Alaska Department of Environmental Conservation

Amendments to:

State Air Quality Control Plan

Vol. III: Appendices

Appendices to:

Volume II, Section II. Air Quality Control Program;
Volume II, Section III.A Statewide Carbon Monoxide Control Program;
Volume II, Section III.B Anchorage Transportation Control Program; and
Volume II, Section III.D.2 Eagle River Limited Maintenance Plan

Public Review Draft

June 28th, 2010

The State of Alaska's State Air Quality Control Plan Volume III, Appendix to Volume II of this plan, is amended to include the following documents:

Volume II, Section II. Air Quality Control Program is amended by removing the following regulations:

- 18 AAC 50 Air Quality Control as amended through April 1, 2010;

and replacing them with the following regulations currently under public review and comment:

- 18 AAC 50 Air Quality Control as amended through {*Adoption Date of Regulations*}.

Volume II, Section III.B Anchorage Transportation Control Program adopted into the State Air Quality Control Plan {*Adoption Date of Regulations*} is amended as follows:

- Appendix III.B.1 is amended by adding the following documents:

  · Anchorage Assembly Resolution No. 2010-174, dated June 8, 2010, a resolution of the Municipality of Anchorage adopting revisions to the Anchorage Carbon Monoxide Maintenance Plan (dated May 13, 2010) that deletes the commitment to I/M as a primary CO control measure.

- Appendix III.B.3 is amended by adding the following document:

  · Anchorage 2007 Carbon Monoxide Emission Inventory and 2007-2023 Emission Projections, prepared by the Municipality of Anchorage, dated March 2010.

- Appendix III.B.6 is amended by adding the following document:

  · Analysis of Probability of Complying with the National Ambient Air Quality Standard for Carbon Monoxide in Anchorage between 2007 and 2023, prepared by the Municipality of Anchorage, dated March 2010.

- Appendix III.B.9 is amended by adding the following document:

  · Municipality of Anchorage Ordinance No. 2010-35(S), adopted by the Anchorage Assembly May 11, 2010; an ordinance repealing Anchorage Municipal Code Chapters 15.80 and 15.85, relating to motor vehicle emissions inspection and maintenance (I/M) program; amending Chapter 15.80 and 15.85 in the interim to revise existing fees and program administration; amending section 9.30.155 to repeal reference to I/M certification; and amending the fine schedule at section 14.60.030.

- Appendix III.B.10 is amended by adding the following document:

  · Estimation of Background Carbon Monoxide Concentrations for Anchorage Project-Level Conformity Analyses, no date.

Note: After the close of the public comment period, Appendix III.B.10 will be amended to include the following documents:

- Affidavit of Oral Hearing; and
- Alaska Department of Environmental Conservation's response to written and oral comments on the Anchorage Carbon Monoxide Maintenance Plan.

Volume II, Section III.D.2 Eagle River PM-10 Control Plan adopted into the State Air Quality Control Plan {*Adoption Date of Regulations*} is amended by adding the following appendices:

- Appendix III.D.2.2- Anchorage Assembly Resolution (AR) 2010-4, dated January 12, 2010, adopting the Eagle River PM-10 Limited Maintenance Plan.
- Appendix III.D.2.5- PM_{10} design values for Eagle River and qualification for Limited Maintenance Plan.
- Appendix III.D.2.6- 2007 and 2020 PM_{10} Emission Inventories for the Eagle River Limited Maintenance Area.
- Appendix III.D.2.11- Natural Events Action Plan for Windblown Dust Events in Anchorage, Alaska.

Volumes II and III of the *State Air Quality Control Plan*, as amended {*Adoption Date of Regulations*}, includes the following document which is adopted by reference in 18 AAC 50.030:

- "Quality Assurance Project Plan for the State of Alaska Air Monitoring & Quality Assurance Program", dated February 23, 2010.

DEPARTMENT OF

ENVIRONMENTAL CONSERVATION

18 AAC 50

Air Quality Control

Public Review Draft

June 28th, 2010

The lead in language of 18 AAC 50.030 is amended to read:

18 AAC 50.030. State air quality control plan. Volumes II and III of the *State Air Quality Control Plan* for implementing and enforcing the provisions of AS 46.14 and this chapter, as amended through ***{adoption date of these proposed regulations}*** [NOVEMBER 6, 2009], are adopted by reference. The plan includes the following documents which are also adopted by reference:

. . .

18 AAC 50.030(4) is amended to read:

(4) the department's ***Quality Assurance Project Plan for the State of Alaska Air Monitoring & Quality Assurance Program***[*ALASKA QUALITY ASSURANCE MANUAL FOR AMBIENT AIR QUALITY MONITORING*], as amended through **February 23, 2010**[AUGUST 21, 1996];

(Eff. 1/18/97, Register 141; am 6/21/98, Register 146; am 9/4/98, Register 147; am 1/1/2000; Register 152; am 12/30/2000; Register 156; am 9/21/2001, Register 159; am 1/27/2002, Register 161; am 3/2/2002, Register 161; am 5/3/2002, Register 162; am 2/20/2004, Register 169; am 6/24/2004, Register 170; am 10/1/2004, Register 171; am 12/14/2006, Register 180; am 12/30/2007, Register 184; am 5/17/2008, Register 186; am 7/25/2008, Register 187; am, 11/9/2008, Register 188; am 5/6/2009, Register 190; am 11/4/2009, Register 192; am 4/1/2010, Register 193; am__/__/____, Register ___)

Authority: AS 46.03.020 AS 46.14.030 Sec. 30, ch. 74, SLA 1993
AS 46.14.020 AS 46.14.140

18 AAC 50.215(a) is amended to read:

18 AAC 50.215. Ambient air quality analysis methods. (a) A person who submits meteorological or ambient air monitoring data under AS 46.03, AS 46.14, or this chapter shall obtain the data in accordance with

(1) the department's ***Quality Assurance Project Plan for the State of Alaska Air Monitoring & Quality Assurance Program*** [*ALASKA QUALITY ASSURANCE MANUAL FOR AMBIENT AIR QUALITY MONITORING*], adopted by reference in 18 AAC 50.030 for PM-10, **PM 2.5**, total suspended particulates (TSP), lead, carbon monoxide, nitrogen dioxide, sulfur dioxide, ozone and ammonia;

(Eff. 1/18/97, Register 141; am 6/21/98, Register 146; am 10/1/2004, Register 171; am 7/25/2008, Register 187; am __/__/____, Register ___)

Authority: AS 46.03.020 AS 46.14.140 Sec. 30, ch. 74, SLA 1993
AS 46.14.030 AS 46.14.180

Alaska Department of Environmental Conservation

Amendments to:

State Air Quality Control Plan

Vol. III: Appendices

Appendix III.B.1

"Anchorage Assembly Resolution No. 2010-174"

Public Review Draft

June 28th, 2010

Submitted by: Chair of the Assembly at the Request of the Mayor
Prepared by: Department of Health and Human Services
For reading: June 8, 2010

CLERK'S OFFICE
APPROVED
Date: 6-8-10

ANCHORAGE, ALASKA
AR No. 2010-174

A RESOLUTION OF THE MUNICIPALITY OF ANCHORAGE ADOPTING REVISIONS TO THE ANCHORAGE CARBON MONOXIDE MAINTENANCE PLAN THAT DELETE THE COMMITMENT TO I/M AS A PRIMARY CONTROL MEASURE.

WHEREAS, Anchorage prepared and submitted a Carbon Monoxide Maintenance Plan that was incorporated into the Alaska State Implementation Plan for Air Quality and approved by the U.S. Environmental Protection Agency (EPA) in July 2004; and

WHEREAS, the State Implementation Plan includes a commitment to the continued operation of the vehicle inspection and maintenance program (I/M) as a primary control measure to reduce carbon monoxide (CO) emissions in Anchorage; and

WHEREAS, Anchorage has not violated the federal air quality standard for CO since 1996 and projections show that Anchorage will continue to comply with the standard if the I/M program is discontinued; and

WHEREAS, in July 2008 the Anchorage Assembly directed the Department of Health and Human Services to work with the Alaska Department of Environmental Conservation to amend the Maintenance Plan to remove the commitment to I/M as a primary control measure and make it a "local option" not required by the EPA; and

WHEREAS, such amendments to the Maintenance Plan were prepared in accordance with the transportation planning process required under Section 114 of Title 23 of the United States Code and Section 110 of the Clean Air Act; and

WHEREAS, the amended Maintenance Plan was released for public comment and recommended for approval by the Anchorage Metropolitan Area Transportation Solutions (AMATS) Air Quality Advisory Committee and the AMATS Technical Advisory Committee; and

WHEREAS, the AMATS Policy Committee recommended approval of the amended CO Maintenance Plan during their May 27, 2010 meeting; now, therefore,

THE ANCHORAGE ASSEMBLY RESOLVES:

Section 1. That the amended CO Maintenance Plan be approved and forwarded to the

Alaska Department of Environmental Conservation for inclusion in the State Implementation Plan for air quality and for approval by the EPA.

Section 2. This resolution shall be effective immediately upon passage and approval by the Assembly.

PASSED AND APPROVED by the Anchorage Assembly this 8th day of June, 2010.

Chair

ATTEST:

Municipal Clerk

Alaska Department of Environmental Conservation

Amendments to:
State Air Quality Control Plan

Vol. III: Appendices

Appendix III.B.3

"Anchorage 2007 Carbon Monoxide Emission Inventory and 2007-2023 Emission Projections, dated March 2010"

Public Review Draft

June 28th, 2010

Anchorage 2007 Carbon Monoxide Emission Inventory and 2007 – 2023 Emission Projections

Municipality of Anchorage
Air Quality Program
Environmental Services Division
Department of Health and Human Services
March 2010

Preface

This document discusses the methodology used to prepare the base year 2007 CO emission inventory and emission projections for the 2007 – 2023 period covered by the Anchorage maintenance plan.

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Introduction

This document provides technical support and justification for the methods used to prepare the maintenance demonstration for Anchorage, submitted as a revision to the Alaska State Implementation Plan (SIP).

As part of the plan revision, a comprehensive inventory of the sources of CO emissions for base year 2007 was compiled. Historically, violations of the CO NAAQS have occurred most often on winter weekdays, therefore a 24-hour inventory was prepared that reflects ambient temperatures, traffic volumes and other emission source activity levels experienced on a typical winter "design day" in 2007.

In April 2007 an air quality conformity analysis was prepared when the Anchorage Long Range Transportation Plan was amended to include the Knik Arm Crossing. The most recent population, employment, and land use assumptions and forecasts were used in the development of this analysis. Specific forecasts were developed for analysis years 2007, 2017 and 2027. This demographic data was used to generate the 2007 base year CO inventory for the maintenance plan revisions. In addition this data was used directly or interpolated to generate forecasts for 2009, 2011, 2013, 2015, 2017, 2019, 2021 and 2023.

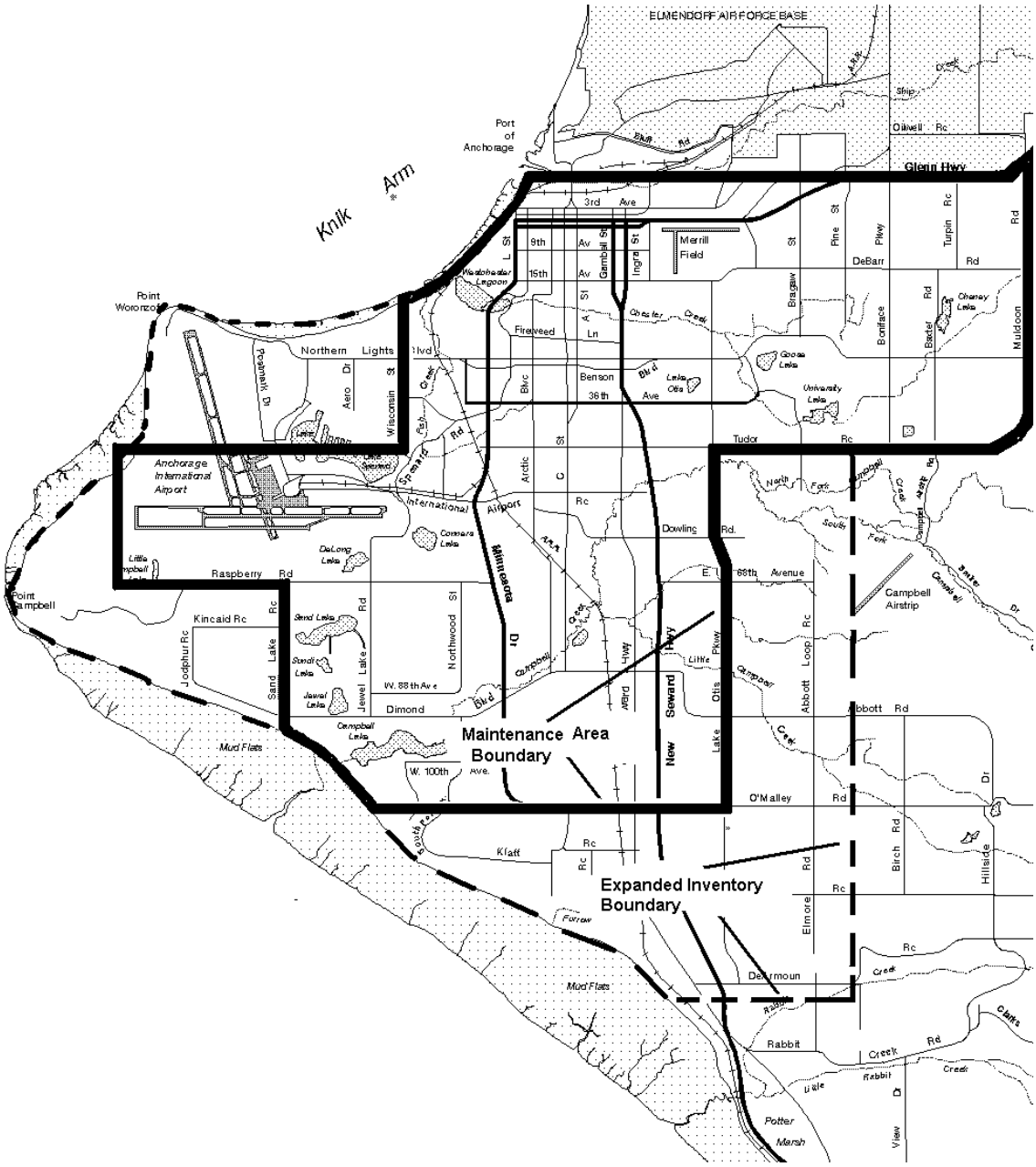
The methodology employed to develop the 2007 base year emission inventory and projections through 2023 was very similar to that employed to develop previous emission inventories for the CO attainment plan in 2000 and the maintenance plan in 2004.

Inventory Boundary

The Anchorage nonattainment area boundary was established in 1978. Upon EPA's approval of the maintenance plan in 2004, the area encompassed by this boundary became the maintenance area. The inventory boundary contains this maintenance area plus some additional area to the south and west where significant residential and commercial growth has occurred over the past two decades. For this reason, the inventory area was expanded slightly to encompass areas not included in the nonattainment area. The boundary of the maintenance area is shown along with the expanded inventory area in Figure 1. The inventory area encompasses approximately 200 square kilometers of the Anchorage Bowl.

Figure 1.

Anchorage Maintenance Area Boundary with Expanded Inventory Area



Anchorage Transportation Model and Inventory Grid System

The CO inventory was based in large part on traffic activity outputs from the Anchorage Transportation Model. The Anchorage Transportation Model is used by AMATS* and the Municipality of Anchorage to evaluate transportation plans and programs. It was validated against measured traffic volumes in base year 2002 and utilizes the latest planning assumptions to forecast future travel activity.. The model was developed using TransCAD travel demand modeling software. Because TransCAD is a GIS-based model, post-processing software could be used to overlay a grid system on the inventory area. The post-processor was used to disaggregate the inventory area into grid cells, each one square kilometer in size.

Transportation activity estimates (e.g., vehicle miles of travel, number of trip starts, and vehicle speeds) were produced for each of the cells. The grid location of every roadway link in the transportation network is known. Thus, the attributes of a particular roadway link (e.g., traffic volume, speed, and prior travel time) could be assigned to a particular grid. If a roadway link crossed the boundary between two or more grids, its attributes were assigned to the appropriate grid in relation to the proportion of the length of link contained in each grid. In other words, if 80% of a roadway link lies within a particular grid, 80% of the vehicle travel is assigned to that grid and 20% to the other grid.

Demographic information (population, number of dwelling units, income, and employment information) is collected by census tract. Because most census tracts in Anchorage are larger in size than the one-kilometer grids, the demographic characteristics of a particular grid had to be estimated from lower resolution census tract data. If, for example, a particular census tract was comprised of three one kilometer grids, the population and employment in that census tract was divided equally among the three grids contained in the census tract. This demographic information was helpful in developing gridded estimates of non-vehicular source activities, like wood burning and space heating where the amount of activity (i.e. wood burning or residential space heating) was assumed to be related to the number of dwellings in a grid.

Emissions from other area sources such as Ted Stevens Anchorage International Airport, Merrill Field, marine vessel operations at the Port of Anchorage and railroad activity in the rail yard and haul routes were assigned to the grids where the activity takes place. Similarly, emissions from point sources such as electrical power plants were assigned to the grid where the source is located.

The Anchorage emission inventory grid system is shown in Figure 2.

* AMATS stands for Anchorage Metropolitan Area Transportation Solutions. AMATS is the designated metropolitan planning organization for the Municipality of Anchorage. It is responsible for prioritizing federal transportation funding. It is also responsible for air quality planning in the Municipality.

Figure 2

Anchorage Inventory Grid System

Overview of Hybrid Emission Estimation Methodology

Between 1997 – 2003, the Municipality of Anchorage (MOA), Fairbanks North Star Borough and Alaska Department of Environmental Conservation (ADEC) invested a great deal of effort quantifying the sources of CO emissions in Anchorage and Fairbanks, particularly those from cold starts and warm-up idling. Sierra Research, working under contract with ADEC, performed cold temperature emission tests on 35 vehicles in Anchorage and Fairbanks during the winters of 1998-99 and 2000-2001. This testing showed that cold start /warm-up idle emissions are a very important source of CO emissions and using engine block heaters is an effective way to reduce emissions.

MOBILE6 alone would ordinarily be used to quantify vehicle emissions. However, a conventional MOBILE6 approach to computing vehicle emission rates does not adequately address the emissions impact of extended warm-up idling at the beginning of a trip nor does it provide a means to estimate the emission reductions resulting from engine block heater use. To address these limitations, a "hybrid" approach was developed to quantify motor vehicle emissions. This hybrid approach utilizes idle emissions data generated from the Sierra Research emission testing [1] to estimate warm-up idle emissions while MOBILE6 is used to estimate the emissions that occur during the travel mode.

