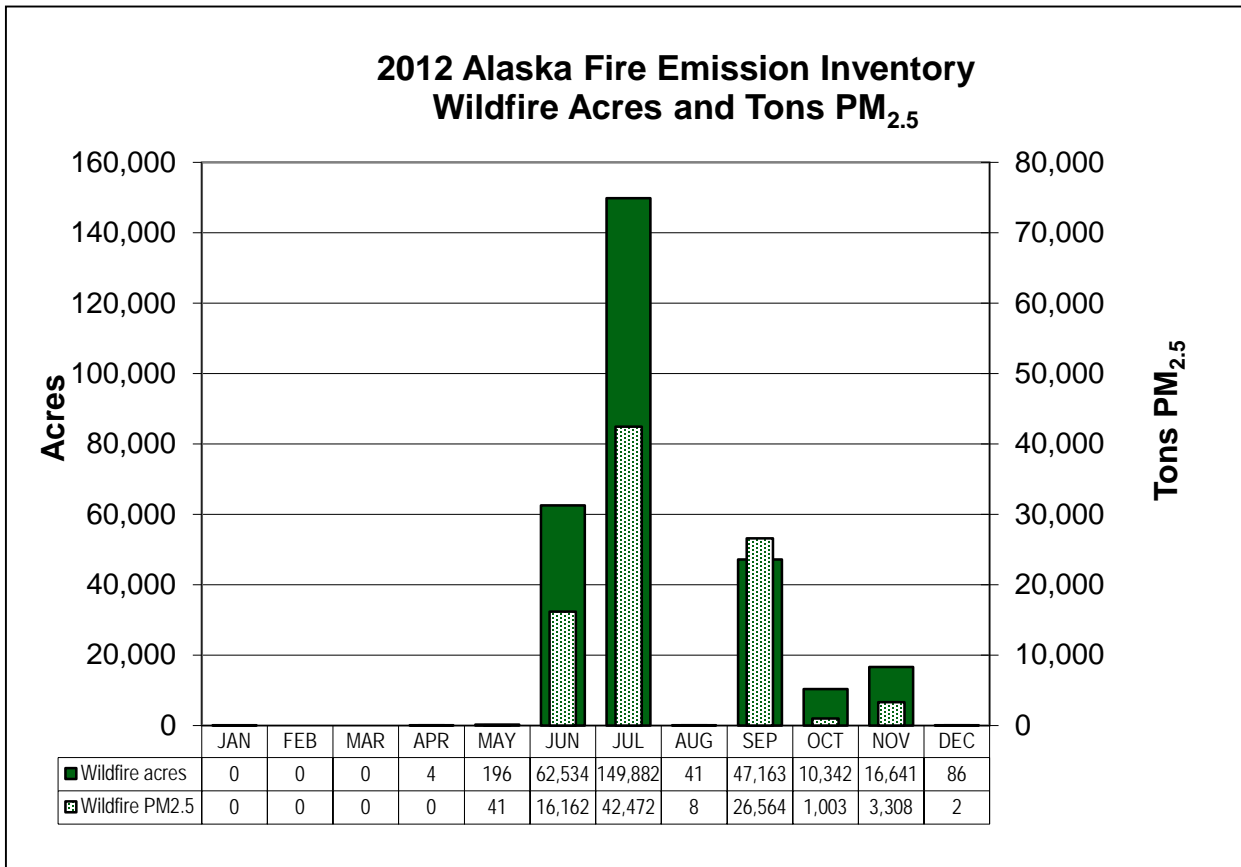


FIGURE 5

Figure 5 shows the wildfire acres and tons of PM_{2.5} by month.

Wildfire starts occurred April through December in 2012. June and July were the months calculated by the template to have the largest acreage burned (212,416 acres or 74.0%) while July and September were calculated to produce the most tons of PM_{2.5} (69,036 tons or 77.1%). September had the third largest wildfire acreage burned: 47,163 acres burned (16.4%) and 26,564 tons of PM_{2.5} produced (29.7%). The other months accounted for 27,310 (9.5%) acres burned and produced 20,524 (22.9%) tons of PM_{2.5}.

The template averages the 'month' of the fire between the start and end dates, i.e., a fire with a start in June may not be called out until August; the template would call this fire a 'July' fire whether or not most of the active burning was in June, July, or August.

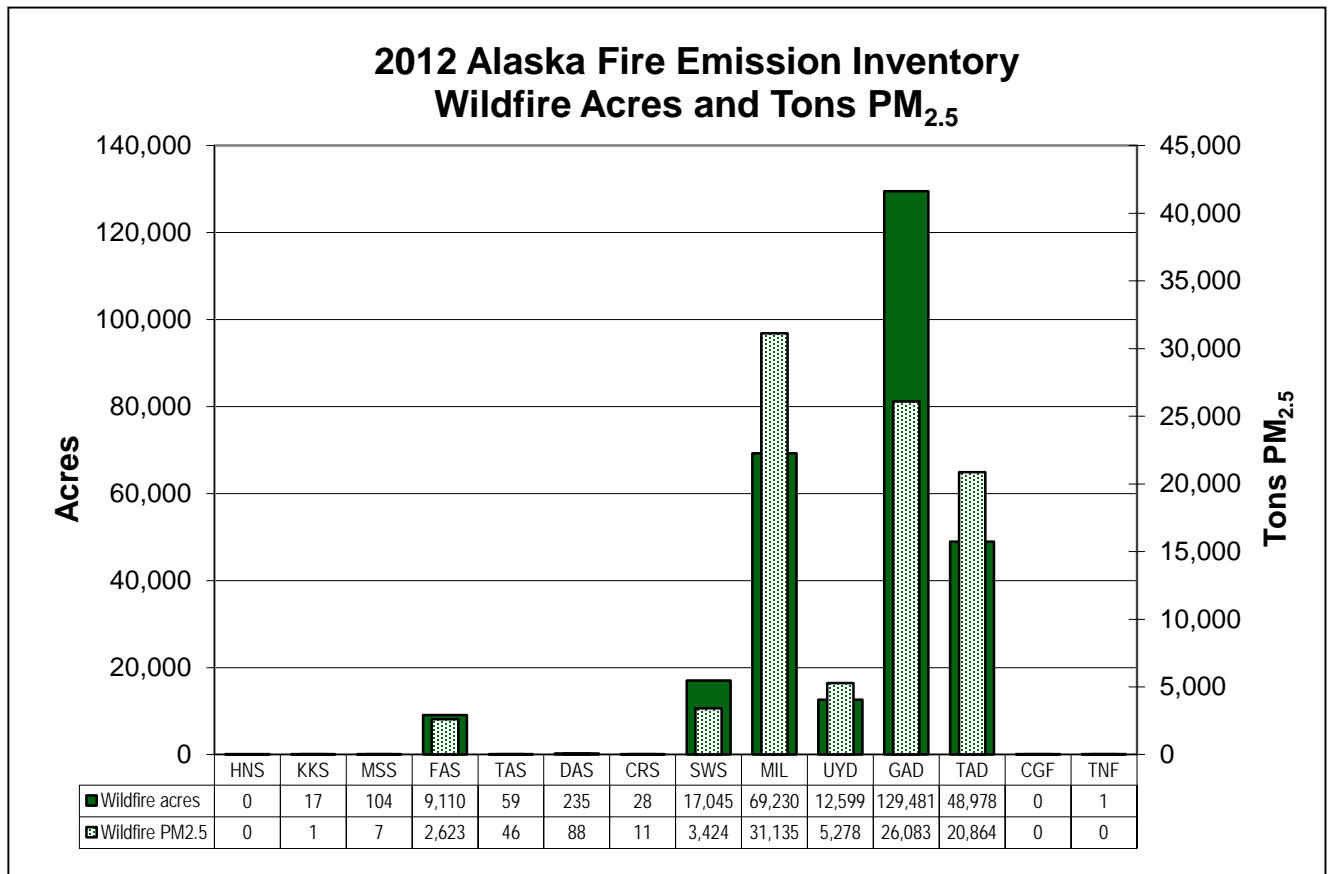


FIGURE 6

Figure 6 shows the wildfire acres and tons of PM_{2.5} by Fire Management Zone. A map of the Fire Management Zones is on Page 5.

