2009 Alaska
Wildfire 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 2009 prescribed fire emissions as required by the Enhanced Smoke Management Plan. It also reports on the statewide wildfire emissions occurring in 2009. The category of "Wildland Fire Use" was not used during the 2009 fire season. (See page 6 for a further explanation.)

During the summer of 2009 there were 527 wildfires, of which 331 were human caused and 196 were caused by lightning. A total of 2,951,592.9 acres were burned. The acreage burned was the third highest of the last 10 years. The fire season began at the end of April, with the majority of reported fires occurring May through August in the northern half of the state.

Fire activity during the 2009 season was not usual. Early season fire potential predictions were for lower than average burned acres. However, due to changing weather patterns, the month of May in the Fairbanks area was the driest in over 80 years, and Fairbanks' driest July on record also had the high temperature record. The McGrath area also was hotter and drier than normal. The summer was the smokiest since 2005. Smoke blanketed the northern half of the state at the end of July and the beginning of August from Deadhorse and Barrow, to Kotzebue and Nome, south to the Alaska Range, and east into Canada. Southern portions of the state also experienced smoke, but usually for shorter periods of time. [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 wildfire 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 wildfire related data into daily situation reports, available on their website: http://fire.ak.blm.gov/predsvcs/intel.php

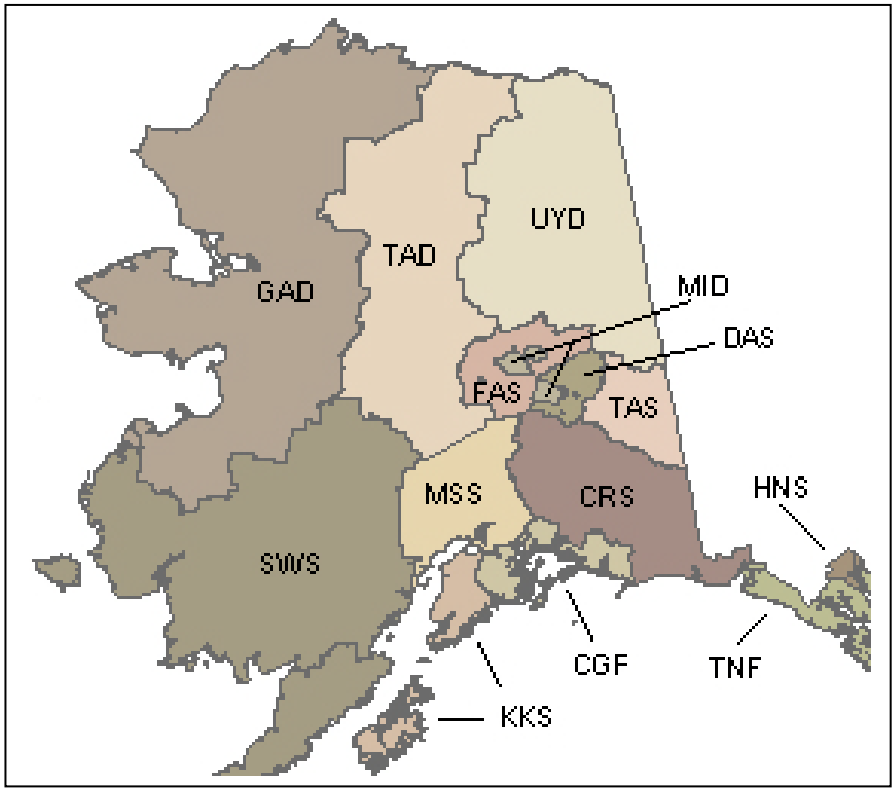
[1] Alaska Enhanced Smoke Management Plan for Planned Fire, Procedures Manual, Executive summary, June 2009
[2] Alaska Fire Season 2009, prepared by the AICC, website: http://fire.ak.blm.gov/content/aicc/stats/2009.pdf
[3] Alaska Interagency Coordination Center website: http://fire.ak.blm.gov/aicc.php
[4] ibid

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).

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 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)



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

Method for 2009 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 2009 wildfire inventory. A summary of the 2009 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 2009 daily Alaska Interagency Coordination Center situation reports, was entered. One 'short cut' was taken: 246 fires were less than 0.2 acre in size. After reviewing approximately 25 of those listed as 0.1 to 0.2 acre and determining most of them had been grass fires, the emission factor of 0.75 (grass) was used for all fires listed as 0.2 acres or less. This was accomplished using EXCEL. The total acreage of these 246 fires was 26.5 acres, or less than 0.0009% of the total acreage burned in 2009.

The wildfire acreage in the Emission Inventory is about 5 acres less than reported by the AICC, probably due to rounding issues.

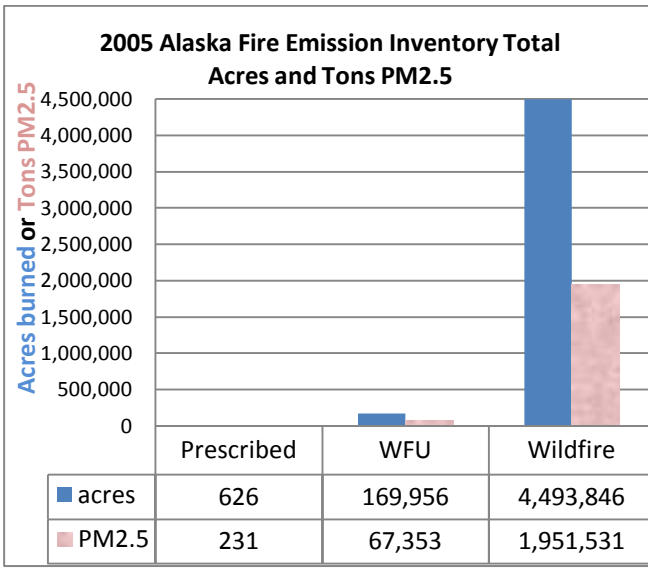
The fires in the emission inventory are categorized into two groups: Prescribed Fires and Wildfires. The category of "Wildland Fire Use" (WFU) is obsolete and was not used by agencies during the 2009 fire season. This category was used in the past to describe the management of lightning-caused wildfires to meet land and resource management objectives. The National Wildfire Coordinating Group has ceased the use of this term to eliminate confusion. Current national policy is that a wildfire may be concurrently managed to meet one or more objectives, and that fire management objectives can change over time as fire moves across the landscape. As a result, this category (WFU) is not recorded as a separate category in this report.[6]

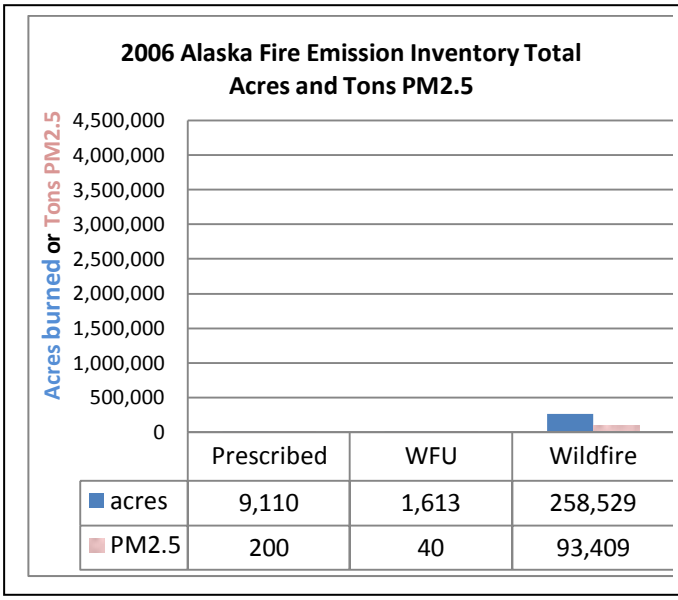
The following definitions are taken from the 2009 Alaska Enhanced Smoke Management Plan for Planned Fire.

