2007 Alaska
Wildland Fire Emissions Inventory

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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). 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 updated ESMP will be an important component of Alaska's Regional Haze State Implementation Plan.

This report accomplishes the Department of Environmental Conservation's responsibility for reporting 2007 prescribed fire emissions as required by the Enhanced Smoke Management Plan. It also reports on the statewide wildland fire and "wildland fire use" emissions occurring in 2007. "Wildland Fire Use" is a category of naturally-ignited fires that are managed for specific resource management objectives.

During the summer of 2007 there were 246 human caused fires and 260 fires ignited by lightning. A total of 649,411.1 acres were burned, most started by lightning (85.8% or 556,950.6 acres). The fire season began in mid-April, with the majority of reported fires occurring in the northern half of the state. The season ended when the northern Alaska Anaktuvuk River fire was called out on October 9, 2007. This tundra fire accounted for almost 40% of the statewide acreage total, and surpassed all previously recorded acreage for fires north of 68 degrees latitude, combined, since 1956.[2]

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 wildland fire management and suppression in Alaska. [3]

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.[4] The AICC collects most wildland fire related data into daily situation reports, available on their website: http://fire.ak.blm.gov/predsvcs/intel.php

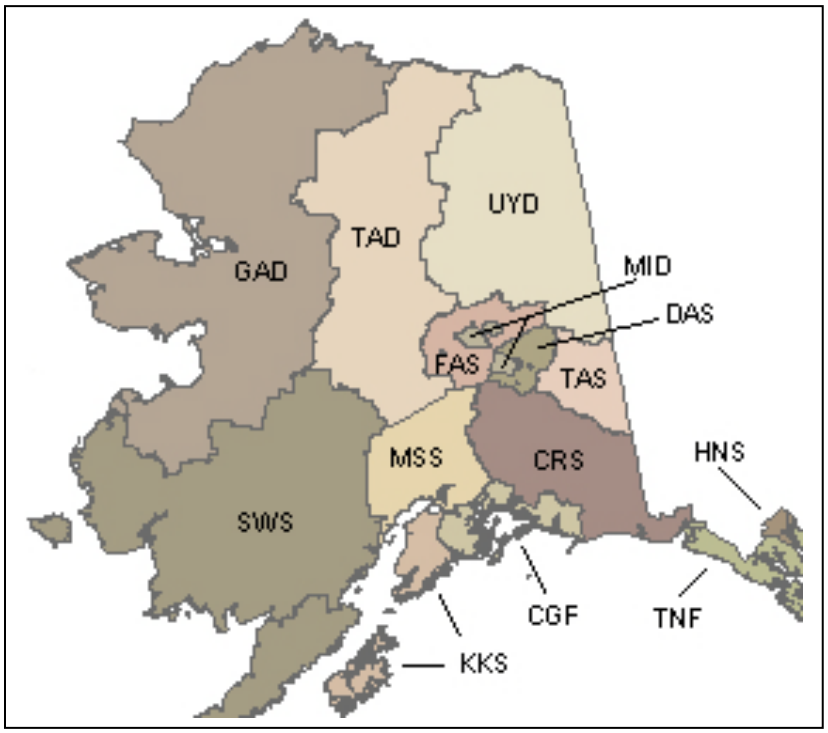
Alaska has 14 Fire Management Zones. Fire management planning, preparedness, suppression operations, prescribed fire, and related activities are coordinated on an interagency basis (i.e., the AICC).

[1] Alaska Enhanced Smoke Management Plan for Planned Fire, Procedures Manual, Executive summary, June 2009
[2] Alaska Fire Season 2007 Report, Predictive Services, Alaska Interagency Coordination Center, Alaska Fire Service, Ft. Wainwright, AK
[3] Alaska Interagency Coordination Center website: http://fire.ak.blm.gov/aicc.php
[4] ibid

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.[5]

The fourteen Alaska Fire Management Zones are shown in 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 (MIL)
- 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)



[5] Division of Forestry Fire Program webpage: http://forestry.alaska.gov/fire/

Method for 2007 Alaska Wildland Fire 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 2007 wildland fire inventory. A summary of all the 2007 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 requirements of the template, and the 'emission factor' for each fire, as determined by the description on the 2007 daily Alaska Interagency Coordination Center situation reports, was entered. One 'short cut' was taken: 195 fires were less than 0.25 acre in size. After reviewing approximately 25 of those listed as 0.1 acre and determining most of them had been grass fires, the emission factor of 0.75 (grass) was used for all fires listed as 0.1 acre. This was accomplished using EXCEL. However, when reviewing the daily sit reps, if any 0.1 acre fire had been started in, for example, black spruce, the black spruce emission factor (57.57) was used.

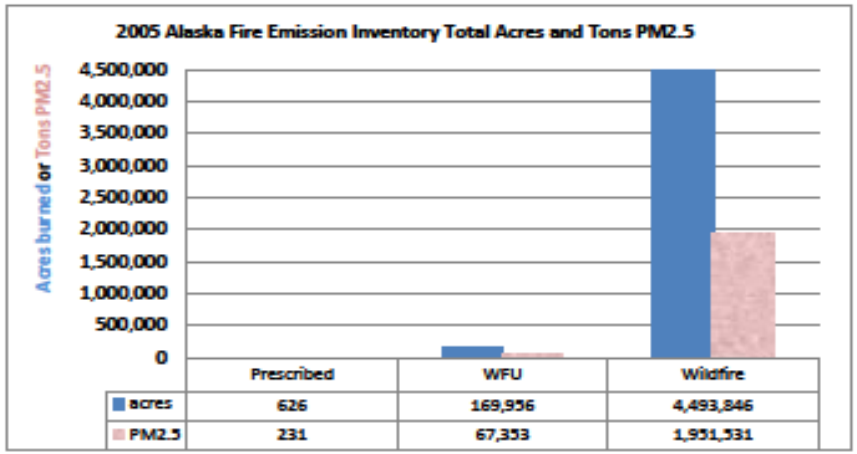
The total acreage in the Emission Inventory is greater than that reported by the AICC as all prescribed fires were not compiled within the 2007 AICC data provided to ADEC. Prescribed fires added 21,761 acres to the total.

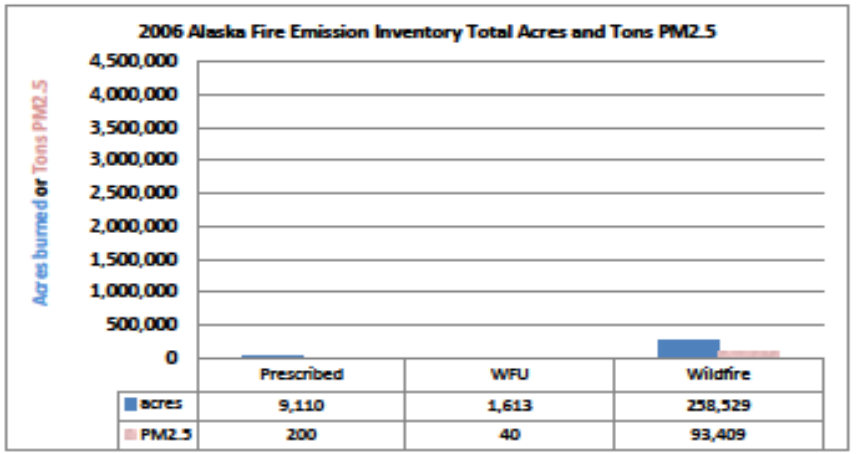
The fires in the emission inventory are categorized into three groups: Prescribed Fires, Wildland Fire Use (WFU), and Wildfires. The following definitions are taken from the Alaska Enhanced Smoke Management Plan for Planned Fire.