All 14 Fire Management Zones reported wildfires, although Haines (HNS) and Chugach National Forest (CGF) fire acreages rounded to zero and show as '0' on the chart. Six zones - Haines (HNS), Kenai-Kodiak (KKS), Tok (TAS), Valdez/Copper River (CRS), Chugach National Forest (CGF), and Tongass National Forest (TNF) - reported less than 100 acres burned for 2012.

The five Fire Management Zones reporting the most acreage burned by wildfire also produced the most tons PM_{2.5}. The numbers are shown on the above chart, percentages are below.

- Galena Fire District (GAD) 45.1% acres 29.1% tons PM_{2.5}
- Military (MID / MIL) 24.1 % acres 34.8% tons PM_{2.5}
- Tanana Fire Management Zone (TAD) 17.1% acres 23.3% tons PM_{2.5}
- Southwest District (SWS) 5.9% acres 3.8% tons PM_{2.5}
- Upper Yukon District (UYD) 4.4% acres 6.4% tons PM_{2.5}

The remaining 9 Fire Management Zones (HNS, KKS, MSS, FAS, TAS, DAS, CRS, CGF, and TNF) reported 3.4% of the total acreage burned and 2.6% of the PM_{2.5} produced.

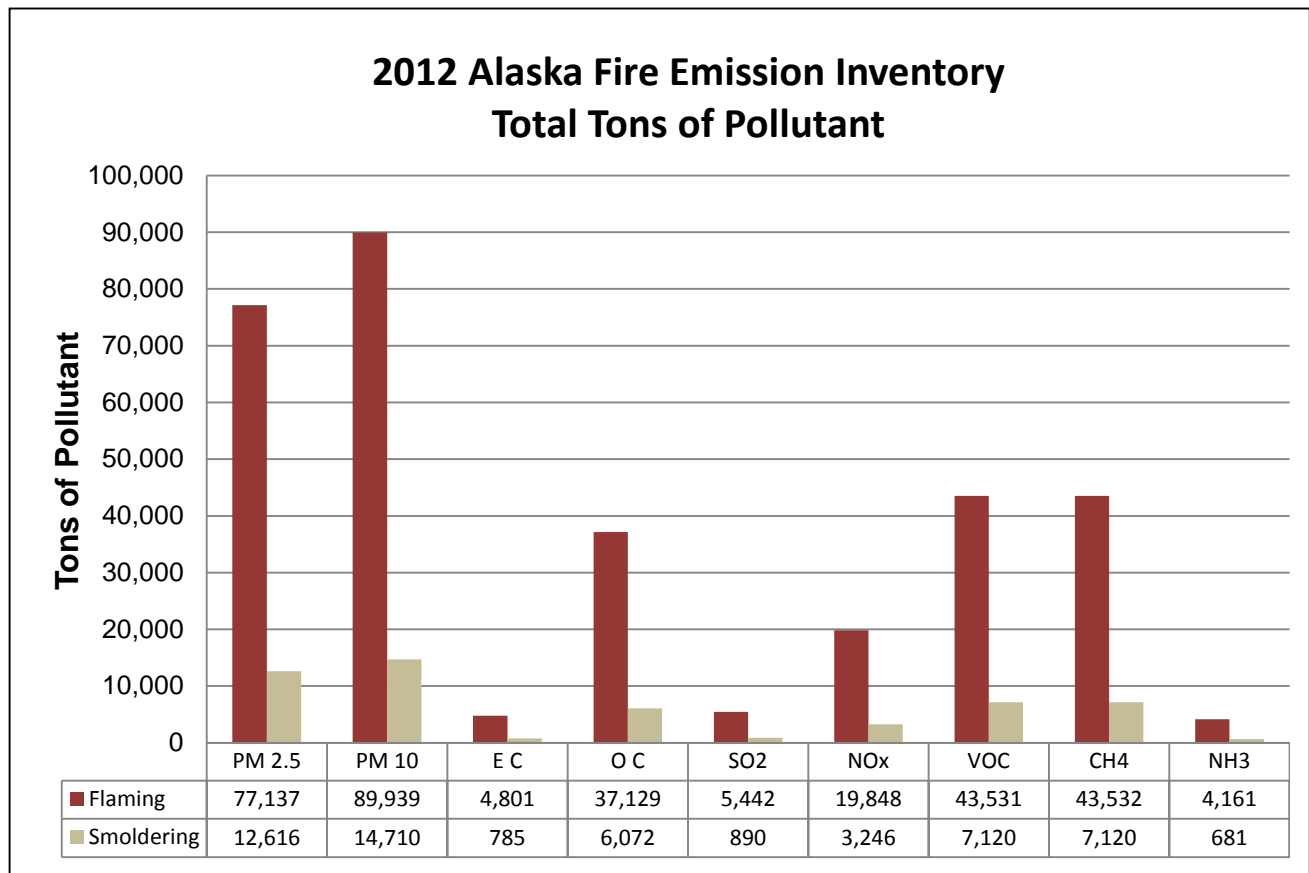


FIGURE 7

Figure 7 shows the total tons of pollutant produced by the 2012 fires for nine different air pollutants.

The graph shows the flaming and smoldering tons of the air quality pollutants from wildfires and prescribed burns. The emission factors (EF) for the pollutants, shown below, are also used in the template, and are based on the Western Regional Air Partnership (WRAP) Phase II 2002 fire emissions inventory (Air Sciences, Inc., 2004, 2005). The template calculated smoldering tons only if the emission factor of the fire was '5' or greater.

Pollutant	Symbol	Name in Figure 7	EF Broadcast Burns (lbs/ton)	EF Piled Burns (lbs/ton)
fine particulate matter	PM _{2.5}	PM 2.5	24.1	8.0
coarse particulate matter	PM ₁₀	PM 10	28.1	8.0
elemental carbon	EC	EC	1.5	0.6
organic carbon	OC	OC	11.6	4.3
sulfur dioxide	SO ₂	SO2	1.7	1.7
nitrogen oxides	NO _x	NOx	6.2	6.2
volatile organic compounds	VOC	VOC	13.6	6.3
methane	CH ₄	CH4	13.6	7.7
ammonia	NH ₃	NH3	1.3	0.5