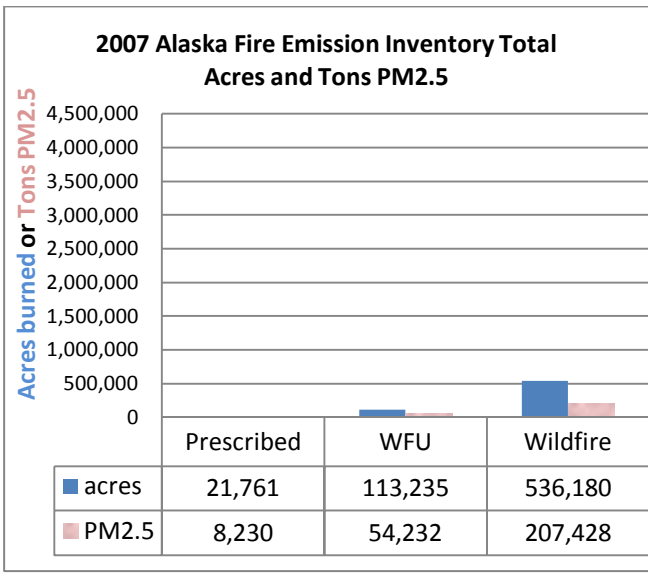
- **Prescribed Fire**, or controlled burn, is any fire ignited by management actions to meet specific objectives. A written, approved prescribed fire plan must exist. In a federal action, National Environmental Policy Act requirements must be met prior to ignition. Prescribed fire is a type of open burning.

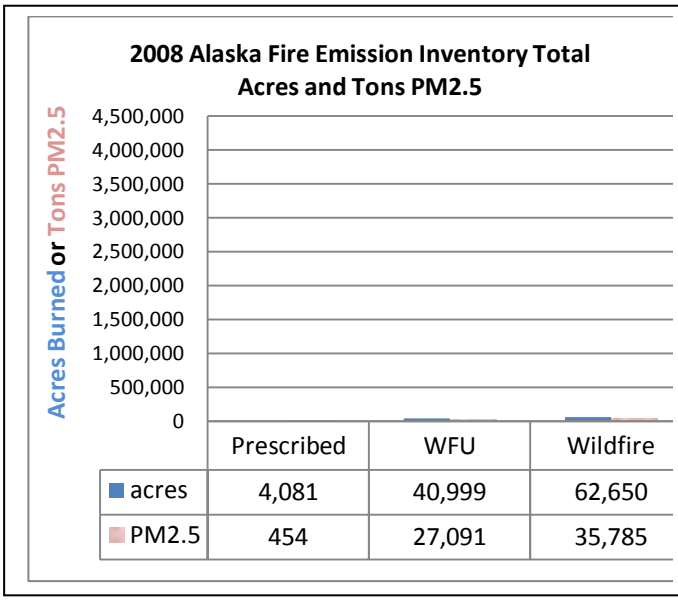
- **Wildfire** is any non-structure fire, other than prescribed fire, that occurs in the Wildland. **Wildland** is an area where development is generally limited to roads, railroads, power lines, and widely scattered structures. The land may be neglected altogether or managed for such purposes as wood or forage production, wildlife, recreation, wetlands or protective plant cover.

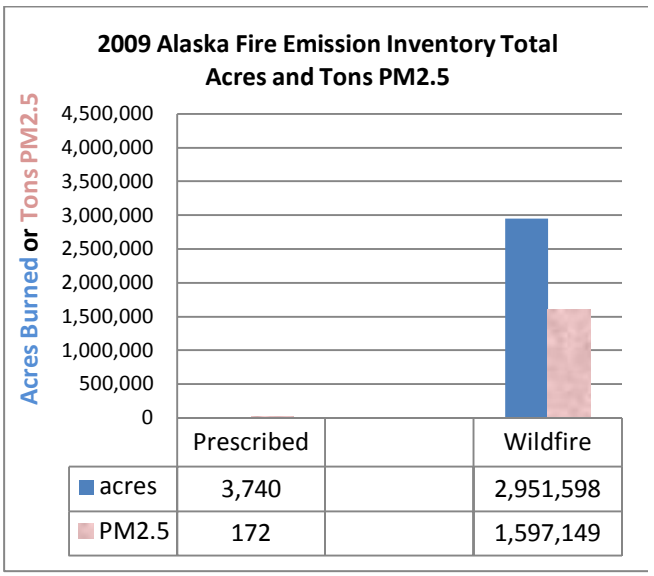
[6] NWCG Memorandum Ref# NWCG024-2010, Terminology Updated Resulting from Release of the *Guidance for the Implementation of Federal Wildland Fire Management Policy (2009)*, April 30, 2010.











This page shows five years of Alaska wildfire emissions from Prescribed Fire, Wildland Fire Use (except for 2009), and Wildfires for the years 2005 through 2009.

The scale of the acres burned and tons of PM 2.5 was kept the same for each graph to show the differences between the years.

Discussion of Results

The Fire Emission Template presents results through 10 graphs. Figures 1 through 10 are discussed on this and the following pages. The former category of Wildland Fire Use (WFU) is built into the template and cannot be easily removed; the WFU columns are blank in the charts. A listing of the emission factors used for vegetation groups is provided after Figure 10.