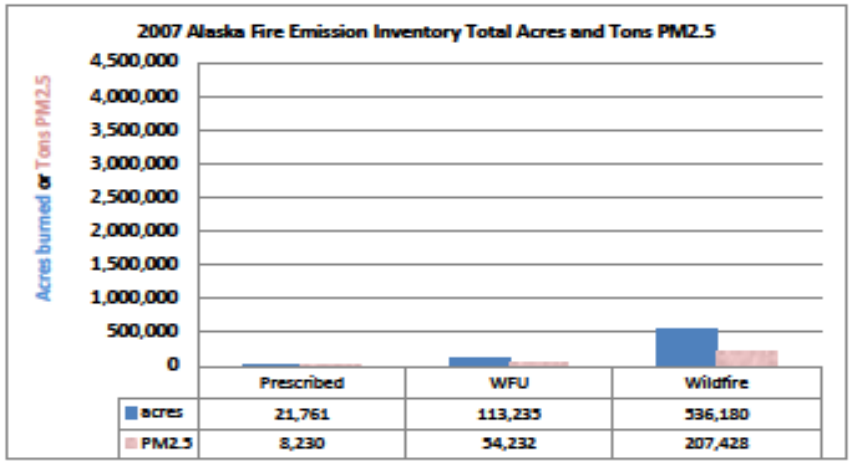
- **Prescribed Fire**, or controlled burn, is any fire ignited by management actions to meet specific objectives. A written, approved prescribed fire plan must exist. In a federal action, National Environmental Policy Act requirements must be met prior to ignition. Prescribed fire is a type of open burning.

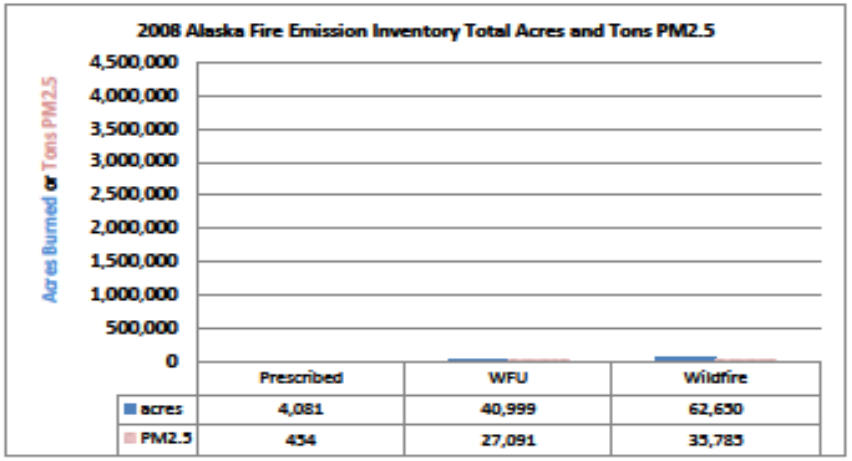
- **Wildland Fire Use** (WFU) fires entail the application of the appropriate management response to naturally-ignited wildland fires to accomplish specific resource management objectives in pre-defined designated areas outlined in Fire Management Plans.

- **Wildland fire** 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.









This page shows four years of Alaska wildland fire emissions for Prescribed Fire, Wildland Fire Use, and Wildland Fires for the years 2005 through 2008. The scale of the acres burned or tons of PM 2.5 was kept the same for each graph to show the differences between the years. Note that for 2006, the report included 38,092 acres "prescribed fire" which included events in small permitted burns, administered by the Alaska DNR. These burn acres were not included in the 2006 graph to be consistent with the other years depicted which did not include the DNR permit acreage.

Discussion of Results

The Fire Emission Template presents results through 12 graphs. Figures 1 through 12 are discussed on the following pages. A listing of the emission factors used for vegetation groups is provided after Figure 12.

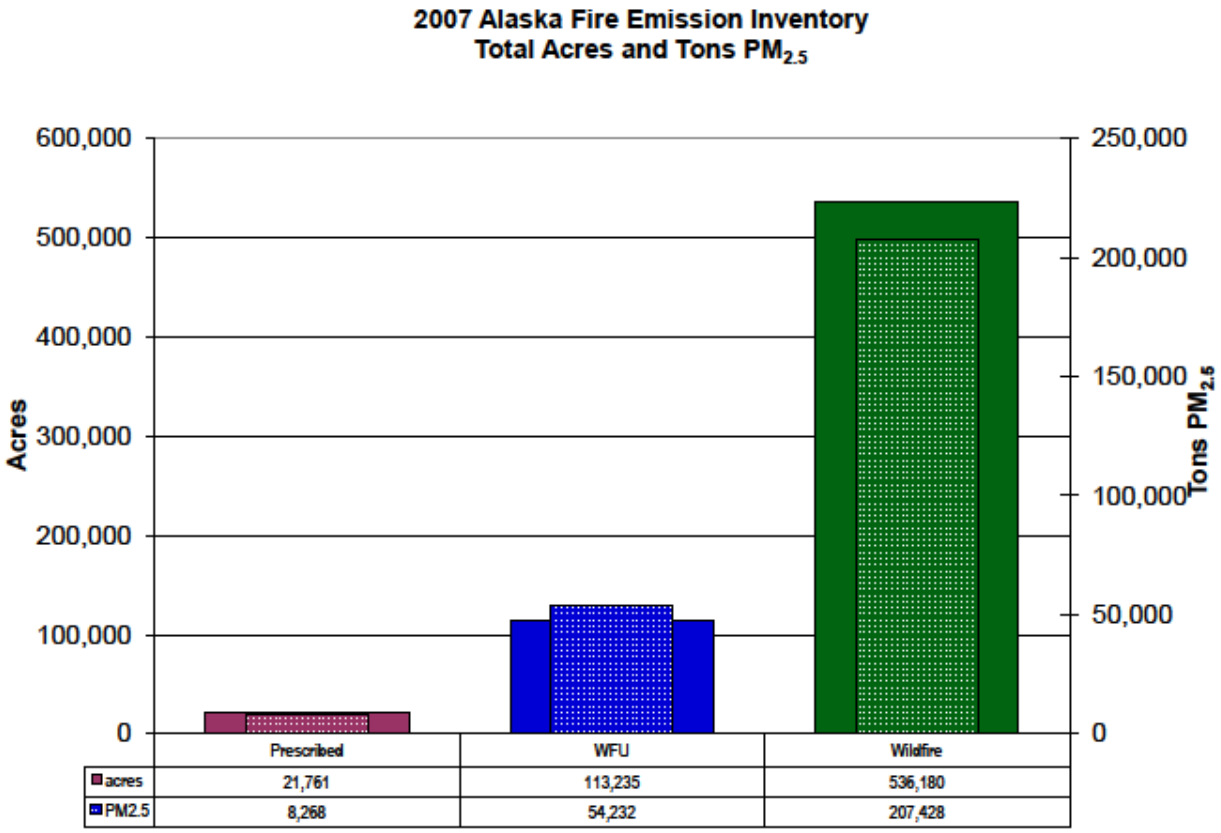
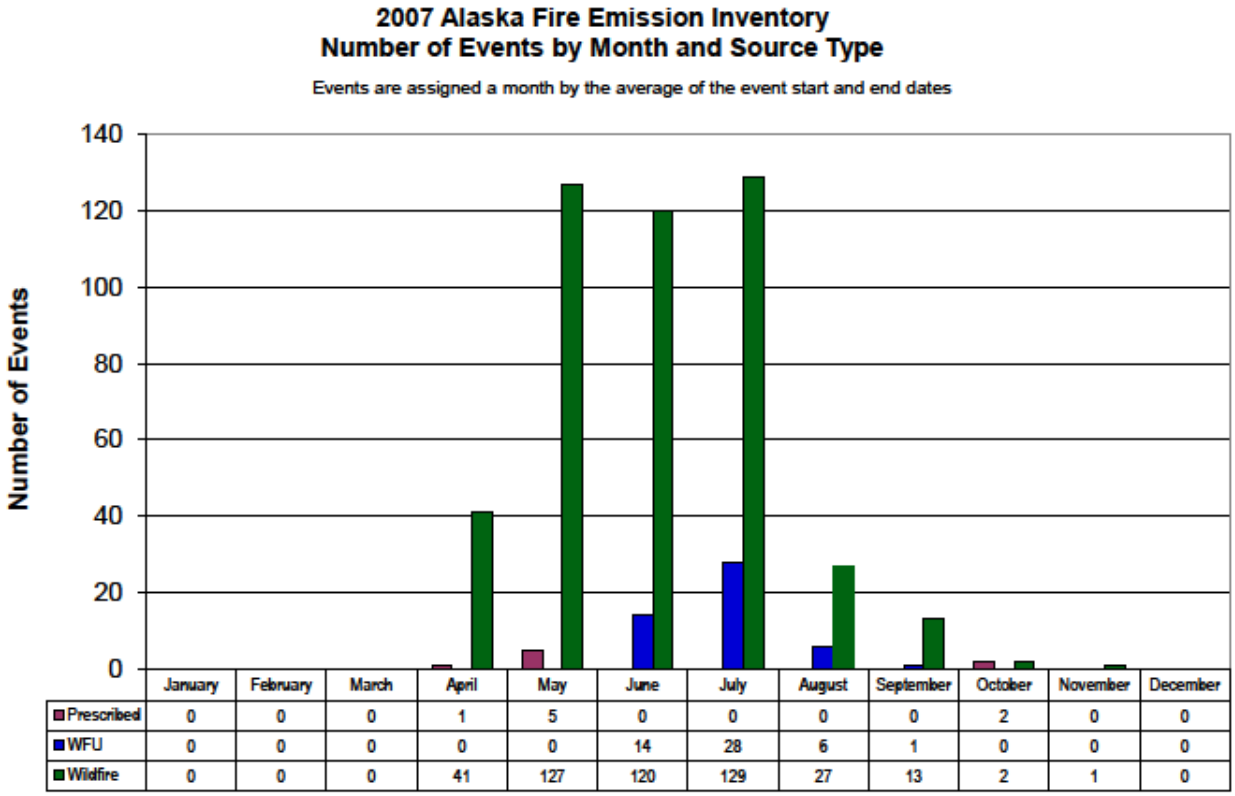


