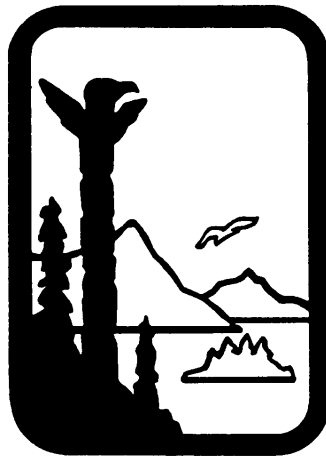


DRAFT

Natural Event Action Plan
for Particulate Matter from Wildfire Smoke
for the Municipality of Anchorage
Alaska



State of Alaska Department of Environmental Conservation
Air & Water Quality Division
Air Quality Improvement Section
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Anchorage AK 99501

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Introduction

On June 4 1996, the Gambell Street monitoring station in Anchorage, Alaska, measured a 24-hour PM_{10} concentration of $210 \mu\text{g m}^{-3}$, an exceedance of the NAAQS. This concentration of particulates was attributed to a plume of smoke that extended from a wildfire in the Big Lake and Houston area, which lies to the north of Anchorage. The Big Lake Fire (also commonly referred to as the Miller's Reach Fire) occurred in June of 1996, possibly as the result of mishandling fireworks. The fire started on the evening of Sunday, June 2, 1996. The fire was nearly contained until Monday night when north winds increased causing the fire to spread rapidly. Ultimately the fire became the most destructive in Alaska history and gained national recognition. The fire burned over 37,000 acres, destroyed at least 344 buildings and damaged 18 others, doing approximately \$10 million in damages, and caused the evacuation of approximately 1,800 people.



Photograph 1 - On day 3, the fire explodes, jumping from 1,500 acres to more than 10,000. Heat and dense smoke prevent an accurate count of the homes and businesses destroyed. As the fire leaps roads and drives south, officials extend the evacuation zone toward Knik Arm. A thick haze of smoke drifts over Anchorage, and health authorities issue air quality alerts. Photo by Anchorage Daily News photographer Anne Raup. Republication rights have been purchased from the Anchorage Daily News.

The northern winds that caused the uncontrollable growth of the fire also blew a thick cloud of smoke to Anchorage on Tuesday, June 4, 1996. The smoke caused the particulate concentrations to rise at all of the Anchorage monitors, and caused an exceedance of the NAAQS for 24-hour PM_{10} at the Gambell Station. The next day the wind changed direction and the PM_{10} concentrations dropped towards seasonal normal (below the 24-hour standard for PM_{10}).

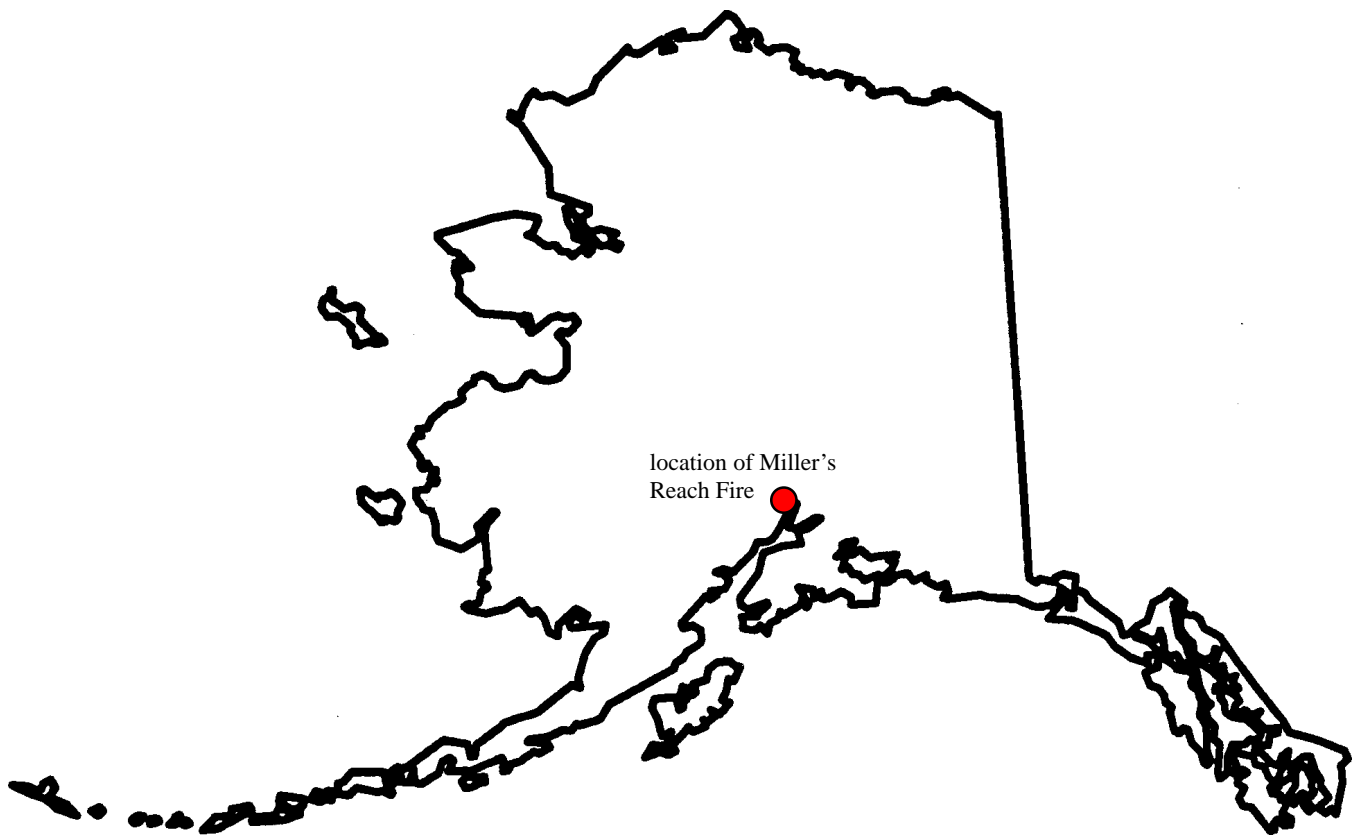


Figure 1 - Map of the state of Alaska

The Natural Event Action Plan for Wildland Fire Particulate Matter for Anchorage, Alaska, was written with the following goals in mind:

- To document the Miller's Reach Fire showing that this natural event was responsible for the NAAQS exceedance on June 4, 1996,
- To show that without the smoke from the Miller's Reach Fire, PM_{10} concentration at the Gambell Station in Anchorage would not have caused an NAAQS exceedance,
- To establish programs to promote education about the harmful effects of high concentrations of PM_{10} in smoke from wildfires,
- To establish programs to enhance public awareness of wildfires that are impending or occurring and which may adversely impact air quality due to smoke containing high concentrations of PM_{10} ,
- To minimize public exposure to smoke that may contain high concentrations of PM_{10} ,
- To reduce controllable sources of PM_{10} in times when wildfire smoke threatens to exceed the NAAQS (for example: prohibit burning activities in at-risk areas),
- To prevent as many wildland fires as possible, and to suppress those that threaten the public health with high concentrations of PM_{10} , and
- To identify, study and implement whatever mitigation measures are available and practical.

Protecting the public health is the highest priority of the State of Alaska Department of Environmental Conservation (ADEC) Division of Air & Water Quality.