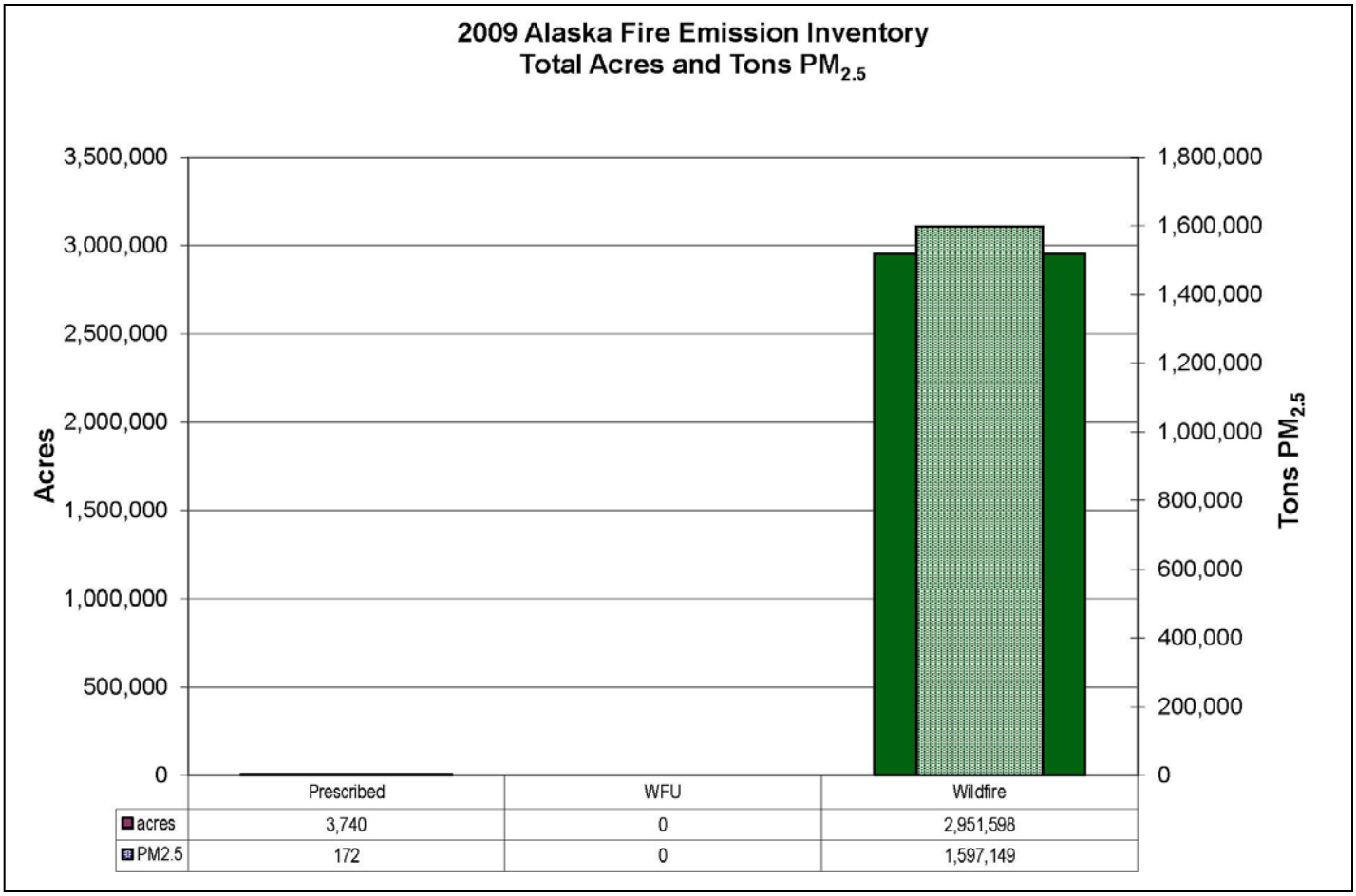
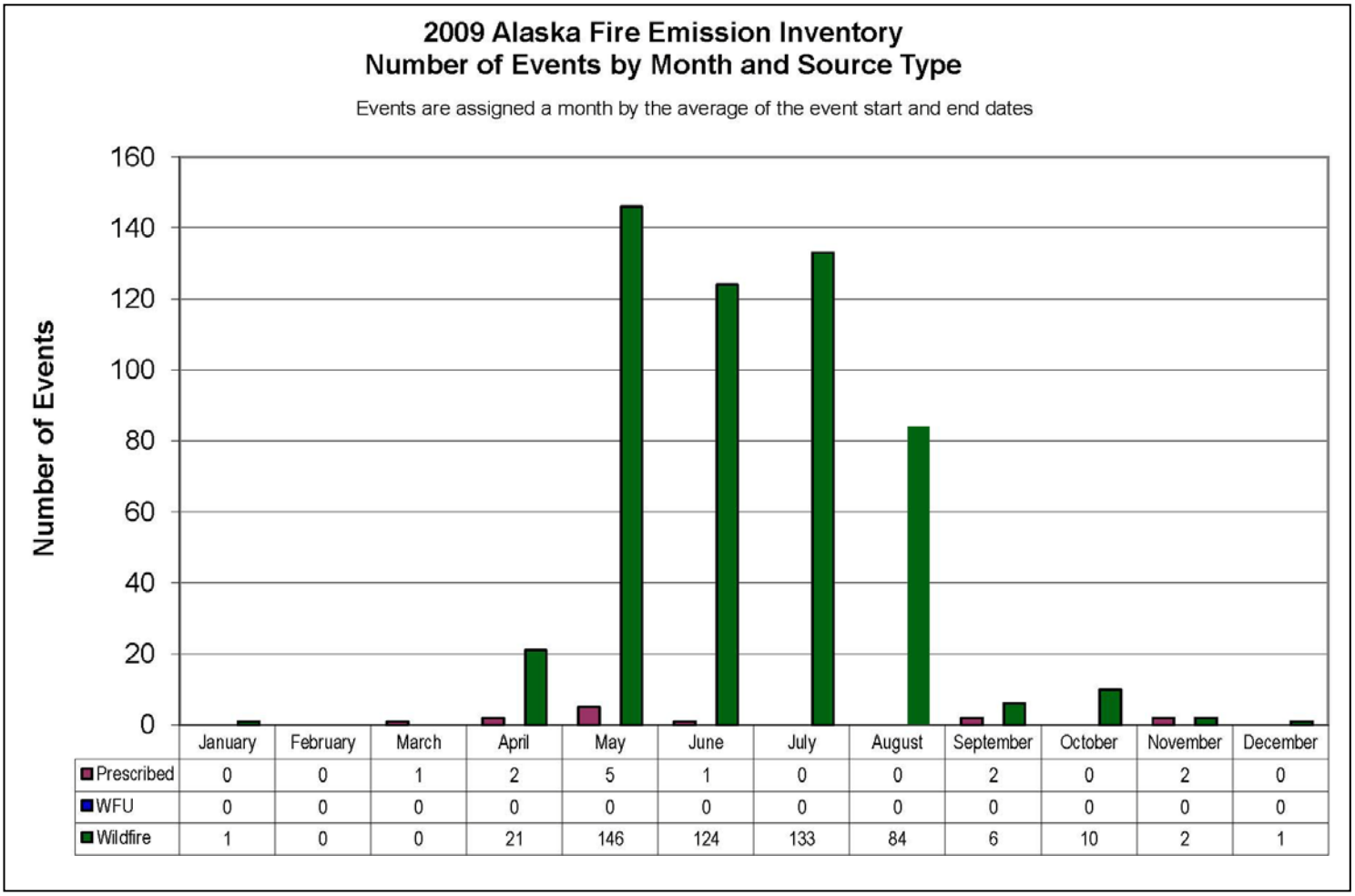


FIGURE 1

Figure 1 shows the number of acres burned and the tons of PM2.5 produced for both fire types (prescribed and wildfire) during the 2009 season.

- *Prescribed fires* were approximately 0.1% (3,740 acres) of the total 2009 Alaskan fires, producing 172 tons of PM2.5 (approximately 0.1%) of the total PM2.5 produced.

- *Wildfires* were approximately 99.9% (2,951,598 acres) of the total 2009 Alaskan fires, producing 1,597,149 tons of PM2.5 (approximately 99.9%) of the total PM2.5 produced.



	January	February	March	April	May	June	July	August	September	October	November	December
Prescribed	0	0	1	2	5	1	0	0	2	0	2	0
WFU	0	0	0	0	0	0	0	0	0	0	0	0
Wildfire	1	0	0	21	146	124	133	84	6	10	2	1

FIGURE 2

Figure 2 shows the total number of wildfires in 2009, by month and type of fire (prescribed or wildfire).