FIGURE 1

Figure 1 shows the number of acres burned and the tons of $PM_{2.5}$ produced for each fire type (prescribed, WFU, and wildfire) during the 2007 season.

- *Prescribed fires* were approximately 3.2 % (21,761 acres) of the total 2007 Alaskan fires, producing 8,268 tons of $PM_{2.5}$ (approximately 3.1 %) of the total $PM_{2.5}$ produced.
- *Wildland Fire Use* (WFU) fires were approximately 16.9 % (113,235 acres) of the total 2007 Alaskan fires, producing 54,232 tons of $PM_{2.5}$ (approximately 20.1 %) of the total $PM_{2.5}$ produced.
- *Wildfires* were approximately 79.9 % (536,180 acres) of the total 2007 Alaskan fires, producing 207,428 tons of $PM_{2.5}$ (approximately 76.8 %) of the total $PM_{2.5}$ produced.



	January	February	March	April	May	June	July	August	September	October	November	December
Prescribed	0	0	0	1	5	0	0	0	0	2	0	0
WFU	0	0	0	0	0	14	28	6	1	0	0	0
Wildfire	0	0	0	41	127	120	129	27	13	2	1	0

FIGURE 2

Figure 2 shows the total number of wildland fires in 2007, by month and type of fire (prescribed, WFU, or wildfire).

Most of the Prescribed fires in 2007 occurred in the early season, April and May (75%, 6 fires), with a couple in October.

Most of the WFU fires occurred in June and July (85.7%, 41 fires), with a few in August and September.

Most of the Wildfires occurred in May, June and July (81.7%, 376 fires), with a fair number in April (8.9 %, 41 fires) and a few after August (3.5%, 16 fires).

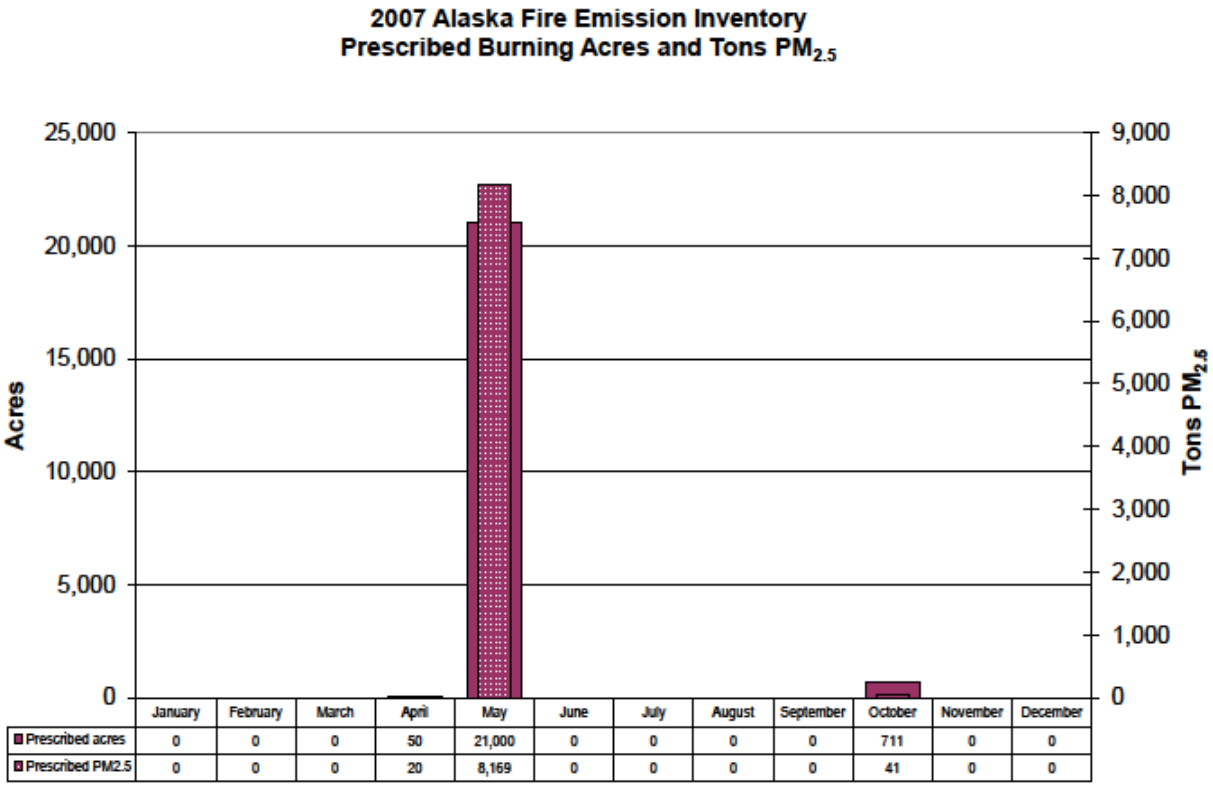


FIGURE 3

Figure 3 shows the acres of prescribed burns and tons of $PM_{2.5}$ produced in 2007.