DOCUMENTATION OF THE NATURAL EVENT

The first section of this Natural Event Action Plan (NEAP) establishes the causal relationship between the Miller's Reach Fire and the measured exceedance of the 24-hour NAAQS for particulate matter. Included are:

- A map showing the location of Anchorage relative to the Houston/Big Lake area approximately 60 miles to the north,
- A chronology of the fire and newspaper references showing the events of June 2 through June 9, 1996, which clearly describe the fire and especially note the smoke impacting Anchorage on Tuesday June 4, 1996,
- Relevant meteorological data, including Doppler radar and satellite data showing the smoke plume covering Anchorage on June 4, 1996,
- An analysis of historical PM_{10} data for June demonstrating that an exceedance would not have occurred without the emissions from the Miller's Reach Fire, and
- A description of the quartz filters collected on June 4, 1996, indicating that large amounts of deposited matter originated from the fire.
- A plot of hourly PM_{10} measurements collected in Anchorage during the smoke event using a beta-attenuation monitor.



Figure 2 - Map of the Miller's Reach Fire relative to Anchorage. The red outlines denotes the extent of the burned area.

Chronology of the Miller's Reach Fire of June 1996

The Miller's Reach Fire started on Sunday, June 2, 1996, and was finally contained on June 15, 1996. The fire began as a small blaze near the Miller's Reach subdivision near Houston, Alaska. The fire, which started small and was nearly contained on June 2nd, grew explosively over the next few days due to dry, windy weather. The fire was entirely out of control until June 7th, when the wind dropped off, the relative humidity increased, and some light rain fell. Below is an outline of the events of the first eight days of the fire including pertinent newspaper articles. Copies of the full articles are included in Appendix B.

- June 2, 1996** The Miller's Reach Fire started at 4:45 PM, temporarily closing the Parks Highway. The fire spread to 60 acres. By night, though still burning, the fire was partially contained. A total of 17 State Division of Forestry firefighters, including seven smokejumpers, and 32 emergency firefighters responded.
- June 3, 1996** The fire was nearly contained in a narrow strip near its starting point, but 1,500 acres were burning by evening. About 500 people were evacuated from local subdivisions. High winds, gusting up to 40 mph, commenced in the evening. There were about 100 firefighters deployed at this point, and prospects seem poor.
First Anchorage Daily News (ADN) story appears in the Metro section, page B-1:
4th fire strikes Houston; smoke closes Parks [Highway]; 48 firefighters respond
- June 4, 1996** By evening the fire had burned across at least 10,000 acres, and 50-100 homes estimated destroyed. Two hundred firefighters are now deployed. Smoke was blown south to Anchorage. A thick blanket of smoke caused City and State officials to issue an air quality alert. The Gambell monitoring station measured a PM₁₀ concentration that exceeded the NAAQS (210 µg m⁻³). Other Anchorage monitoring stations showed elevated PM₁₀ concentrations, but did not exceed the NAAQS.
ADN story:
Hundreds flee Houston blaze; Authorities evacuate 500 from path; flames consume Twin Lake cabin (headline)
‘The 2-day-old blaze, nearly controlled Monday, was kicked back to life by winds gusting up to 40 mph, [Kevin] Koechlein [director of public safety for the Mat-Su Borough] said.
‘From Anchorage, it looked like all the north was ablaze. The evening sun first turned an eerie salmon red. Then the winds shifted and blew the smoke across the Chugach Range where it blanketed the deep glacial valleys.’
- June 5, 1996** 450 firefighters are now deployed. Up to 250 dwellings burned. Estimated 37,000 acres burned. Winds gusted to more than 30 miles per hour from both the north and southeast for the first part of the day, but dropped to a light breeze by evening. Columns of smoke rose 15,000 feet into the sky.
ADN stories:
WILDFIRE; Inferno rages; crews no match (headline)
“I’ve had one simple rule yesterday and today – don’t kill anybody. We’re trying to save structures as best we can, but this is an extraordinarily volatile and dangerous fire for firefighters,” said Tom Botner,...

Couple makes stand to save their home
More than 200 wait, worry and hope at Wasilla shelter
Residents rally to save orphaned animals
Fire jumps swamp: It's time to go
Fireworks debate rises with flames
Black spruce and wind fuel fire
Smoke puts city on air quality alert

'When Dorothy Miller looks out of the window...she usually sees the city spread out before her. Tuesday morning, she saw only a blanket of smoke. "It was completely covered," said Miller. "You couldn't see the town at all."

'Smoke from the raging Houston fire, more than 60 miles away, has enveloped the Anchorage area...

'By Tuesday night, the pollution level in Anchorage exceeded federal air quality standards, prompting city and state officials to issue a health alert advising with health problems that can be aggravated by such conditions to stay indoors.'

June 6, 1996 Hope for defeating the fire first mentioned. Winds are down and the air is cooler and moister (50% humidity). Two hundred sixteen structures lost total at this point, but none in the last 24 hours. One thousand three hundred firefighters deployed, including one third of the nation's hot-shot elite fire fighting crews.

ADN stories:

'OUT OF CONTROL'; Fire cuts new path of waste (headline)

Relief and ruin become neighbors

Only ashes remain, but they'll rebuild

Emotions run high as residents await news

Inmates evacuated

Mushers pull together to get dogs to safety

From goats to iguanas, volunteers round up displaced pets

Innkeeper soothes a neighborhood's frazzled nerves

Fill buckets, firefighters warn city

Wind-and-black-spruce fire leaves tragedy, salvation side by side

'What is a smoky nuisance in Anchorage...'

Fighting fires (editorial)

'The entire Anchorage area at one time or another was covered by windblown smoke Tuesday...'

June 7, 1996 The fire was reported to be slowing down.

ADN stories:

A FIGHTING CHANCE; Fire slows down (headline)

Looters rifle empty homes

Victims join ranks of relief workers

Hot Shots hit the front lines; Elite firefighter teams arrive from Outside to Bolster Alaska crews

Phone companies work to keep lines open

'Hello...fire's all around...leave a message' Alaska crews

Phone companies work to keep lines open

'Hello...fire's all around...leave a message'

Wasilla ponders possible evacuation

Keep water coming and watch for embers

Q & A; Ins and outs of federal disaster aid

June 9, 1996 Firefighters contained 60% of the fire by night. Hoping for complete containment by Monday evening. They were aided by cooler weather and light rain which slowed the fire's spread.

Friends, family, strangers keep neighborhood watch

Even when doused and buried, blaze may stay alive

INFERNO; A look at Mat-Su's devastating Fire (ADN special pull-out section)

Disaster managers team up against fire; Firefighting command system works from Houston classrooms

Meteorological Data

On Monday, June 3rd, the winds in the Anchorage area were predominantly light and variable from the east. While the winds near Houston were light in the morning, they increased steadily during the day with gusts reaching nearly 35 knots by evening. This increase in wind speed caused the fire to grow quickly, but didn't bring smoke to Anchorage on Monday.

By early Tuesday morning the winds

meteorological data were collected only sporadically during the Miller's Reach Fire. Typical observations were merely notes in the Incident Command log.

Regardless of the paucity of local meteorological data, Doppler radar confirms the plume of smoke tracking south and covering Anchorage. Below are a pair of Doppler images² taken on June 4, 1996 which clearly indicate that the plume came directly south from the Houston/Big Lake area and covered Anchorage.