The majority of Prescribed fires in 2009 occurred in the early season, March, April and May (8 fires total, 61.5%), with two each in September and November, 30.8%.

Most of the Wildfires occurred during the summer months of May, June, July, and August (90.2%, 487 fires), with a couple fires in April (7.0%, 24 fires) and 19 fires spread throughout September through December (3.5%). Many of the fires in the first couple weeks of May were small, escaped residential grass fires or small burn pile fires.

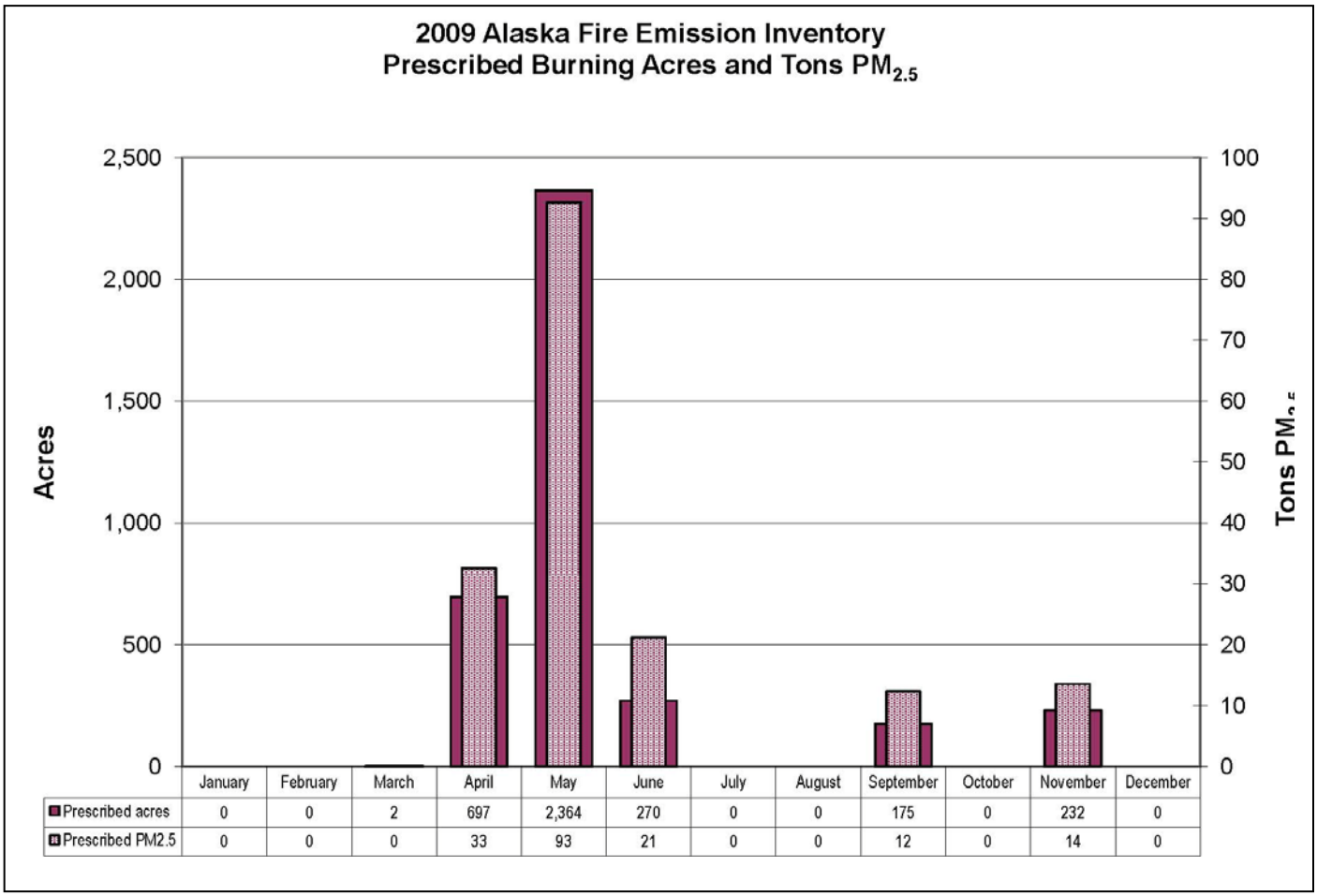


FIGURE 3

Figure 3 shows the acres of prescribed burns and tons of $PM_{2.5}$ produced in 2009.

Over half of the prescribed burn acreage occurred in May (2,364 acres, 63.2%), producing the largest amount of $PM_{2.5}$ (93 tons, 54.1%). September (175 acres and 12 tons of $PM_{2.5}$) and November (232 acres and 14 tons of $PM_{2.5}$) produced the fewest tons in 2009.