Most prescribed burn acreage occurred in May (96.5%, 21,000 acres), producing the largest amount of $PM_{2.5}$ (99.3%, 8,169 tons). April and October prescribed fires produced very few tons of $PM_{2.5}$.

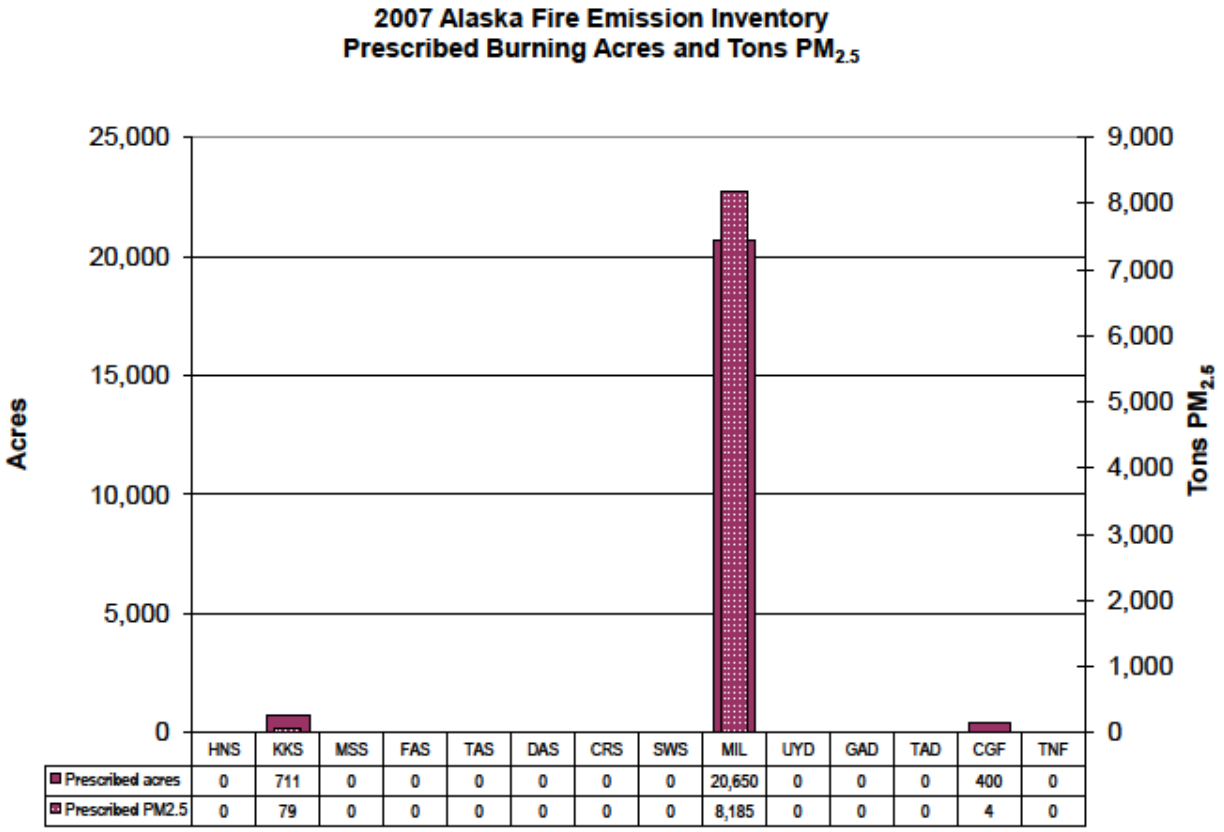


FIGURE 4

Figure 4 shows the acres of Prescribed Burns and the tons of $PM_{2.5}$ produced by Fire Management Zone.

The Military burned the most prescribed acres in 2007 (20,650 acres or 94.9%) and consequently produced the most tons of $PM_{2.5}$ (8,185 tons or 99 %).

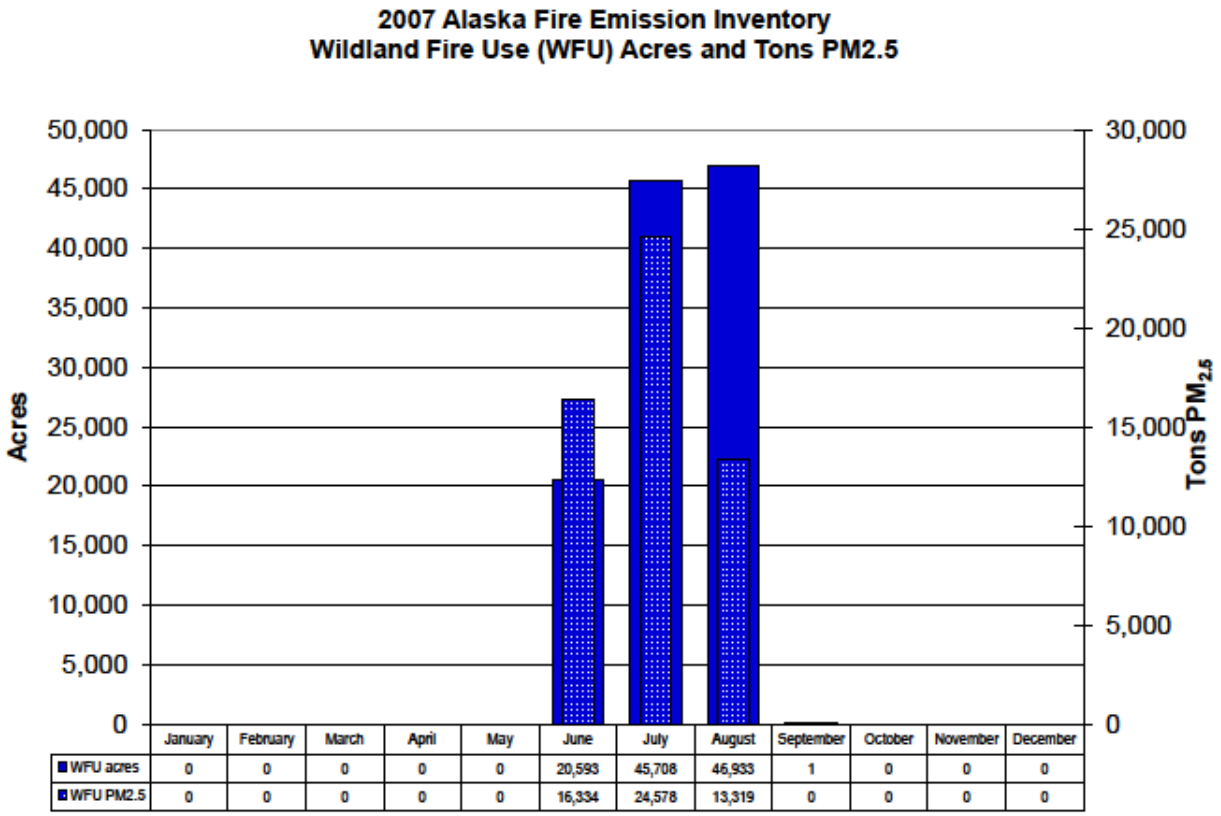


FIGURE 5

Figure 5 shows Wildland Fire Use (WFU) Acres and Tons $PM_{2.5}$ by month.