The MOBILE6 model was run with supplemental speed (SFTP) correction factors disabled. The purpose of the SFTP speed correction factors is to reflect the increase in emissions that occur during aggressive driving (e.g. hard accelerations and decelerations). During the winter of 1999-2000, Sierra Research performed a study in Anchorage and Fairbanks that showed that winter driving in Alaska had almost none of the high speed, high acceleration rate driving that is represented by the SFTP speed correction factors. [2] For this reason, MOBILE6 was run with these correction factors disabled

Time-of-Day Estimates of CO Emissions

Separate estimates of mobile CO emissions were prepared for the morning commute (7 a.m. – 9 a.m.), the evening commute (3 p.m. – 6 p.m.) and combined off-peak periods (6 p.m. – 7 a.m. and 9 a.m. – 3 p.m.). These estimates relied on time-of-day activity estimates (e.g., number of trip starts and VMT) generated by the Anchorage Transportation Model. A 24-hour inventory was compiled by summing the separate emission contributions from each time period.

Activity estimates for non-vehicular sources were available on a 24-hour basis only, however. Time-of-day estimates had to be developed from these 24-hour values. For some sources (e.g. airport, natural gas combustion), activity was assumed to be continuous throughout the day and emissions were apportioned accordingly. Fireplace and wood stove usage is more likely to occur in the evening after 6 p.m. For this reason, 90% of all wood burning activity was assumed to take place during the off peak time period.

Table 1 shows the specific time periods inventoried and gives examples of the types and levels of activity characteristic of those time periods. (Note that the 2-hour AM peak comprises 8.3% of a 24-hour day, the 3-hour PM peak comprises 12.5% of the day, and the 19-hour off peak period comprise 79.2% of the day.)

Table 1.
CO emission inventory time periods and apportionment of characteristic source activity
% of activity occurring within each time period

Source Category	AM Peak. 7 a.m. – 9 a.m.	PM Peak. 3 p.m. – 6 p.m.	Off-Peak periods 9 a.m. – 3 p.m. 6 p.m. – 7 a.m.	Comments
motor vehicle idle and travel emissions	From model (~16%)	From model (~27%)	From model (~57%)	Travel activity higher in AM and PM peak periods
Residential wood burning	3.0%	7.0%	90.0%	Most burning in evening
space heating	8.3%	12.5%	79.2%	Evenly distributed through day
Ted Stevens Int'l Airport	8.3%	12.5%	79.2%	Evenly distributed through day
Merrill Field	8.3%	12.5%	79.2%	Evenly distributed through day
Miscellaneous / Other *	8.3%	12.5%	79.2%	Evenly distributed through day
Point Sources	8.3%	12.5%	79.2%	Evenly distributed through day

* Miscellaneous/other emissions are comprised largely of sources related to construction and industrial activity like generator sets, welding activities, and pumps.

Motor Vehicle Emissions

A great deal of effort was devoted to developing a credible highway motor vehicle emissions inventory that reflected real world conditions and driver behavior in Anchorage. Unlike the inventories prepared as part of previous air quality attainment plans, this inventory explicitly quantifies the CO emissions that occur during cold starts and lengthy warm-up idles that precede many vehicle trips. Separate estimates were made of the emissions associated with the initial warm-up idle period and the after-idle, “on-road” trip period. Sample calculations for warm-up idle and on-road emissions are available by request along with copies of the MOBILE6 input files used to compute on-road emission factors for analysis years.

As discussed earlier, a hybrid approach utilizing locally-generated cold temperature idle emission data in combination with the MOBILE6 model was employed to compute motor vehicle emissions. An essential element of this hybrid approach is the use of “thermal state tracking” to determine how warmed up a vehicle is at three critical points in the vehicle trip. These three critical points and the important factors involved in computing the thermal state of the vehicles operating in each of these three points in the trip are described in Table 2.

Table 2.
Factors involved in computation of thermal state of vehicle at critical points in a vehicle trip.

Critical point in trip	Factors involved in computation of thermal state of vehicle
1. Immediately prior to start-up	How long, and at what temperature the vehicle has been parked before it was started (i.e. length of cold soak)
2. After warm-up idle, immediately prior to travel portion of trip	Length of cold soak and subsequent idle
3. During travel portion of trip (within grid of interest)	Duration of prior cold soak and warm-up idle, length of trip (miles) and average speed.

Intuitively, the effect of each of the three factors on the thermal state or degree of warmth of a vehicle is fairly obvious. One would expect that vehicles that are parked for long periods of time would be in a colder thermal state than those parked for short periods; a long warm-up idle period would result in a warmer thermal state than a short idle; and long travel time at a high rate of speed would result in a warmer vehicle than a short trip at slow speeds. An elaborate spreadsheet was developed that incorporates the results of the thermal state calculations described above along with post processor outputs from the Anchorage Transportation Model, outputs from the MOBILE6 model, warm-up idle emission data from research conducted in Anchorage and Fairbanks and from locally-derived information on driver idling behavior. This spreadsheet allowed for separate computation of warm-up idle emissions and on-road trip emissions.

Estimation of Warm-up Idle Emissions

Three key sources of information were required to estimate idle emissions: (1) the duration of the idle period preceding the trip; (2) the amount of time since the vehicle last operated and has been cooling or "soaking" in ambient conditions; and (3) the idle emission rate. The idle emission rate is largely a function of engine and catalyst temperature and thus is dependent on idle duration and soak time.

Idle Duration

Idle duration was quantified by the MOA Air Quality Program during the winter of 1997-98 as part of the Anchorage Driver Behavior Study.[3] The objective of this field study was to observe and document winter season driver idling behavior prior to the beginning of a trip. Over 1300 start up idles were observed and documented at various times and locations in Anchorage. In addition to documenting the duration of each of the idles, the trip origin (e.g., home, work, shopping, etc.), time of day, ambient temperature, weather and windshield icing conditions were also recorded. One important objective of the study was to develop estimates of median idle duration by trip purpose* and time-of-day. Because drivers were not questioned, the trip purpose was not known. Nevertheless, a methodology was developed to use data collected in the study to estimate idle duration for home-based work (HBW), home-based other (HBO) and non home-based (NHB) trips for each time-of-day. The methodology used to develop these estimates is described in Appendices A and C of the Anchorage Driver Behavior Study. The idle duration assumptions used to develop CO inventories for 2007, 2009, 2011, 2013,

* The Anchorage Transportation model now categorizes all travel into eight trip purposes instead of three. The original three trip categories (HBW =:home-based work , HBO =home based other , and NHB = non home-based have been expanded into seven separate categories. The model now provides estimates of the number of trip starts in the following categories: (1) HBW = home-based work, (2) HBSCH = home-based school, (3) HBS = home-based shopping, (4) HBO = home-based other, (5) NHBW = non home-based work, (6) NHBNW = non home-based non-work ; and (7) TRK = truck .

2015, 2017, 2019, 2021 and 2023 are shown in Table 3. The longest idle duration was associated with home-based trips (work, school and shopping) during the 7 a.m. – 9 a.m. time period.*

Table 3.
Assumed warm-up idle duration by trip purpose and origin (in minutes)

Trip Type	Trip origin	AM Peak 7 a.m. – 9 a.m.	PM Peak 3 p.m. – 6 p.m.	Off-Peak Periods 9 a.m. – 3 p.m. 6 p.m. – 7 a.m.
Home-based work	home	7	3	3
	work	3	1	3
Home-based school	home	7	2	2
	school	1	1	1
Home-based shopping	home	7	2	1
	shopping	1	1	1
Home-based other	home	7	2	2
	other	1	1	1
Non home-based work	NA	3	3	2
Non home-based, non-work	NA	1	1	1
Truck	NA	3	3	1

It should be noted that during the ten years since this survey data was collected, a number of changes have occurred that could have changed idling behavior among Anchorage drivers. One change of particular note is the increasing proliferation of remote "auto start devices" that allow drivers to start their vehicles remotely. Recent survey data suggest that approximately 27% of Anchorage vehicles are now equipped with such devices. The effect of auto starts on idle times in Anchorage has not been studied. Even if the use of auto starts has increased average idle duration, the effect on overall CO emissions is likely small. A 2001 study performed by Sierra Research examined the effect of idle duration on the CO emissions that occur over the course of a typical vehicle trip of 7.3 miles.[4] Sierra found that overall CO emissions for trips preceded by a 2-minute idle (281.4 grams) were greater than those preceded by a 15-minute idle (246.7 grams). Thus, it is possible that the use of remote starters may actually *reduce* overall CO emissions is the idle time following a cold start is limited to 15 minutes or less. Overall trip emissions would increase, however, if idle times following an auto start were extended to 20 minutes or more. More recently Sierra examined the possible impact of auto starts on CO emissions in Fairbanks, Alaska where the proportion of vehicle equipped with these devices approaches 50%. They concluded that if drivers opted to use these devices for extended idling (20 minutes or longer) CO emissions could increase by 0.18 tons per day. This amounts to an increase of about 0.5% in total CO emissions in Fairbanks.

Soak Time

Vehicle emissions of CO are highest just after startup and decrease rapidly as the engine warms. The emissions that occur during start up are largely a function of how long the engine has been shut off and cooling at ambient temperatures. Because these data suggest that soak time is a critical factor in determining vehicle CO emissions, it was important to develop credible estimates of soak times in Anchorage as part of the CO emission inventory preparation.

Fortunately, information was available from a local travel survey that allowed average vehicle soak times to be estimated for the a.m., mid-day, p.m. and night periods by trip purpose. Hellenthal and Associates

* 35% of home-based trips were assumed to begin with cars parked in garages and 65% outside. Warm-up idle time for cars parked inside was not quantified in the idling study but was assumed to be 30 seconds. The idle times shown in Table 3 reflect the weighted average of idle times for garage and outside-parked vehicles.

conducted a household travel behavior survey of 1,548 Anchorage households between February 25 and April 12, 1992.[5] Soak times were estimated by examining travel logs from the survey. Drivers recorded the time when each trip began and ended. The time elapsed between the end of one trip and the beginning of the succeeding trip was presumed to be equal to the soak time for that driver's vehicle. Estimates of average soak times derived from the Hellenthal travel behavior survey are shown in Table 3. Morning home-based trips for work, school and shopping have the longest average soak time (12 hours) while NHB trips and home-based trips originating at locations other than home have the shortest average soak time (one hour).

Table 4.
Average soak time prior to trip start (in hours)

Trip Type	**Trip origin**	**AM Peak 7 a.m. – 9 a.m.**	**PM Peak 3 p.m. – 6 p.m.**	**Off-Peak Periods 9 a.m. – 3 p.m. 6 p.m. – 7 a.m.**
Home-based work	home	12	3	3
	work	5	5	5
Home-based school	home	12	2	2
	school	0.5	0.5	0.5
Home-based shopping	home	12	2	2
	shopping	1	0.5	0.5
Home-based other	home	12	2	2
	other	1	1	1
Non home-based work	NA	4	5	3
Non home-based, non-work	NA	1	1	1
Truck	NA	2	2	2

Estimation of Idle Emissions as a Function of Idle Duration and Soak Time

Emission data from the testing Sierra Research conducted in Anchorage and Fairbanks during the winters of 1998-99 and 2000-2001 were used to construct a lookup table that provided an estimate of the warm-up idle emissions (in grams CO per start) as a function of idle duration and soak time. CO and HC emissions were measured during the first 20 minutes following a cold start. The values in the look-up table were revised slightly from those used in the Year 2000 attainment plan to reflect the supplemental data collected by Sierra Research in the winter of 2000-2001. The revised lookup table is shown in Table 5. The values were utilized in the emission inventory spreadsheet to compute idle emissions.

No data were collected from commercial trucks during the idle study. These comprise a small part of the total vehicle population and are largely low-emitting heavy-duty diesel vehicles (HDDV). These vehicles were assumed to emit CO at 30% the rate of the average light duty vehicles (LDVs) that make up the majority of the Anchorage vehicle population. This assumption is roughly consistent with MOBILE6 model estimates for HDDV versus LDV emission factors.

Table 5.
Idle emission look up table for calendar year 2000 (with ethanol-blended gasoline)
CO emissions (in grams per start) as a function of soak time and idle duration

Pre-Soak Time (hrs)	Revised Year 2000 Idle Emissions (assumes 2.7% EtOH and Year 2000 Anchorage I/M) Initial Idle Time (min)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0.00	1.6	3.2	4.8	6.4	8.0	9.5	11.1	12.7	14.3	15.9	17.4	19.0	20.6	22.2	23.8
0.17	1.9	3.5	5.1	6.7	8.3	9.9	11.4	13.0	14.6	16.2	17.8	19.4	20.9	22.5	24.1
0.25	2.4	4.0	5.6	7.2	8.7	10.3	11.9	13.5	15.1	16.7	18.2	19.8	21.4	23.0	24.6
0.50	4.8	6.4	8.0	9.6	11.1	12.7	14.3	15.9	17.5	19.1	20.6	22.2	23.8	25.4	27.0
1.00	11.1	14.3	15.9	17.5	19.1	20.7	22.3	23.8	25.4	27.0	28.6	30.2	31.7	33.3	34.9
1.50	16.4	23.8	26.1	27.7	29.3	30.8	32.4	34.0	35.6	37.2	38.8	40.3	41.9	43.5	45.1
2.00	20.8	32.6	36.7	38.5	40.1	41.7	43.3	44.9	46.4	48.0	49.6	51.2	52.8	54.4	55.9
2.50	24.5	39.9	46.6	49.1	50.7	52.3	53.9	55.5	57.1	58.7	60.2	61.8	63.4	65.0	66.6
3.00	27.5	45.9	55.3	58.9	60.6	62.2	63.8	65.4	67.0	68.6	70.1	71.7	73.3	74.9	76.5
4.00	32.0	55.0	68.8	74.8	77.5	79.1	80.7	82.3	83.8	85.4	87.0	88.6	90.2	91.8	93.3
5.00	35.1	61.1	78.0	86.3	90.0	91.9	93.5	95.1	96.6	98.2	99.8	101.4	103.0	104.6	106.1
6.00	37.2	65.3	84.3	94.4	99.1	101.2	102.8	104.4	106.0	107.6	109.2	110.7	112.3	113.9	115.5
7.00	38.6	68.2	88.6	100.0	105.3	107.8	109.5	111.0	112.6	114.2	115.8	117.4	119.0	120.5	122.1
8.00	39.6	70.1	91.5	103.8	109.7	112.5	114.1	115.7	117.3	118.9	120.4	122.0	123.6	125.2	126.8
9.00	40.3	71.4	93.5	106.4	112.7	115.6	117.3	118.9	120.5	122.1	123.7	125.3	126.8	128.4	130.0
10.00	40.7	72.3	94.8	108.2	114.7	117.8	119.6	121.2	122.7	124.3	125.9	127.5	129.1	130.6	132.2
12.00	41.2	73.4	96.4	110.3	117.0	120.4	122.1	123.7	125.3	126.9	128.5	130.1	131.6	133.2	134.8

The cold temperature idle data collected by Sierra Research provides a "snapshot-in-time estimate" of cold start emissions from the fleet in 2000-2001. Since this data was collected, a number of changes have occurred that have and will continue to change fleet-wide idle emissions factors. The ethanol-blended gasoline program, in place at the time that Sierra Research collected this idle emission data, was discontinued in 2003. The fleet is being continually replaced with newer and presumably cleaner vehicles. The net effect of this fleet turnover is a continual reduction in the idle CO emission rate over time. The latest revision of the SIP deletes the commitment to I/M and for the purposes of this analysis the benefits of I/M are assumed to be zero in 2011. As a consequence the idle emission rate will increase slightly.[*]

The effect of all these changes on idle emissions can be modeled using MOBILE6. Conformity analysis guidance recommends using MOBILE6 emission factors at 2.5 mph to estimate idle emissions. Thus, predicted reductions in the MOBILE6 emission factor at 2.5 mph were used to adjust the initial 2000-2001 idle data from Sierra. MOBILE6 can be used to estimate the idle CO reduction from fleet turnover on overall idle CO emission rates over time relative to the 2000-2001 period when the Sierra data was collected. MOBILE6 can also be configured to help estimate the effect of CO controls such as the ethanol-blended gasoline program (which was discontinued in 2003) and of the I/M program on idle emissions. The hybrid model utilizes a look-up table derived from MOBILE6 model runs that contains adjustment factors that account for fleet turnover, and changes in ethanol gasoline and I/M requirements. These adjustment factors are shown in Table 6. For example, in order to determine the idle emission factor for a cold start trip (soak time > one hour) in the year 2009 (assuming that the I/M program is in place the ethanol-blended gasoline program is not reinstituted), the data and Table 5 would be multiplied by an adjustment factor of 0.594 to yield the idle emission rate.

Thus, idle emissions for a trip with a 3 minute idle following a 10-hour cold soak is computed as follows:

2009 idle EF = (Yr 2000 Idle EF for 3 min idle after 10 hr cold soak) x (adj factor for 2009)

= 94.8 grams x 0.594 = 56.3 grams

[*] Extending the new car grace period from four to six years is expected to diminish the effectiveness of I/M in reducing CO emissions during idling by about 15%.

Table 6.
Idle CO adjustment factors
Estimation of idle CO based on 2000-2001 Sierra Data

Warm Start Idle (Cold Soaks < one hour)			
Year	**w IM & oxy**	**w IM, no oxy**	**no IM, no oxy**
2000	**1.00**	1.15	1.39
2007	0.64	**0.70**	0.82
2008	0.58	**0.63**	0.74
2009	0.55	**0.59**	0.71
2010	0.53	**0.57**	0.68
2011	0.51	0.54	**0.65**
2012	0.49	0.52	**0.62**
2013	0.47	0.50	**0.60**
2014	0.45	0.48	**0.58**
2015	0.44	0.47	**0.57**
2016	0.43	0.46	**0.55**
2017	0.42	0.45	**0.54**
2018	0.41	0.44	**0.53**
2019	0.40	0.43	**0.52**
2020	0.39	0.42	**0.51**
2021	0.39	0.41	**0.50**
2022	0.38	0.41	**0.49**
2023	0.38	0.41	**0.49**

Cold Start Idle (Cold Soaks >= one hour)			
Year	**w IM & oxy**	**w IM, no oxy**	**no IM, no oxy**
2000	**1.00**	1.15	1.39
2007	0.61	**0.64**	0.83
2008	0.55	**0.61**	0.75
2009	0.52	**0.57**	0.72
2010	0.50	**0.55**	0.69
2011	0.48	0.52	**0.66**
2012	0.46	0.50	**0.63**
2013	0.44	0.48	**0.61**
2014	0.43	0.46	**0.59**
2015	0.41	0.45	**0.58**
2016	0.40	0.44	**0.56**
2017	0.39	0.43	**0.55**
2018	0.38	0.42	**0.53**
2019	0.37	0.41	**0.52**
2020	0.36	0.40	**0.51**
2021	0.36	0.39	**0.51**
2022	0.35	0.39	**0.50**
2023	0.35	0.39	**0.49**

Note: Shaded cells in table above reflect adjustment factors used to model actual or anticipated changes in implementation of ethanol-blended gasoline and I/M programs. Ethanol was discontinued in 2003 and I/M is slated to continue indefinitely.

Modeling the Effect of Engine Block Heater Usage on Warm-up Idle CO Emissions

Quantifying the benefits of engine block heater use was a principal objective of emission studies conducted by Sierra Research in 1998-1999 and 2000-2001. This research showed that in the year 2000, engine block heaters reduced CO emissions by an average of 86 grams after a cold start.