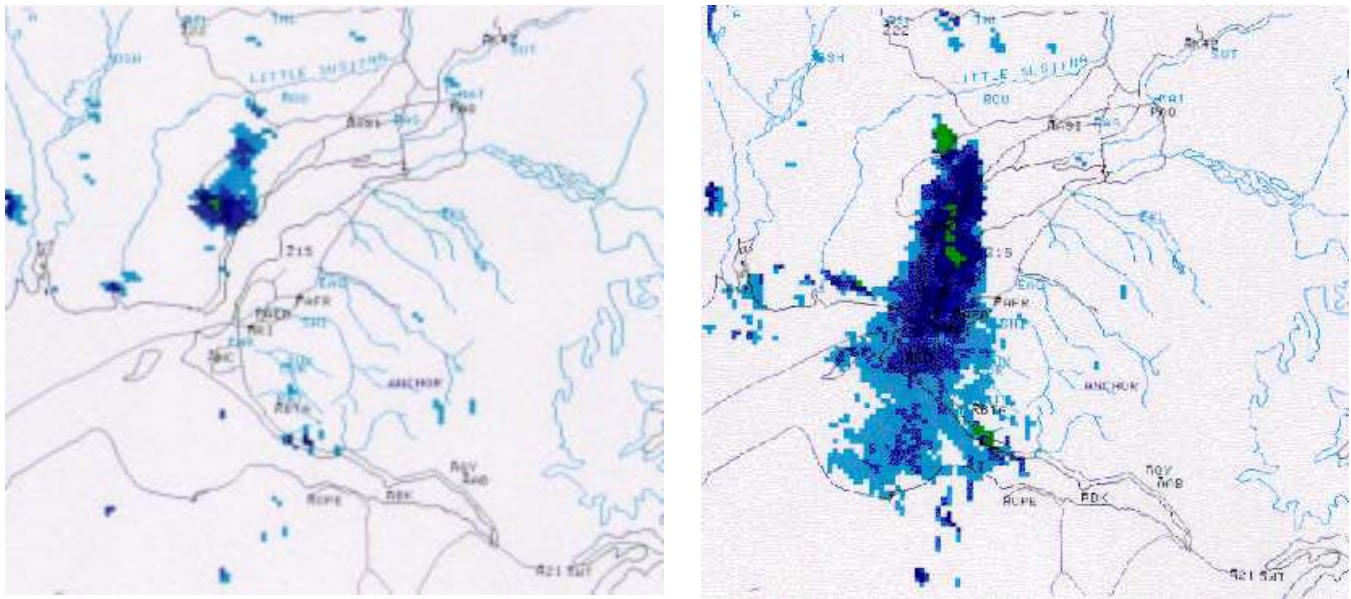


Figure 4 - Doppler images showing the plume of smoke traveling to Anchorage on June 4, 1996.

Below are false-color satellite images³ showing the smoke plume from the Miller's Reach Fire on June 4th, 1996, (left) and June 5th, 1996 (right). The images show wildfire smoke being blown directly from the Miller's Reach Fire to the Anchorage area on the 4th, and on the 5th smoke being blown to the west, missing Anchorage.

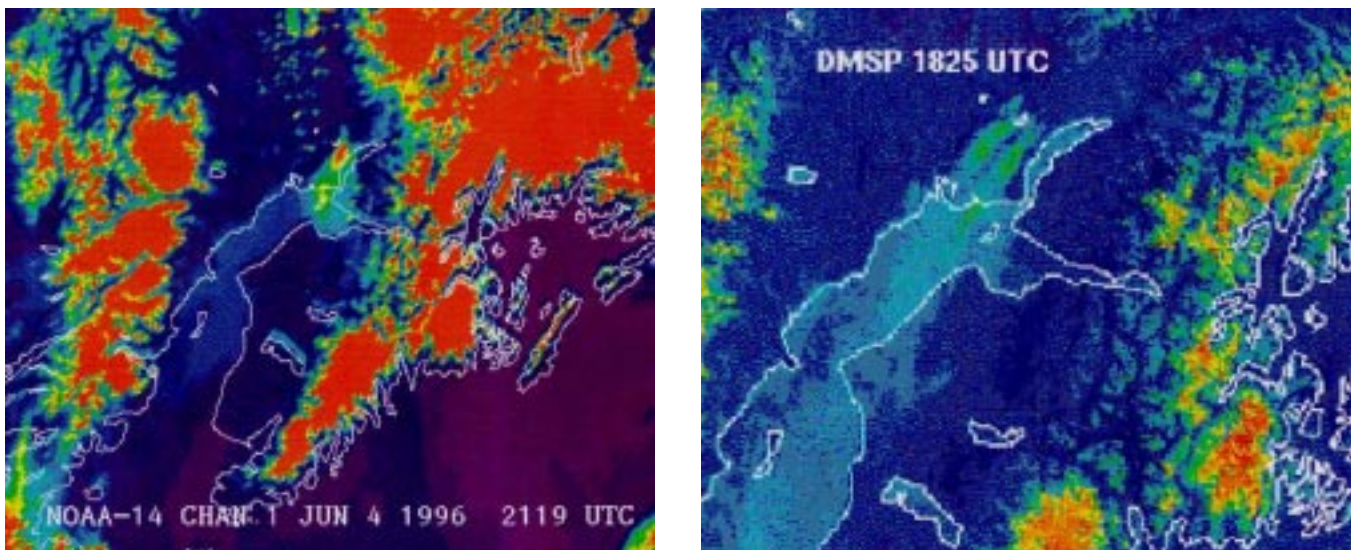


Figure 5 - Satellite images of the plume of smoke on June 4-5, 1996.

By late Tuesday evening the winds had started shifting towards the south. By Wednesday afternoon the wind flow pattern was bringing clean air up from the south, and diverting the smoke plume to the west and blowing the fire back onto itself. Ambient PM₁₀ concentrations dropped at monitoring sites throughout the Anchorage area, and at the Gambell station values fell back below the NAAQS.

Historical Data for the Gambell Monitoring Station

It is necessary to address the possibility that there could have been an exceedance of the NAAQS at the Gambell Station on June 4, 1996, without the smoke from the Miller’s Reach Fire. To this end the historical PM₁₀ data have been analyzed to determine whether or not that possibility can be discounted.

The Anchorage area PM₁₀ data experience predictable peaks and valleys over the course of the year. Below is a chart⁴ showing the mean average concentrations for each month recorded at the Gambell Station between January 1988, when the station began operation, and July 1992. Data after July 1992 were excluded in order to eliminate bias due to the volcanic ash deposited from the eruption of Mount Spurr. The highest concentrations of particulate matter in the lower atmosphere were observed during the months of April (break-up) and November (freeze-up) when the weather is typically cool and dry and there is little snow-cover on the roadways.

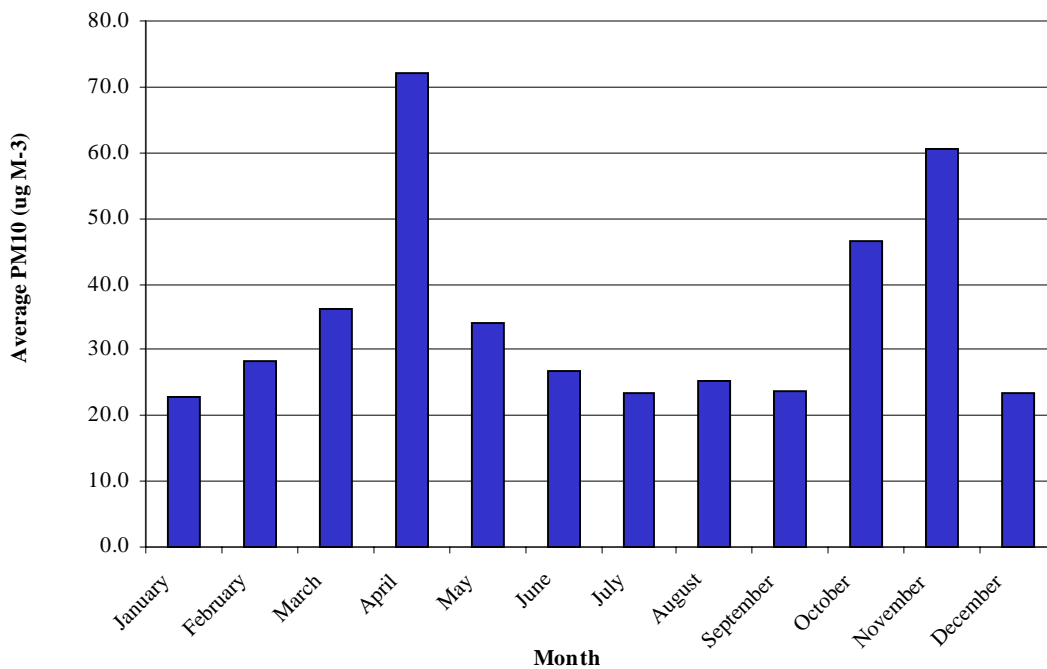


Figure 6 - Average monthly PM₁₀ concentrations at the Gambell monitoring station.