July and August were the largest acreage burned months for WFU fires (45,708 and 46,933 acres respectively, or a total 81.8%). However, June, with less than half the acreage (20,593 acres) of August, produced more $PM_{2.5}$ (16,334 tons or 30.1%) compared to 13,319 tons (24.6 %) produced in August.

The WFU acres burned in August may have had lower fire emission factors due to the type of vegetative cover than those lands burned in June or July.

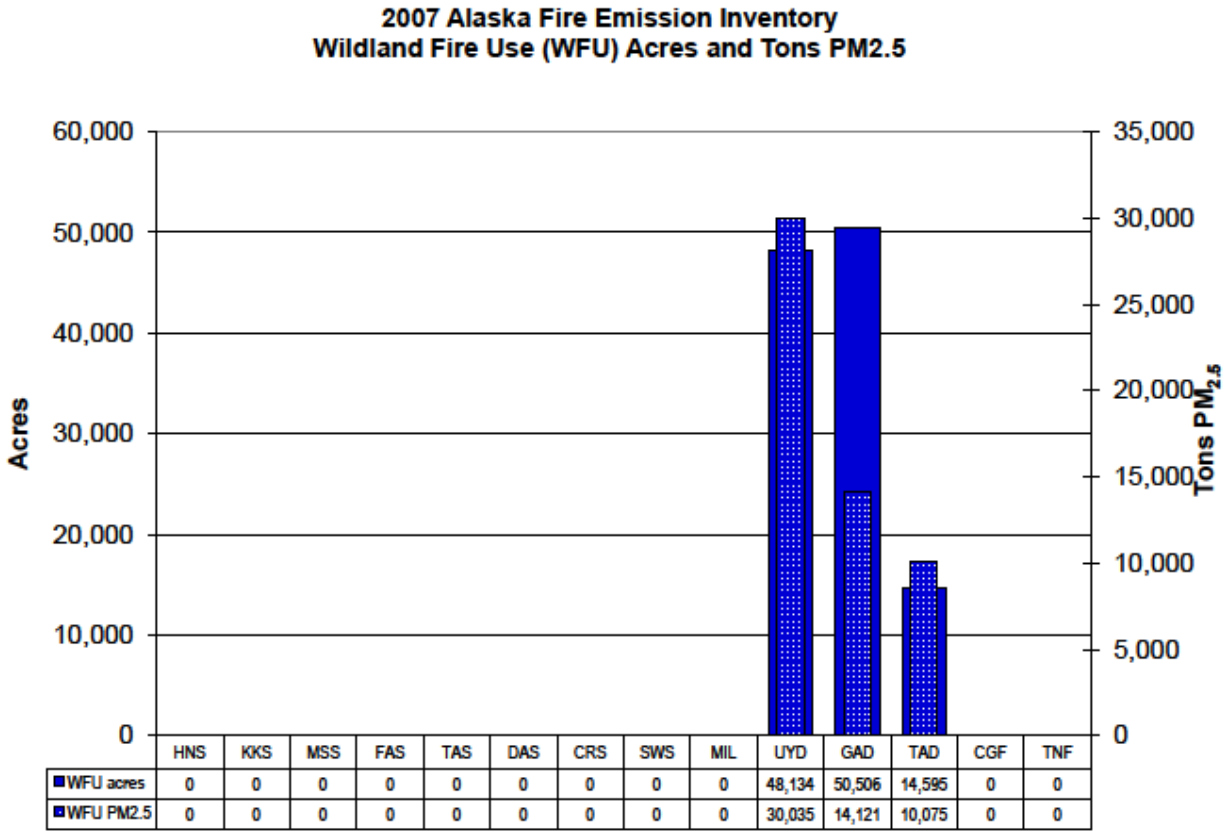
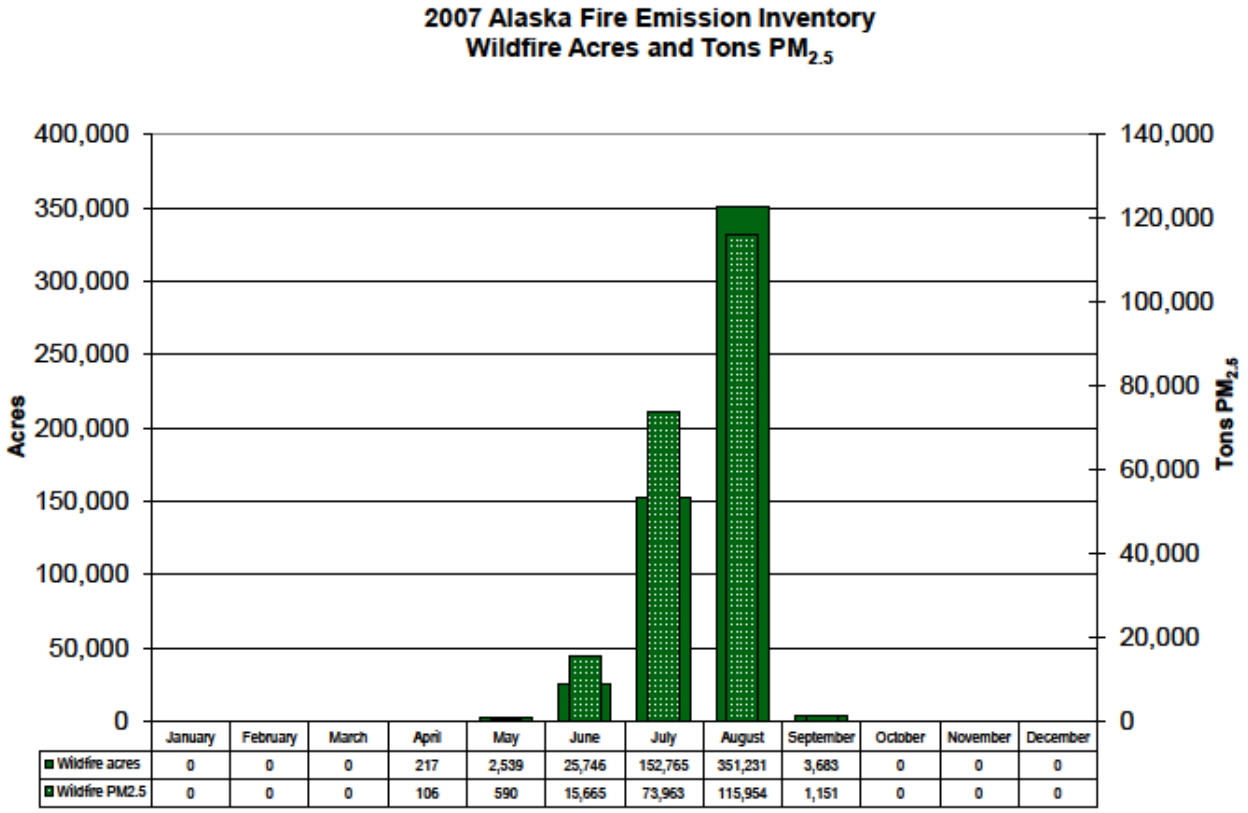


FIGURE 6

Figure 6 shows the Wildland Fire Use (WFU) Acres and Tons $PM_{2.5}$ (by Fire Management Zone)

The three areas utilizing WFU acres were the Upper Yukon Fire Management Zone, UYD (48,134 acres or 42.5%), the Galena Fire Management Zone, GAD (50,506 acres or 44.6%), and the Tanana Fire Management Zone, TAD (14,595 acres or 12.9%).