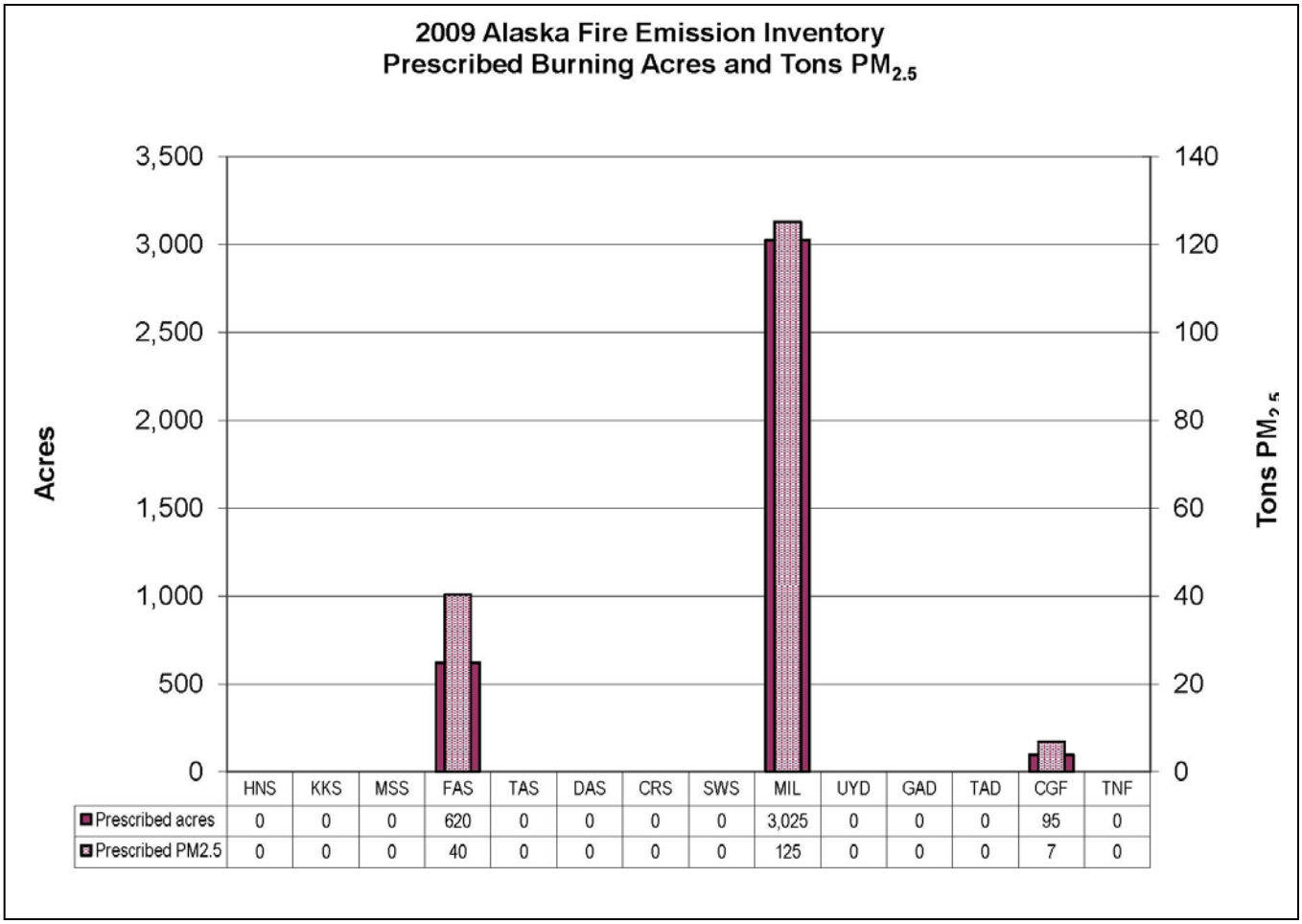


FIGURE 4

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 2.

The Military burned most of the reported prescribed burn acres in 2009 (3,025 acres or 80.9%) and consequently produced most of the tons of $PM_{2.5}$ (125 tons or 72.7%).