There has never been an exceedance of the NAAQS 24-hour standard for PM₁₀ in June, with the exception of June 4, 1996. In fact, discounting an exceedance caused by high winds on May 14, 1996, and several exceedances due to the eruption of Mount Spurr in 1992, Anchorage has never recorded an exceedance between the months of May through October. During these months typically 90% of the airborne particulates are attributed to road dust from paved and unpaved roads⁵. Typically the combined

impact of other sources (industrial sources, wood stoves etc.), measured by the technique of chemical mass balance receptor modeling, is less than 10%.

The mean PM_{10} concentration for all June days, excluding those from the year 1996, is $29 \mu\text{g m}^{-3}$ (216 days total). The standard deviation for that same data set is $\pm 14 \mu\text{g m}^{-3}$. The NAAQS is over eight and a half standard deviations above the mean for June data. The exceedance for June 4, 1996, had the astronomical PM_{10} concentration of $210 \mu\text{g m}^{-3}$ (approximately 13 standard deviations above the mean). It is virtually impossible to attribute this concentration to random distribution. Therefore, absent emissions caused by the Miller's Reach Fire, there was effectively no chance of an NAAQS exceedance on

Hourly Beta-Attenuation PM₁₀ Measurements

Below is a graph of the hourly PM₁₀ concentrations measured by beta-attenuation monitor (BAM) at the Gambell Monitoring Station. This graph shows the smoke impacting the city on June 4, 1996 and then disappearing afterwards as the wind changed direction.

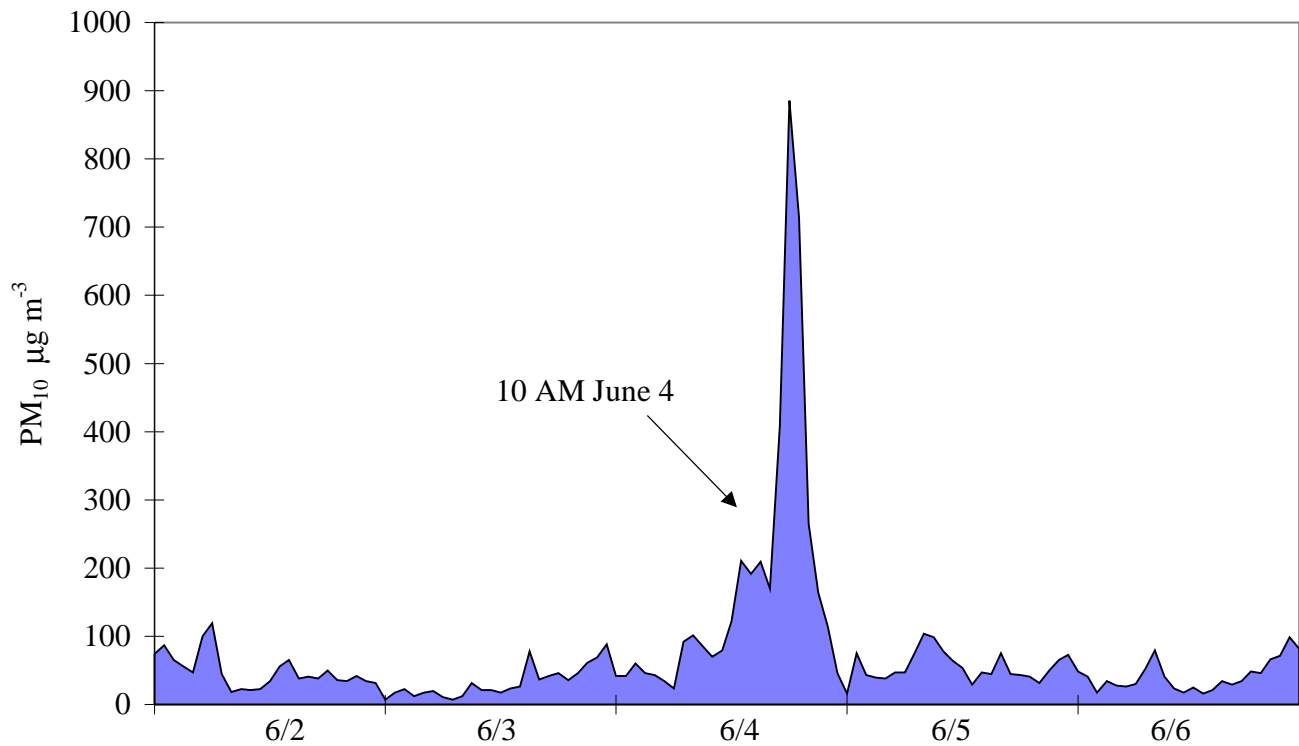


Figure 8 - Hourly beta-attenuation PM₁₀ measurements

WILDFIRE SUPPRESSION

Fire protection responsibility is divided into three areas within the state. The U. S. Bureau of Land Management's (BLM) Alaska Fire Service protects the northern region, the State Division of Forestry protects the southern region, and the U. S. Forest Service is responsible for the national forests (primarily in the south-east). Since land ownership in Alaska is somewhat complicated, Alaska has developed a single fire plan across all land ownerships.

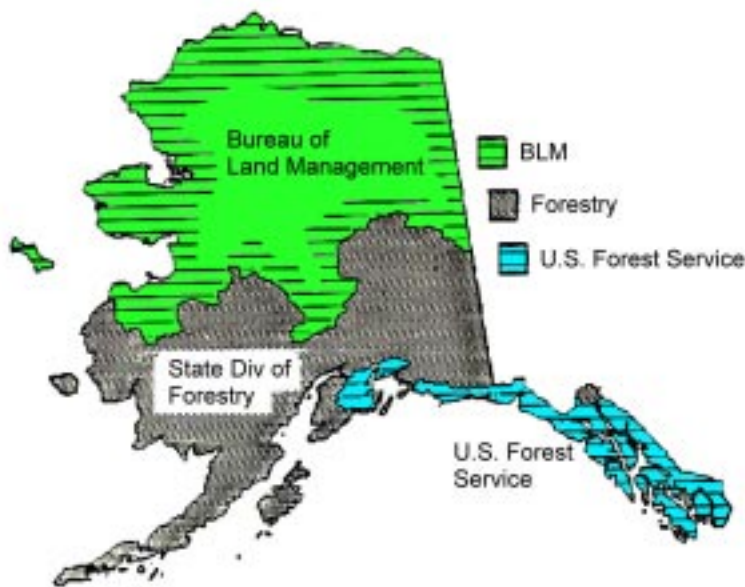


Figure 9 - Areas of fire protection responsibility across the state of Alaska.

(DNR) Division of Forestry. That was 562 fires covering 1,058,910 acres. Forestry is the agency responsible for managing fires in the Anchorage region. Virtually all wildfires occur during the short May-September wildfire season.

Wildland fires occur frequently during the summer months in Alaska. The Division of Forestry maintains a fleet of aircraft to detect and fight wildfires. Private and commercial pilot reports of wildfires have also played a major role in helping the Division of Forestry and the Alaska Fire Service (BLM) to respond quickly to wildfires. Pilots can report fires to the Division of Forestry on 132.45 VHF-AM, to BLM Dispatch on 127.45 VHF-AM. The Division of Forestry maintains dispatch offices in Soldotna, Big Lake, McGrath, Glennallen, Tok, Delta, and Fairbanks between April 1-August 30.

A sophisticated lightning detection system identifies areas of concentrated lightning strikes and directs the deployment of detection aircraft flights. Lightning is the major source of fires outside of the road system. Storms produce as many as 3,500 lightning strikes a day. It is not uncommon to have 50 to 80 lightning fires burning in different locations simultaneously.