The UYD and TAD wildland fire use fires were probably in vegetative types with higher fire emissions (ie, more black spruce) than the GAD wildland fire use vegetative types (i.e., more tundra). UYD and TAD produced 40,110 tons of $PM_{2.5}$ (74%) while burning a total 62,729 acres (55.4%); GAD produced 14,121 tons of $PM_{2.5}$ (26%) while burning 50,506 acres (44.6 %).



	January	February	March	April	May	June	July	August	September	October	November	December
Wildfire acres	0	0	0	217	2,539	25,746	152,765	351,231	3,683	0	0	0
Wildfire PM2.5	0	0	0	106	590	15,665	73,963	115,954	1,151	0	0	0

FIGURE 7

Figure 7 shows the Wildfire Acres and Tons $PM_{2.5}$ (by month)

Wildfire starts occurred April through September in 2007, but August was the month with the largest acreage burned (351,231 acres or 65.5 %) and tons $PM_{2.5}$ produced (115,954 tons or 55.9 %) was August.

The template averages the 'month' of the fire between the start and end dates; i.e., since the Anaktuvuk River fire started in July and was out in early October, its "average" month became August.

The second largest month was July with 152,765 acres burned (28.5%) and 73,963 tons $PM_{2.5}$ produced (35.7 %)

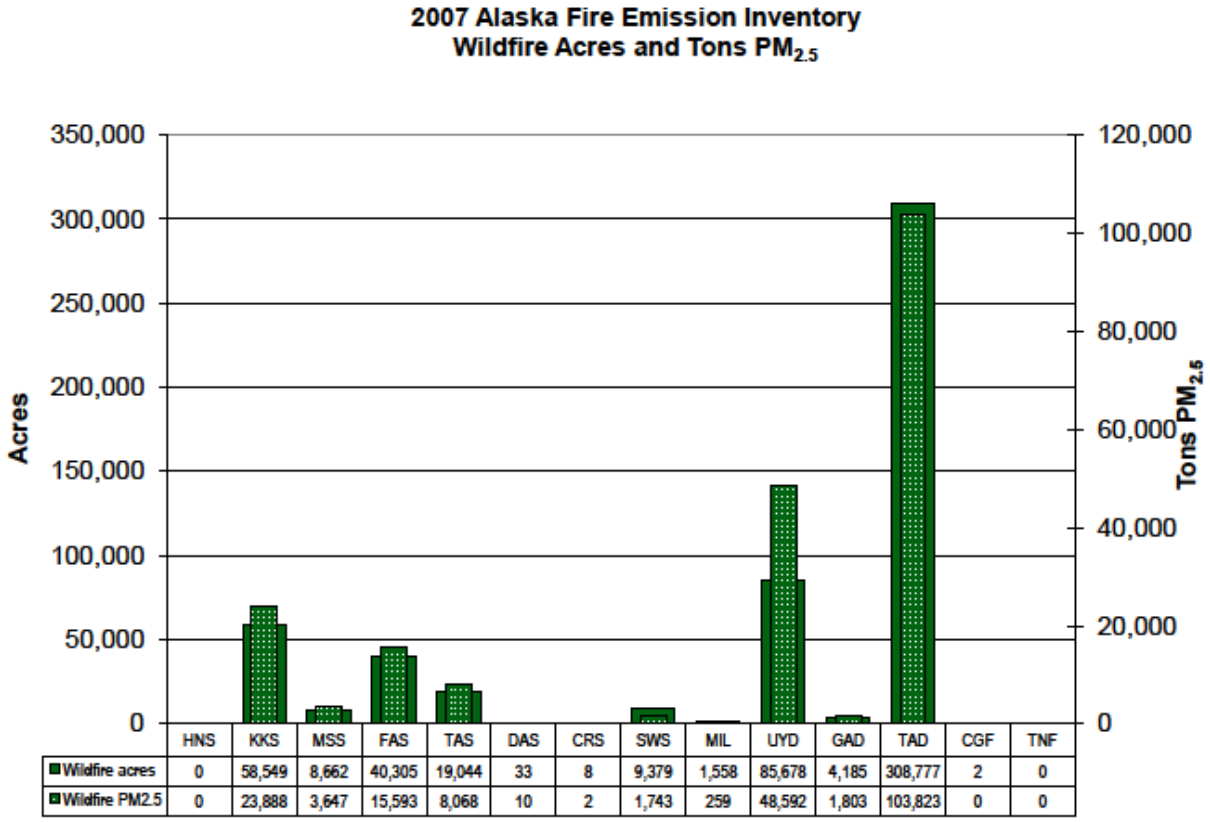


FIGURE 8

Figure 8 shows the Wildfire Acres and Tons $PM_{2.5}$ (by Fire Management Zone)

Of the 14 Fire Management Zones, 12 reported wildfires, although only 8 zones reported wildfires over 40 acres. The Haines area, Northern Southeast Area Office (HNS) in figure 8 indicates "0" acres burned and "0" acres PM2.5 produced; however, the acreage burned totaled less than 1 acre and did not show on the graph.

The two Fire Management Zones reporting the most acreage burned by wildfire were the Tanana Fire Management Zone, TAD (308,777 acres or 57.6%) and the Upper Yukon Fire Management Zone, UYD (85,678 acres or 16.0%). The preceding two Fire Management Zones also produced the most tons $PM_{2.5}$. TAD produced 103,823 tons $PM_{2.5}$ or 50.0 %, and UYD produced 48,592 tons $PM_{2.5}$ or 23.4 %.