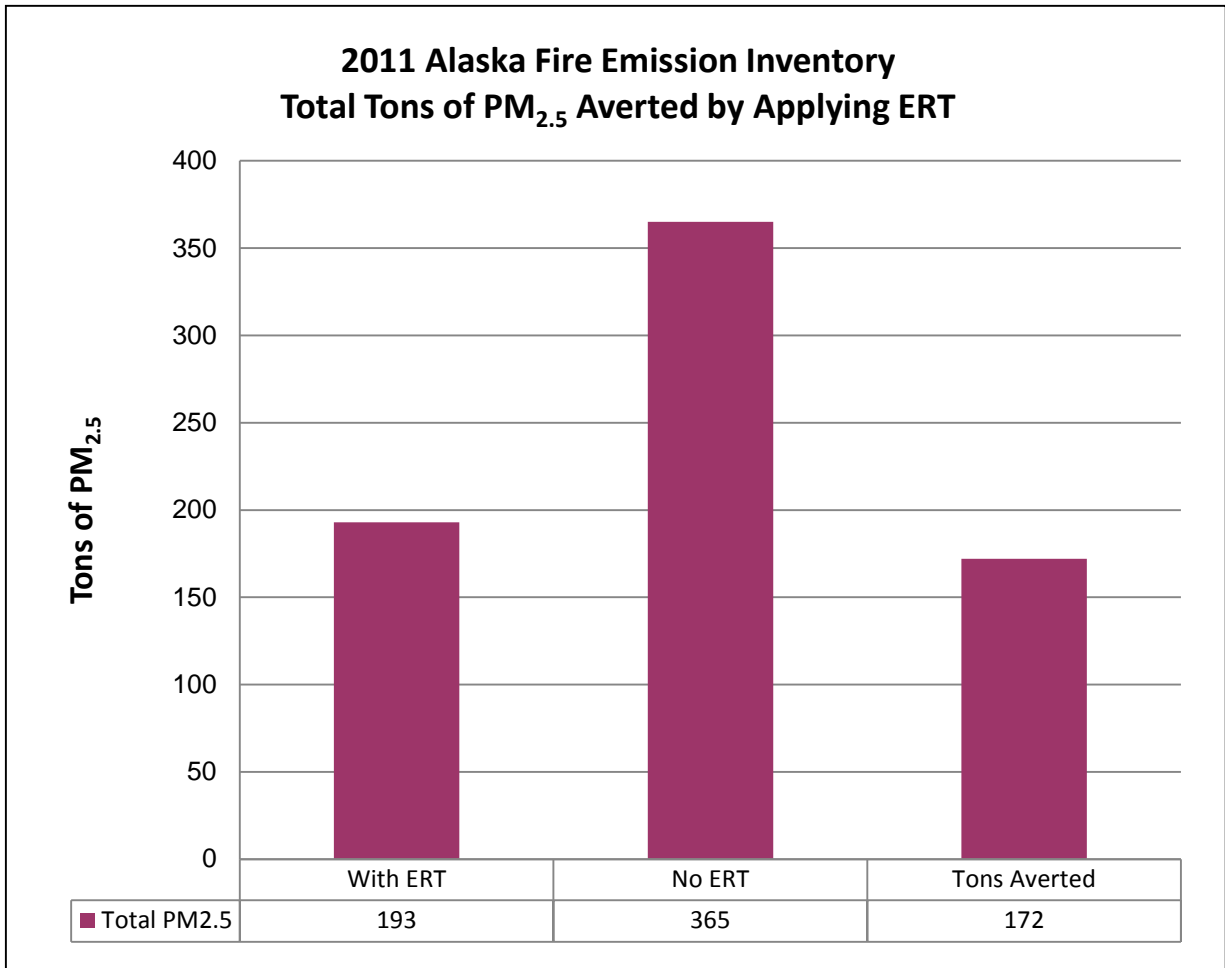


FIGURE 8

Figure 8 shows the total tons of PM_{2.5} averted by applying an Emission Reduction Technique (ERT) before or during a prescribed burn.

The graph shows the total tons of PM_{2.5} with Emission Reduction Techniques, what the numbers would have been without ERTs, and the 172 tons of PM_{2.5} (47.1 %) averted with the use of ERTs during prescribed burns. The emission reduction techniques used during prescribed burns greatly reduce the tons of PM_{2.5} produced.

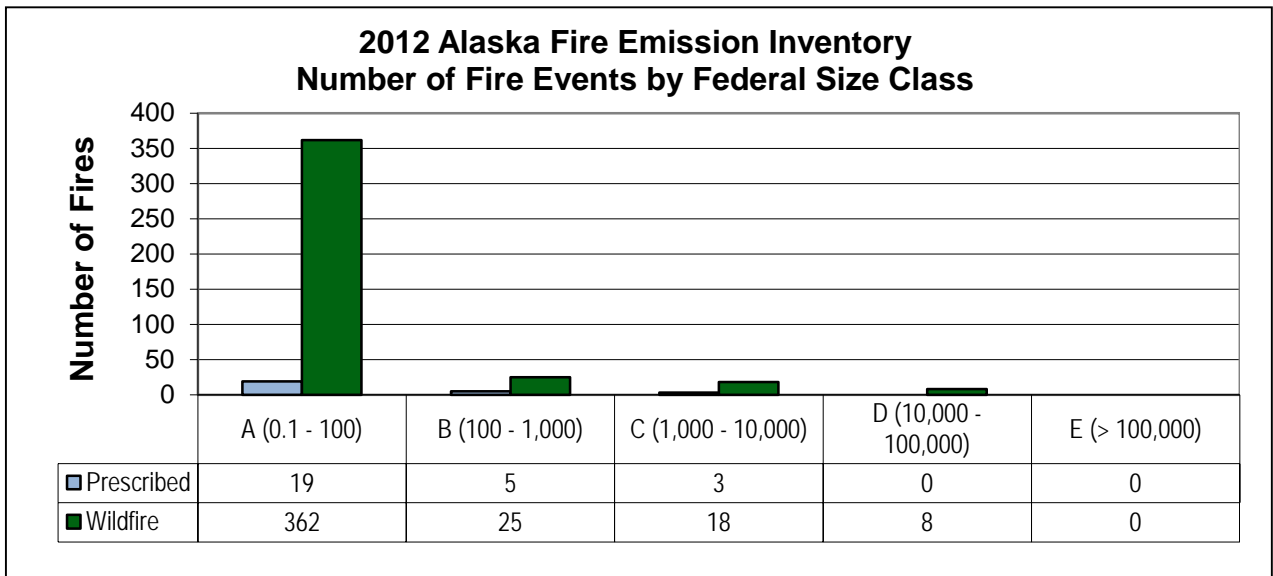


FIGURE 9

Figure 9 shows the number of fire events by Federal size class and Figure 10 shows the total tons of PM_{2.5} per Federal size class. The wildfire category is the larger in each of the federal fire size classes, ranging from Class A (0.1 to 100 acres) to Class D (10,000 to 100,000 acres).

In 2012, there were a total of 381 fires (86.6%) in the Class A size (less than 100 acres); 8 fires (1.8%) in Class D (10,000 to 100,000 acres), and no fires (0%) in Class E (greater than 100,000 acres). As shown by the chart, Federal Class A (0.1 to 100 acres) was the largest size fire category for both prescribed fires and wildfires. Alternately, as shown by Figure 10, the wildfire size category D with the least fires (8 or 1.8%) produced the most particulates (68.6%).