For the purpose of estimating the effect of block heater use on CO emissions in this inventory, the absolute benefit of block heater use on CO reductions was presumed to proportional to the average idle CO emission rate of the fleet. Thus the absolute reductions from block heater usage were expected to decline over time as the fleet is replaced with newer, lower emitting vehicles. To account for idle emission changes resulting from fleet turnover, and from changes in ethanol-blended gasoline and I/M requirements that have or are slated to occur, discount factors were used to adjust the 86 gram per start CO reduction estimated from block heater usage in 2000-2001. These discount factors are shown in Table 6.

An example of how these discount factors are used along with the 2000-2001 Sierra data to compute idle emissions is shown in the example below for analysis year 2013.

Compute block heater reduction in 2013:

Year 2000 block heater CO reduction = 86 grams pr cold start

Year 2013 *cold start idle discount factor (assume no I/M with no oxy gasoline) = 0.61*

Year 2013 block heater reduction = 86 g x 0.61 = 52.4 grams per cold start

Between 1999 and 2008, the municipality hired a public opinion research firm to perform annual telephone surveys to estimate engine block heater plug-in rates among Anchorage drivers at ambient temperatures below 15 °F.[6] The survey firm estimated at-home plug-in rates before and after the MOA and ADEC began a television, radio and print media campaign aimed at increasing plug-in rates among Anchorage drivers. For morning trips that begin at home initial survey data suggested that plug-in rates increased from about 10% in October 1999 to about 20% after the campaign. Since the initial survey, the MOA and ADEC have had on-going public awareness and incentives programs to encourage block heater use. Survey data suggest that some additional increases in plug-in rates may have occurred, however, for the purpose of the maintenance demonstration, the plug-in rate was assumed static at 20%.

In Anchorage almost all block heater usage occurs at home because electrical receptacles are not generally available at work places and other locations. For this reason, the emission inventory spreadsheet was configured to assign plug-in benefits only to trips that begin at home during the 7 a.m. – 9 a.m. period and for the first portion (9 a.m. – 3 p.m.) of the off-peak period. Trips beginning at work, shopping centers, and other "non-home" locations were assumed to have a zero plug-in rate.

Home-based morning trips comprise a small fraction of all trips taken over the entire day. When this is considered, the overall plug-in rate for all trips taken during the day is about 2%. The plug-in rate assumptions used to model block heater benefits in the spreadsheet are shown in Table 7.

Table 7.
Block heater plug-in rates by time-of-day, trip origin and trip purpose after media campaign promoting block heater use

Trip Type	Trip origin	AM Peak 7 a.m. – 9 a.m.	PM Peak 3 p.m. – 6 p.m.	Off-Peak Periods 9 a.m. – 3 p.m. 6 p.m. – 7 a.m.
Home-based work	home	**20%**	0%	**10%**
	work	0%	0%	0%
Home-based school	home	**20%**	0%	0%
	school	0%	0%	0%
Home-based shopping	home	**10%**	0%	0%
	shopping	0%	0%	0%
Home-based other	home	**20%**	0%	**5%**
	other	0%	0%	0%
Non home-based work	NA	0%	0%	0%
Non home-based, non-work	NA	0%	0%	0%
Truck	NA	0%	0%	0%

The transportation model post-processor provides data on the number of trips generated within each grid cell for a particular time period for each of the seven trip purposes. The emission inventory spreadsheet uses this data along with user-supplied data on idle duration (Table 3), soak time (Table 4), per start idle emission estimates (Table 5), idle emission adjustment factors (Table 6) and block heater

usage rates (Table 7) to estimate total idle emissions for each grid cell. A spreadsheet algorithm was developed that utilizes post-processor employment and household data from each grid cell to estimate the proportion of trips that originate at home versus work or "other" locations for each of the seven trip purposes. The largest plug-in benefits were accrued in grid cells with large numbers of morning home-based trips because plug-ins rates are the highest for those trips.

Summary of Warm-up Idle Emissions Estimates for 2007-2023

Results of the spreadsheet calculation of warm-up idle emission estimates are summarized in Table 8. These estimates include estimated reductions resulting from block heater use. Idle emissions increase in 2011 because I/M Program benefits are assumed to cease after 2010. Note that the estimated emission rate (emissions per vehicle start) are highest during the AM peak.

Table 8.
Estimated warm-up idle emissions by time-of-day
Anchorage inventory area - (all values in tons per day)

	AM Peak		PM Peak		Off-Peak Periods		**Total**	
	# Vehicle Starts	Total Emissions (tons)	# Vehicle Starts	Total Emissions (tons)	# Vehicle Starts	Total Emissions (tons)	**# Vehicle Starts**	**Total Emissions (tons)**
2007	91,852	5.56	172,607	3.68	374,548	7.11	**639,007**	**16.35**
2009	92,960	4.81	175,095	3.19	379,554	6.19	**663,669**	**14.19**
2011	94,069	5.27	177,584	3.52	384,559	6.85	**673,862**	**15.64**
2013	95,177	4.97	180,072	3.32	389,564	6.46	**681,460**	**14.76**
2015	96,285	4.77	182,561	3.18	394,570	6.20	**689,376**	**14.15**
2017	97,393	4.59	185,049	3.06	399,575	5.97	**697,378**	**13.62**
2019	97,888	4.41	187,971	2.99	406,167	5.83	**706,895**	**13.24**
2021	98,383	4.29	190,893	2.95	412,759	5.74	**716,572**	**12.99**
2023	98,878	4.21	193,815	2.94	419,351	5.71	**726,391**	**12.86**

Estimation of On-Road Travel Emissions

On-road travel emissions were estimated on a grid-by-grid basis using travel outputs (vehicle miles traveled or VMT and speed by road facility category* and trip purpose). The post processor also provided information that was used to indirectly develop grid-by-grid estimates of the thermal state†. of vehicles operating on each facility type These estimates of the travel activity and characteristics were used in conjunction with emission factor estimates generated by MOBILE6 with supplemental FTP speed correction factors disabled to better reflect winter season driving behavior in Alaska.

* The post-processor developed estimates of VMT and speeds for five facility categories which include (1) freeways and ramps; (2) major arterials; (3) minor arterials; (4) collectors; and (5) local roads. In addition, the post-processor estimated "intrazonal" VMT, travel that occurs within a traffic analysis zone and not explicitly accounted for by the travel demand model.

† The thermal state of a vehicle mode is dependent on the soak time, idle duration, and the amount of time spent traveling on the road before arriving in the grid of interest. Warm engines emit less CO than cold ones.

VMT Estimation

The Anchorage Transportation Model and its post-processor were used to estimate VMT within each of the grids in the inventory area. The transportation model was validated against 2002 traffic data and meets FHWA standards.[7] Past model estimates of VMT have agreed closely with count-based estimates from the Highway Performance Monitoring System (HPMS).[8] Transportation model estimates and projections of VMT are shown in Table 8. No adjustments were made to transportation model estimates because of their close agreement with previous HPMS-based VMT estimates.

For the maintenance projections prepared for this plan, transportation model runs were made for 2007, 2017, and 2027. VMT for intervening years (2009, 2011, 2013, 2015, 2019, 2021, and 2023) was estimated by interpolation.

Because there are 5 facility categories and 7 trip purposes, the VMT in each one-kilometer grid was separated into 35 (5 x 7) different categories, each with potentially different travel activity characteristics. The number of VMT categories grows to 36 when intrazonal VMT is considered. (Intrazonal trips are defined as trips that begin and end within the same transportation analysis zone in the Transportation Model. All intrazonal VMT was presumed to be on local roads.)

The travel accrued within each of these seven purposes was assigned a different operating mode depending on the idle duration, soak time, and prior travel time associated with each. Thus, freeway travel accrued by home-based work trips was likely assigned a different CO emission rate than freeway travel accrued by non home-based work trips. Thus, the VMT within a single one-kilometer grid could be disaggregated into 36 different operating modes (and emission rates) depending on the trip purpose and facility type.

Vehicle Speed Estimation

The Anchorage Transportation Model and its post-processor provide estimates of vehicle speeds by facility category and time-of-day. Thus for each grid, the post-processor generates an estimate of the average speed of vehicles traveling on freeways, major arterials, minor arterials, collectors and local streets. The speed estimates for these facility categories are average speeds and include periods when vehicles are stopped at signals or in traffic. Thus speed estimates generated by the model change in relation to the amount of congestion on the network. If network capacity is not expanded in relation to growth in VMT, slower speeds result.

Because the primary purpose of the transportation model is to evaluate the capacity needs of the roadway and transit network, the speed outputs generated by the model are not considered to be as important as VMT. Unlike VMT, modeled speed estimates are usually not reconciled to observed network values. Thus modeled vehicle speed estimates can deviate substantially from observed speeds. Indeed, the vehicle speed estimates generated by the Anchorage Transportation Model were significantly higher than those measured in a recent travel time study conducted by the Municipality and the Alaska Department of Transportation in October – November 1998.[9]

Because speed is an important variable in the estimation of CO emissions, the emission inventory spreadsheet was used to apply linear speed adjustment factors to the speed outputs from the model to bring them into closer agreement with speeds observed in the travel time study. In the travel time study, average vehicle speed was measured on freeways and major arterials during the AM, PM and off peak periods. Because data were not available for minor arterials and collectors, speed adjustment factors for these facility categories were assumed to be identical to the adjustment factors determined for major arterials. The speed adjustment factors incorporated into the emission inventory spreadsheet are shown in Table 9.

Table 9.
Speed Adjustment Factors

Facility Category	Time Period	Observed Average Speed Oct – Nov 1998 MOA travel time study (MPH)	Predicted Average Speed Anchorage Transportation Model (1996) (MPH)	Speed Adjustment Factor
Freeways	AM Peak.	56.6	49.2	1.0
Freeways	Off-peak	61.2	48.0	1.0
Freeways	PM Peak.	57.8	49.2	1.0
Major Arterials	AM Peak.	29.7	40.2	0.74
Major Arterials	Off-peak	29.4	35.1	0.84
Major Arterials	PM Peak.	24.7	39.5	0.63
Minor Arterials	AM Peak.	---	38.7	0.74
Minor Arterials	Off-peak	---	36.2	0.84
Minor Arterials	PM Peak.	---	38.5	0.63
Collectors	AM Peak.	---	30.1	0.74
Collectors	Off-peak	---	28.7	0.84
Collectors	PM Peak.	---	29.8	0.63

Note that model output freeway speeds were significantly different from observed speed but they were not adjusted (i.e., adjustment factor = 1.0). The travel time study did not include ramps in the estimation of observed freeway speed. However, the transportation model included on-ramps and off-ramps in the model as part of the freeway category. The higher speeds observed in the travel time study were presumed to be the result of not including ramps in speed measurements. The freeway speed outputs from the model were deemed reasonable and no adjustment was applied.

A default speed of 15 miles per hour was assigned to all VMT on local roadways and 25 miles per hour for intrazonal travel.

Estimation of Vehicle Thermal State

One of the most important variables in the estimation of vehicle CO emissions during the travel mode is the thermal state of the engine. Cold vehicles emit significantly more CO. The thermal state of the vehicle at any given point in a trip is a function of its soak time (the time since the engine was last running and start-up), the amount of time it was warmed-up prior to the trip, and the amount of prior travel time:

$$\textit{Operating mode} = f\,(\textit{soak time, idle duration, prior travel time})$$

MOBILE6 allows the user to supply assumptions regarding the soak distribution of the vehicles started by time-of-day and emission factor estimates are very sensitive to these assumptions. Modeled emissions are significantly higher when a large proportion of vehicles are assumed to have had long soak times.

Sierra Research developed a method that allowed the computed thermal state of the vehicle with a given soak, idle and travel time to be translated into the operating mode fractions used to model on-road emission factors for the MOBILE5b/Cold CO-based Anchorage attainment plan. However, MOBILE6 no longer uses the operating mode fraction as a model input. Instead, Sierra identified six soak distributions that correspond to the bag fractions used in the attainment plan.

Table 10 compares the bag fraction approach used in the attainment plan to the soak distribution approach used in the maintenance plan. To develop the maintenance inventory, the VMT accrued by a particular trip type (e.g. home-based work trips beginning at home) was assumed to be characterized by one of six possible thermal states. For example, if transportation model outputs indicated that this VMT was in the coldest thermal state, MOBILE6 was run with a soak distribution in which 41.8% of the vehicles were assumed have a soak time of 10 minutes and 58.2% of vehicles a soak time of 12 hours or more. If transportation model outputs indicated that the VMT was in the hottest thermal state, 94% of the VMT was accrued by vehicles with a soak time of 10 minutes and just 6% by vehicles with a soak time of 12 hours or more. MOBILE6 emission factors for "cold VMT" were significantly higher than "hot VMT."

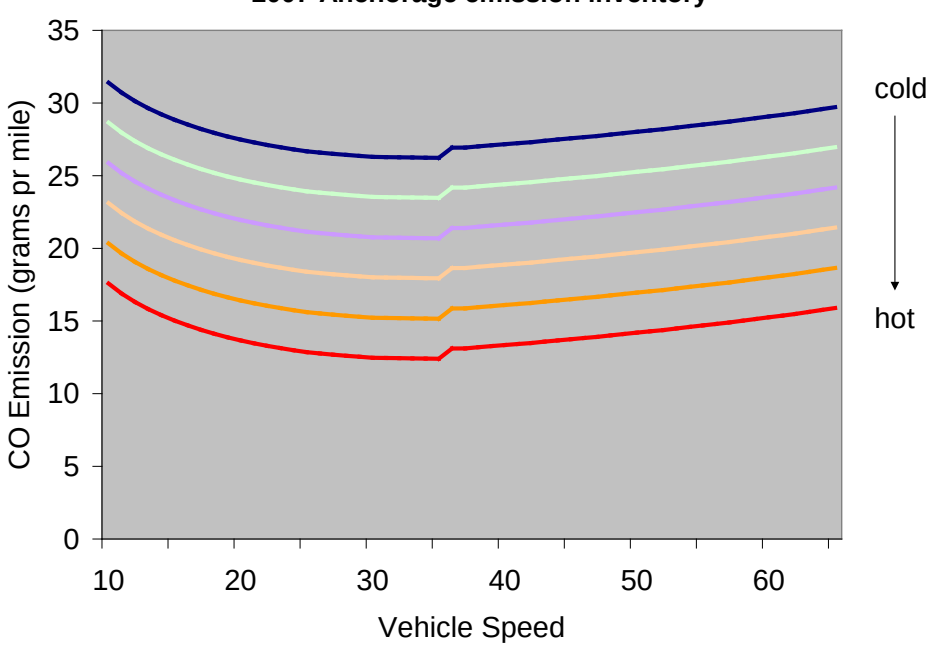
Table 10.

Soak distributions for MOBILE6 with comparable operating mode fractions used in MOBILE 5b/Cold CO Model

Thermal State	Operating Mode Fraction (input for MOBILE5b/Cold CO Model) PCCN / PCHC / PCCC*	Soak Distribution % of vehicles soaked for 10 min vs. 12 hours (input for MOBILE6 Model)
Cold	27.9 / 20.0 / 27.9	41.8% 10 min, 58.2% 12 hours
↓	22.9 /25.0 / 22.9	52.2% 10 min, 47.8% 12 hours
	17.9 / 30.0 / 17.9	62.7% 10 min, 37.3% 12 hours
	12.9 / 35.0 / 12.9	73.1% 10 min, 26.9% 12 hours
	7.9 / 40.0/ 7.9	83.6% 10 min, 16.4% 12 hours
Hot	2.9 / 45.0 / 2.9	94.0% 10 min, 6.0% 12 hours

Figure 3

MOBILE6 On-road emission factor as a function of speed and thermal state
2007 Anchorage emission inventory



* PCCN = % of VMT accrued by non-catalyst-equipped vehicles operating in cold start mode, PCHC = % of VMT accrued by catalyst and non-catalyst vehicles operating in hot start mode; and PCCC = % of VMT accrued by catalyst-equipped vehicles operating in cold start mode. The sum of these % do not add to 100%. The unspecified portion is the % of VMT accrued by vehicles in the hot-stabilized mode. (If PCCN/PCHC/PCCC = 22.9 /25.0 / 22.9, then the % VMT accrued in the hot stabilized mode would be 100 – (22.9+25.0) = 52.1%.

The discontinuities at 15 and 35 mph in Figure 3 reflect a change in the facility type inputs to MOBILE6. All VMT accrued at speeds above 35 mph was assumed to be on freeways and all local road VMT was assigned a default speed of 15 mph. All other VMT was assumed to be accrued on arterials.

An extensive look-up table was then developed for the emission inventory spreadsheet that allowed one of the six soak distributions in Table 10 to be assigned on the basis of the various possible soak times, idle durations, and prior travel times. Soak time and idle duration were supplied as user inputs in the spreadsheet and were based on the local driver behavior studies discussed in the earlier section on estimation of idle emissions. These user inputs varied by time-of-day and trip purpose.

The third variable necessary in the estimation of operating mode was the average prior travel time of the vehicles traveling within the grid of interest. If vehicles had long prior travel times they were likely to be in a fully warm state, and hence, a large proportion of the VMT accrued in the grid would be in the hot fraction. Anchorage Transportation Model post-processor outputs were used to estimate prior travel time. The post-processor provides separate estimates of the amount of VMT accrued by vehicles that began their trips less than 505 seconds ago and more than 505 seconds ago. A spreadsheet algorithm was then developed to estimate average prior travel time for the VMT accrued within each grid by facility type and trip purpose.

The end result of this work was a spreadsheet look-up table that allowed the assignment of a particular soak distribution or thermal state for each the 36 different categories of VMT in each grid. Separate assignments were provided by facility category and for the trip purposes within each facility category. Because the emission factor is a function of the soak distribution, different emission factors were assigned to the VMT within each grid depending on the time-of-day, trip purpose, and facility type.

MOBILE6 Model

The MOBILE6 emission factor model was used to estimate travel emissions. MOBILE6 was run with Supplemental Federal Test Procedure (SFTP) speed correction factors disabled. The SFTP speed correction factors are used to model the so called “aggressive driving component” of the drive cycle used to compute emission factors. The effects of SFTP were disabled in the model to reflect observed drive cycle behavior in Alaska. Sierra Research conducted studies in Anchorage and Fairbanks to characterize the behavior of Alaskan drivers in the winter. As one might expect, they found a low proportion of driving in hard acceleration or hard deceleration modes when roads are often icy. They determined that the old FTP, without the so-called “aggressive driving supplement”, fairly approximated the winter drive cycle in Alaska. The primary effect of excluding the SFTP was to reduce emission factors computed for the on road portion of trip emissions. However, disabling the SFTP emission component in MOBILE6 has the secondary effect of reducing the benefits of fleet turnover on future emissions. In other words, using MOBILE6 with SFTP disabled provides a more pessimistic maintenance forecast than the “default” version of the model with SFTP factors enabled.

Vehicle registration distributions were based on data from detailed parking lot surveys conducted by ADEC during the winters of 1999 and 2000. The assumptions about the age distribution of vehicles were compared to parking lot survey data collected in 2007. There was very little difference in the age distributions determined in 1999 and 2001 and the more recent data. All these surveys indicated that the in use vehicle population is newer than suggested by vehicle registration data.

Odometer measurements collected by the Anchorage I/M program allowed mileage accumulation rates of vehicles subject to I/M requirements to be estimated. Default mileage accumulation rates were used for diesels and other I/M exempt vehicles.