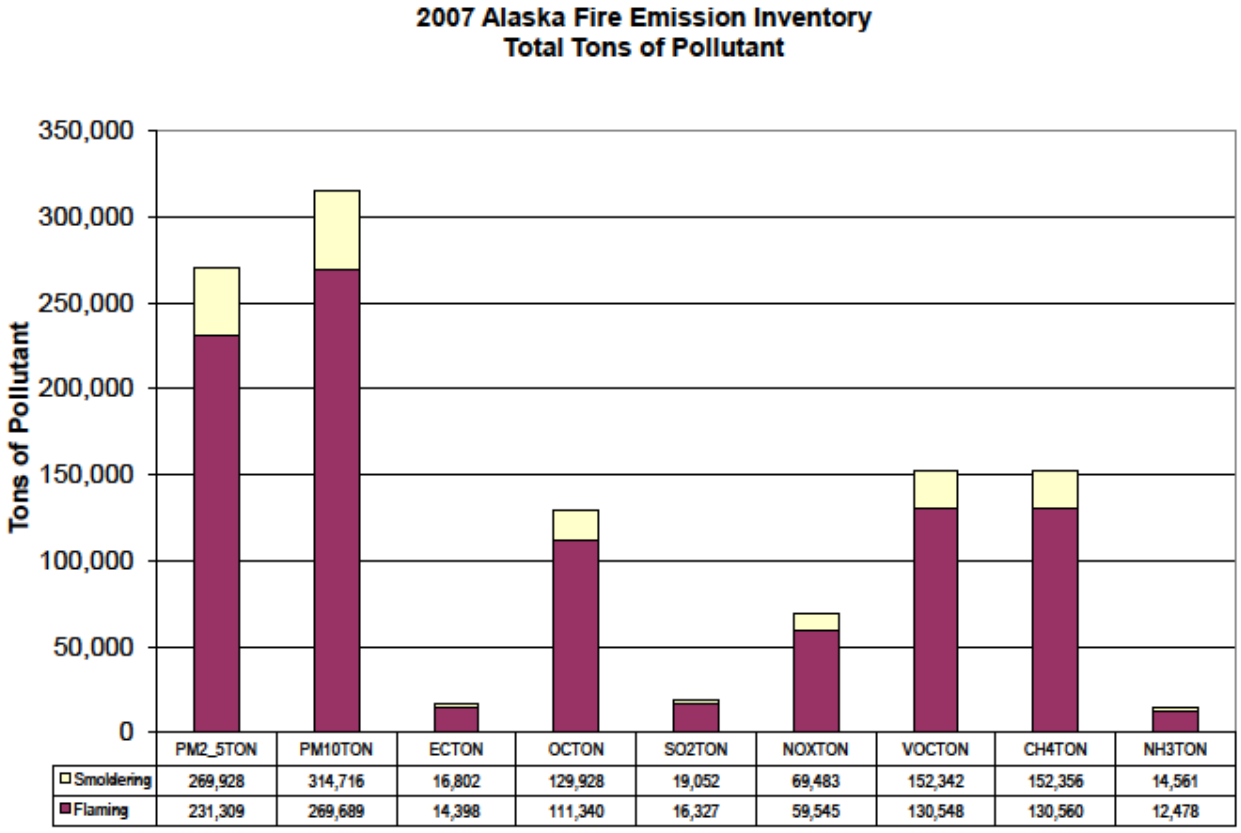


FIGURE 9

Figure 9 shows the Total Tons of Pollutant for nine different air pollutants: fine particulate matter (PM2.5), coarse particulate matter (PM10), elemental carbon (EC), organic carbon (OC), sulfur dioxide (SO2), nitrogen oxides (NOx), volatile organic compounds (VOC), methane (CH4), and ammonia (NH3).

This graph shows the flaming and smoldering tons of nine different air quality pollutants from all of the 2007 wildfires, wildland fire use fires and prescribed burns.

The total tons of pollutant shown under the 'smoldering' category are the total tons. Tons from smoldering are not listed separately.

The template calculated smoldering tons only if the acreage of the fire was 5 acres or greater.

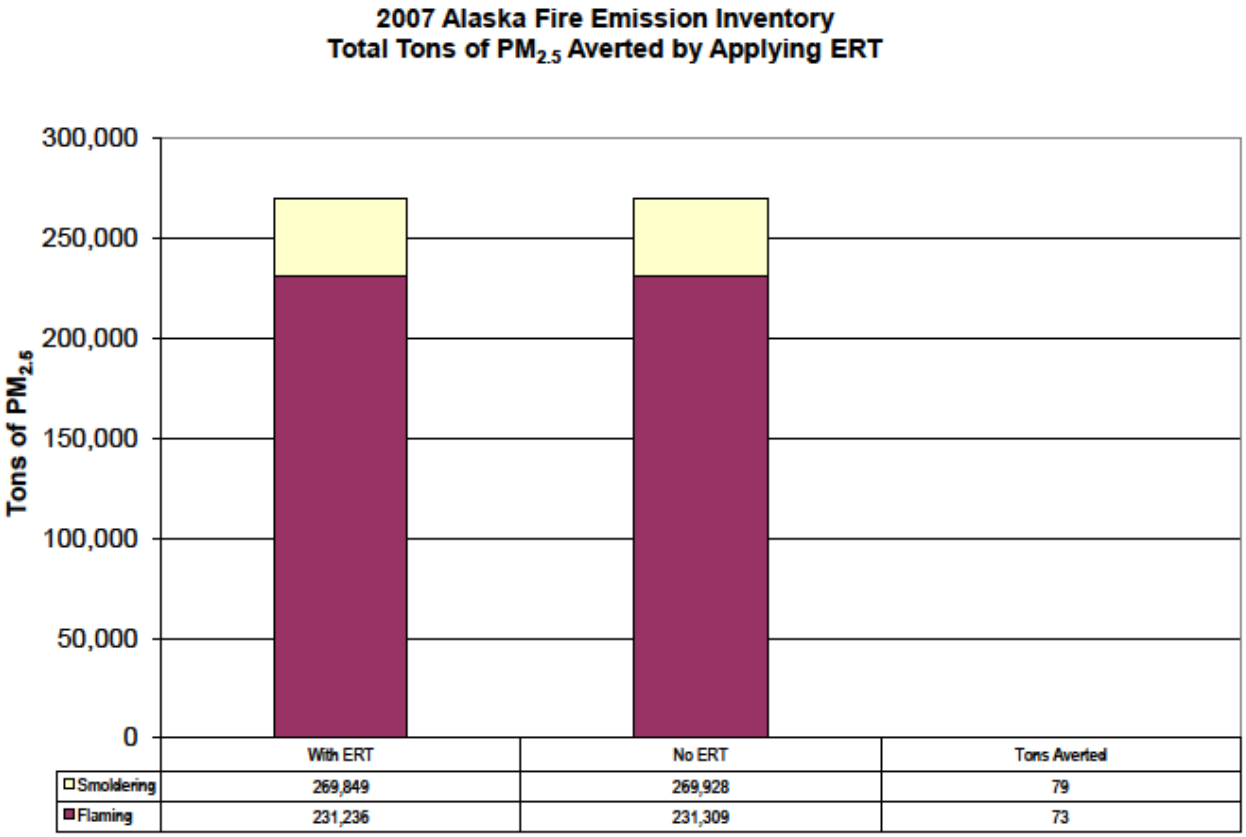


FIGURE 10

Figure 10 shows the Total Tons of $PM_{2.5}$ Averted by Applying ERT (Emission Reduction Technique)

This graph shows the tons $PM_{2.5}$ with Emission Reduction Techniques, what the numbers would be without ERTs, and the 79 tons $PM_{2.5}$ (0.03 %) averted with use of an ERT during 2 prescribed fires.