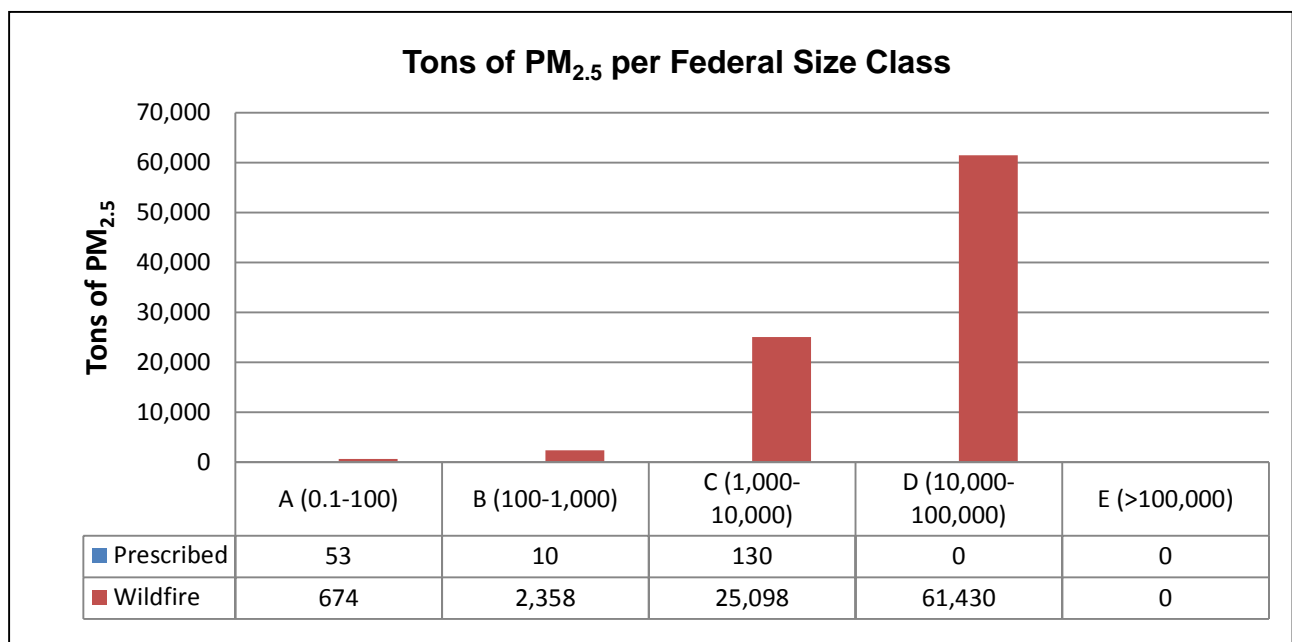


FIGURE 10

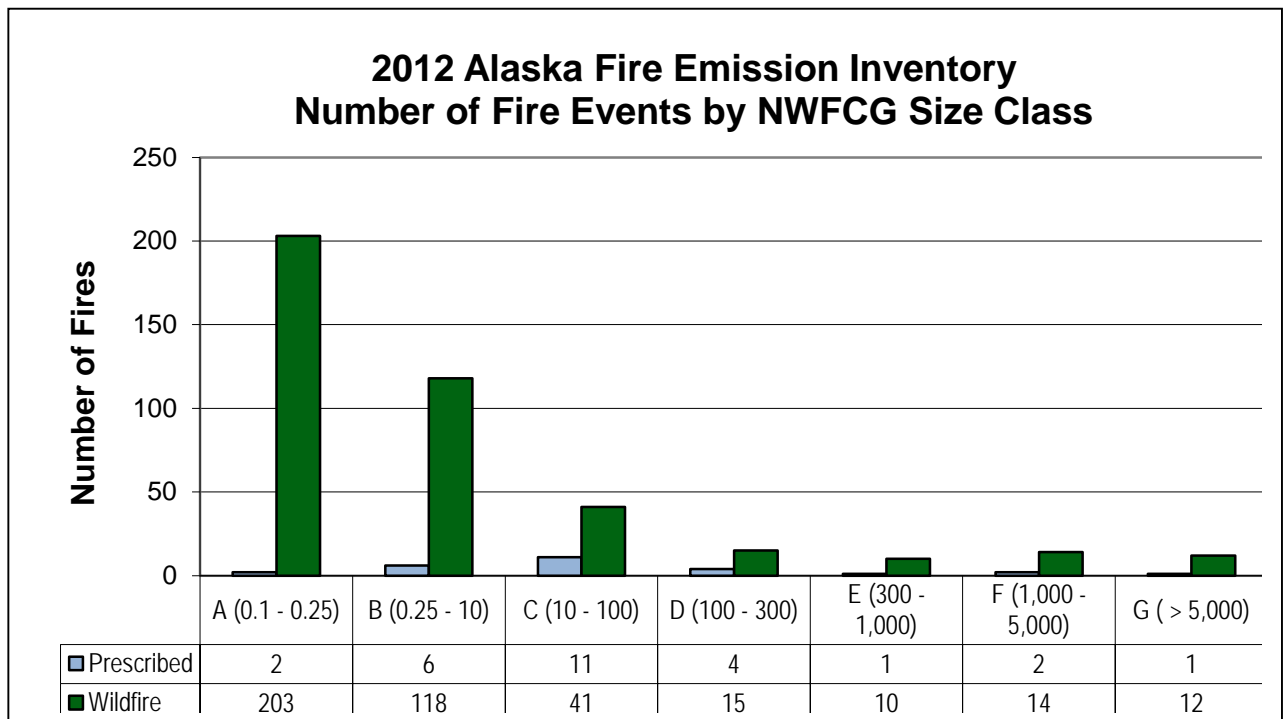


FIGURE 11

Figure 11 shows the number of fire events by National Wildland Fire Coordinating Group (NWFCG) size class and Figure 12 shows the total tons of PM_{2.5} per NWFCG size class.

The wildfire category is the larger in each of the NWFCG fire size classes in Figures 11 and 12. In 2012, 74.8% of the fires were less than 10 acres, and 46.6% were less than 0.25 acre. There were 13 fires (2.9%) larger than 5,000 acres. Those 13 fires produced 80.7% of the total tons PM_{2.5}. Fires less than 100 acres in size produced minimal PM_{2.5} emissions in 2012 (0.7%).

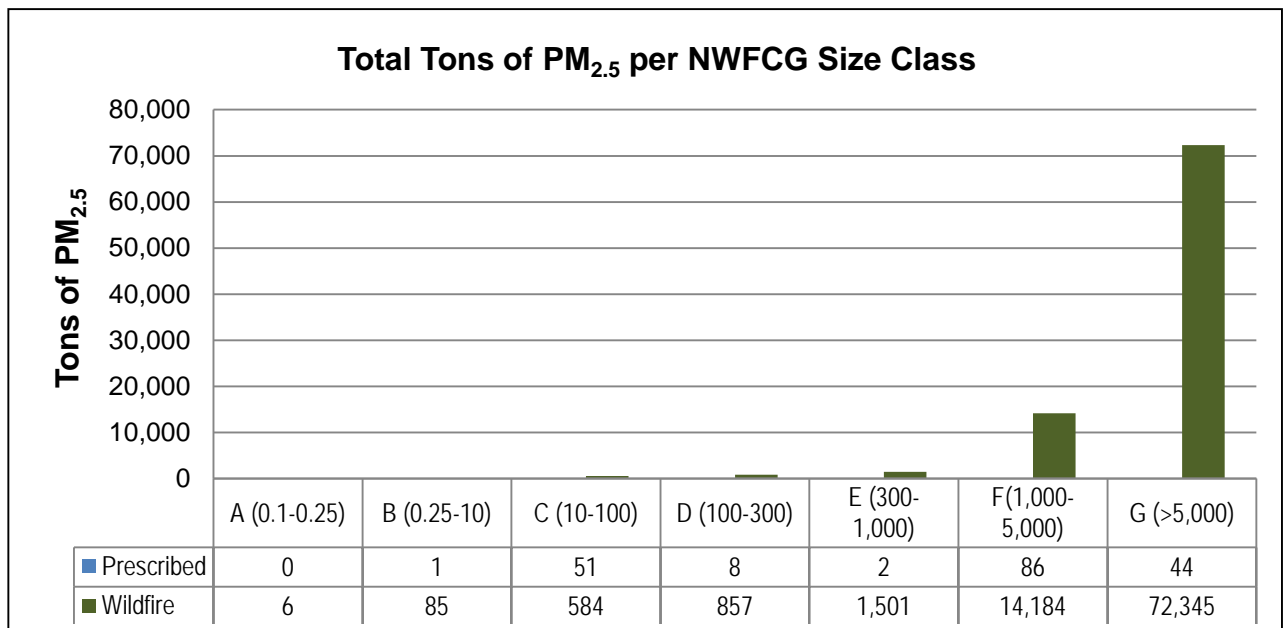


FIGURE 12

Appendix

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A. 1. Emission Factors Used

The Emission Factors (tons/acre) shown on this page and the next, were used for the various vegetation types and mixes found in wildfires. When two vegetation types were listed in the AICC situation report for a specific fire, the two vegetation emission factors (EF) were added together and roughly divided by two to come up with an average emission factor for the fire.

In 2012, for the 12 largest fires, the Air Quality and Smoke Management Committee supported using LANDFIRE vegetation types to more accurately determine emission factors. The vegetation types were determined post-fire for the 12 wildfires. The 57 vegetation types were assigned emission factors to match the values used in prior years. As noted below, several revisions to the EF were made.

In future years, LANDFIRE vegetation types will continue to be used for a minimum of 12 wildfires, or the number of fires it takes to reach 80% of the fire acreage burned. The LANDFIRE vegetation types and the assigned emission factors are shown on the following page. When multiple vegetation types were mapped, the emission factors were weighted by percent and a single number was calculated for the fire.