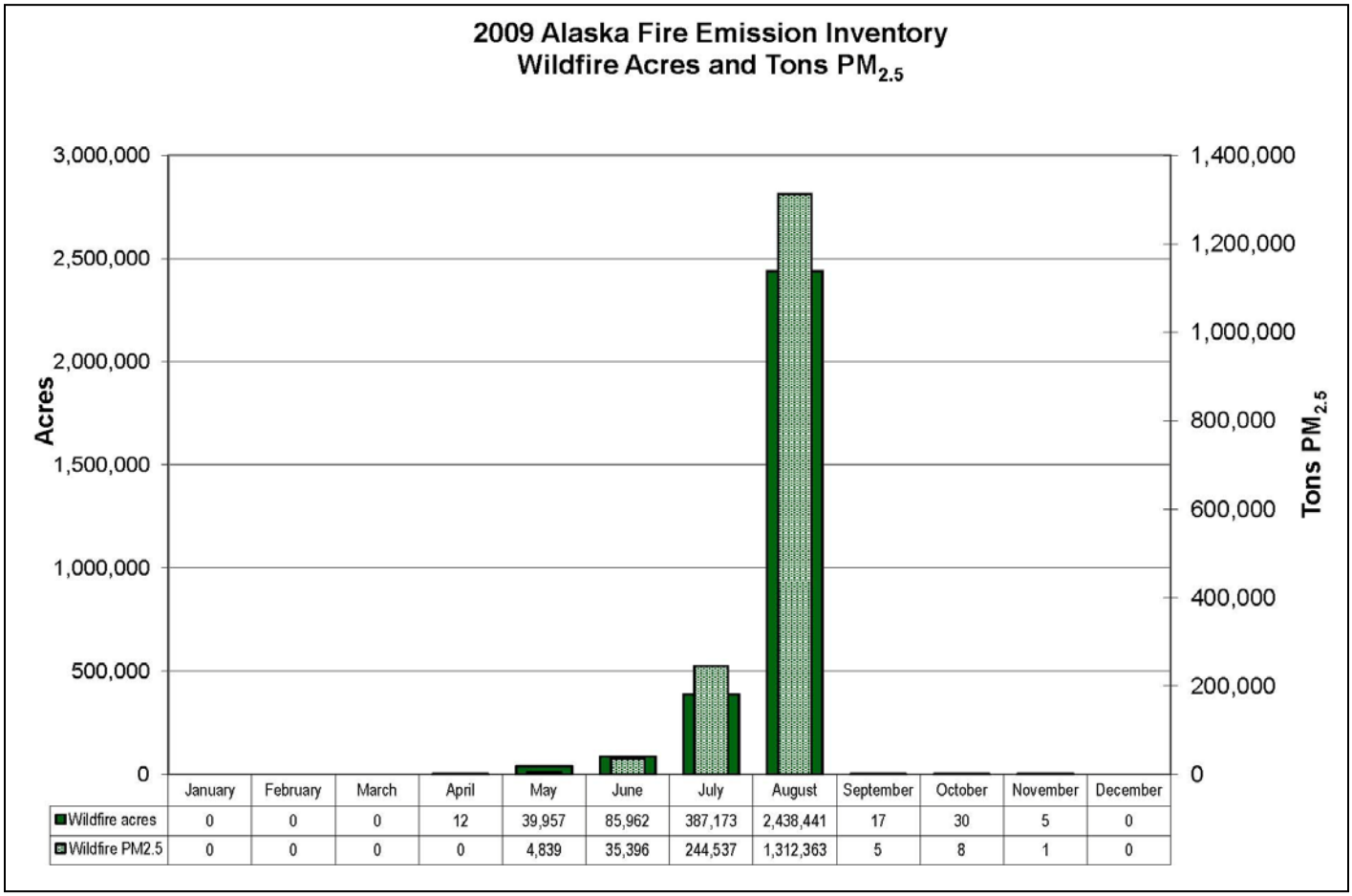


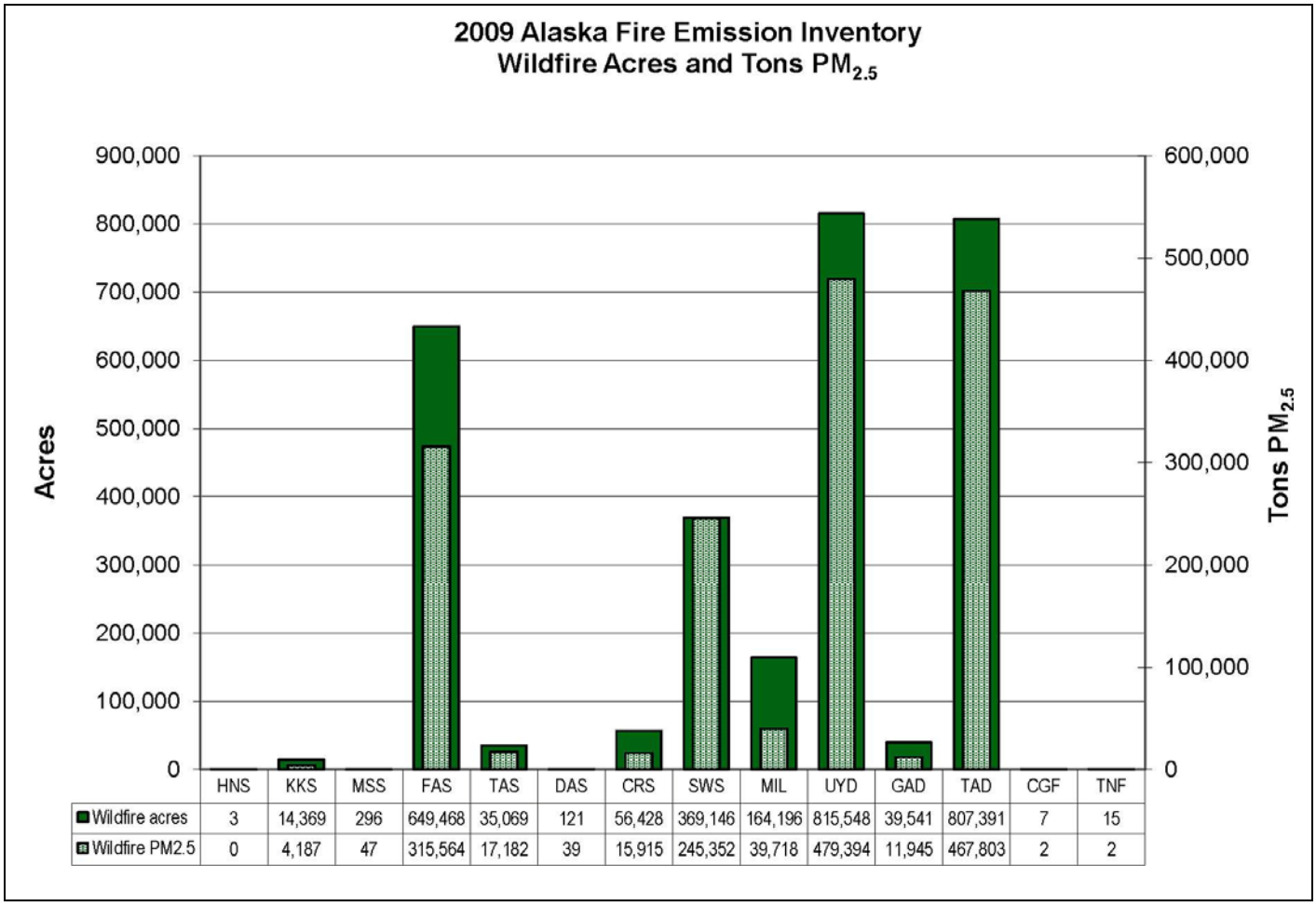
FIGURE 5

Figure 5 shows the Wildfire Acres and Tons $PM_{2.5}$ (by month)

Wildfire starts occurred April through November in 2009, but August was the month with the largest acreage burned (2,438,441 acres or 82.6%) and tons $PM_{2.5}$ produced (1,312,363 tons or 82.2%).

Note: The template averages the 'month' of the fire between the start and end dates.

The second largest acreage burned month was July with 387,173 acres burned (13.1%) and 244,537 tons $PM_{2.5}$ produced (15.3 %).



	HNS	KKS	MSS	FAS	TAS	DAS	CRS	SWS	MIL	UYD	GAD	TAD	CGF	TNF
Wildfire acres	3	14,369	296	649,468	35,069	121	56,428	369,146	164,196	815,548	39,541	807,391	7	15
Wildfire PM2.5	0	4,187	47	315,564	17,182	39	15,915	245,352	39,718	479,394	11,945	467,803	2	2

FIGURE 6

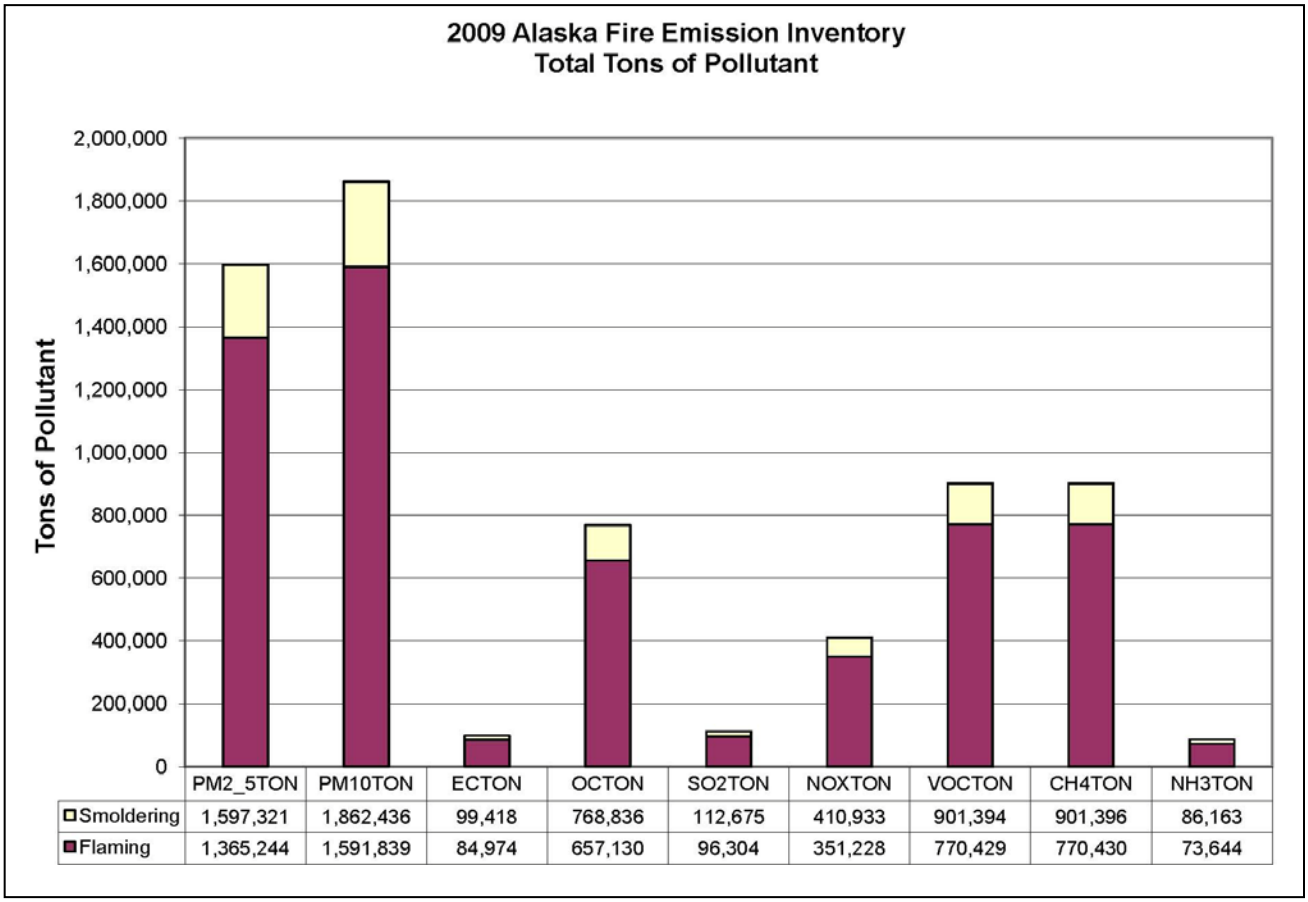
Figure 6 shows the Wildfire Acres and Tons $PM_{2.5}$ (by Fire Management Zone). A map of the Fire Management Zones is on Page 2.

All 14 Fire Management Zones reported wildfires; 11 zones reported wildfires totaling over 120 acres. The other three zones:- Tongass National Forest (TNF), Haines (HNS), and Chugach National Forest (CGF) - reported less than 20 acres of wildlands burned.