The National Weather Service (NWS) provides support with fire weather forecasts, smoke dispersion forecasts, Doppler and satellite images showing smoke plumes. They have fire weather meteorologist and warning coordinating meteorologists on staff.

Within its area, a given agency fights all fires regardless of ownership. The State Division of Forestry (Forestry) has the responsibility for managing wildfires on the lands around Anchorage. Forestry has agreements with other fire agencies to draw additional resources, including fire teams from outside of Alaska. Fire management in the state uses concerted inter-agency efforts involving a wide range of options from aggressive initial attack to passive monitoring of fires burning on lands where resource values do not warrant the cost of suppression.

In 1997 over 79% of the wildfires in Alaska were located within the jurisdiction of the State of Alaska Department of Natural Resources

The Intelligent Fire Management Information System (IFMIS) is a microcomputer-based decision support system developed at Forestry Canada's Northwest Region. It was developed primarily for forest fire preparedness planning and for dispatching initial attack resources to wildfires. Its use in Alaska has been limited so far to producing color-coded maps displaying changing fuels conditions and for assessing fire danger. The maps are generated using daily weather observations, and the codes and indices calculated daily by the Fire Weather Index (FWI) module of the Canadian Forest Fire Danger Rating System (CFFDRS).

The Division of Forestry Fire Fighting Organization

Forestry uses the NIIMS Incident Command System (ICS), making their organization capable of easy integration with professional fire personnel from around the country. This system is the standard, and makes it possible for firefighters from other states to be quickly brought into action in Alaska when necessary. The ICS was used during the Miller's Reach Fire, during which one Incident Commander directed 37 fire departments, over 1,800 state and federal firefighters, 103 agencies and organizations, local and national media, local and national political visits, and the evacuation of more than 1,500 people requiring emergency services.

A sophisticated fire danger rating system has been developed incorporating weather, fuel loading, and other information. It provides basic data used to predict fire behavior and prepare a strategy after a wildfire starts. This information has been available over the internet since 1996 at <http://fire.ak.blm.gov/>. The National Weather Service also maintains a fire weather forecast web page at <http://www.alaska.net:80/~nwsar/html/firewx/firewx.html>. These resources assist fire fighting agencies providing the information necessary to make good decisions quickly.

There are 73 Type II emergency fire fighter crews that can be mobilized within the state, each of which is made up of 16-persons trained to national ICS standards. These are largely comprised of veteran fire fighters with years of experience. The state also participates in the federal smokejumper program, with the Alaska Fire Service maintaining 64 smokejumpers and two Alaskan hot shot crews of 20-persons each. Forestry has many types of aircraft that are used to fight fires including air tankers, transports, reconnaissance planes and helicopters.

The Division of Forestry administers Rural Community Fire Protection (RCFP) grants from the U.S. Forest Service. Volunteer Fire Departments serving communities with populations of under 10,000 may apply for grants of up to \$5,000 on a 50/50 cost share basis to organize, train, and equip fire protection units. The division approved 19 of 53 grants last year funding training and the purchase of pumps, radios, protective clothing, fire extinguishers, smoke detectors, fire tools, and other supplies. In addition to the grants, the division issued fire supplies and equipment valued over \$155,000 to volunteer fire departments.

Wildfire Priorities

The fire plan also recognizes the natural role of fire in the landscape, changing vegetative patterns that benefit wildlife and as a source of regeneration for some species such as black spruce. The state fire plan prioritizes areas according to fire protection levels based upon natural terrain, vegetative changes, or values at risk.

Critical Protection

Areas receiving critical protection are those in which wildfires would threaten human life, inhabited property, and designated developments. Wildfires that threaten a critical site receive priority over all other fires.

Full Protection

Full protection areas receive initial attack and aggressive suppression efforts until controlled. This level of protection is extended to historic sites, uninhabited private property, high-value natural resources, and other high value areas that do not involve protecting human life and inhabited property.

Modified Protection

The intent of this option is to reduce the cost and impact of suppression and to provide land managers and owners some options within agency constraints and mandates. Either high or low levels of protection can be extended depending on seasonal factors.

Limited Protection

This category covers areas of low value, where the impact of suppression may be more damaging or costly than the effect of fire. Fire suppression is only taken to keep the fire within the management unit or to protect specific values.

Approximately 51% of state, municipal and private land are in a category in which suppression action is not normally required. Since 1984 1,528 fires or 7.4 million acres have been allowed to burn without initial suppression.

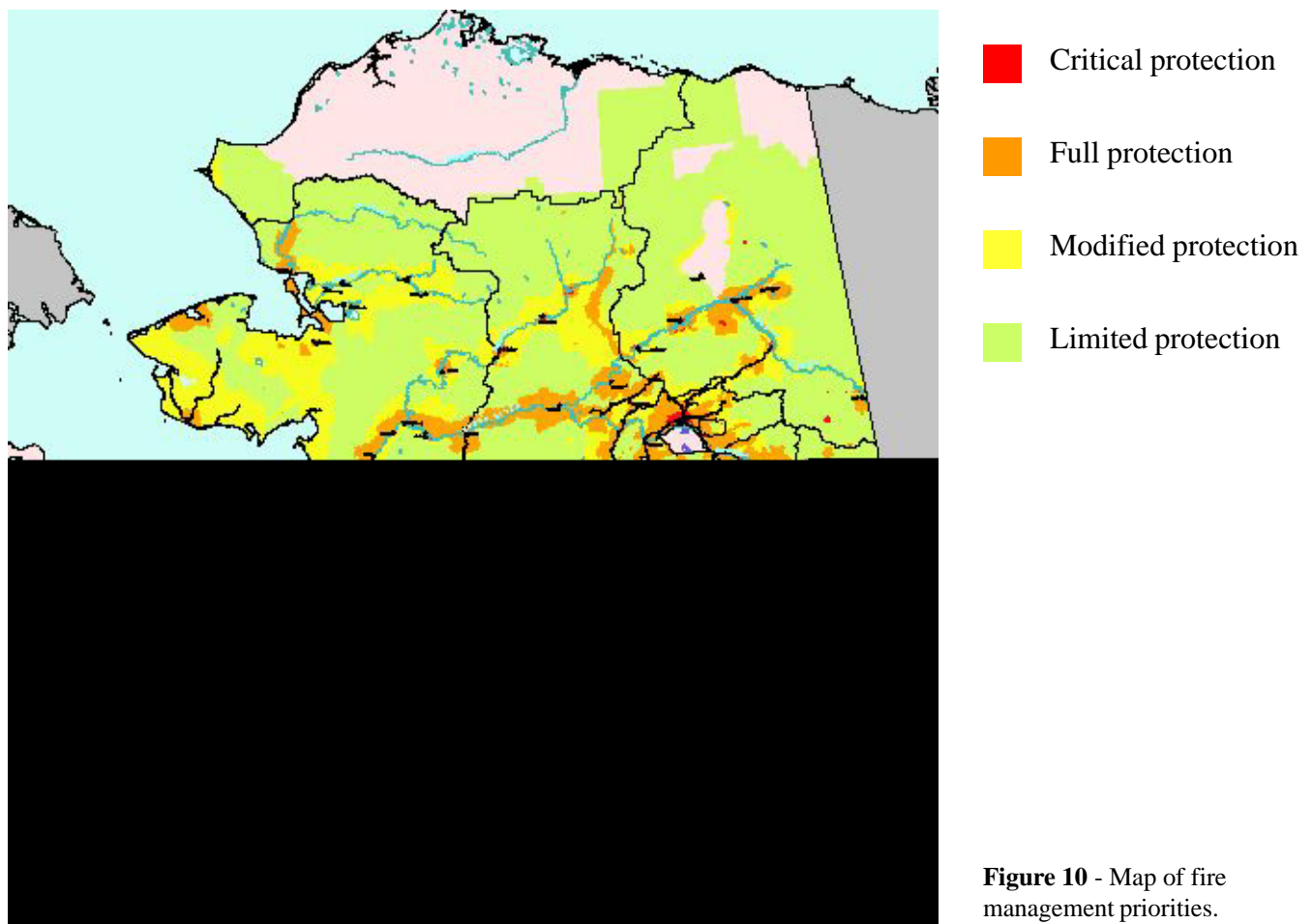


Figure 10 - Map of fire management priorities.