The Canadian Forest Fire Danger Rating System (CFFDRS) served as the primary source of emission factors as it is used by the BLM Alaska Fire Service.⁶

	<u>Wildfire EF</u>	<u>Prescribed EF</u>
Grasses - Western perennial	0.75	0.75
Intermediate brush	15	15
Black spruce Alaskan	57.57	48.76
Black spruce (57.57) and brush (15)	36	
Black spruce (57.57) and tundra (12)	34.5	
Black spruce (57.57) and grass (0.75)	29	
Black spruce (57.57) and white spruce (30.35)	45	
Spruce and hardwoods estimate	44	
Tundra (~avg 19.05 and 4.45)	12	
Tundra (12) and grass (0.75)	6.5	
Tundra (12) and brush (15)	13.5 (decreased from 15)	
Tundra (12) and white spruce (30.35)	24	
Brush (15) and grass (0.75)	8	
Grass (0.75) and hardwoods (30.35) estimate ⁷	6	
Grass (0.75) and slash (14.35)	7.5	
Tussocks / peat estimate	8.5 (increase from 5)	
Old burn estimate	20	
Unknown vegetation type estimate	20 or 30*	
Unknown pile estimate	10	
"Light fuels" estimate	10	

* Previous years used "30" as the emission factor estimate for an unknown vegetation type. During the 2012 fire season, an emission factor of either "20" or "30" was used depending upon location (i.e., predominant vegetation type) of the fire. Fires located in the SWS or GAD were estimated to have an emission factor of "20", the rest were estimated as "30." Overall, only a small percentage of fires did not list at least one vegetative type that could be used for an emission factor.

⁶ 2005 Alaska Wildland Fire Emissions Inventory and Wildland Fire Emissions Inventory Template, prepared by Air Sciences, Inc., for the Alaska Department of Environmental Conservation, project no. 217-2, June 2007, section 1.4.

⁷ estimate "low" as only grass/slash understory may burn

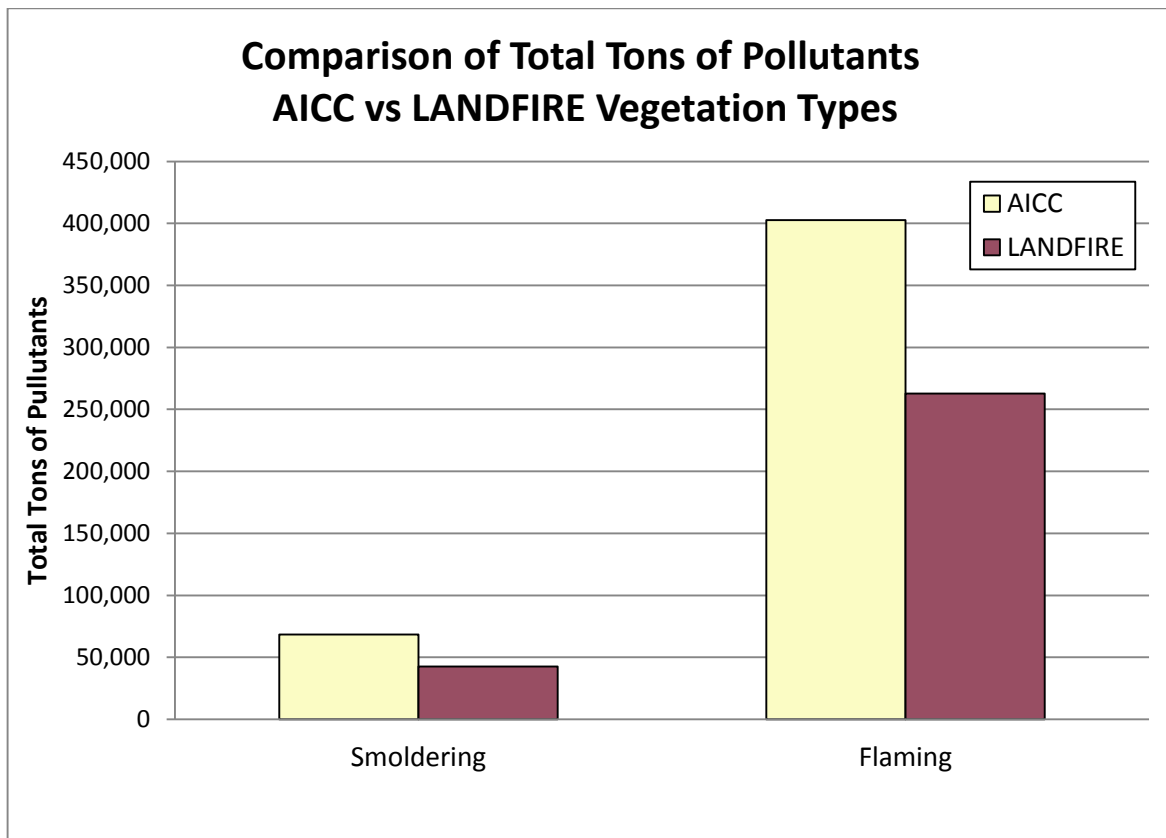
A.2. LANDFIRE vegetation types and emission factors for the 12 fires

LANDFIRE #	Existing Vegetation Type Name	Emission Factor	Vegetation Type Group
-9999	No Data	0	No Data
11	Open Water	0	Open Water
31	Barren	0	Barren
2600	Western North American Boreal White Spruce Forest	30.35	White Spruce Forest and Woodland
2601	Western North American Boreal Treeline White Spruce Woodland	30.35	White Spruce Forest and Woodland
2602	Western North American Boreal Spruce-Lichen Woodland	34.785	Spruce-Lichen Woodland
2603	Western North American Boreal White Spruce-Hardwood Forest	44	White Spruce-Hardwood Forest and Woodland
2604	Western North American Boreal Mesic Black Spruce Forest	57.57	Black Spruce Forest and Woodland
2605	Western North American Boreal Mesic Birch-Aspen Forest	30.35	Birch-Aspen Forest
2606	Western North American Boreal Dry Aspen-Steppe Bluff	30.35	Dry Aspen-Steppe Bluff
2607	Western North American Boreal Subalpine Balsam Poplar-Aspen Woodland	30.35	Balsam Poplar-Aspen Woodland
2609	Alaska Sub-boreal Mesic Subalpine Alder Shrubland	8	Alder Shrubland
2610	Western North American Boreal Mesic Scrub Birch-Willow Shrubland	8	Willow Shrubland
2611	Western North American Sub-boreal Mesic Bluejoint Meadow	0.75	Wet Meadow
2612	Western North American Boreal Dry Grassland	0.75	Boreal Grassland
2631	Western North American Boreal Alpine Dwarf-Shrub Summit	8	Dwarf Shrubland
2634	Western North American Boreal Alpine Dryas Dwarf-Shrubland	8	Dwarf Shrubland
2635	Western North American Boreal Alpine Ericaceous Dwarf-Shrubland	8	Dwarf Shrubland
2636	Western North American Boreal Alpine Dwarf-Shrub-Lichen Shrubland	8	Dwarf Shrubland
2638	Alaska Arctic Mesic Alder Shrubland	8	Alder Shrubland
2639	Alaska Arctic Mesic-Wet Willow Shrubland	8	Willow Shrubland
2677	Alaska Sub-boreal White-Lutz Spruce Forest and Woodland	30.35	White Spruce Forest and Woodland
2679	Alaska Sub-boreal White Spruce-Hardwood Forest	44	White Spruce-Hardwood Forest and Woodland
2682	Alaska Arctic Scrub Birch-Ericaceous Shrubland	8	Dwarf Shrubland
2683	Alaska Arctic Mesic Sedge-Willow Tundra	13.5	Shrub Tundra
2684	Alaska Arctic Mesic Sedge-Dryas Tundra	13.5	Shrub Tundra
2685	Alaska Arctic Acidic Sparse Tundra	10	Sparse Tundra
2687	Alaska Arctic Lichen Tundra	13.5	Shrub Tundra
2688	Alaska Arctic Acidic Dryas Dwarf-Shrubland	8	Dwarf Shrubland
2689	Alaska Arctic Non-Acidic Dryas Dwarf-Shrubland	8	Dwarf Shrubland
2690	Alaska Arctic Dwarf-Shrubland	8	Dwarf Shrubland
2691	Alaska Arctic Acidic Dwarf-Shrub Lichen Tundra	13.5	Shrub Tundra
2692	Alaska Arctic Non-Acidic Dwarf-Shrub Lichen Tundra	13.5	Shrub Tundra
2699	Alaska Arctic Mesic Herbaceous Meadow	0.75	Herbaceous Meadow
2740	Boreal Aquatic Beds	0.75	Freshwater Aquatic Bed
2741	Polar Tidal Marshes and Aquatic Beds	0.75	Tidal Marsh
2744	Arctic Herbaceous Wetlands	0.75	Freshwater Marsh
2745	Boreal Herbaceous Wetlands	0.75	Wet Meadow
2747	Arctic Sedge Meadows	0.75	Wet Meadow
2751	Boreal Coniferous Woody Wetland	34.5	Peatland Forests
2753	Boreal Coniferous-Deciduous Woody Wetland	57.57	Black Spruce Forest and Woodland
2756	Arctic Dwarf Shrub Wetland	8	Dwarf Shrubland
2757	Boreal Dwarf Shrub Wetland	8	Dwarf Shrubland
2762	Arctic Floodplains	15	Floodplain Forest and Shrubland
2763	Boreal Floodplains	15	Floodplain Forest and Shrubland
2771	Aleutian Peatlands	15	Shrub and Herbaceous Peatlands
2772	Arctic Peatlands	15	Shrub and Herbaceous Peatlands
2773	Boreal Peatlands	15	Shrub and Herbaceous Peatlands
2776	Boreal Riparian Stringer Forest and Shrubland	30.35	Riparian Stringer Forest and Shrubland
2777	Boreal Shrub Swamp	8	Shrub Swamp
2781	Arctic Sedge-Tussock-Lichen Tundra	10	Sparse Tundra
2782	Boreal Tussock Tundra	8.5	Tussock Tundra
2783	Arctic Tussock Tundra	8.5	Tussock Tundra
2784	Arctic Shrub-Tussock Tundra	8.5	Tussock Tundra
2785	Arctic Shrub Tundra	13.5	Shrub Tundra
2786	Boreal Shrub-Tussock Tundra	8.5	Tussock Tundra
2792	Arctic Sparsely Vegetated	0	Bedrock, Scree, and Talus
2793	Boreal Sparsely Vegetated	0	Bedrock, Scree, and Talus