MOBILE6 was configured to reflect the assumption that there would be no CO reductions from I/M after 2010. I/M was assumed to be in place in analysis years 2007 and 2009. When the CO reduction provided by I/M in analysis years 2007 and 2009 was modeled with MOBILE6, an I/M

program effectiveness of 85% and compliance rate of 90% among non-OBD vehicles was assumed. The compliance rate for OBD-equipped vehicles was assumed to be slightly higher, 93%. Copies of input files for model runs for analysis years 2007, 2009, 2011, 2013, 2015, 2017, 2019, 2021 and 2023 are available upon request.

Calculation of On Road CO Emissions

An Excel spreadsheet was developed to assemble the information necessary to calculate CO emissions from on road travel in each grid cell. As discussed earlier, the spreadsheet was used to compute the emission contributions of 36 possible different categories of travel, with varying speeds and operating modes. The emissions from these various categories of travel were then summed to determine on-road emissions in each grid using the following formula:

$$\textit{On-road emissions} = \sum_{i=1}^{36}(VMT_1 \times EF_1) + (VMT_2 \times EF_2).....(VMT_{21} \times EF_{36})$$

Summary of On-road Travel Emissions Estimates for 2007-2023

Results of the spreadsheet calculation of travel emissions are shown by time of day in Table 11. Note that emissions increase slightly between 2009 and 2011 due to the assumed termination if the I/M program and then decline slowly thereafter.

Table 11.
On road travel emissions by time-of-day (all values in tons per day)

	AM Peak		PM Peak		Off-Peak Periods		**Total**	
	VMT	Emissions (tons)	VMT	Emissions (tons)	VMT	Emissions (tons)	**VMT**	**Emissions (tons)**
2007	527,941	8.01	886,324	14.27	1,930,047	28.76	**3,344,312**	**51.04**
2009	540,120	7.03	905,950	12.53	1,971,213	25.39	**3,417,283**	**44.95**
2011	552,298	7.82	925,576	13.83	2,012,380	28.13	**3,490,253**	**49.79**
2013	564,476	7.46	945,202	13.15	2,053,546	26.77	**3,563,224**	**47.37**
2015	576,655	7.20	964,828	12.67	2,094,713	25.81	**3,636,195**	**45.68**
2017	588,833	6.99	984,453	12.17	2,135,879	25.06	**3,709,166**	**44.22**
2019	597,788	6.86	1,003,095	12.07	2,178,132	24.68	**3,779,015**	**43.62**
2021	606,744	6.73	1,021,736	11.90	2,220,386	24.34	**3,848,865**	**42.97**
2023	615,699	6.67	1,040,377	11.85	2,262,639	24.32	**3,918,715**	**42.85**

Aircraft Operation Emissions

In June of 2005 Sierra Research, Inc. prepared the "Alaska Aviation Inventory" for the Western Regional Partnership (WRAP).[10] They compiled air pollutant emission estimates for airports across Alaska including Ted Stevens Anchorage International Airport (ANC) and Merrill Field Airport in Anchorage. Both summer and winter CO emissions associated with aircraft operation for various pollutants were estimated for the year 2002. Sierra collaborated with CH2MHill to collect the specific information on aircraft operations at ANC and Merrill Field necessary for input into the Federal Aviation Administration's EDMS Model (Version 4.2). EDMS was used to generate estimates of CO emissions from aircraft and aircraft support equipment. In EDMS, aircraft support equipment includes both ground support equipment (GSE) and on-board auxiliary power units (APUs) that are used to provide power to aircraft

when on the ground. Winter season CO emissions estimates for ANC and Merrill are shown in Table 12.

Table 12.
24-hour CO emissions estimates from aircraft at ANC and Merrill Field in 2002

	Aircraft Support Equipment APU and GSE (tons per day)	Aircraft (tons per day)	TOTAL
ANC	8.21	3.32	**11.53**
Merrill	0.00	0.63	**0.63**

ANC is currently revising their master plan. The draft Master Plan contains an analysis of historical trends in aircraft operations and projections through 2027. The draft Plan projects an average annual growth rate of 2.4% between 2005 and 2027. Historical data on total operations in 2002 when Sierra prepared their emissions estimates were used along with the growth projections in the draft Master Plan to project future emissions from ANC. Emissions were presumed to grow in direct proportion to total operations. Results are shown in Table 13.

Table 13
Projected aircraft operations and CO emissions at ANC

Calendar Year	Estimated or Projected Annual Aircraft Operations	CO Emissions (tons per day)
2002 (base year of Sierra inventory)	309,236	**11.53**
2007	331,708	**12.37**
2009	347,845	**12.97**
2011	363,982	**13.57**
2013	379,810	**14.16**
2015	395,327	**14.74**
2017	410,845	**15.32**
2019	435,440	**16.24**
2021	460,036	**17.16**
2023	484,631	**18.07**

Winter CO emissions from Merrill Field were computed in a similar manner. Sierra's 2002 CO emissions estimate (0.633 tons/day) was scaled upward in proportion to the projected increase in aircraft operations at Merrill. The Merrill Field Master Plan (2000) contains growth projections for the period 1997 through 2020. Annual operations are projected to increase from 187,190 in 1997 to 270,800 in 2020. Assuming linear growth, CO emissions can be projected for the period 2007-2023. These projections are shown in Table 14.

Table 14

Projected Aircraft Operations and CO Emissions at Merrill Field Airport

Calendar Year	Estimated or Projected Aircraft Operations	CO Emissions (tons per day)
1997	187,190	
2002 (base year of Sierra inventory)	205,366	**0.633**
2007	223,542	**0.689**
2009	230,813	**0.711**
2011	238,083	**0.734**
2013	245,353	**0.756**
2015	252,624	**0.779**
2017	259,894	**0.801**
2019	267,165	**0.823**
2021	274,435	**0.846**
2023	281,706	**0.868**

Residential Wood Burning Emissions

The basic assumptions used in the preparation of emission estimates from residential wood burning were not changed from those used in the Year 2000 Anchorage Attainment Plan. Assumptions regarding wood burning activity levels (i.e. the number of households engaging in wood burning on a winter season design day) were corroborated by a telephone survey conducted by Ivan Moore Research (IMR) in 2003. IMR asked approximately 600 Anchorage residents whether they had used their fireplace or woodstove during the preceding day. The survey was conducted when the preceding day had a minimum temperature between 5 and 15 degrees F. Survey results were roughly consistent with the assumptions used in the attainment plan inventory. The basic assumptions used to estimate wood burning were based on data from a telephone survey[11] performed by ASK Marketing and Research in 1990.

The ASK survey asked Anchorage residents how many hours per week they burned wood in their fireplace or wood stove.[*] Because the AP-42 emission factors for fireplaces and wood stoves are based on consumption in terms of the amount of wood (dry weight) burned, hourly usage rates from the survey had to be converted into consumption rates. Based on discussions between MOA and several reliable sources (OMNI Environmental Services, Virginia Polytechnic Institute, Colorado Department of Health), average burning rates (in wet weight) of 11 pounds per hour for fireplaces and 3.5 pounds per hour for wood stoves were assumed for the Anchorage area. Residential wood burning assumptions are detailed in Table 15.

[*]A previous telephone survey attempted to quantify wood consumption directly by asking residents how much wood (e.g., cords) they burned each winter. Many residents had difficult quantifying their consumption in this manner, for this reason the 1990 survey asked about hours of usage per week.

Table 15.
Estimation of residential wood burning CO emission factors for Anchorage

Device	Average use per weekday (hours per household per day)	Average dry weight of wood consumed (lbs per hour)*	Average amount of wood burned per household (dry lbs / day)	Estimated wood burning CO emissions per household (lbs/day)
Fireplaces	0.156	7.15 lbs/hr	1.11	0.141
Wood Stoves	0.032	2.275 lbs/hr	0.073	0.006
TOTAL Fireplaces + woodstoves	0.188	------	1.18	**0.147**

* The moisture content of wood burned was assumed to be 35%. Thus, dry burning rates were 65% of wet rates.
** The wood stove emission factor was determined by assuming that the wood stove population in Anchorage is comprised of equal proportions of conventional, catalyst, and non-catalyst stoves. The emission factor above was calculated as the weighted average of the AP-42 emission factors for each stove type. AP-42, 5th Edition (Oct 1996)

Survey results suggest wood burning rates are relatively low in the Anchorage area. The vast majority of wood burning is "pleasure burning;" very few residents need to burn wood for primary or supplemental heat. If the average fire in the fireplace and/or woodstove is assumed to last three hours, Table 15 suggests that about 1 in every 16 households in Anchorage burns wood on a typical winter weekday.

The Anchorage Transportation Model post-processor provided information on the number of households in each grid. The calculated CO emission rate of 0.147 lbs of CO per day was assigned to each household in a grid. Thus wood burning emissions were highest in grids with high housing density.

Projecting future trends in wood heating in Anchorage is difficult. On one hand, anecdotal evidence suggests that fewer wood burning appliances are being installed in new homes in Anchorage. This is consistent with trends being observed nationally. On the other hand, increases in natural gas prices could result in increases in wood heating. For the purpose of this inventory, residential wood burning was assumed to increase in direct proportion with the number of households in the Anchorage inventory area. Area-wide wood burning emissions for the period 2007 - 2023 are shown in Table 16.

Table 16.
Estimated Anchorage-wide 24-hour CO emissions from residential wood burning

Calendar Year	Number of Households in Inventory Area	24-Hour Emissions (tons)
2007	84,936	6.24
2009	86,582	6.36
2011	88,229	6.48
2013	89,875	6.60
2015	91,522	6.72
2017	93,168	6.84
2019	94,045	6.91
2021	94,923	6.97
2023	95,800	7.04

Emissions from Natural Gas Combustion for Space Heating

The methodology used to compute natural gas space heating emissions for the maintenance demonstration is identical to that used in the Year 2000 Anchorage CO Attainment Demonstration and the 2004 Anchorage CO Maintenance Plan. A telephone survey conducted by ASK Marketing and Research in 1990[12] indicated that natural gas is the fuel used for virtually all space heating in Anchorage. ASK survey results are shown in Table 17.

Table 17.
Methods of Home Heating in Anchorage (ASK Marketing & Research, 1990)

Natural gas	88.2%
Electricity	9.2%
Fuel oil	0.2%
Wood / other	1.3%
Don't know	1.1%
Total	**100.0%**

Enstar distributes natural gas to Kenai, Anchorage and other parts of Southcentral Alaska. According to Enstar, in 1996 approximately 80% of their gas sales were to Anchorage.[13] Table 19 indicates that about 88% of all homes in Anchorage are heated with natural gas. A small fraction of homes are heated by wood or fuel oil. Wood heating has already been quantified separately in the inventory. The consumption of fuel oil for space heating was small in 1990 and likely even smaller in 2007. Calculated area-wide CO emissions from space heating with fuel oil are negligible (less than 25 pounds per day) and are not included in the inventory. Finally, the emissions associated with electrical heating occur at the generation plant. These emissions are accounted for separately in the point source inventory.

A detailed report of natural gas sales to residential, commercial and industrial customers was available for calendar year 1990* for Southcentral Alaska.[14] Peak winter usage rates were estimated for residential customers and for commercial/industrial customers from this report. Demographic data (i.e. number of households, number of employees) were used to estimate per household consumption rates for residential customers and per employee consumption for commercial/industrial customers. The most recent AP-42 CO emission factors (July 1998) for uncontrolled residential furnaces (40 lbs CO/ 10^6 $ft^{3)}$) and small boilers (84 lbs CO/ 10^6 $ft^{3)}$) were used to characterize residential and commercial space heating emission. Calculated peak natural gas consumption and emission rates are shown in Table 18.

Table 18
Peak winter season natural gas consumption rates and
CO emission rates in Anchorage (1990)

	Consumption Rate per Day	AP-42 Emission Factor (lbs. per 10^6 ft^3)	CO Emission Rate (lbs per day)
Residential	658 ft^3 per household	40	0.0263 per household
Commercial/ Industrial	434 ft^3 per employee	84	0.0364 per employee

* Although data from more recent years was available, the reporting format had changed and less detailed data were available. Unlike the 1990 report, natural gas consumption was not reported separately for residential, commercial/industrial, and power generation customers.

On an area-wide basis, CO emissions from natural gas combustion were calculated by multiplying the CO emission rates in Table 19 by the number of households and employees in the inventory area. Table 19 presents the results of this calculation for the period 2007 – 2023. Emissions resulting from the combustion of natural gas for power generation are excluded. These emissions are accounted for separately in the point source inventory.

Table 19
CO Emissions from natural gas combustion (excludes power generation)

Calendar Year	Number of Households in Inventory Area	Number of Employees in Inventory Area	Calculated Total Natural Gas Consumption (mcf)	CO Emissions from Natural Gas Combustion (tons/day)
2007	84,936	145,516	119,127	3.77
2009	86,582	146,755	120,749	3.82
2011	88,229	147,994	122,372	3.86
2013	89,875	149,234	123,994	3.91
2015	91,522	150,473	125,617	3.95
2017	93,168	151,712	127,238	3.99
2019	94,045	153,731	128,693	4.04
2021	94,923	155,750	130,148	4.09
2023	95,800	157,769	131,602	4.14

CO emissions from natural gas combustion were also calculated on a grid-by-grid basis by multiplying the emission rate per household or per employee by the number of households or employees in each grid. Thus, grid cells with a large number of households and/or employees were assigned the greatest emissions.

Other Miscellaneous Sources

Use of NONROAD to Estimate Emissions from Snowmobiles, Snow Blowers, Welders, Air Compressors and Other Miscellaneous Sources

As a starting point for this analysis, the EPA NONROAD model (version 2005) was run for base year 2007. The model provides estimates of non-road equipment types and activity levels for Anchorage. These model outputs were reviewed carefully to assess whether or not nonroad equipment populations and usage (i.e., hours per year) were reasonable. The NONROAD model uses a top-down approach in which state-level equipment populations are allocated to counties on the basis of activity indicators that are specific to certain equipment types. Anchorage is the major wholesale and retail distribution center for the state. Because the NONROAD model activity indicator is based on the number of businesses within a particular SIC code, the model has a tendency to over-allocate the equipment to Anchorage and ignore usage that occurs outside the Anchorage area. For example, the NONROAD estimate for generator sets is likely heavily skewed by sales to non-Anchorage customers who come to Anchorage to purchase a generator for use in areas outside of the power grid.

The default model outputs are given in terms of average monthly, year-round use. These outputs were adjusted to reflect the fact that activity levels for non-road sources would be expected to be reduced on

a typical midwinter exceedance day when ambient temperatures are near 0 °F. The activity levels of all-terrain vehicles, motorcycles, pressure washers, air compressors and pumps are likely substantially reduced in midwinter. Pressure washer activity, for example, was assumed to be 10% of that estimated by NONROAD. Other sources were also adjusted significantly from the NONROAD model's default outputs. These local adjustment factors are shown in Table 20. It is important to note, that without adjustment, the NONROAD model's estimate of CO emissions from the sources listed in the table is 120.8 tons per day in 2007, whereas total motor vehicle emissions (idle plus travel) are estimated to be just 67.1 tons per day. Given what is known about the CO problem in Anchorage, clearly something is amiss. After the activity adjustment factors are applied to the NONROAD model estimates, the total contribution from the sources listed in the table is 9.1 tons per day.

Default output emissions from commercial and residential snowblowers were also reduced. Anchorage climatological records indicate that CO exceedances are typically preceded by cold, clear weather without snow. Thus, snowblower activity is likely to be lower on elevated CO days. For this reason the NONROAD estimate of residential and commercial snowblower activity was cut by 50%.

The NONROAD model default estimate for the snowmachine population in Anchorage is 34,985. Although there are a considerable number of snowmobiles in Anchorage, virtually all use occurs outside of the nonattainment area. Snowmobile use in Anchorage is banned on public land throughout the Anchorage nonattainment area because of safety and noise issues. Although there is some use in surrounding parklands, (i.e., Chugach State Park) these areas are located at least three miles from the emission inventory area boundary. However, there is likely to be some small amount of engine operation for maintenance purposes, etc. This was assumed to average about 0.1 hours per unit per month inside the inventory area. This usage rate is about 50 times lower than the NONROAD default value.

Finally, some of the NONROAD model outputs were clearly unreasonable. For example, there is no commercial logging activity in the Anchorage bowl. For this reason, the NONROAD model's estimate of CO emissions from logging equipment chain saws was disregarded. The NONROAD estimate of "other" chainsaw use was cut by 80% to reflect that little garden or home wood cutting activity is likely to take place in mid-winter.

Table 20
Estimation of NONROAD CO emissions in 2007

	Number of Units	**EPA NONROAD Model Estimate of CO emissions (unadjusted)**	**Activity Adjustment Factor**	**Revised CO Inventory Estimate (tons/day)**
air compressors	251	0.83	0.50	0.42
ATVs	14,481	0.90	0.02	0.02
chainsaws	6,159	0.56	0.20	0.14
concrete saws	144	0.60	0.25	0.15
forklifts	94	0.41	1.00	0.41
generator sets	4,758	7.13	0.25	1.78
pressure washers	1,898	3.08	0.10	0.31
pumps	1,227	1.73	0.25	0.43
snowblowers commercial	864	2.26	0.50	1.13
snowblowers residential	9,517	1.02	0.50	0.51
snowmobiles	34,985	96.73	0.02	1.93
welders	419	2.10	0.50	1.05
other	91,767	3.47	varies	0.84
TOTAL NONROAD		**120.83**		**9.12**

In order to estimate future year emissions (2009 through 2023) the sources listed in Table 20 were increased in proportion to growth in households or employment. If the nonroad road source was primarily related to household activities, the growth in emissions was assumed to be proportional to the projected growth in the number of households in the inventory area. These household- related sources include snowmobiles, motorcycles and generator sets. If the nonroad source was primarily related to commercial activity, growth in emissions was assumed to be tied to growth in employment. Commercial or employment-related sources include welders, pumps and air compressors.

The emissions from the sources listed above were apportioned among the grid cells that make up the inventory area by using the number of households or employment in the grid as a surrogate for source activity. Activities that would normally primarily occur in residential areas (snowmobiles, residential and commercial snowblower use, ATVs and motorcycles) were apportioned on the basis of the number of households in each grid. Activities that would normally occur in commercial or industrial areas (welders, pumps, and air compressors), were apportioned on the basis of the amount of employment in each grid.

Table 21
CO emissions from NONROAD sources (2007-2023)

Calendar Year	CO Emissions from NONROAD Sources (tons/day)
2007	9.12
2009	9.24
2011	9.35
2013	9.47
2015	9.59
2017	9.70
2019	9.82
2021	9.93
2023	10.04

Railroad Emissions

Because railroad emissions are a relatively insignificant source of CO, no changes have been made to the estimates or methodology employed in the 2004 CO Maintenance Plan. The Alaska Railroad (ARR) supplied data on line haul and switchyard fuel consumption to the Alaska Department of Environmental Conservation for calendar year 1999. Total fuel consumption in the Anchorage switchyard was estimated to be 370,000 gallons during calendar year 1999. ARR also provided data on line haul fuel consumption between milepost 64 and 146. Annual fuel consumption along this 82-mile section of track was estimated to be 771,000 gallons. Only 14 miles of track (roughly MP 104 through MP 118) are inside the emission inventory area. The proportionate share of consumption within the inventory area was estimated to be 131,600 gallons. Twenty-four hour consumption rates were calculated by dividing annual totals by 365.