PUBLIC EDUCATION PROGRAMS

Between 1990-1995⁶ there were, on average, 661 fires burning over a million acres and costing \$21.7 million annually. The majority of fires are caused by humans. Fire prevention education is the most effective way to decrease the numbers of fires started by humans. By preventing as many human-caused fires as possible, the risk of endangering public health through exposure to high concentrations of PM₁₀ is also minimized. Another aspect of public education is informing the public about wildfires and their adverse health effects including exposure to PM₁₀ from smoke, and identifying specific actions that can be taken to protect themselves.

There are two purposes to the education portion of the NEAP: informing the public about the health effects of wildfire smoke and reducing the numbers of human-caused fires. Information is made available to the public about the effects of wildfire smoke exposure, what they can expect when a large fire occurs, what measures are taken to control fires and smoke, and when wildfire events are likely to occur.

Fire Mitigation

Anchorage Fire Department Battalion Chiefs, State Forestry officials, and State Farm Insurance Company have been working both separately and together visiting homes and holding community meetings in the Hillside area of Anchorage to help citizens make their homes more defensible from wildfire. Anchorage faces the ocean to the north, west and south. The Hillside area represents the eastern edge of the Anchorage. Hillside is residential and heavily wooded. Hillside is the area most at risk to wildfire, and a wildfire in the Hillside area would then threaten Anchorage both directly and with smoke emissions.

The mitigation measures used in the Hillside area include pamphlets describing how to protect homes and property, how to build a fire resistant house, how to create a defensible space around a house, and extra steps to take when fire danger gets extremely high. The distribution packets also contain coupons that can be used to rent or purchase fire mitigation equipment.

State of Alaska Department of Public Safety and Z. J. Loussac Public Library

The State Fire Marshall's Office and the media staff at the Loussac Library Video Center have purchased and created a series of public education videos which air regularly on public access cable channels 42, 43, 44, 47 and 74 in Anchorage. This project was funded by FEMA in response to the Miller's Reach Fire. The wildfire preparedness programming includes the following video titles:

Fire Power	Wildfire '90
Minimum Isn't Enough	Safe Buildings/Save Lives
Fire Safe Inside & Out	Wildfire Control: An Introduction
Protecting Your Home	Everyone's Responsibility
Firewise Landscaping I	Firestorm 1991
Firewise Landscaping II	The Oakland Story
Firewise Landscaping III	Northland Wildfires (Lessons Learned)
Be Cool About Fire Safety	

Anchorage Fire Department Fire Prevention Office

The Anchorage Fire Department (AFD) has had a full time education coordinator working on the Fire Prevention program for nearly three years. This office runs multiple programs designed to educate the public about the dangers of wildfires and structure fires, and has a major campaign to address the problem of child fire-starters. The following programs are currently being run or coordinated by the AFD:

1. Learn Not To Burn.
2. Clown program.
3. Firestoppers for Children.
4. Nobody Gets Hurt Week.
5. Alaska State Fair Activities.

Learn Not To Burn

The Learn Not To Burn curriculum was developed for educators by the National Fire Protection Association approximately 20 years ago. In 1996 Anchorage became one of 10 cities nationwide to get a pilot program and used the new and highly refined curriculum in the Muldoon area. This highly successful program provides both fire safety and fire prevention information.

The AFD began a 6-year program of implementation of the new curriculum at all preschools and elementary schools. The implementation schedule has been greatly accelerated with half of the Anchorage elementary schools committed to teach the curriculum by the end of the 1997-1998 school year, and 100% participation is expected in the fall of 1998.

One of the factors making this new schedule possible is the contribution of all of the curriculum materials donated by the Denali Safety Council⁷ (DSC). Another important factor was the preparation of a training video that was created by the Loussac Public Library media staff.

Clown Program

A member of the AFD Fire Prevention Office travels to elementary schools dressed as a clown throughout the school year. During these visits the clown presents fire safety and fire prevention information to young children in an entertaining manner. The clown demonstrates fire safety lessons and entertains children throughout south-central Alaska.

Firestoppers for Children Program

Nationwide statistics indicate that 40-70% of all documented, intentionally set fires are set by children under the age of 18⁸. In 1995, 50% of the fires in Alaska were caused by children, accounting for 40% of the fire deaths in the state. The Firestoppers for Children Program is a purely voluntary program for parents and children that has two main goals:

1. educating children who display dangerous fire behavior and
2. to provide referral information for parents whose children need help beyond what the education program can provide.

When a problem is identified there is an assessment done for evaluation purposes. This process is initiated only for children who have admitted to, or been witnessed using fire inappropriately. The assessment is used to determine if education or more serious referral is appropriate for a child. Very often parents contact the Firestoppers for Children Program.

The education component helps children understand why their behavior was inappropriate and identifies corrective action. The education component is taught by program specialists one on one with children at first, and then by a combination of parents and specialists and children in groups. They are taught the benefit of preventing fires instead of starting them, as well as the consequences of their actions related to fire. Homework is assigned that relates to making their home safe from fire. Parentally supervised restitution or community service can be used to demonstrate to the child responsibility for his actions.

In more serious cases, when education is not effective children are referred to mental health agencies. As always, participation is strictly voluntary and a parent must sign a Consent Form Release of Information Form. Typical referral agencies are:

- ◆ mental health professional,
- ◆ child protective services,
- ◆ school counselor,
- ◆ in-patient hospitalization,
- ◆ physician for a medical evaluation,
- ◆ parenting classes for parents, and
- ◆ attention deficit/hyperactivity disorder evaluation.

This program is only in its second year, and already nearly 300 children have been contacted. Although it is too early to identify a trend, the fire rate with children appears to be dropping.

Nobody Gets Hurt Week

Nobody gets hurt week was established in Alaska, by proclamation of the Governor, as May 18-24, 1998. Activities are scheduled during this week on the topics of recreational safety, fire safety, slips, trips and falls, disaster preparedness, and vehicle safety. Tuesday May 19th 1998 is Fire Safety Day, and many activities are promoted across the state to promote fire safety and fire prevention. The Fire Service asked all parents and retailers to remove matches and lighters from where children can reach them.

Alaska State Fair

The AFD, in cooperation with the DSC, participates in the Alaska State Fair. The State Fair Board subsidizes the cost for rental of a large area. The area is used for three activities:

1. A fire safety trailer, which is an interactive fire safety education vehicle which includes such activities as climbing out windows.
2. A tent where organizations set up educational displays to teach injury prevention, water safety, etc.

3. The Kiddie Kombat Challenge, where children compete with each other in such activities as the hose haul, stair climb, and body drag. This is a hands on opportunity to find out what a firefighter does.

The State Fair Events have been nationally recognized for their educational quality.

Brochures

The Alaska Department of Environmental Conservation distributes brochures on air quality, on the health effects of particulate matter as well as wood smoke, and on open burning. The MOA Department of Health and Human Services also produces and distributes brochures and handouts on air quality for the public.

Billboards

There are billboards along all of the major roadways in the Anchorage area that indicate the current level of fire danger. The fire danger is assessed by multiple factors including weather and fuel loading and dryness. These billboards are maintained by the State Division of Forestry and are updated regularly during the fire season. The billboard system is currently expanding, with new boards being installed throughout the state road system, especially around Anchorage.