A.3. Comparison between the AICC and LANDFIRE vegetation types and total calculated emissions.

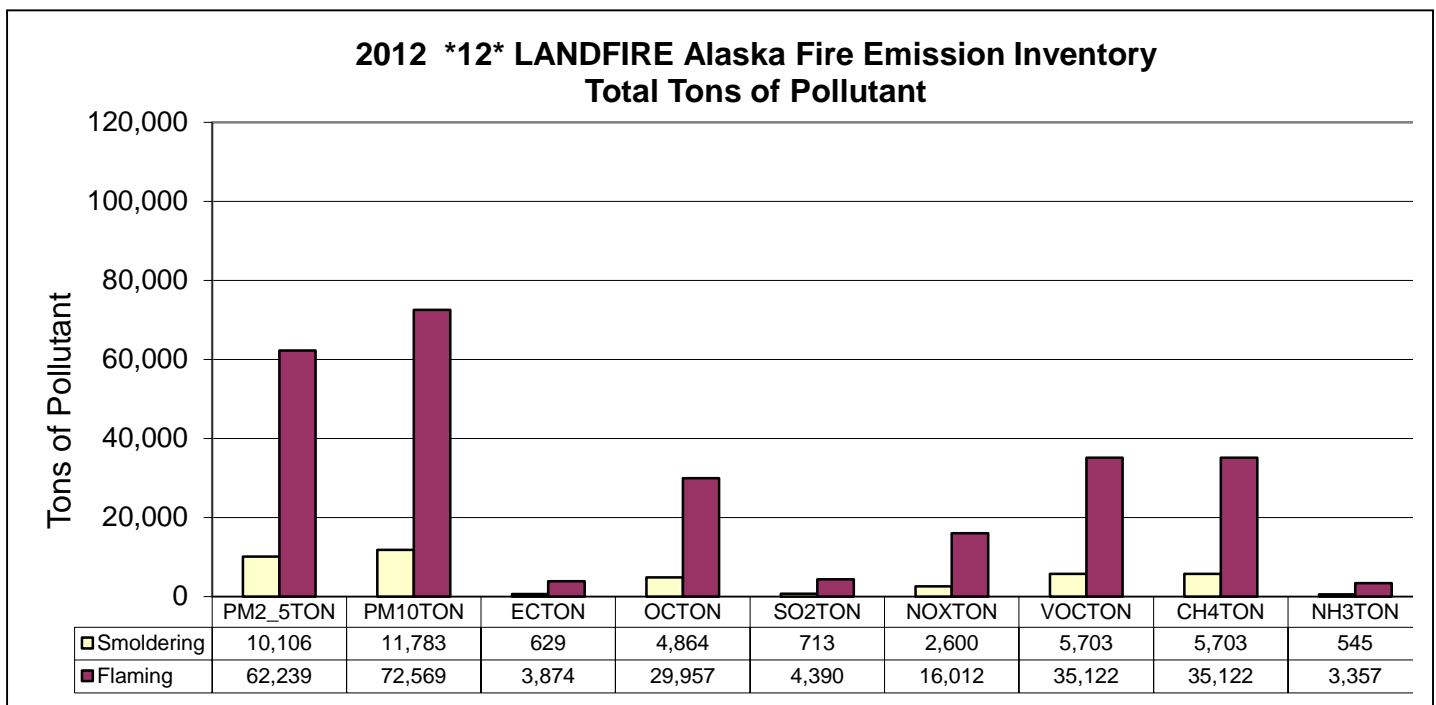
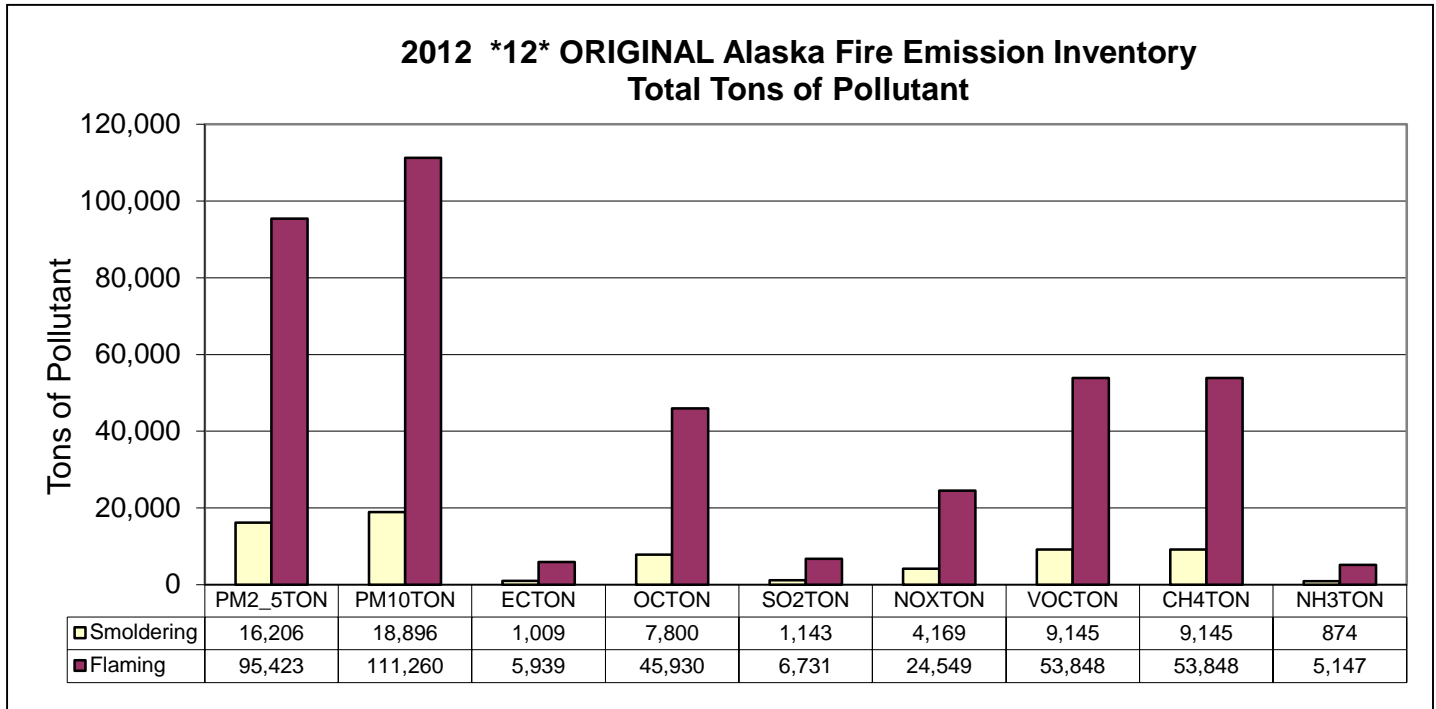
The following graph shows the difference between the “AICC” vegetation type total smoldering and flaming pollutant levels and the “LANDFIRE” vegetation type pollution levels for the 12 largest fires. In 2012, use of LANDFIRE EF showed lower emissions than the AICC EF because the LANDFIRE vegetation types reported had lower emission factors than the AICC vegetation types. The relationship may be different in future years. Use of LANDFIRE is considered to be more accurate since the vegetative types were determined post-burn instead of the first day of the burn.