EPA guidance[15] provides separate emission factors for yard and line haul emissions. These factors, expressed on a gram per gallon basis, were applied to ARR fuel consumption estimates to compute emissions.

Railroad fuel consumption and emissions are summarized in Table 22. Switchyard emissions were distributed to the three grid cells that encompass the rail yard in the Ship Creek area of Anchorage. The rail route in Anchorage crosses 15 grids cells in the Anchorage inventory area. Line haul emissions were distributed equally among these 15 grid cells.

Table 22
Alaska Railroad emission estimates 2007-2023

	Consumption (gal/year)	Consumption (gal/day)	Locomotive Emission Factor (grams/gal)	CO emissions (tons/day)
Yard	370,000	1,014	38.1	0.04
Line Haul	131,634	361	26.6	0.01
Total	**501,634**	**1,375**		**0.05**

Although railroad activity is expected to increase in future years, above the activity levels reported in 1999, the emissions increases that might be expected from this growth are likely to be offset by improvements in locomotive control technology. The Alaska Railroad recently replaced 28 of their 62 locomotives with new models that produce less pollution and are more fuel efficient. In addition, between 2002 and 2007, the railroad equipped two-thirds of their locomotives with devices that reduce the amount of time locomotives idle in the Anchorage switchyard and reduce fuel consumption. For the purpose of this analysis, CO emissions from the ARR were assumed to remain the same through 2023. Although this is a crude assumption, the significance of ARR emissions is very small. Hence, refining these future year projections would have a negligible effect on the overall inventory.

Marine Vessel Emissions

The Port of Anchorage serves primarily as a receiving port for goods such as containerized freight, iron, steel and wood products, and bulk concrete and petroleum. Commercial shipping lines, including Totem Ocean Trailer Express and Horizon Lines bring in four to five ships weekly into the Port. The Port is currently undergoing a significant expansion that is intended to modernize the facility and double its size. In 2005, over 5 million tons of commodities moved across the Port's docks.

Despite the magnitude of this activity at the Port, CO emissions are relatively small. In June 2005, Pechan and Associates prepared an emission inventory for the ADEC that estimated winter and summer season CO emissions from the Port for the year 2002.[16] This report provided an estimate of total emissions that occur from all four modes of commercial marine activity for the winter (defined as October through March). These four modes include cruise, reduced speed zone (RSV), maneuvering, and hotelling. However, as defined for modeling purposes, the cruise and RSV modes occur far from Port. Cruise mode activity occurs more than 25 miles form Port and the RSV mode occurs 2 miles or more from Port. Because cruise and RSV mode CO emissions occur so far from Port and therefore have little or no influence on CO concentrations in the Anchorage CO maintenance area, these emissions were excluded from this inventory.[*] In addition to the 2002 inventory, the Pechan inventory also includes a forecast of winter CO emissions for 2005 and 2018. Interpolation and extrapolation was used to estimate CO emissions from Port of Anchorage marine activity from 2007 – 2023. These estimates are shown in Table 23.

[*] Cruise and RSV emissions account for about 56% of total winter CO emissions. Therefore only 44% of the emissions in the Pechan inventory were included in this inventory.

Table 23.
Estimated CO emissions from the Port of Anchorage

Year	Estimated CO emissions (tons per day)
2007	0.09
2009	0.10
2011	0.11
2013	0.12
2015	0.12
2017	0.13
2019	0.13
2021	0.13
2023	0.13

Emissions from Point Sources

Point source emissions estimates for the year 2005 served as the basis for the 2007 base year point source emission inventory prepared for this maintenance plan and projections through 2023. Point source emissions were expected to grow in relation to the number of households. Thus the emission estimates for 2005 were adjusted upward in proportion to the growth in the number of households in the inventory boundary area.

ADEC is responsible for issuing operating permits to all stationary sources that have fuel-burning equipment with a combined rating capacity of greater than 100 million Btu per hour. The MOA also issues operating permits to all point sources in Anchorage with a combined rating capacity of greater than 35 million Btu per hour. The ADEC and MOA permit systems were used to inventory all stationary sources that are required to obtain such permits in the Anchorage non-attainment area. In addition, point sources that produce more than 10 tons per year (TPY) of CO (minor sources) were individually quantified to achieve a more precise estimate of the minor source contribution to the overall emission inventory from stationary sources.

The identification of minor sources was accomplished by contacting fuel distributors in Anchorage. We determined whether any facilities consumed sufficient quantities of fuel to exceed the annual 10 TPY of CO threshold. Using EPA's emission factors, AP-42 (fifth edition), fuel quantities equivalent to 10 TPY of CO were compared to sales of fuel to large users. This identified potential 10+ TPY of CO point sources. This approach determined that only permitted sources in Anchorage emitted more than 10 TPY of CO.

The ADEC point source computations were based on annual information provided by the source. The emission factors were from the most current version of AP-42. The ADEC calculated daily point source emissions for a typical wintertime day during the peak CO season by dividing the annual activity levels by the number of days per year. Actual facility operating information was available for 2005. Source emission estimates were based on actual fuel consumption and operations rather than permit allowable emissions.

Based on ADEC-issued air quality permits, there are six point sources in the Anchorage non-attainment area. Estimated annual emissions from each source for 2005 and projected daily emissions for the 2007-2023 period are listed in the table at the end of this section. Three of the six point sources identified in the Anchorage inventory were gas-fired (primarily natural gas) electrical generating facilities. Other sources include a sewage sludge incinerator, and two bulk fuel storage facilities.

Source Descriptions and Emission Estimation Information

There are three point sources that are located outside the non-attainment area. Two are located on military bases at Elmendorf Air Force Base and Fort Richardson. These facilities were excluded from the base year inventory because the CO emissions on these two military facilities are not considered significant contributors to the Anchorage attainment problem. The third facility is Anchorage Municipal Light and Power Sullivan Power Plant. It is located approximately two kilometers east of the northwest corner boundary of the nonattainment area. Even though this source is located outside the boundaries of both the attainment area and emission inventory area, it is included in the inventory. Emissions from the Sullivan Plant were assigned to the furthest northwest grid in the inventory area. This grid is located approximately 2 kilometers west of the power plant.

The ADEC used facility-reported information and AP-42 emission factors to estimate emissions for each of the six point sources. The methodology and emission factors used to estimate actual emissions at each facility is available upon request.

The ADEC Operating Permit system results in the collection of the emission information through requirements for annual and triennial emission reports, on-site inspections, the reporting of source test data and quarterly production levels and fuel usage, and interactions with each source. In addition, there was no CO emission control equipment identified on any of the sources included in the inventory. Therefore, 100% of the emission estimates resulting from the application of the AP-42 factors identified above was assumed for the inventories.

Based on the above information, the application of a Rule Effectiveness factor did not appear to be appropriate and was not included for any of the point sources included in this inventory.

Summary of Point Source Emissions

The estimates of actual emissions for a typical winter day (in tons per day) at each point source for the year 2005 and the projections for 2007 through 2023 are provided in Table 24.

Table 24
Point Source CO Emissions Summary (tons per day)

	Projected Daily CO Emissions based on growth in number of households									
Owner	**2005**	**2007**	**2009**	**2011**	**2013**	**2015**	**2017**	**2019**	**2021**	**2023**
Tesoro Alaska Petroleum Company, Anchorage Terminals I & II	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Anchorage Water & Wastewater Utility, Point Woronzof, John Asplund Wastewater Treatment Facility	0.26	0.27	0.27	0.28	0.28	0.29	0.30	0.30	0.30	0.30
Chugach Electric Association, International Station Power Plant	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Anchorage Municipal Light & Power, George Sullivan Plant Two	0.93	0.95	0.97	0.99	1.00	1.02	1.04	1.05	1.06	1.07
Anchorage Municipal Light & Power, Hank Nikkels Plant One	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08
Flint Hills Resources Alaska, LLC	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
TOTAL POINT SOURCE EMISSIONS	**1.28**	**1.31**	**1.33**	**1.36**	**1.38**	**1.41**	**1.43**	**1.45**	**1.46**	**1.47**

Emissions Summary

2007 Base Year Area-wide CO Inventory

Based on the methodology outlined in the previous section, total CO emissions from all sources in the inventory area were calculated for a typical winter weekday in 2007, when conditions are conducive to elevated CO concentrations. Total area-wide CO emissions are estimated to be 100.7 tons per day. Motor vehicles account for an estimated 65.1% of these area-wide emissions.

Table 25
Sources of Anchorage CO emissions in 2007 base year in Anchorage inventory area

Source Category	CO Emitted (tons per day)	% of total*
Motor vehicles	67.4	66.7%
Aircraft – Ted Stevens Anchorage International and Merrill Field Airport Operations	13.1	12.9%
Wood burning – fireplaces and wood stoves	6.2	6.2%
Space heating – natural gas	3.8	3.7%
Miscellaneous (snowmobiles, snow removal, welding, rail, marine, etc.)	9.3	9.2%
Point sources (power generation, sewage sludge incineration)	1.3	1.3%
TOTAL	**101.0**	**100.0%**

Projected Area-Wide CO Emissions (2007-2023)

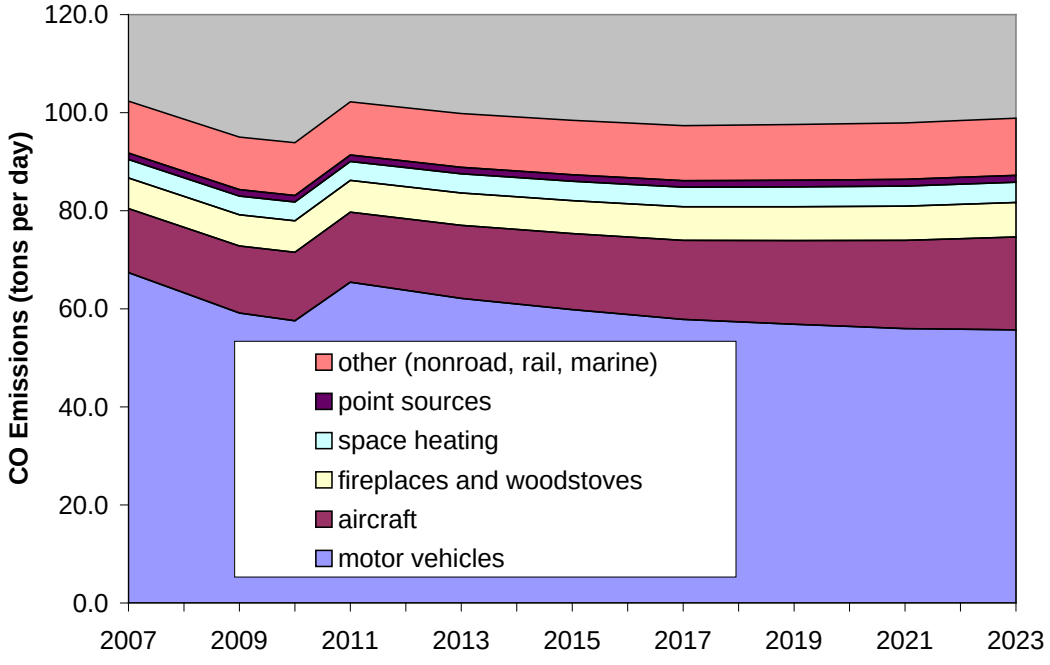
As described in the previous sections, CO emissions for the Anchorage inventory area were projected for each of the source categories for a 24-hour day in 2007, 2009, 2011, 2013, 2015, 2017, 2019, 2021 and 2023. Results are tabulated in Table 26. Area-wide CO emissions for the period 2007-2023 are plotted in Figure 4. CO emissions decline over time due to expected improvements in emission controls on newer vehicles. Total area-wide CO emissions are expected to increase slightly because of the growth of other sources such as Ted Stevens Anchorage International Airport. Nevertheless, total CO emissions projected for 2023 (88.3 tons per day) are approximately 12.5% lower than emissions in base year 2007 (101.0 tons per day).

Table 26
Total CO emitted during typical 24-hour winter day in the Anchorage bowl inventory area (tons per day)

	motor vehicles		aircraft							
year	**idle mode**	**travel mode**	**Stevens Int'l Airport**	**Merril Field**	**wood burning**	**space heating**	**rail/ marine**	**nonroad**	**Point Sources**	**TOTAL CO EMISSIONS**
2007	16.3	51.0	12.4	0.7	6.2	3.8	0.2	9.1	1.3	**101.0**
2008	15.3	48.0	12.7	0.7	6.3	3.8	0.2	9.2	1.3	**97.4**
2009	14.2	45.0	13.0	0.7	6.4	3.8	0.2	9.2	1.3	**93.7**
2010	13.7	43.9	13.3	0.7	6.4	3.8	0.2	9.3	1.3	**92.6**
2011	15.6	49.8	13.6	0.7	6.5	3.9	0.2	9.4	1.3	**100.9**
2012	15.2	48.6	13.8	0.7	6.5	3.9	0.2	9.4	1.3	**99.7**
2013	14.8	47.4	14.1	0.8	6.6	3.9	0.2	9.5	1.3	**98.5**
2014	14.5	46.5	14.4	0.8	6.7	3.9	0.2	9.5	1.3	**97.8**
2015	14.2	45.7	14.7	0.8	6.7	4.0	0.2	9.6	1.3	**97.1**
2016	13.9	44.9	15.0	0.8	6.8	4.0	0.2	9.6	1.3	**96.6**
2017	13.6	44.2	15.3	0.8	6.8	4.0	0.2	9.7	1.3	**96.0**
2018	13.4	43.9	15.8	0.8	6.9	4.0	0.2	9.8	1.3	**96.1**
2019	13.2	43.6	16.2	0.8	6.9	4.0	0.2	9.8	1.4	**96.2**
2020	13.1	43.3	16.7	0.8	6.9	4.1	0.2	9.9	1.4	**96.4**
2021	13.0	43.0	17.2	0.8	7.0	4.1	0.2	9.9	1.4	**96.5**
2022	12.9	42.9	17.6	0.9	7.0	4.1	0.2	10.0	1.4	**97.0**
2023	12.9	42.8	18.1	0.9	7.0	4.1	0.2	10.0	1.4	**97.5**

Figure 4.

Projected Area-wide CO Emissions in Anchorage (2007-2023)



Compilation of Micro-Area Inventory for Turnagain Monitoring Station

The area-wide CO inventory discussed in the previous section will be necessary to prepare the motor vehicle emission budget for use in future region-wide air quality conformity determinations. However, this "area-wide view" of emissions is not very useful in analyzing the factors leading to high CO concentrations at particular locations in Anchorage. Monitoring data, including a saturation monitoring study conducted in 1997-98 have demonstrated that CO concentrations vary widely throughout Anchorage and that some areas are more prone to high concentrations and have a greater potential to violate the national ambient air quality standard.

The Turnagain monitoring station, located in a Spenard-area neighborhood, has the highest CO concentrations of all the monitoring stations in Anchorage. Maximum 8-hour concentrations are typically 10 to 20% higher than the next highest site called Garden in east Anchorage. During the 1997-98 CO Saturation Study 8-hour CO concentrations at Turnagain were the highest among the 20 sites included in the study.[17] An analysis of the probability of exceeding the national ambient air quality standard has been performed for both the Turnagain and Garden sites. This analysis suggests that the probability of violating the standard at Turnagain at current CO emission levels is about 1 in 100 while the probability of violating at the Garden station is less than 1 in 1,000.[18] For this reason, it was decided that the Turnagain site should be used for the maintenance demonstration. In order to perform this demonstration, CO emissions in the area immediately surrounding the Turnagain site must be known for base year 2007 and projected through 2023.

Because the Anchorage inventory data is disaggregated into one-kilometer^2 grids, CO emissions can be analyzed in the area immediately surrounding the Turnagain station. A nine-square kilometer area including and surrounding the Turnagain site was selected for analysis. The area selected is shown in Figure 5. As can be seen in the figure, the emissions in the nine grids comprising this analysis area are among the highest in the inventory area. Figure 6 shows that precise location of the Turnagain monitoring station in relation to the area selected for the micro-inventory.

In 2007, this nine square kilometer area contained an estimated population of 19,776. Total estimated employment was 9,005. This area is one of the most densely populated areas in the Anchorage bowl.

Figure 5
CO emissions distribution in Anchorage
(Turnagain micro-inventory area boundary noted with red border)

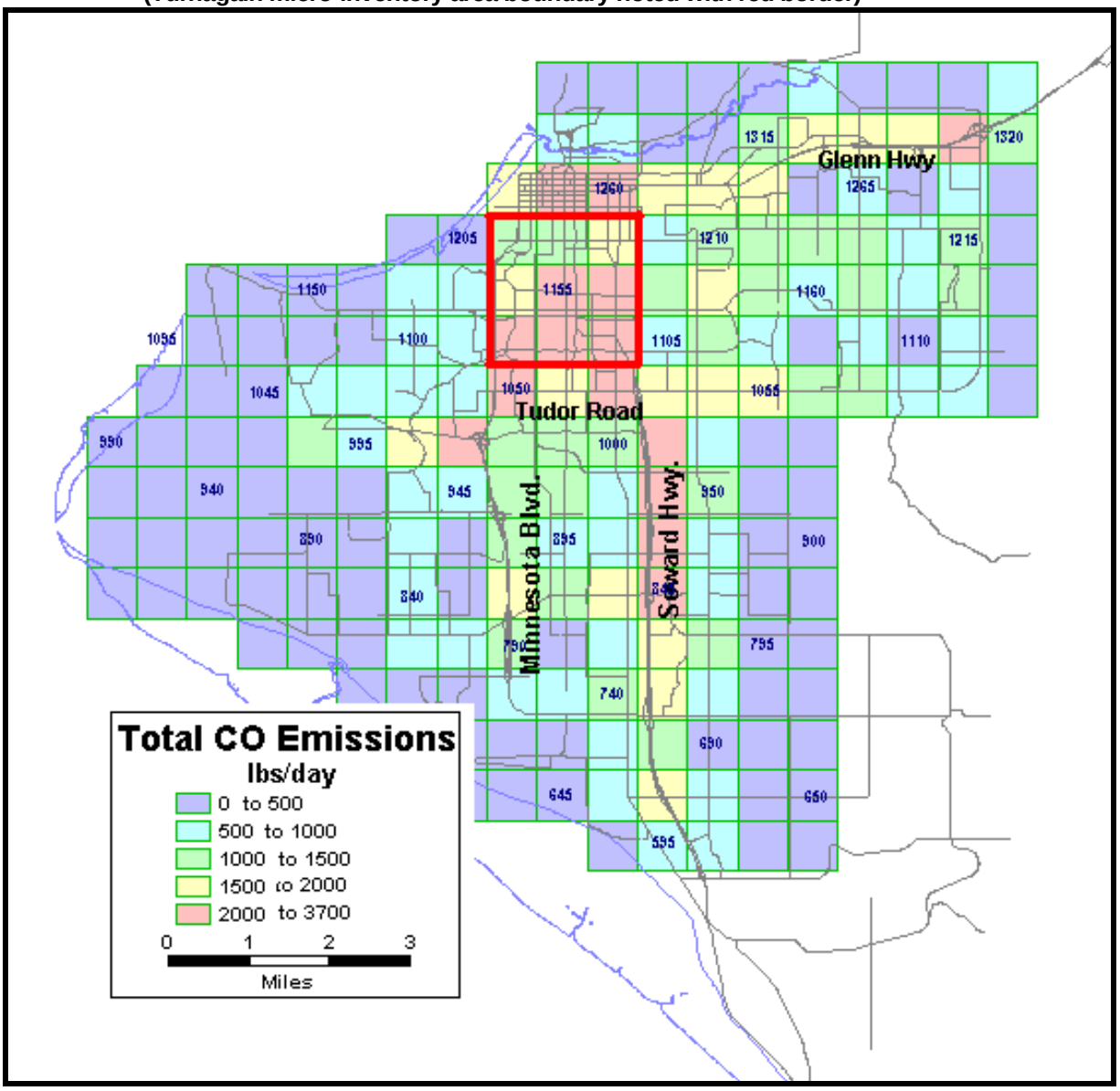


Figure 6
Aerial photo of Turnagain micro-inventory area boundary

2007 Base Year CO Micro-Inventory for Turnagain Site

Results of the 2007 base year micro-inventory for the nine-kilometer^2 area surrounding the Turnagain station are shown in Table 26. Total CO emissions in the micro-inventory area are estimated to be 6.01 tons per day. Motor vehicles account for an estimated 73.4% of the emissions in the area. Note that there is no contribution from aircraft operations or point sources in the area.