The three Fire Management Zones reporting the most acreage burned by wildfire were the Upper Yukon Fire Management Zone, UYD (815,548 acres or 27.6%), the Tanana Fire Management Zone, TAD (807,391 acres or 27.4%), and the Fairbanks Area Forestry, FAS (649,468 acres or 22%). The preceding three Fire Management Zones also produced the most tons $PM_{2.5}$:

- UYD produced 479,394 tons $PM_{2.5}$ or 30.0%,
- TAD produced 467,803 tons $PM_{2.5}$ or 29.3%, and,
- FAS produced 315,564 tons $PM_{2.5}$ or 19.8%.

The remaining 11 Fire Management Zones reported 23% of the total acreage burned and 20.9% of the $PM_{2.5}$ produced.



	PM2_5TON	PM10TON	ECTON	OCTON	SO2TON	NOXTON	VOCTON	CH4TON	NH3TON
Smoldering	1,597,321	1,862,436	99,418	768,836	112,675	410,933	901,394	901,396	86,163
Flaming	1,365,244	1,591,839	84,974	657,130	96,304	351,228	770,429	770,430	73,644

FIGURE 7

Figure 7 shows the Total Tons of Pollutant produced by the 2009 fires 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).

The graph shows the flaming and smoldering tons of the nine air quality pollutants from all of the 2009 wildfires and prescribed burns.

The 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.

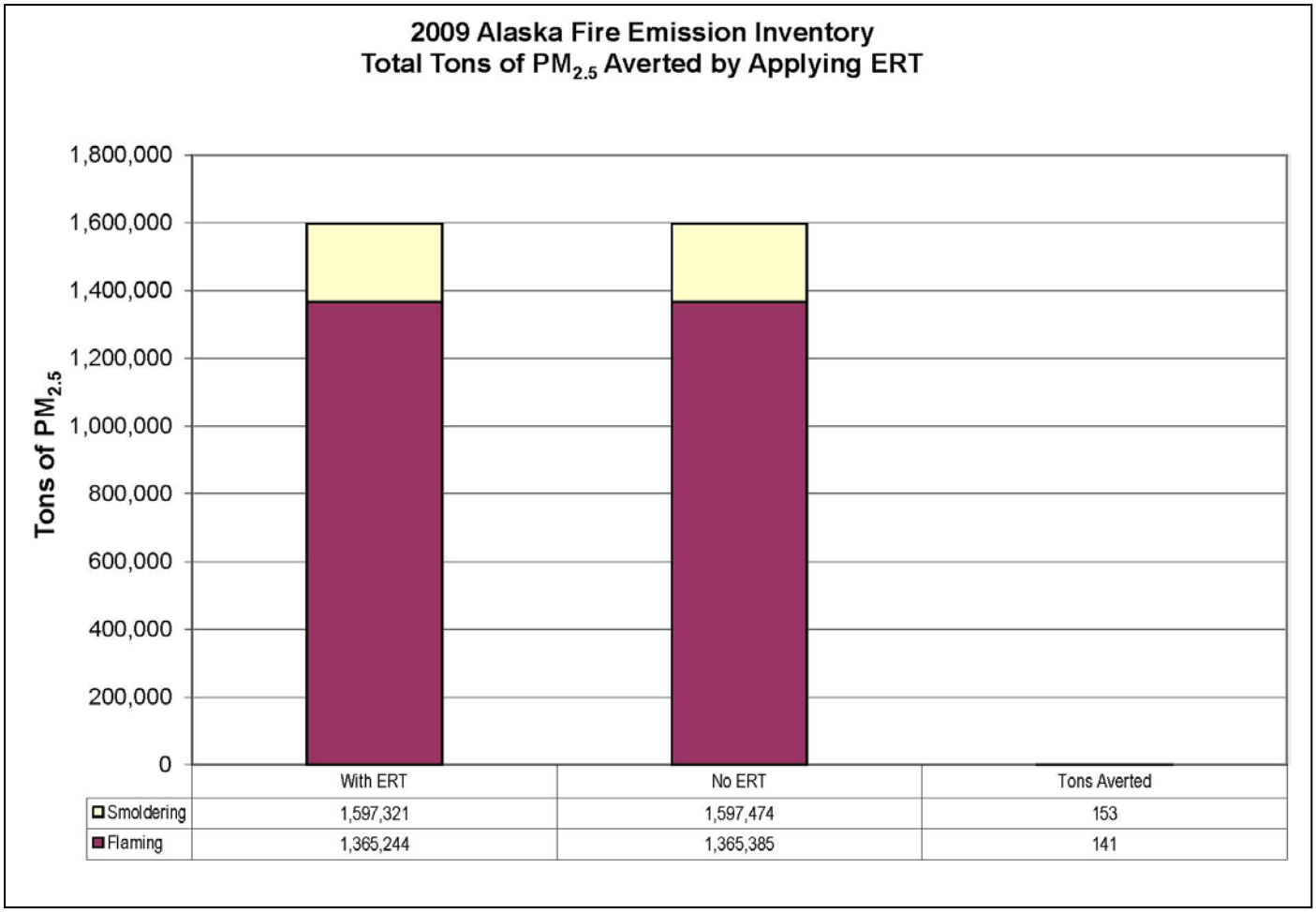
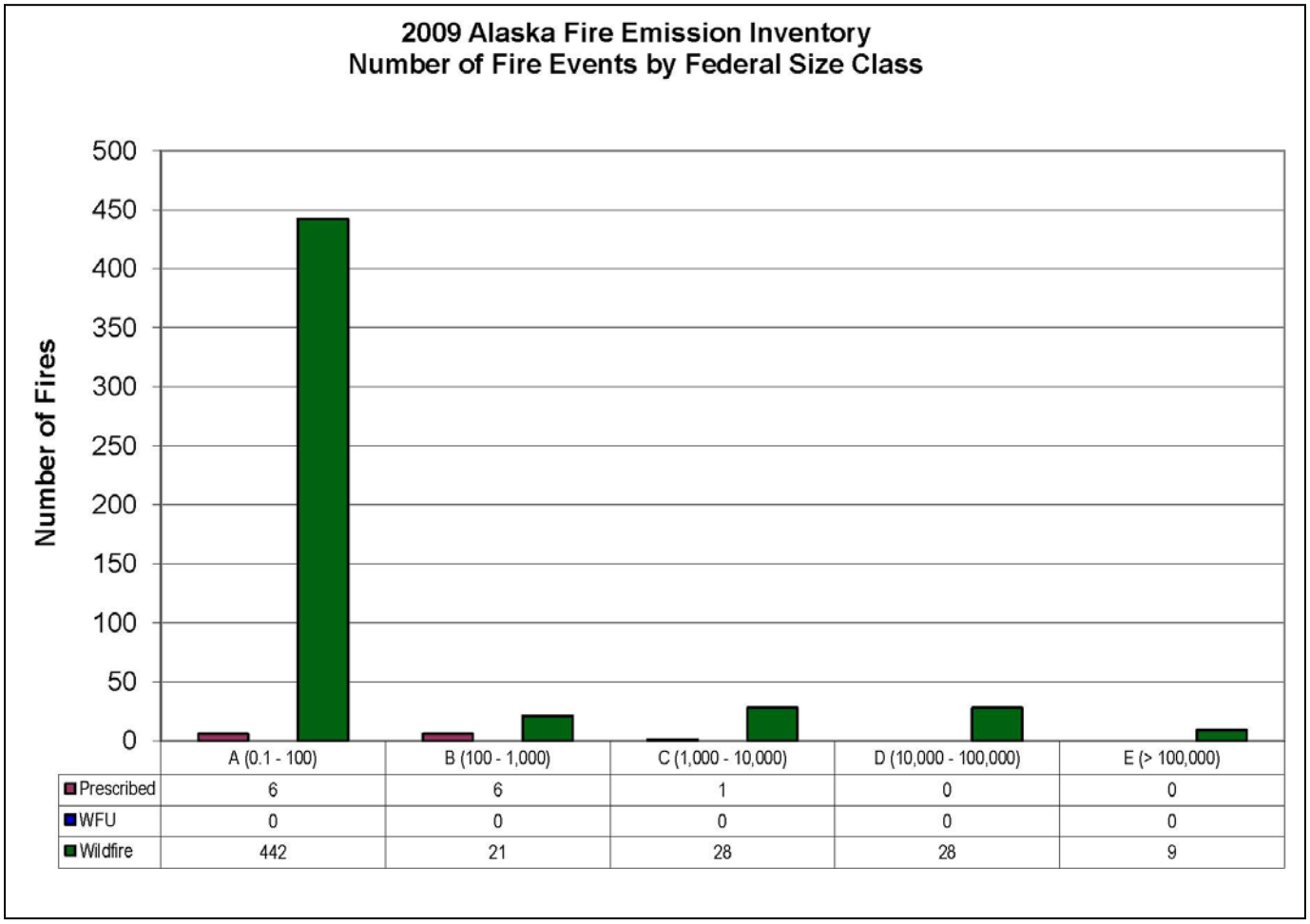