Public Service Announcements

The State Division of Forestry offices can close areas to open burning including issuing a campfire ban if conditions become dangerous for wildfires. Forestry keeps a full-time Public Information Officer (PIO) on staff during the summers to prepare and issue press releases when there are campfire bans, open-burn closures, or other events. The PIO works in coordination with other state and local officials to publicize wildfire and wildfire danger information. Announcements are issued to radio, television, and news print media.

Spruce Bark Beetles

The AFD distributes pamphlets informing the public of the threat of spruce bark beetles. Beetles kill spruce trees in Alaska, and are normally found in spruce forests. When a tree dies it becomes a fire hazard due to dry, flammable needles and the low scrub brush and grasses that grow up in the vacated area. The AFD, the Alaska Cooperative Extension Service, and the Anchorage Office of Emergency Management all distribute information to the public concerning spruce bark beetles.

Beetle killed trees are a significant source of fuel for wildfires. A number of steps are recommended to prevent or eliminate beetle infestation. The MOA allows year round burn permits to help alleviate spruce bark beetle problems and issues an excellent guide for conducting controlled burns which minimize smoke.

Other Internet Fire Resources for the Public

There are also a few world-wide web pages that are available to the public that contain information about existing fires and fire danger. The state Division of Forestry maintains several web pages including one that contains current fire information located at <http://www.dnr.state.ak.us/forestry/fireinfo.htm>. This page contains links to various sites showing current fire situation reports for the state, as well as the rest of the country.

The Initial Attack Management System (IAMS) is suite of computer applications developed by Bureau of Land Management Alaska Fire Service to aid dispatchers and fire managers. IAMS Maps is one of these applications and provides graphical representation of various kinds of geographic data. Maps has been modified to produce output to the <http://fire.ak.blm.gov/> web site to allow internet access to the data that IAMS stores. Dynamic data such as lightning (available May - Sept.), fires, etc. are updated every 15 minutes during the fire season.

NATURAL EVENT ACTION PLAN FOR WILDFIRE SMOKE

NEAP Objectives

Minimization of public exposure to smoke is primarily accomplished through public service announcements and other warning networks when an event is imminent or occurring. For the purpose of issuing health alerts the Anchorage Air Pollution Control Agency (AAPCA, a division of MOA DHHS) monitors PM₁₀ concentrations using continuous beta-attenuation monitors. When concentrations exceed or are predicted to exceed the 24-hour NAAQS the AAPCA takes actions prescribed in the Anchorage Air Pollution Episode Plan. Public service announcements are distributed to radio, television and printed news media to increase general public awareness of an air pollution episode. Should conditions become extreme the DHHS contacts the Municipal Office of Emergency Management for more drastic actions.

On the morning of June 4, 1996, the MOA DHHS determined that air in the Municipality of Anchorage was unhealthy and issued an Air Pollution Health Advisory (Appendix D) to the broadcast and printed news media according to the Anchorage Air Pollution Episode Plan. Attached to the advisory was an addendum prepared by the MOA Public Health Officer regarding the health effects of wildfire smoke. Public service announcements were broadcast throughout the day warning people about the episode, the danger to their health, prescribed actions for at-risk persons, an air quality forecast, and contact numbers for more information.

NEAP Component 1 - PM10 Monitoring Program and Pollution Standard Index

The AAPCA and ADEC operate a PM₁₀ monitoring program. The MOA network has samplers throughout the city, as well as in communities along the Knik Arm. Although most of the monitors are FRM high-volume 24-hour samplers, the MOA has three beta-attenuation monitors that provide real-time data. The beta-gauge air samplers provide short-term information, as well as hourly and 24-hour averages. The data can be accessed remotely by modem.

These real-time data are used in the calculation of the Pollution Standard Index (PSI) each week day. There is a telephone recording (343-4899) that provides current PSI forecast information to the public. This recording is normally updated each week day, however the frequency of updates is increased when an episode is realized or the risk of one becomes high.

The Anchorage Air Pollution Control Agency uses information available from the National Weather Service to forecast air pollution events. NWS forecasts are updated four times a day for Anchorage at a minimum. When the PSI becomes, or is predicted to become dangerously high, it triggers the Anchorage Air Pollution Episode Plan.

NEAP Component 2 - Anchorage Air Pollution Episode Plan

The MOA has created an Anchorage Air Pollution Episode Plan (Appendix C). The episode plan is designed to define specific procedures to be followed when the ambient air is or is expected to be

unhealthy. The MOA plan directly addresses airborne particulates (PM_{10} , $PM_{2.5}$), as well as carbon monoxide (CO) and sulfur dioxide (SO_2).

The plan states that the MOA Director of Health and Human Services shall declare an air pollution episode alert, warning or emergency when the concentration of contaminants in the ambient air has reached or is predicted to reach the following levels (italicized lines do not pertain to particulate matter):

Air Alert

PM_{10} exceeding $150 \mu\text{g m}^{-3}$ (24-hour average)
 SO_2 exceeding 0.14 parts per million (PPM, 24-hour average)
CO exceeding 9.0 PPM

Air Warning

PM_{10} exceeding $350 \mu\text{g m}^{-3}$ (24-hour average)
 SO_2 exceeding 0.30 parts per million (PPM, 24-hour average)
CO exceeding 15 PPM

Air Emergency

PM_{10} exceeding $420 \mu\text{g m}^{-3}$ (24-hour average)
 SO_2 exceeding 0.60 parts per million (PPM, 24-hour average)
CO exceeding 30 PPM

Once the AAPCA staff and the Municipal Medical Officer evaluates the situation, they make their recommendation to the director of the DHHS. Once the director declares an alert, warning or emergency the episode plan is activated. At that time the following duties fall upon the AAPCA:

Air Alert

- 1) The municipal medical officer, municipal manager, fire chief, and mayor are notified of the alert and the reason why the alert was declared.
- 2) The air quality message is updated to provide information to the public.
- 3) The news media is notified of the alert by issuing a health advisory describing the reasons for the alert and advising the public of any restrictions and requests called for by the alert.
 - a) Ask the public to stop using wood stoves and fireplaces when an alternative heat source is available.
 - b) Prohibit open burning during the alert.
- 4) Monitor air pollution levels at appropriate intervals to assess episode status.

Air Warning

- 1) Continue the actions called for during the air pollution alert.
- 2) Define the boundaries of high concentration areas by the best available method.
- 3) Businesses are asked to suspend or reduce incinerator use.
- 4) Notification is given to State of Alaska Department of Environmental Conservation (ADEC) and the U. S. Environmental Protection Agency (EPA) of the air pollution warning. The director shall confer with the municipal manager and, if deemed necessary, assemble an air emergency task force to review possible measures should air pollution levels reach emergency concentrations. The task force may include members from appropriate municipal, state and federal agencies.

Air Emergency

- 1) Continue the actions called for during the air pollution alert and warning.
- 2) Ask for assistance from the EPA emergency response team.
- 3) The municipal emergency operations center (Component 3 below) is activated following conference with the municipal manager.
- 4) A health advisory is issued with a description of actions individuals can take to protect themselves.

- 5) Assemble an air emergency task force as described for an air warning. The task force selects proper voluntary and mandatory measures to be implemented during the air emergency.
- 6) Publicize and enforce, as warranted, the measures selected by the emergency task force. Measures may include, but are not limited to, the following:
 - a) Excuse nonessential municipal employees from work.
 - b) Reduce or curtail municipal services.
 - c) Close schools.
 - d) Close or limit the operation of businesses whose operation is not essential to protect public health and welfare.
 - e) Ban the use of incinerators.
 - f) Ban the use of wood stoves and fireplaces, except where they are the sole source of heating.
 - g) Eliminate bus fares.

Once declared, an air pollution episode level remains in effect until the criteria for that level no longer exist. At that time the next lower rating will be declared and publicized by the director until concentrations fall below the alert level criteria. If conditions worsen then the episode level will be upgraded accordingly. When an Air Emergency is declared the Municipal Office of Emergency Management becomes activated and can take more extreme steps.