Table 27
Sources of CO Emissions in Turnagain Micro-inventory Area
2007 Base Year

Source Category	CO Emitted (tons per day)	% of total
Motor vehicles	4.42	73.4%
Aircraft – Ted Stevens Anchorage International and Merrill Field Airport Operations	---	---
Wood burning – fireplaces and wood stoves	0.62	10.3%
Space heating – natural gas	0.28	4.6%
Miscellaneous (snowmobiles, snow removal, welding, rail, marine, etc.)	0.70	11.7%
Point sources (power generation, sewage sludge incineration)		---
TOTAL	**6.01**	**100.0%**

Projected CO Emissions in the Turnagain Micro-Inventory Area (2007-2023)

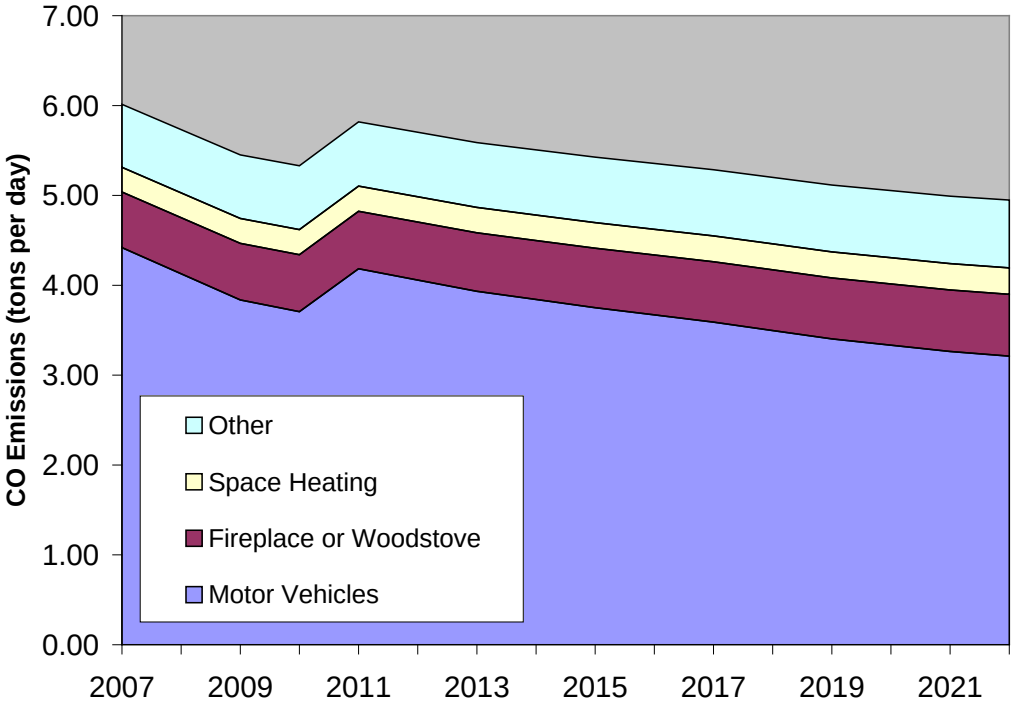
Projected emissions in the Turnagain micro-inventory area are tabulated for the period 2007-2023 in Table 27. CO emissions increase slightly in 2011 due to the assumed termination of the I/M Program and decline steadily thereafter. By 2023 CO emissions in the Turnagain area are projected to decline by about 12% from the 2007 base year.

Table 28
Total CO emitted during typical 24-hour winter day when CO is elevated in Turnagain micro-inventory area (tons per day)

	Motor Vehicles		Area Sources			
	idle mode	**travel mode**	**wood burning**	**space heating**	**other**	**TOTAL CO EMISSIONS**
2007	1.16	3.26	0.62	0.28	0.70	**6.01**
2009	1.08	3.04	0.62	0.28	0.70	**5.73**
2011	1.10	3.08	0.64	0.28	0.71	**5.82**
2013	1.07	2.99	0.65	0.28	0.72	**5.70**
2015	1.03	2.90	0.65	0.28	0.72	**5.59**
2017	1.01	2.83	0.66	0.28	0.72	**5.51**
2019	0.98	2.77	0.66	0.29	0.73	**5.43**
2021	0.96	2.71	0.67	0.29	0.73	**5.36**
2023	0.94	2.65	0.67	0.29	0.73	**5.29**

Figure 7

Projected CO Emissions in Turnagain CO Micro-Inventory Area 2007-2023



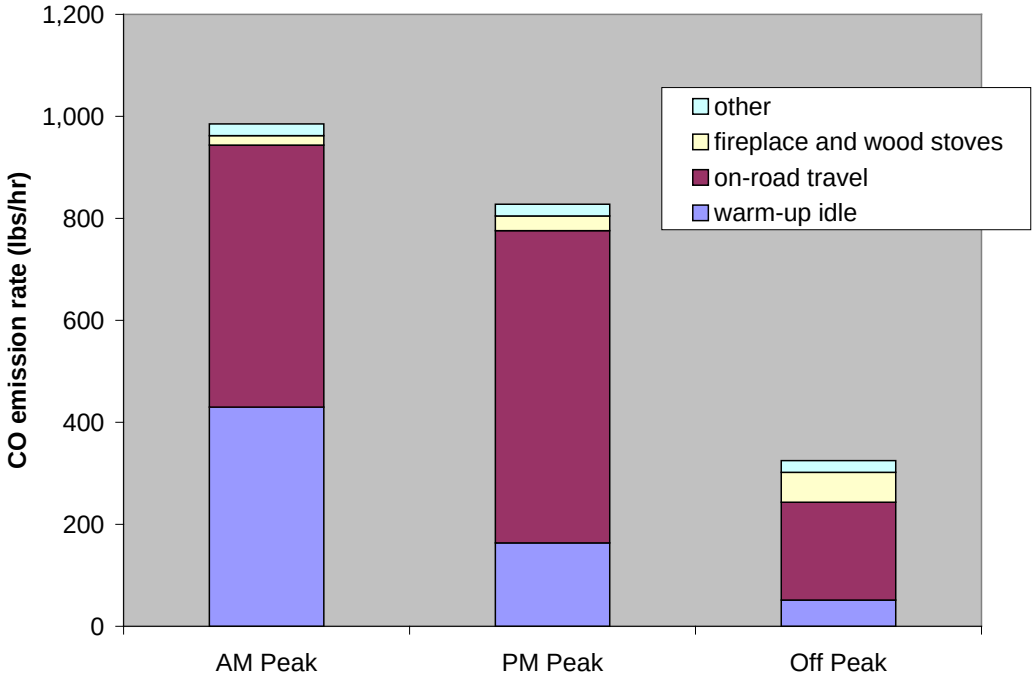
Time-of-Day Inventory at Turnagain

CO sources vary by time-of-day. For example, idle emissions are an important source of CO during the morning commute hours but less so during other times of day. For this reason, separate estimates of CO emissions were generated for each of the 200 grid cells that comprise the Anchorage inventory area for the AM Peak (7 AM – 9 AM), the PM Peak (3 PM – 6 PM) and Off Peak (6 PM – 7 AM, 9 AM – 3 PM) periods. Results are available by request.

Figure 8 shows that CO emission rates vary considerably by time-of-day in the Turnagain micro-inventory area. Time-of-day modeling suggests that CO emission rates are highest during the AM Peak (7 AM – 9 AM). CO concentrations at the Turnagain site are typically highest during morning hours, corresponding with this period of peak emissions.

Figure 8

CO emission rate by time-of-day in Turnagain CO micro-inventory area (2007)



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[3] "Winter Season Warm-up Driver Behavior in Anchorage," Air Quality Program, Municipality of Anchorage, June 2001.

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[8] 1997 and 1998 Vehicle Miles of Travel in the Anchorage Bowl, prepared by Alaska Department of Transportation and Public Facilities and the Municipality of Anchorage, January 2000.

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[11] "Air Quality Survey of Anchorage Residents," prepared by ASK Marketing & Research for the Municipality of Anchorage, April 1990.

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[13] Personal communication with Dan Dieckgraff, Enstar Natural Gas, March 22, 2001.

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[15] EPA Technical Highlights Document, EPA420-F-97-051, December 1997.

[16] Commercial Marine Inventories for Select Alaska Ports, prepared for the Alaska Department of Environmental Conservation by E.H. Pechan and Associates, June 2005.

[17] Winter 1997-98 Anchorage Carbon Monoxide Saturation Study, Municipality of Anchorage Department of Health and Human Services, September 1998.

[18] Analysis of the Probability of Exceeding the CO Standard between 2007 and 2023, Municipality of Anchorage Department of Health and Human Services, April 2009.

Alaska Department of Environmental Conservation

Amendments to:

State Air Quality Control Plan

Vol. III: Appendices

Appendix III.B.6

"Analysis of Probability of Complying with the National Ambient Air Quality Standards for Carbon Monoxide in Anchorage between 2007 and 2023, dated March 2010"

Public Review Draft

June 28th, 2010

Appendix to Section III.B.6, Anchorage CO Maintenance Plan

Air Quality Program
Municipality of Anchorage
Department of Health and Human Services
March 2010

Analysis of the Probability of Complying with the National Ambient Air Quality Standard for CO in Anchorage between 2007 and 2023

Background

In July 2008, the Anchorage Assembly directed the Municipal Department of Health and Human Services to work with the State of Alaska to remove the I/M Program as a requirement in the State Implementation Plan for air quality with a stipulation that it be retained as a local option and not be subject to a further SIP revision if further local action results in changes to or a discontinuation of the program. As a result a new probabilistic maintenance demonstration must be prepared that analyzes the impact of terminating I/M on prospects for future compliance with the national ambient air quality standard (NAAQS).*

Prior to the preparation of the previous Anchorage CO Maintenance Plan in 2004, the Municipality of Anchorage (MOA), the Alaska Department of Environmental Conservation (ADEC) and EPA Region 10 staff agreed that a probabilistic approach should be used in the Anchorage maintenance demonstration. The MOA, ADEC and EPA agreed that this demonstration must show a 90% or greater probability of meeting the national ambient air quality standard (NAAQS) in each year during the 2007-2023 lifetime of the Maintenance Plan.

The MOA is using the same methodology used in the 2004 Plan in this revised maintenance demonstration. This methodology relies on conventional statistical methods to estimate the probability of complying with the NAAQS in the year 2007, the base year for the analysis. The "roll forward" technique, used in the previous maintenance demonstration, is used to estimate probability of complying with the standard in future years. This technique relies on CO emissions projections for years 2008 through 2023 to help estimate the probability of complying with the NAAQS during this time period.

Method

Estimating the Probability of Complying with the NAAQS in Base Year 2007

The NAAQS for CO is set at 9 ppm for an 8-hour average not to be exceeded more than once per year. Because the NAAQS effectively disregards the highest 8-hour average in determining compliance, *the measure of whether a community meets the standard is determined by the magnitude of the second highest 8-hour average, or second maximum*. For this reason, this analysis focuses on the probability of the second maximum being above or below the 9 ppm NAAQS.

Standard regression analysis techniques can be used to estimate the probability of complying with the CO NAAQS in 2007. By definition, a violation occurs when the second maximum concentration is higher than 9 ppm. The probability that this will or will not occur

* Even though I/M may continue for many years as a local option program, CO reduction benefits were ignored because it is no longer a committed primary control measure in the SIP.

can be computed using the prediction interval. The prediction interval is defined mathematically as follows:

Equation 1 $$y_p = y_h + t_{(\alpha;\, n-2)} \cdot s\{pred\}$$

where $$s\{pred\} = \sqrt{MSE[1 + \frac{1}{n} + \frac{(X_k - \bar{X})^2}{\sum (X_i - \bar{X})^2}]}$$

In this circumstance, we are interested only in the upper limit of the prediction interval[†]. In this case we want to compute the value corresponding to the upper 90th percentile interval in base year 2007. If 2007 could be "repeated" numerous times, with the "normal" variety of meteorological conditions and other variables that effect CO concentrations, the second maximum concentration would fall at or below this value 90% of the time. This value is the base year 2007 design value (2007 $DV_{90\%}$).

Over the past 30 years, CO monitoring has been conducted at ten permanent CO stations[‡] and at numerous additional temporary stations throughout Anchorage and Eagle River. Data suggest that the Turnagain monitor, located in a residential area in west Anchorage, has the highest CO concentrations of the four monitors in the current network. (See analysis in the Attachment at the end of this report.) Although it is difficult to compare recent data from Turnagain with data collected from other sites a decade or more earlier, studies suggest that the CO concentrations at Turnagain are likely representative of the highest ambient CO concentrations encountered in Anchorage. For this reason, Turnagain was selected as the site for the maintenance demonstration.

First and second maximum 8-hour CO concentrations measured at Turnagain are shown in Table 1.[§]

Table 1
1st and 2nd Maximum CO Concentrations at Turnagain Station (1999-2008)

	Highest 8-hour average CO Concentration (ppm)	2nd Highest 8-hour average CO Concentration (ppm)
1999	10.1	7.6
2000	7.2	5.5
2001	9.8	7.7
2002	6.5	5.9
2003	8.3	6.7
2004	8.1	7.9
2005	5.7	4.6
2006	6.5	6.1
2007	5.5	5.3
2008	6.3	5.4

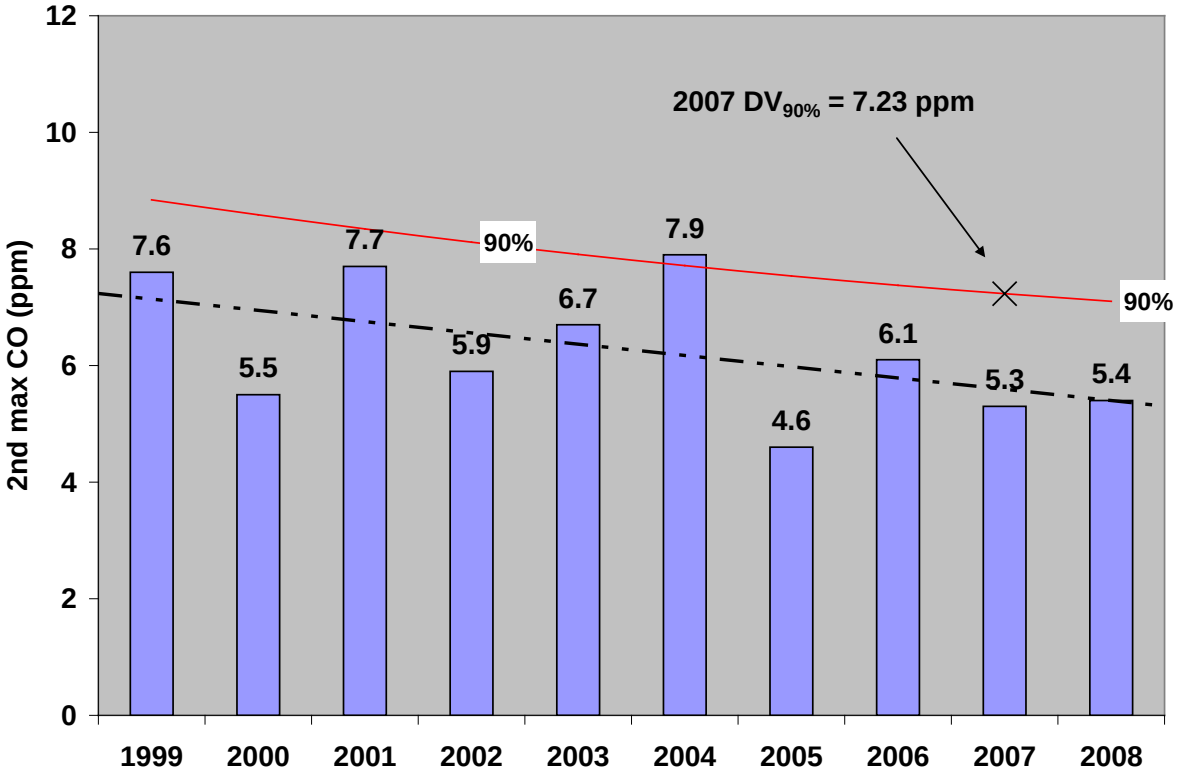
[†] This is known as a one-sided prediction interval. In this case we use the one-sided t-statistic when using Equation 1.

[‡] For the purposes of this discussion, we define a permanent monitoring station as one that has employed Federal Reference Method monitors over the course of at least one CO season. Temporary monitoring was conducted with bag samplers in the 1980's and more recently with portable industrial hygiene-type CO monitors. Temporary monitoring has been conducted at more than 30 locations in the Municipality.

[§] The Turnagain station began operation October 16, 1998; thus 1999 was the first complete year of data collected at this site.

An Excel spreadsheet was used to compute the upper 90th percentile prediction interval from the second maximum concentrations at Turnagain using Equation 1. The results of this computation are plotted in Figure 1. Figure 1 shows that there was a 90% probability that the base year 2007 value would be less than or equal to 7.23 ppm. This computed concentration will serve as the base year 2007 design value for the roll forward analysis discussed later in this report.

Figure 1
90th Percentile Prediction Interval Computed from Turnagain 2nd Maximum



The precise probability of complying with the 9 ppm NAAQS in 2007 was also estimated with the spreadsheet. The probability associated with a second maximum of less than or equal to 9.0 ppm can be estimated through iteration. The one sided t-statistic associated with various probabilities can be used in Equation 1 until the desired 9.0 ppm value is bracketed within two prediction intervals (see Table 2). In this case the desired 9.0 ppm value falls very nearly at the 99.0% interval. Thus, the probability of complying with the NAAQS in 2007 was estimated to be approximately 99%. The chance of violating the NAAQS in 2007 was about 1-in-100.