Overall emissions in 2012 for the 12 fires were calculated to be approximately 35% lower with the use of LANDFIRE vegetation types.



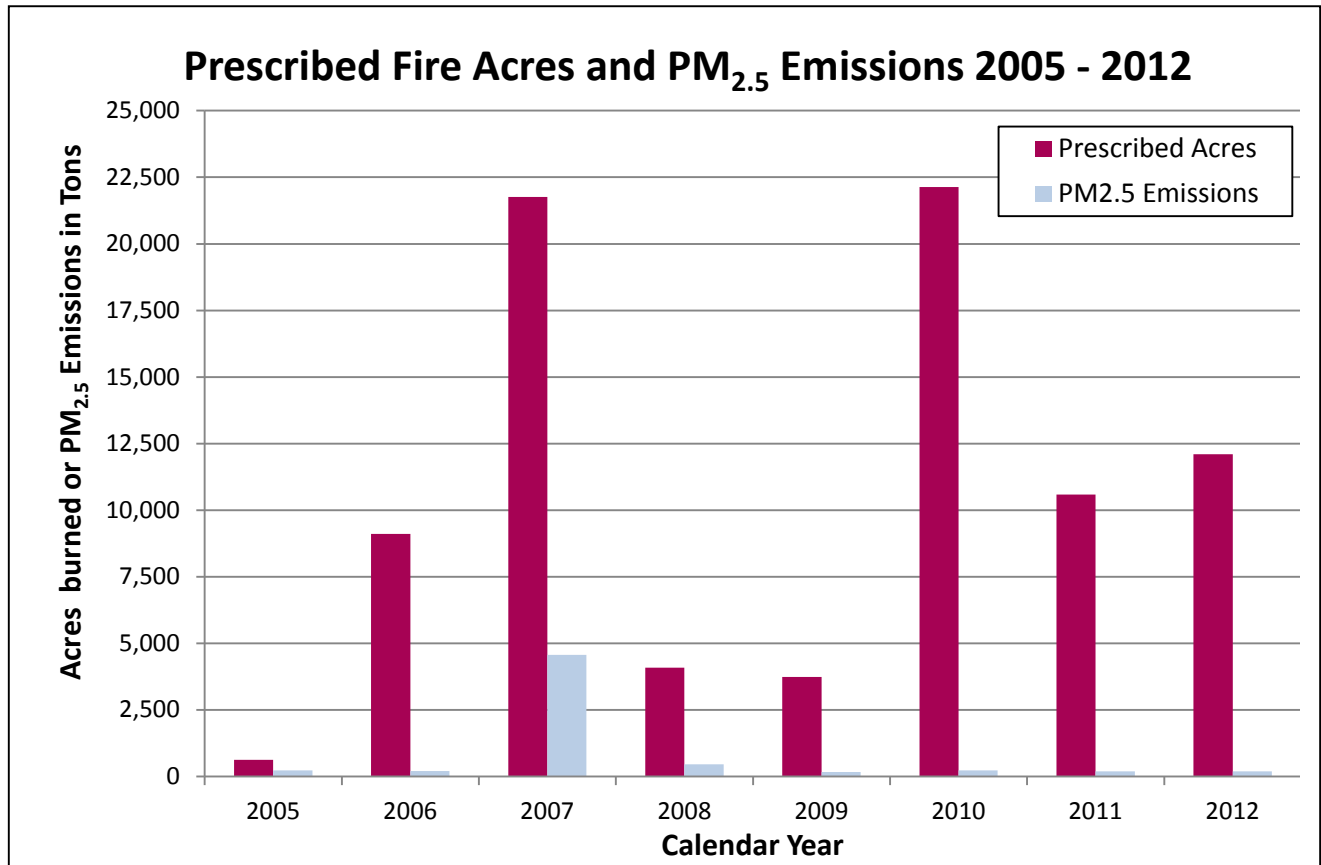
A.4. Comparison between the AICC and LANDFIRE vegetation types and specific calculated emissions.

The following graphs show the difference between the “AICC” vegetation type pollutant levels and the “LANDFIRE” vegetation type pollution levels for the 12 largest fires. As noted previously, in 2012, use of LANDFIRE EF showed lower emissions than the AICC EF. Use of LANDFIRE is considered to be more accurate since the vegetative types were determined post-burn instead of the first day of the burn. Individual calculated pollutant emissions in 2012 for the 12 fires were also approximately 35% lower with the use of LANDFIRE vegetation types.



B. Comparison of Yearly Prescribed Burn Acres and Emissions

The graph below shows eight years of acreage burned and PM_{2.5} emissions from prescribed fire for the years 2005 through 2012.



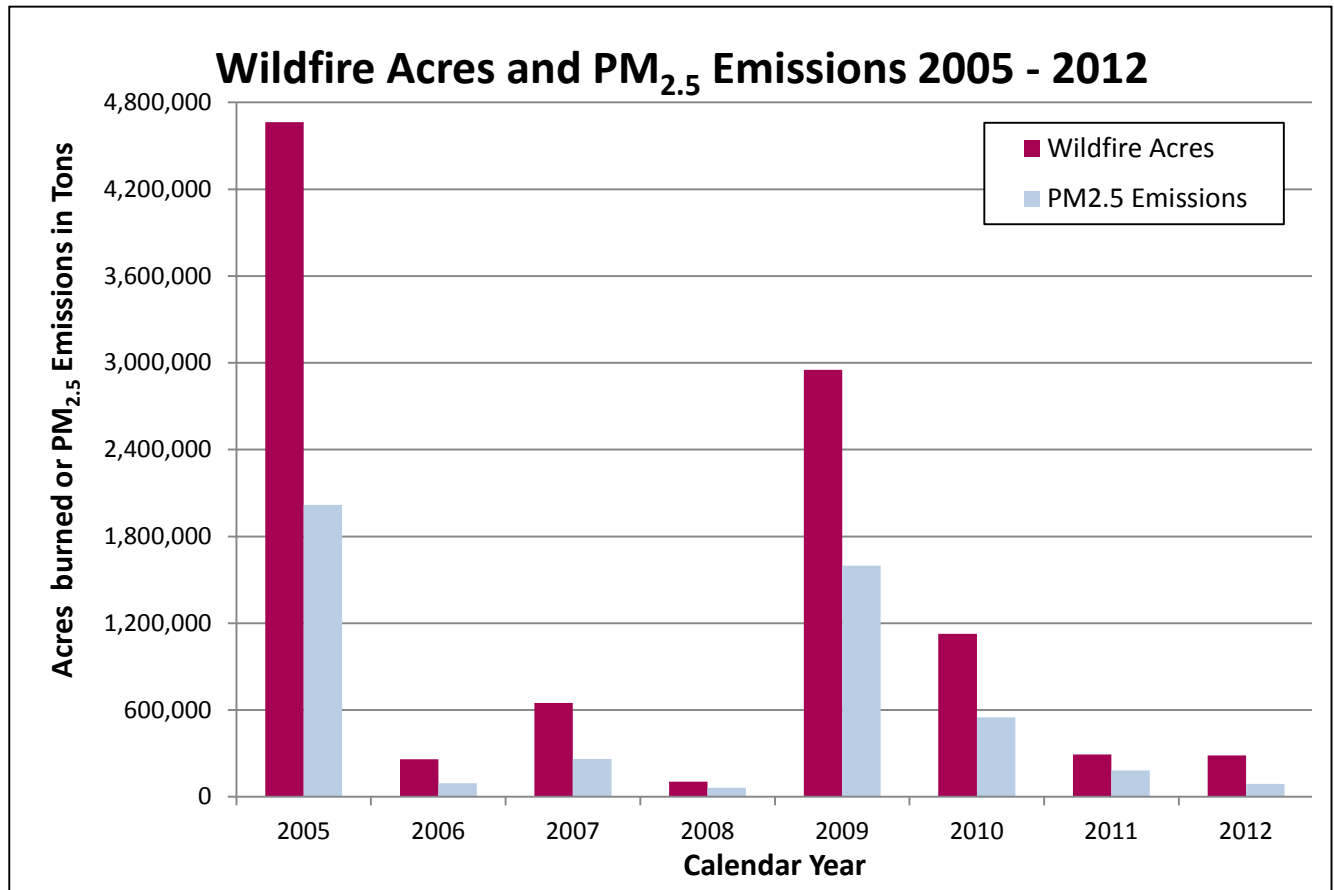
Graph details are below:

Calendar Year	2005	2006	2007	2008	2009	2010	2011	2012
Acres	626	9,110	21,761	4,081	3,740	22,136	10,585	12,095
Tons PM _{2.5}	231	200	4570 *	454	172	227	189	193

* The tons PM_{2.5} for 2007 were revised downward from the previous total of 8,230 tons due to re-calculating with a lower emission factor for one fire, Oklahoma Range. No vegetation types had been listed in the AICC daily report, so a value of "30", for unknown vegetation type, was originally used. The original value appeared high compared to other years, and after further research the vegetation types were found and the emission factor was calculated to be 16.

C. Comparison of Yearly Wildfire Acres and Emissions

The yearly wildfire acreage burned and PM_{2.5} emissions for the past eight years are shown on the graph below. The Wildland Fire Use category acreage was added to the wildfire acreage for years 2005 through 2008 for consistency in the graph. The detailed numbers following the graph include the acreage and PM_{2.5} emissions for Wildland Fire Use. The category was discontinued after 2008.

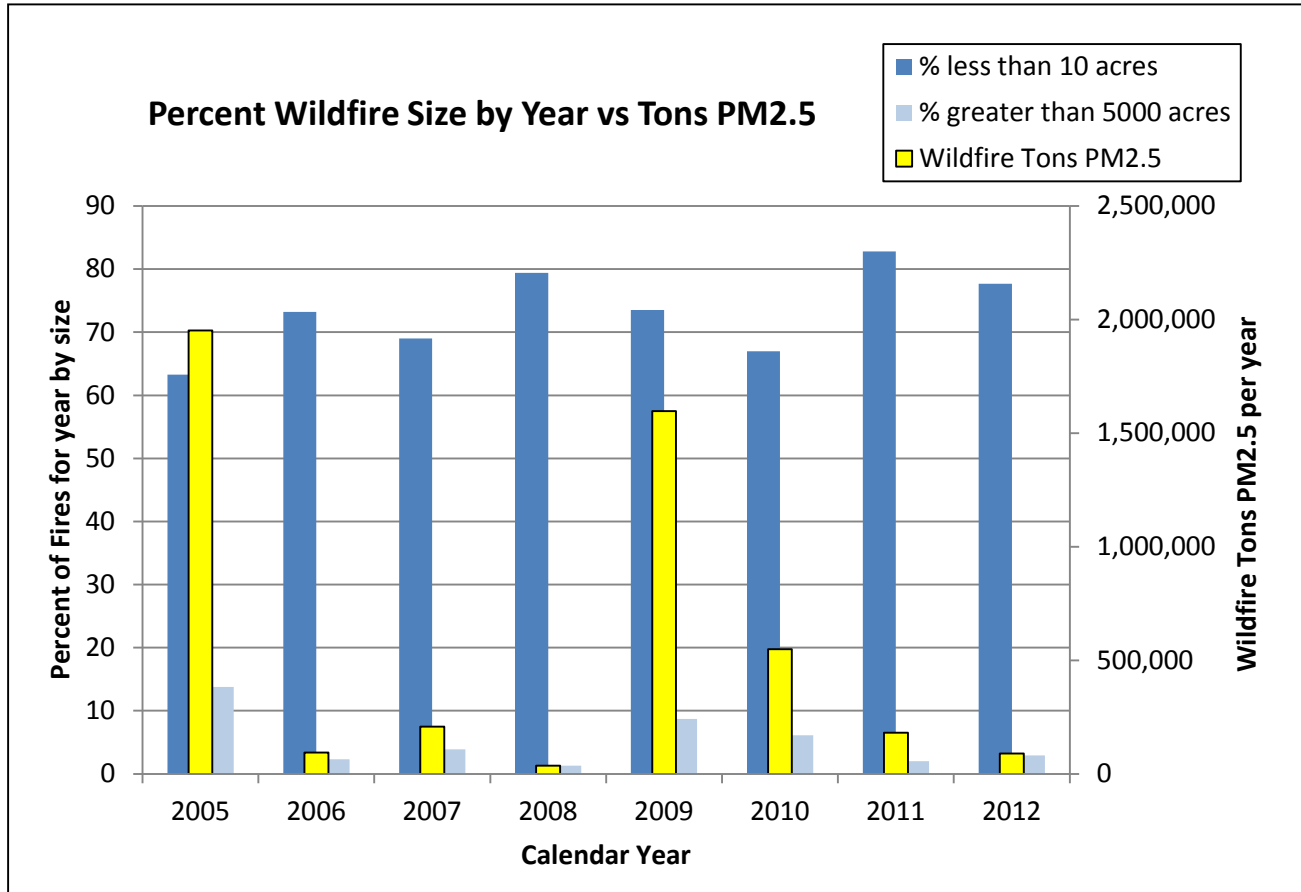


Graph details are below. From 2009 on, the discontinued category of Wildland Fire Use is included within the Wildfire category.

Calendar Year	2005	2006	2007	2008	2009	2010	2011	2012
Wildfire Acres	4,493,846	258,529	536,180	62,650	2,951,598	1,125,499	293,018	286,888
Wildfire Tons PM _{2.5}	1,951,531	93,409	207,428	35,785	1,597,149	549,494	180,976	89,560
Wildland Fire Use Acres	169,956	1,613	113,235	40,999	N/A	N/A	N/A	N/A
Wildland Fire Use Tons PM _{2.5}	67,353	40	54,232	27,091	N/A	N/A	N/A	N/A

D. Percent Wildfires by size by year compared to Tons PM2.5 per year

The number of small fires (less than 10 acres) and the number of larger fires (5000 acres or larger) is compared to the Total Tons Wildfire PM2.5 produced per year as shown below. The data seems to indicate the larger the acreage of large fires (over 5000 acres) the greater the amount of emissions produced. The number of small fires (10 acres or less) do not seem to have much effect on total emissions.



Numeric details for the above graph:

Calendar Year	2005	2006	2007	2008	2009	2010	2011	2012
% less than 10 acres	63.3	73.2	69	79.4	73.5	67	82.8	77.7
% greater than 5000 acres	13.8	2.3	3.9	1.3	8.7	6.1	2.0	2.9
Wildfire Tons PM _{2.5}	1,951,531	93,409	207,428	35,785	1,597,149	549,494	180,976	89,560