FIGURE 8

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 tons $PM_{2.5}$ with Emission Reduction Techniques, what the numbers would have been without ERTs, and the 153 tons $PM_{2.5}$ (0.01 %) averted with use of an ERT during prescribed burns.



	A (0.1 - 100)	B (100 - 1,000)	C (1,000 - 10,000)	D (10,000 - 100,000)	E (> 100,000)
Prescribed	6	6	1	0	0
WFU	0	0	0	0	0
Wildfire	442	21	28	28	9

FIGURE 9

Figure 9 shows the Number of Fire Events by 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 E (greater than 100,000 acres).

In 2009, there were a total of 448 fires (83.0%) in the Class A size (less than 100 acres); 26 fires (4.8%) in Class D (10,000 to 100,000 acres), and nine fires (1.7%) in Class E (greater than 100,000 acres).

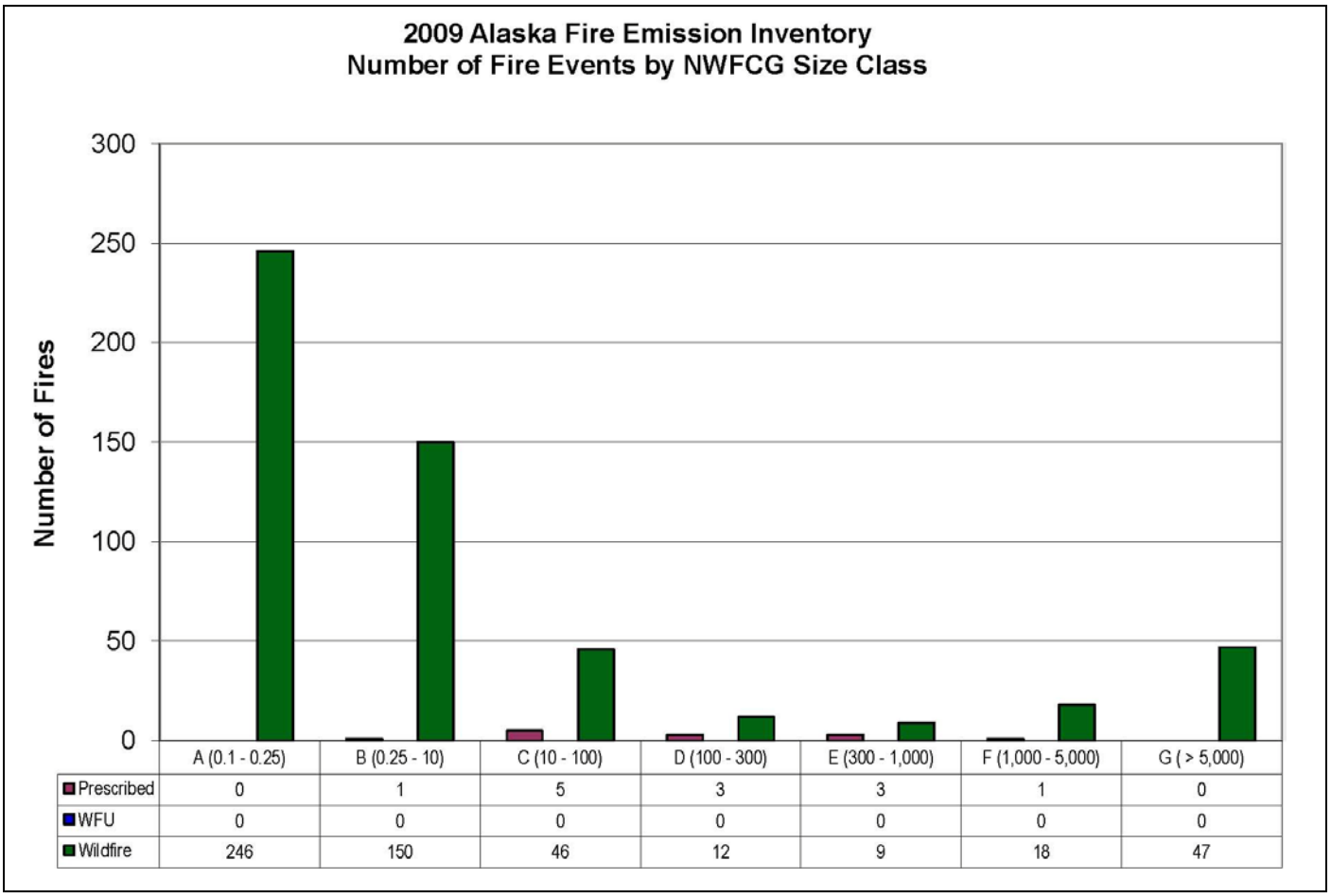


FIGURE 10

Figure 10 shows the Number of Fire Events by NWFCG (National Wildland Fire Coordinating Group) Size Class

The wildfire category is also the larger 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 (246 fires) and Class size B (151 fires) were the two largest classes – 73.5% of the fires were less than 10 acres. In 2009, there were 47 fires (8.7%) 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.[7]

	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[8]	6	
Grass (0.75) and slash (14.35)	7.5	
Tussocks / peat estimate	5	
old burn estimate	20	
unknown vegetation type estimate	20 *	
unknown pile estimate	10	
“light fuels” estimate	10	

* Previous years used “30” as the emission factor estimate for an unknown vegetative type. However, during the 2009 fire season, most of the unknown vegetative type fires over 200 acres were in Southwestern Alaska, so a smaller emission factor estimate was used.

[7] 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.

[8] estimate “low” as only grass/slash understory may burn