Table 2
Second Maximum CO Concentration Associated with Various Upper Bound Prediction Intervals

Probability that 2007 CO Concentration will be less than Computed 2nd Max Concentration	Computed Second Maximum CO Concentration (ppm)
80.0%	6.64
90.0%	7.23
95.0%	7.78
97.5%	8.30
99.0%	***8.99***
99.9%	10.88

Estimating the Probability of Complying with the NAAQS between 2007 - 2023

One assumption implicit in using the roll forward method is that the second maximum CO concentration in any future year will be proportional to the magnitude of the CO emissions in that year relative to base year emissions in 2007. In other words, if CO emissions in a future year are projected to decrease by 10% relative to base year 2007, the expected CO concentration in that future year will also decrease by 10%. If this occurs, there will be concurrent increase in the probability of complying with the NAAQS in that year.

CO emissions were estimated for the 9 kilometer^2 area surrounding the Turnagain CO monitoring station for base year 2007 using EPA-prescribed models such as the MOBILE6, NONROAD, AP-42 and the FHWA model EDMS to estimate CO emissions.[**]

CO emissions in 2007 were estimated to be 5.99 tons per day (tpd) in the "micro-inventory area" surrounding Turnagain. The computed 90th percentile concentration or 2007 $DV_{90\%}$ was 7.23 ppm. If one assumes that CO concentrations increase in direct proportion to emissions, the amount of CO that could be emitted in the Turnagain area and retain a 90% probability of complying with the standard can be computed as follows:

Amount of CO emissions associated with a 90% probability of complying with the NAAQS $= (9.0 \text{ ppm} / 2007\ DV_{2007}) \times \text{CO emissions in 2007}$

$= (9.0 \text{ ppm}/7.23 \text{ ppm}) \times 6.01 \text{ tpd} =$ ***7.48 tpd***

This computation suggests that if CO emissions in the Turnagain area increased from 6.01 tpd to 7.48 tpd, the probability of complying with the NAAQS would be 90%. In the same manner as shown above, the amount of emissions corresponding with other probabilities of compliance (i.e. 90%, 95%, 99%, etc.) can be readily computed with the spreadsheet. The spreadsheet was used to create a lookup table listing probabilities along with corresponding quantity of emissions. Table 3 shows the results of these spreadsheet computations. As would be expected, the probability of complying with the NAAQS increases with lower emission rates.

[**] MOBILE6 is used to estimate vehicle emissions, NONROAD us used to estimate various nonroad sources such as snowmobiles and portable electrical generators, EDMS is used for airport operations and AP-42 is used to estimate various area sources such as natural gas space heating, fireplaces and wood stoves. These models and emission inventory procedures are described more fully in the *Anchorage CO Emission Inventory and Emission Projections 2007-2023,* included as Appendix A of the Anchorage SIP submittal.

Table 3
CO Emission Rates Associated with Varying Probabilities of Compliance with the NAAQS at the Turnagain Station

Probability that 2nd Max CO Concentration will be less than 9.0 ppm	Corresponding CO Emission Rate (tpd)
99.9%	4.97
99.5%	5.39
99.3%	5.63
99.0%	6.02
98.0%	6.35
97.0%	6.60
96.0%	6.78
95.0%	6.96
94.0%	7.06
93.0%	7.16
92.0%	7.26
91.0%	7.37
90.0%	7.48

In addition to estimating base year 2007 CO emissions in the 9 kilometer^2 area surrounding Turnagain, emissions were projected through the year 2023. Projections were prepared using the aforementioned MOBILE6, NONROAD, AP-42, and EDMS modeling procedures. Population and employment forecasts prepared by the University of Alaska Institute of Economic and Social Research (ISER) were used to estimate key parameters necessary to estimate growth in vehicle travel[††], space heating, fireplace and woodstove use and other CO emission sources. The MOBILE6 model was configured to reflect that the four-year new car exemption will be extended to six years beginning January 2010.

The results of this “micro-inventory” and forecast of CO emissions in the Turnagain area are shown in Table 4. The probability of complying with the NAAQS at the level of emissions projected for each year was determined from the lookup table (Table 3).

[††] The Anchorage Transportation Model was used to provide information on vehicle travel. It relies in large part on ISER projections in the development of travel forecasts.

Table 4
Projected CO Emissions and Probabilities for Compliance with the NAAQS (2007-2023)

	CO Emissions from Various Sources in the 9 km^2 Area Surrounding the Turnagain Station (all emissions in tons per day)					
Year	Motor Vehicles	Fireplace or Woodstove	Space Heating	Other	**TOTAL CO EMISSIONS**	**Probability of Compliance**
2007	4.42	0.62	0.28	0.70	6.01	99.0%
2008	4.13	0.62	0.28	0.70	5.73	99.3%
2009	3.84	0.63	0.28	0.71	5.45	99.5%
2010	3.71	0.63	0.28	0.71	5.33	99.6%
2011	4.18	0.64	0.28	0.71	5.82	99.2%
2012	4.06	0.65	0.28	0.72	5.70	99.3%
2013	3.93	0.65	0.28	0.72	5.59	99.4%
2014	3.84	0.66	0.28	0.73	5.51	99.4%
2015	3.75	0.66	0.29	0.73	5.43	99.5%
2016	3.67	0.67	0.29	0.73	5.36	99.6%
2017	3.59	0.67	0.29	0.74	5.29	99.6%
2018	3.50	0.68	0.29	0.74	5.20	99.7%
2019	3.40	0.68	0.29	0.74	5.12	99.8%
2020	3.33	0.68	0.29	0.75	5.05	99.9%
2021	3.26	0.68	0.29	0.75	4.99	99.9%
2022	3.21	0.69	0.29	0.75	4.95	>99.9%
2023	3.16	0.69	0.30	0.76	4.90	>99.9%

Table 4 suggests that there is a very high likelihood of complying with the NAAQS at the Turnagain station. CO emissions are projected to increase slightly in 2011 if the I/M program is (assumed) terminated but the probability of compliance remains above 99%. Although not shown here, a similar analysis was performed for the Garden station. That analysis indicated that there is an even greater likelihood of compliance at that site. The probability of compliance was greater than 99.9% each year between 2007 and 2023.

Sensitivity Analysis

The roll forward probability analysis presented in the last section relies on modeled projections of future emissions. What happens to the estimated probabilities if these projections underestimated the growth in CO emissions between 2007 and 2023?

This sensitivity analysis investigates the sensitivity of the probability estimates presented in Table 4 to assumptions regarding:

1. future growth in vehicle miles traveled (VMT), vehicle starts and idling, and;
2. future growth of wood stove and fireplace use.

For the purpose of this analysis, we will adjust initial assumptions regarding VMT, and wood stove and fireplace use and re-compute the estimated probability of complying with the NAAQS during the 2007-2023 period. The manner in which each of these assumptions was revised is described in the next section.

Revised Assumptions Used in Sensitivity Analysis:

Future Growth in VMT, Vehicle Starts and Idling

Imbedded in these emission computations is the assumption that amount of vehicle miles traveled (VMT) on streets in the 9 kilometer^2 area surrounding the Turnagain station will grow by about than 4% from 2007 levels. Although this appears to be a sensible assumption because the Turnagain area is an older area with little opportunity for significant growth in population, in this sensitivity analysis we will assume that the growth in VMT will be three times that projected by the Anchorage Transportation Model. In other words, we will assume that VMT and vehicle starts and idling will grow by 12% between 2007 and 2023 and determine how this affects the probability of compliance.

Future Growth in Wood Stoves and Fireplace Use

Woodstove and fireplace emissions were assumed to grow in proportion to the growth in the number of households in the Turnagain micro-inventory area. During the 2007-2023 inventory period, wood heating emissions were projected increase by about 11%. Although recent telephone data suggest that Anchorage households do not plan to change their habits with regard to wood burning, there is a possibility that wood burning rates could increase in the next decade if households decide to heat with wood to avoid rising costs of heating with natural gas. For the purpose of this analysis we will assume that wood heating will grow 2% per year per household during the inventory period.

Results of Sensitivity Analysis

The two revised assumptions used in this sensitivity analysis are summarized in Table 5. The *combined* impact of these revised assumptions on CO emissions in the Turnagain micro-inventory area and the consequent effect on probabilities of compliance during the 2007-2023 maintenance plan period is shown in Table 6.

Table 6 suggests that even when the assumptions used in the sensitivity analysis are combined to create a “worst case scenario”, the probability of compliance with NAAQS is well above 90% each year. Even with higher rates of growth in vehicle travel and wood burning, CO emissions continue to decline. The probability of compliance remains at 99% or higher even with these higher growth rates.

Table 5
Comparison of Original Assumptions used in Maintenance Demonstration with Revised Assumptions used in Sensitivity Analysis

	Original Assumptions used in Maintenance Demonstration and Probability Computations	**Revised “Worst Case” Assumptions Used in Sensitivity Analysis**
Growth in VMT and Vehicle Starts and Idling	4% increase between 2007 and 2023	12% increase between 2007 and 2023
Fireplace and Woodstove Use	No change in wood burning rates per household between 2007-2023	2% growth in wood heating per year

Table 6
Comparison of CO Emissions and Probabilities of Compliance with the NAAQS
Original Assumptions used in Maintenance Demonstration vs.
Revised Assumptions used in Sensitivity Analysis

	Original Assumptions		Revised Assumptions in Sensitivity Analysis	
	Estimated Total CO Emissions (tpd)	**Probability of Compliance**	**Estimated Total CO Emissions (tpd)**	**Probability of Compliance**
2007	6.01	99.0%	6.01	99.1%
2008	5.73	99.3%	5.77	99.2%
2009	5.45	99.5%	5.51	99.4%
2010	5.33	99.6%	5.43	99.5%
2011	5.82	99.2%	5.94	99.1%
2012	5.70	99.3%	5.86	99.2%
2013	5.59	99.4%	5.77	99.2%
2014	5.51	99.4%	5.72	99.3%
2015	5.43	99.5%	5.67	99.3%
2016	5.36	99.6%	5.63	99.3%
2017	5.29	99.6%	5.59	99.4%
2018	5.20	99.7%	5.53	99.4%
2019	5.12	99.8%	5.47	99.5%
2020	5.05	99.9%	5.44	99.5%
2021	4.99	99.9%	5.41	99.5%
2022	4.95	>99.9%	5.39	99.5%
2023	4.90	>99.9%	5.38	99.6%

Attachment

Rank-Pair Order Comparison of CO Concentrations at Turnagain with Garden and Seward Highway Monitoring Stations

Permanent monitoring at Turnagain station began in October 1998 following the completion of a CO Saturation Monitoring Study during the winter of 1997-98. This study monitored CO concentrations at some 20 locations using temporary industrial hygiene-type monitoring devices. The saturation study indicated that the Turnagain site had the highest concentrations of all the sites in the study.

The permanent monitoring stations at Turnagain and Garden are located in older residential neighborhoods with relatively low traffic volumes on the roadways adjacent to the monitoring probe. The Seward Highway station (decommissioned in December 2004) was located at the intersection of two heavily traveled arterials, the Seward Highway and Benson Boulevard. In Anchorage CO monitoring is conducted at these permanent stations during the winter months defined as October through March.

Non-overlapping 8-hour maximum CO concentrations measured at the Turnagain, Garden and Seward Highway monitors were compared in rank-order to determine which site has the highest CO concentrations and the greatest potential for exceeding the national ambient air quality standard (NAAQS) for CO. A rank-order comparison involves sequentially ranking non-overlapping 8-hour average concentrations at the two sites being compared in descending order. In other words, the highest concentration measured at one site is compared to the highest concentration at the other, the second highest at the one site is compared to the second highest at the other, the third highest at one site is compared to the third highest at the other, and so on.

Rank-pair comparisons of data were performed only in time periods when data were available from both sites. In other words, in order to perform a fair comparison between two sites, the data compared was limited to periods when both sites were in operation and collecting valid data. Table 1 show the time periods when paired-data from Turnagain was compared to the other two stations.[‡‡]

Table A-1

Comparison Periods for Rank-Pair Analysis

Stations Compared	Comparison Period
Turnagain with Garden	10/16/98 – 12/31/07
Turnagain with Seward Hwy	10/16/98 – 12/31/05

A spreadsheet program was constructed to identify the highest 50 non-overlapping 8-hour maximum CO concentrations at each site for the comparison periods shown in Table 1.

[‡‡] The Turnagain site did not begin operating until October 16, 1998 and monitoring was discontinued at the Seward Highway site on December 31, 2004. Garden has been in more-or-less continuous operation since late 1970's. When data comparisons between two sites were performed the analysis was limited to time periods when both sites were collecting data.

Comparison of Turnagain and Garden Station CO Concentrations - October 1998 through December 2007

Results of the rank-order comparison between the Turnagain and Garden CO stations are shown in Figure 1. (Data used to construct this plot can be found at the end of this report.)

Figure A-1

Rank-Order Comparison of Highest Fifty Non-Overlapping 8-hour Average CO Concentrations Measured at the Turnagain and Garden Monitoring Stations October 1998–December 2007

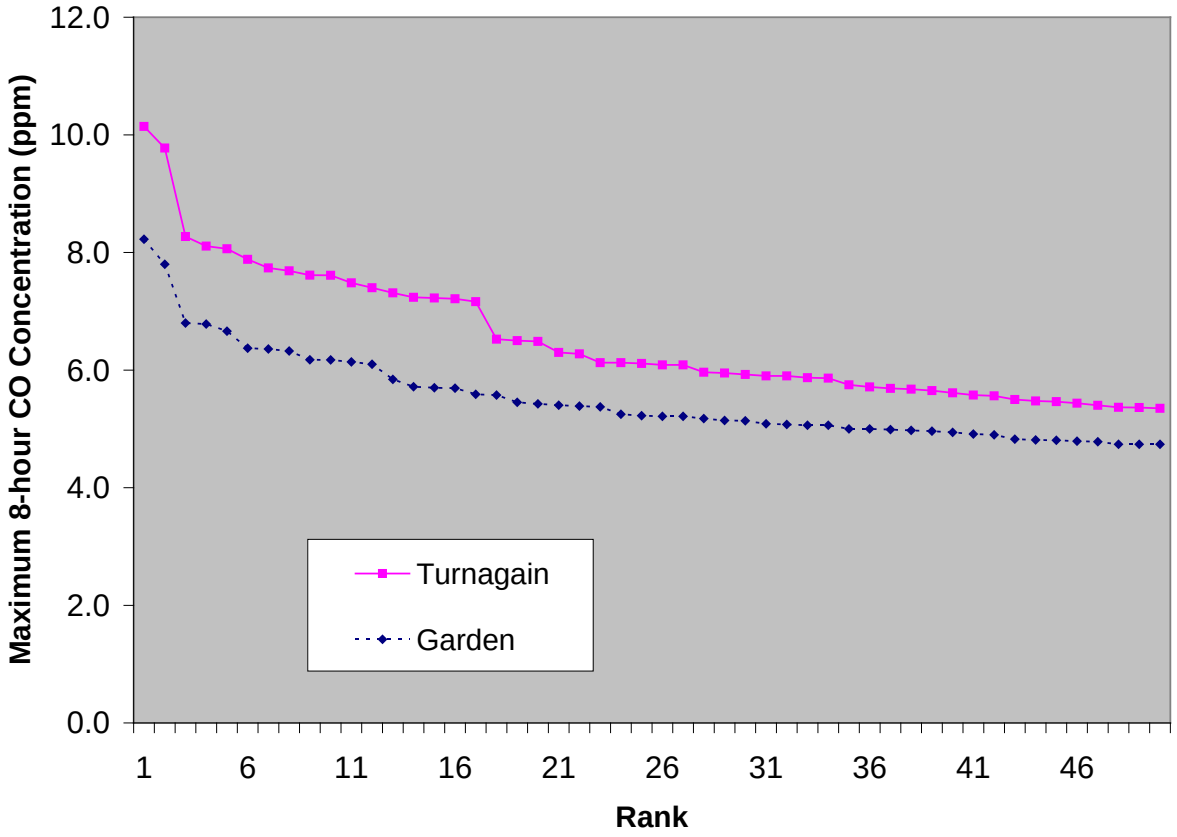


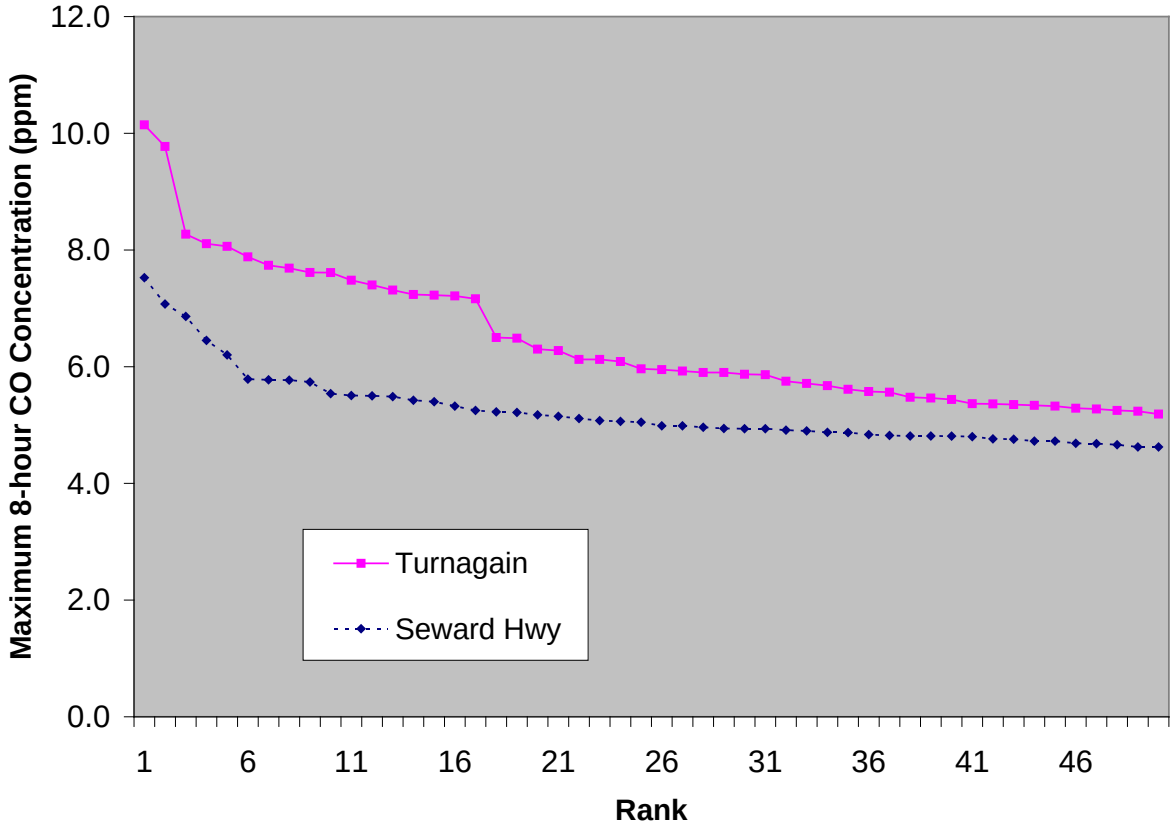
Figure 1 shows that the 50 highest 8-hour average concentrations at the Turnagain station are about 12% to 25% higher than the corresponding rank-pair value at Garden. The greatest differences occur among the highest ranks. For example the highest 8-hour concentration at Turnagain is 23% higher than the highest value at Garden while the 50th highest value at Turnagain is 13% higher than the corresponding 50th highest value at Garden. On a rank-pair basis, the values at Turnagain are significantly and consistently higher than those at Garden. This is particularly true at the extreme (i.e. highest) concentrations. This would suggest that Turnagain has a greater potential of exceeding or violating the NAAQS than Garden. For this reason, data from the Turnagain station were used to perform the probabilistic analysis for the maintenance demonstration.