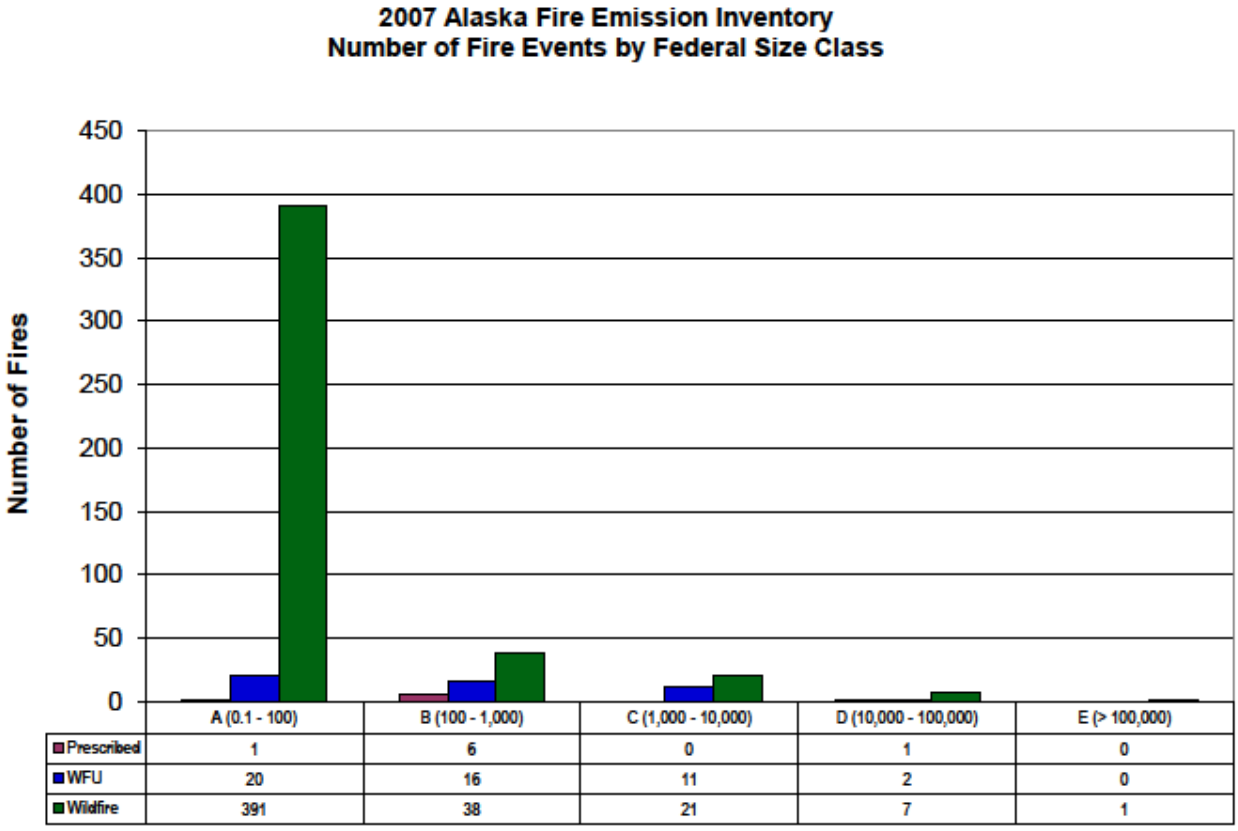


FIGURE 11

Figure 11 shows the Number of Fire Events by Federal Size Class

The wildfire category is the largest in each of the Federal fire size classes, ranging from Class A (0.1 – 100 acres) to Class E (greater than 100,000 acres).

In 2007, there were a total of 412 fires (80%) in the Class A size (less than 100 acres) and one fire in Class E.

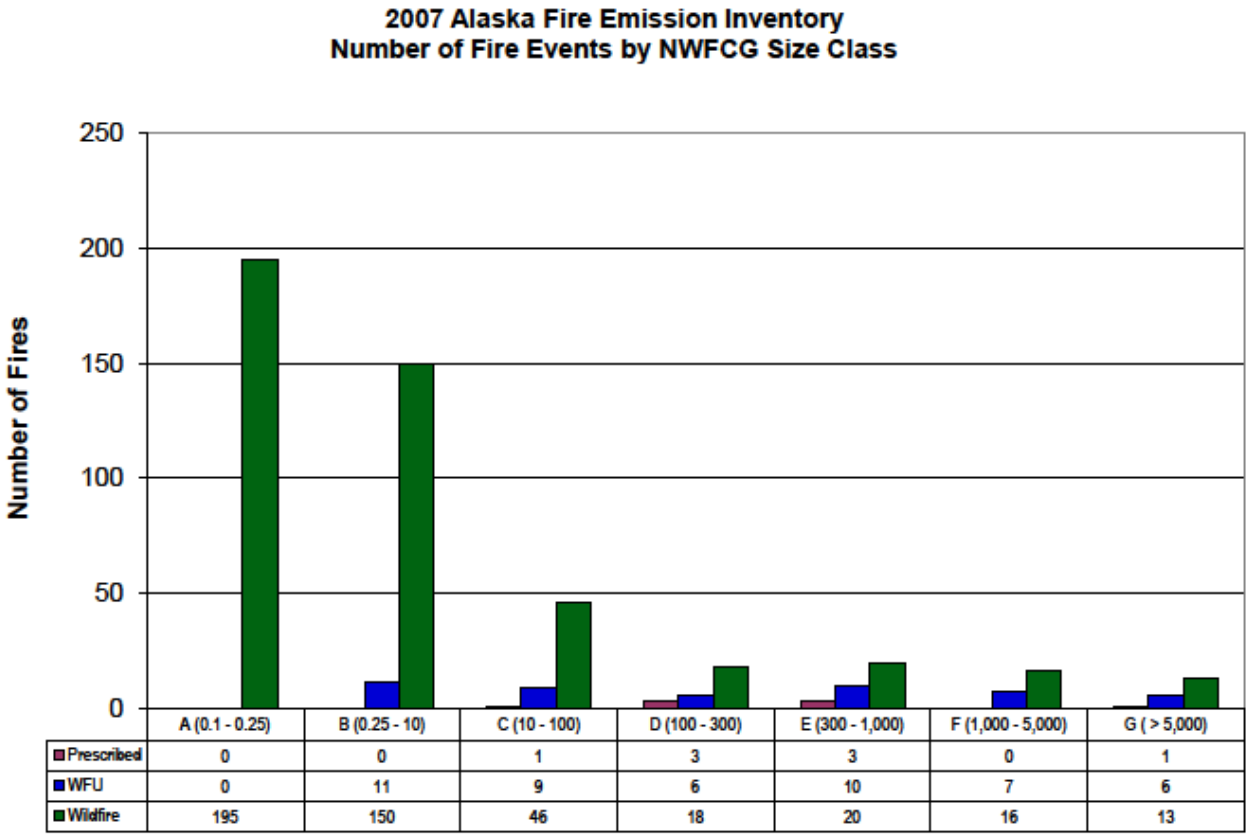


FIGURE 12

Figure 12 shows the Number of Fire Events by NWFCG (National Wildland Fire Coordinating Group) Size Class

The wildfire category is also the largest in each of the NWFCG fire size classes, ranging from Class A (0.1 – 0.25 acres) to class G (greater than 5,000 acres.)

Class size A (195 fires) and Class size B (161 fires) were the two largest classes - 69% of the fires were less than 10 acres. In 2007, only 20 fires (3.9%) were larger than 5,000 acres.

Emission Factors Used

The following Emission Factors (tons/acre) were used for the various vegetation types and mixes shown below. When two vegetation types were listed in the AICC sit rep for a specific fire, the two vegetation emission factors were added together and roughly divided by two, to come up with an average emission factor for the fire.

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

	Wildfire / WFU	Prescribed
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)	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	5	
old burn estimate	20	
unknown vegetation type estimate	30	
unknown pile estimate	10	
“light fuels” estimate	10	

[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