NEAP Component 3 - The Municipal Office of Emergency Management

The MOA Office of Emergency Management (OEM) has adopted a Comprehensive Emergency Management Plan (CEMP), whose scope includes managing all disaster emergencies. The MOA DHHS works with the OEM when an air pollution episode is occurring or imminent.

The OEM has the capacity to issue health alerts through the news media, as well as distributing fax-grams and activating the Emergency Alert System. The fax-gram system is a list of 72 individuals, organizations and agencies to be notified during an emergency or imminent emergency. Fax-grams can target persons that are susceptible to air pollution, delivering specific health advisory messages. The target groups include children, the aged, and those suffering from asthma and other respiratory ailments. The contact list includes (among others):

- The Anchorage School District,
- Day-care facilities,
- Old-age care facilities,
- Hospitals and clinics, and
- Offices of doctors who specialized in respiratory health as appropriate.

The OEM coordinates with the Municipal Medical Officer to make the determination to invoke parts of the CEMP. In the event of an emergency, the CEMP can contact the media to issue press advisories as well as activate the emergency alert system or (if the situation becomes life-threatening) evacuate persons at risk.

Contingency Measures

The State has reviewed and concurs with the actions in the MOA Air Pollution Episode Plan, and believes that these actions are sufficient to protect public health. In the event that the existing plan is found to not fully protect the public, the State recommends that the following measures be explored:

1. Improve communication with the State Division of Forestry. Better awareness of wildfires that may threaten public health will be an important tool in forecasting air pollution episodes. During the Galena Fire in 1997 there was very little awareness of the fire when Anchorage was impacted by its smoke.
2. Increase warning lead times. AAPCA might more effectively protect public health by preparing and distributing an air quality advisory when the potential for an air pollution event exists, even if a specific event is not expected but is only a possibility. This would serve three functions:
 - a. To increase public awareness. With air quality in mind, the public is much more likely to make informed choices during a smoke event even if an air quality alert is not issued, or if the distribution of one is delayed.
 - b. To let the public know that the air quality is being monitored, and that they should be alert for further warnings of specific predicted events.
 - c. To allow at-risk persons to make preparations ahead of time (purchase extra asthma medication, depart the affected area, etc.) to minimize the chance of serious medical emergencies.

The AAPCA has concerns about the risk of creating a skeptical public associated with repeatedly broadcasting warnings when no episode is realized. The AAPCA also feels that there is a risk of overreaction by some of the public, and so any such warning would be worded very cautiously.

3. Improve the distribution of warnings. The AAPCA might install a step in the Air Pollution Episode Plan to make certain that advisories issued by the MOA DHHS are forwarded to the MOA Office of Emergency Management for distribution by the fax-gram system before air pollution reaches levels that would trigger an air emergency. This is important because it ensures that the parties most at-risk are specifically informed of an episode and can therefore be given important information that may not be suitable for a general public service announcement.
4. Incorporate the new PM_{2.5} NAAQS. Smoke particles fall primarily under the new NAAQS for fine particulate matter, and we suggest that the AAPCA might incorporate this standard into its Air Pollution Episode Plan once more data becomes available.
5. Increase public education. The State might institute some programs to further educate the public about the specific dangers of wildfire smoke and steps to take to minimize exposure to it.

The State reserves the right to implement these contingency measures on a case-by-case basis as the need for them arises.

PUBLIC INVOLVEMENT

The State of Alaska Department of Environmental Conservation wrote this NEAP with the assistance of numerous individuals and organizations including the MOA DHHS Air Quality Program, the Anchorage Fire Department, the National Weather Service, the State Division of Forestry, the Alaska Fire Service, the Alaska Wildfire Coordinating Group, the Alaska Interagency Coordinating Center, the the Loussac Public Library, the Anchorage Daily News, the State Fire Marshall's office, the State Climatologist, the Mat-Su Public Safety Office, and the MOA Office of Emergency Management.

The State will make this document available to the public by posting it on the DEC world wide web page for downloading (<http://www.state.ak.us:1221/local/akpages/ENV.CONSERV/home.htm>). The public will be able to respond in writing from that same page. All public comments will be considered in the final revision of this document before it is submitted to the EPA.

RE-EVALUATION OF THE PLAN

The State of Alaska DEC must re-evaluate this plan every five years from the date of submittal to the EPA. Upon completion of each re-evaluation, a letter will be submitted to the EPA with a summary of the findings and comments on the effectiveness of the plan. Data exceeding the NAAQS will be explained and the associated data set provided, as well as an explanation of the actions that were taken to protect public health.

ACRONYMS AND ABBREVIATIONS

AAPCA.....	Anchorage Air Pollution Control Agency
ACES	Alaska Cooperative Extension Service
ADEC	State of Alaska Department of Environmental Conservation
ADN.....	Anchorage Daily News
AFD	Anchorage Fire Department
AWOS.....	Automated Weather Observation Station
BLM.....	DOI Bureau of Land Management
CEMP	MOA Comprehensive Emergency Management Plan
CFFDRS	Canadian Forest Fire Danger Rating System
CO.....	Carbon monoxide
DHHS	MOA Department of Health and Human Services
DNR	State of Alaska Department of Natural Resources
DOI	U. S. Department of the Interior
EPA	U. S. Environmental Protection Agency
FEMA	Federal Emergency Management Agency
Forestry	State of Alaska Division of Forestry
FCP	AFD Firestoppers for Children Program
FRM	Federal Reference Method
FWI	Fire Weather Index
IAMS	Initial Attack Management System
ICS	Incident Command System
IFMIS	Intelligent Fire Management Information System
Mat-Su Borough	Matanuska-Susitna Borough
MOA	Municipality of Anchorage
NAAQS	National Ambient Air Quality Standard
NEAP	Natural Event Action Plan
NFPA	National Fire Protection Association
NIIMS	National Interagency Incident Management System
NOAA.....	National Oceanic and Atmospheric Administration
NWS	National Weather Service
PPM	Part per million
PSA	Public Service Announcement
PSI	Pollution Standard Index
PIO.....	Public Information Officer
RCFP	Rural Community Fire Protection
SO ₂	Sulfur dioxide

End notes

- ¹ Map courtesy of Gary Hufford of the National Weather Service.
- ² Doppler images provided by Jeff Perry of the National Weather Service.
- ³ Hufford, G., Herbert, L., and Sparkman, W., Use of Real Time Multi-Satellite and Radar Data to Support Forest Fire Management, **Weather and Forecasting**, submitted for publication on June 29 1997, accepted on April 2 1998, publication expected in September 1998.
- ⁴ Data set of daily PM₁₀ concentrations was provided by Mr. Steve Morris of the Municipality of Anchorage Department of Health and Human Services, Environmental Services Division, Air Quality Program.
- ⁵ Air Quality in Anchorage. A Summary of Air Monitoring Data and Trends (1980-1996), Air Quality Program, Environmental Services Division, Dept. of Health and Human Services, Municipality of Anchorage, 1997.
- ⁶ Data provided by the State of Alaska Department of Natural Resources, Division of Forestry.
- ⁷ A community safety organization that includes the State Fire Marshall's Office, AFD, other fire departments in the Mat-Su area, Alyeska Pipeline Service Co., State Farm Insurance Co., Doyon Universal Ogden, VECO, Ahtna AGA, Carrs, Alaska Petroleum Contractors, Westmark Hotels, Price/Ahtna, Northwest Tech. Services, Chugach North Tech. Services, Houston Contractors, Alaska Petroleum Joint Crafts Council, Teamsters, Red Cross, MFS Network Technologies, Insurance Women of Alaska, KIMO channel 13, KTUU channel 2, Allen & Peterson, Fairbanks Kiwanis, Natchiq, and Carlile Enterprises.
- ⁸ Data provided by the Municipality of Anchorage Fire Department.