Comparison of Turnagain and Seward Highway Station CO Concentrations October 1998 through December 2004

A similar analysis was performed comparing data from the Turnagain station to Seward Highway. In this case the analysis was confined to the period October 16, 1998 to December 31, 2004 because the Seward Highway station was decommissioned at the end of 2004. The results of this analysis are shown in Figure 2.

Figure A-2

Rank-Order Comparison of Highest Fifty Non-overlapping 8-hour Average CO Concentrations measured at the Turnagain and Seward Highway Monitoring Stations October 1998 – December 2004



Among the highest 50 paired 8-hour concentrations, concentrations at Turnagain are 12% to 38% higher than Seward. The largest differences between the two sites are observed in the very highest 8-hour concentrations where differences between rank-pairs are typically 30% or more. This would suggest that Turnagain has a considerably greater potential of exceeding or violating the NAAQS than Seward.

Conclusion

This analysis demonstrates that the Turnagain site exhibits the highest CO concentrations and greatest potential for violating the NAAQS in the Anchorage network. It is therefore appropriate to use this site for analysis of long-term prospects for continued compliance with the NAAQS.

Turnagain Oct 1998 – Dec 2007				Garden Oct 1998 – Dec 2007				
rank	8-hr avg (ppm)	date	end hour	**rank**	8-hr avg (ppm)	date	end hour	% Diff
1	10.14	1/6/99	19	1	8.23	1/6/99	18	23.3%
2	9.78	12/16/01	20	2	7.80	12/6/99	14	25.3%
3	8.27	12/6/03	1	3	6.80	12/24/98	19	21.6%
4	8.11	1/5/04	18	4	6.78	1/13/04	21	19.5%
5	8.06	12/24/98	23	5	6.66	2/12/99	12	21.0%
6	7.88	1/4/04	20	6	6.37	2/9/99	14	23.7%
7	7.74	11/14/01	12	7	6.36	1/3/04	21	21.7%
8	7.69	12/16/98	24	8	6.33	1/5/04	20	21.5%
9	7.61	1/3/04	21	9	6.18	1/27/99	13	23.3%
10	7.61	2/23/99	12	10	6.17	1/4/04	21	23.3%
11	7.48	1/1/04	22	11	6.14	12/5/03	23	21.9%
12	7.40	12/18/01	17	12	6.10	12/16/01	22	21.3%
13	7.31	2/8/99	11	13	5.84	1/1/04	23	25.2%
14	7.24	12/6/99	14	14	5.72	1/2/04	22	26.6%
15	7.23	12/5/01	15	15	5.70	11/27/99	24	26.8%
16	7.21	1/16/00	3	16	5.69	12/20/03	19	26.7%
17	7.16	11/28/99	1	17	5.59	10/22/98	11	28.2%
18	6.53	11/29/06	16	18	5.58	12/3/01	15	17.0%
19	6.50	2/23/99	3	19	5.45	1/15/04	14	19.2%
20	6.49	2/6/02	12	20	5.43	1/5/99	13	19.6%
21	6.30	12/3/01	16	21	5.40	1/7/04	14	16.6%
22	6.28	12/8/01	1	22	5.39	1/13/00	14	16.5%
23	6.13	2/18/01	6	23	5.38	1/12/00	15	14.0%
24	6.13	11/14/01	3	24	5.25	3/18/02	23	16.7%
25	6.11	1/24/06	12	25	5.23	2/22/99	12	17.0%
26	6.09	2/11/99	9	26	5.21	12/26/98	24	16.8%
27	6.09	1/17/06	14	27	5.21	2/11/00	15	16.8%
28	5.96	2/22/99	13	28	5.18	1/15/00	24	15.2%
29	5.95	12/4/01	16	29	5.14	1/14/99	14	15.7%
30	5.93	11/10/99	12	30	5.14	2/10/00	13	15.3%
31	5.90	1/4/99	24	31	5.09	11/29/01	15	16.0%
32	5.90	12/1/01	5	32	5.08	11/14/01	13	16.3%
33	5.87	1/13/04	1	33	5.06	2/13/99	1	16.0%
34	5.86	1/25/02	12	34	5.06	1/17/06	14	15.8%
35	5.75	12/27/98	4	35	5.00	11/22/99	14	15.0%
36	5.71	12/1/01	24	36	5.00	1/23/03	14	14.3%
37	5.69	1/28/05	11	37	4.99	2/10/99	12	14.1%
38	5.68	11/15/98	24	38	4.98	1/16/00	17	14.1%
39	5.65	11/25/06	12	39	4.96	12/4/01	16	13.9%
40	5.61	2/9/99	13	40	4.94	12/14/04	20	13.6%
41	5.58	12/14/01	15	41	4.91	11/20/98	15	13.5%
42	5.56	12/12/99	3	42	4.90	1/22/03	14	13.5%
43	5.50	12/19/07	14	43	4.83	11/10/99	13	14.0%
44	5.48	11/7/98	2	44	4.81	2/8/99	12	13.8%
45	5.46	1/12/00	13	45	4.81	1/18/05	13	13.7%
46	5.44	2/1/02	13	46	4.79	1/27/05	14	13.5%
47	5.40	11/25/06	3	47	4.78	1/7/04	23	12.9%
48	5.37	1/14/04	2	48	4.74	2/9/99	2	13.3%
49	5.36	12/26/03	16	49	4.74	12/18/01	16	13.2%
50	5.35	12/27/02	15	50	4.74	2/6/02	13	12.9%

Alaska Department of Environmental Conservation

Amendments to:

State Air Quality Control Plan

Vol. III: Appendices

Appendix III.B.9

"Municipality of Anchorage Ordinance 2010-35(S)"

Public Review Draft

June 28th, 2010

Submitted by: Chair of the Assembly at the Request of the Mayor
Prepared by: Dept. of Health and Human Services
For reading: April 27, 2010

CLERK'S OFFICE
AMENDED AND APPROVED
Date: 5-11-10

ANCHORAGE, ALASKA
AO No. 2010–35(S)

AN ORDINANCE REPEALING ANCHORAGE MUNICIPAL CODE CHAPTERS 15.80 AND 15.85, RELATING TO MOTOR VEHICLE EMISSIONS INSPECTION AND MAINTENANCE (I/M) PROGRAM; AMENDING CHAPTER 15.80 AND 15.85 IN THE INTERIM TO REVISE EXISTING FEES AND PROGRAM ADMINISTRATION; AMENDING SECTION 9.30.155 TO REPEAL REFERENCE TO I/M CERTIFICATION; AND AMENDING THE FINE SCHEDULE AT SECTION 14.60.030.

WHEREAS, since July 1985, the Municipality of Anchorage is designated as the acting "implementing agency" and administrator for the Vehicle Inspection and Maintenance (I/M) Program under the State Air Quality Control Plan and State Implementation Plan (SIP), as authorized under AS 46.14.510 and 18 AAC Chapter 52; and

WHEREAS, the current SIP, as approved by the Environmental Protection Agency (EPA), includes a commitment to operate an I/M Program in Anchorage to control carbon monoxide (CO) emissions; and

WHEREAS, the federal Clean Air Act requires the State to revise the SIP to demonstrate that I/M is no longer necessary for compliance with the federal air quality standard for CO and this SIP revision must be approved by the EPA before I/M may be discontinued; and

WHEREAS, pursuant to AAC 52.035(f), the Municipality must submit to the Alaska Department of Environmental Conservation for its approval any amendment to the Municipality's I/M Program at least one year prior to the proposed implementation or amendment date; and

WHEREAS, for purposes of AAC 52.035(f), termination of the program is a significant amendment; now, therefore,

THE ANCHORAGE ASSEMBLY ORDAINS:

Section 1. Anchorage Municipal Code chapter 15.80, Vehicle Inspection and Maintenance Program, is hereby repealed in its entirety**; see Section 9 for effective date of repeal**. As required by section 1.05.050B., the current text of chapter 15.80 is attached.

Section 2. Anchorage Municipal Code section 15.80.010, Mechanic

Certification, is amended to read as follows (*the remainder of the section is not affected and therefore not set out*):

15.80.010 General provisions.

*** *** ***

E. Certification of inspection stations. The I/M program administrator shall certify mechanics, vehicle test and repair facilities (stations) and testing, equipment as necessary to meet all certification requirements specified in the I/M program design.

1. Beginning January 1, 2010, the I/M administrator shall charge a fee for inspection station **operation** [CERTIFICATION] in accordance with section **15.85.405** [**15.85.400**].

*** *** ***

(AO No. 84-110; AO No. 85-8; AO No. 87-27; AO No. 87-35; AO No. 88-154(S); AO No. 88-184; AO No. 93-216(S), § 1, 2-15-94; AO No. 94-195, § 1, 10-25-94; AO No. 96-137(S), §§ 1--6, 1-2-97; Ord. No. 96-154, § 1, 1-2-97; AO No. 99-160, § 1, 1-11-00; AO No. 2000-92, § 1, 8-15-00; AO No. 2003-44, § 1, 3-18-03; AO No. 2006-13, § 1, 2-14-06; AO No. 2008-84(S), § 6, 7-15-08)

Section 3 [2]. Anchorage Municipal Code chapter 15.85, Requirements, Specifications, and Procedures for Motor Vehicle Emissions Inspection and Maintenance (I/M) Program, is hereby repealed in its entirety**; see Section 9 for effective date of repeal**. As required by section 1.05.050B., the current text of chapter 15.85 is attached.

Section 4. Anchorage Municipal Code section 15.85.400, Mechanic Certification, is amended to read as follows (*the remainder of the section is not affected and therefore not set out*):

15.85.400 Certification procedures.

*** *** ***

[EDITOR'S NOTE: EFFECTIVE JANUARY 1, 2010, PURSUANT TO AO 2008-84(S), § 12, A NEW SUBSECTION G IS AMENDED TO THIS SECTION AND WILL READ:

G. THE I/M ADMINISTRATOR SHALL CHARGE A $10,000 FEE FOR THE INITIAL

CERTIFICATION OF A NEW INSPECTION FACILITY OR LOCATION. THE FEE FOR RECERTIFICATION SHALL BE BASED ON THE VOLUME OF TESTS CONDUCTED IN THE PRECEDING TWO-YEAR CERTIFICATION PERIOD IN ACCORDANCE WITH THE FOLLOWING SCHEDULE:

NUMBER OF TESTS CONDUCTED BY I/M TEST FACILITY IN PRECEDING TWO-YEAR CERTIFICATION PERIOD	CERTIFICATION FEE (EVERY 2 YEARS)
10,000 OR MORE	$10,000
MORE THAN 2,000 AND LESS THAN 10,000	$5,000
2,000 OR LESS	$2,000]

Section 5. Anchorage Municipal Code chapter 15.85 is amended to add a new section to read as follows:

15.85.405 I/M Station Operation Fees.

A. Station Operation Fee. A station shall only conduct I/M tests in the municipality if it is certified and is current on its semi-annual operation fee. The semi-annual periods shall run from January 1 through June 30, and July 1 through December 31.

B. Fee Calculation and Payment. The I/M administrator shall calculate a semi-annual station operation fee based upon the volume of tests conducted by a station in the preceding semi-annual period, as set out in the following table:

Number of Tests Conducted by I/M Test Station in Preceding Six-month Period	Semi-annual payment
2,500 or more	$2,500
More than 500 and less than 2,500	$1,250
500 or less	$500

C. Fee notices.

1. The Administrator shall mail each I/M station an invoice for each semi-annual station operation fee no later than August 15 (1st period) and February 15 (2nd period) of each year.

2. An I/M station operation fee shall be received by the Municipality no later than September 15 (1st period) and March 15 (2nd period) of each year.

3. The I/M administrator shall temporarily suspend an I/M station's authorization to perform tests if the station fails to pay the I/M station operation fee when due.

a. The station's authorization to test shall be reinstated when the outstanding semi-annual station operation fee is paid in full.

D. Initial I/M Station Fee. When an I/M station is first certified, or when an I/M station testing authorization is reinstated after a 6-month or more lapse in operations, the station shall pay a station operation fee of $2,500 to the I/M administrator at the time of initial certification or reinstatement.

Section 6 [3]. Anchorage Municipal Code section 9.30.155 is amended to delete all of subsection E. as follows *(the remainder of the section is not affected and therefore not set out)*:

9.30.155 Vehicle license plates and registration.

*** *** ***

[E. A MOTOR VEHICLE THAT IS PARKED, STOPPED OR LEFT STANDING ON A STREET OR PRIVATE PROPERTY OPEN TO THE PUBLIC FOR TRAVEL OR PARKING, AND DOES NOT HAVE CURRENT REGISTRATION PROPERLY ATTACHED AS REQUIRED BY SUBSECTION A OF THIS SECTION, SHALL BE CONSIDERED PRIMA FACIE TO NOT HAVE A CURRENT EMISSIONS (I.M.) CERTIFICATION AS SPECIFIED IN SECTION 15.80.010.

1. A CITATION ISSUED UNDER SUBSECTION E OF THIS SECTION, MAY BE DISMISSED BY THE PARKING AUTHORITY IF AN I.M. INSPECTION CERTIFICATE, DATED PRIOR TO THE DATE OF THE VIOLATION, IS PROVIDED WITHIN 30 DAYS OF THE VIOLATION, AND SHALL OMIT THE SCHEDULED PENALTY FOR THE OFFENSE. ADDITIONALLY, IF THE REGISTERED OWNER DOES NOT PRINCIPALLY UTILIZE AND/OR GARAGE THE VEHICLE WITHIN THE MUNICIPALITY AND PROVIDES THE PARKING AUTHORITY WITH PROOF OF RESIDENCY, SHALL OMIT THE SCHEDULED PENALTY FOR THE OFFENSE. SUCH DISMISSALS

SHALL NOT APPLY TO ANY LATE PENALTIES OR COLLECTION CHARGES.

2. A MOTOR VEHICLE TICKETED FOR VIOLATING THIS SECTION SHALL NOT BE TICKETED AT THE SAME TIME FOR BOTH I.M. AND REGISTRATION VIOLATIONS.]

(CAC 9.44.020; AO No. 78-72; AO No. 80-4; AO No. 85-40; AO No. 92-28; AO No. 92-134(S); AO No. 94-68(S), § 16, 8-11-94; AO No. 95-6, § 4, 5-16-95; AO No. 2003-152S, § 3, 1-1-04)

Section 7 [4]. Anchorage Municipal Code section 14.60.030 is amended to read as follows *(the remainder of the section is not affected and therefore not set out)*:

14.60.030 Fine schedule.

The fine schedule under this chapter is as follows:
TABLE INSET:

Code Section		Offense	Penalty/Fine
***		***	***
[15.80.010	[A.	VEHICLE INSPECTION	200.00]
	[B.	VEHICLE INSPECTION	200.00]
	[F.	IMPROPER INSPECTION	75.00]
	[H.	IMPROPER ADVERTISEMENT	75.00]
[15.80.040	I/M COMPLIANCE		75.00]
[15.80.050	A. NON RESOLUTION		75.00]
	B. OTHER VIOLATION		UP TO 300.00]

*** *** ***

(AO No. 93-167(S-1), § 1, 4-13-94; AO No. 94-108, § 1, 10-5-94; AO No. 94-134, § 2, 9-8-94; AO No. 95-42, § 2, 3-23-95; AO No. 95-67(S), § 9, 7-1-95; AO No. 95-102, § 1, 4-26-95; AO No. 95-118, § 3, 9-1-95; AO No. 95-163(S), § 21, 8-8-95; AO No. 95-195(S-1), 1-1-96; AO No. 96-51(S-1), § 2, 8-1-96; AO No. 96-96(S-1), § 2, 2-1-97; AO No. 96-126(S), § 3, 10-1-96; AO No. 96-137(S), § 9, 1-2-97; AO No. 97-88, § 3, 6-3-97; AO No. 97-

107, § 3, 11-17-97; AO No. 97-133(S), § 1, 11-11-97; AO No. 98-27(S-1), § 2, 11-11-97; AO No. 98-160, § 2, 12-8-98; AO No. 99-13(S), 2-9-99; AO No. 99-91(S), § 4, 7-13-99; AO No. 2000-64, § 1, 4-18-00; AO No. 2000-116(S), § 4, 7-18-00; AO No. 2000-127(S), § 2, 10-14-00; AO No. 2000-129(S), § 26, 11-21-00; AO No. 2001-48, § 1, 3-13-01; AO No. 2001-74(S), § 2, 4-17-01; AO No. 2001-4, § 2, 2-6-01; AO No. 2001-145(S-1), § 11, 12-11-01; AO No. 2003-68, § 1, 9-30-03; AO No. 2003-97, § 4, 9-30-03; AO No. 2003-117, § 2, 1-28-03; AO No. 2003-130, § 8, 10-7-03; AO No. 2003-152S, § 10, 1-1-04; AO No. 2004-1, § 2, 1-1-03; AO No. 2004-99, § 2, 6-22-04; AO No. 2004-100(S-1), § 6, 1-1-05; AO No. 2004-171, § 1, 1-11-05; AO No. 2005-160, § 9, 11-1-05; AO No. 2005-84(S), § 3, 1-1-06; AO No. 2005-185(S), § 35, 2-28-06; AO No. 2005-124(S-1A), § 33, 4-18-06; AO No. 2006-39, § 6, 4-11-06; AO No. 2006-54, § 1, 5-2-06; AO No. 2006-80, § 1, 6-6-06)

Section 8 [5]. The Department of Health and Human Services shall prepare a revised CO Maintenance Plan for submission to the ADEC as an amendment to the State Implementation Plan (SIP) terminating the commitment by the Municipality and State of Alaska to operate an I/M program in Anchorage.

Section 9 [6]. Sections 1**, 3, 6 and 7** [~~through~~ 4] of this ordinance shall become effective **one hundred eighty (180)** ~~thirty (30)~~ days after ADEC provides written notice to the I/M Administrator that both ADEC and EPA have duly accepted and approved termination of the I/M Program in accordance with amendments to the State Air Quality Control Plan and State Implementation Plan (SIP).

Section 10 [7]. Except as provided in Section **9** [~~6~~], this ordinance shall become effective immediately upon passage and approval by the Assembly.

PASSED AND APPROVED by the Anchorage Assembly this 11th day of May, 2010.

Chair

ATTEST:

Municipal Clerk

MUNICIPALITY OF ANCHORAGE
Summary of Economic Effects -- General Government

AO Number: 2010-35(S)

Title: **AN ORDINANCE REPEALING ANCHORAGE MUNICIPAL CODE CHAPTERS 15.80 AND 15.85, RELATING TO MOTOR VEHICLE EMISSIONS INSPECTION AND MAINTENANCE (I/M) PROGRAM; AMENDING CHAPTER 15.80 AND 15.85 IN THE INTERIM TO REVISE EXISTING FEES AND PROGRAM ADMINISTRATION; AMENDING SECTION 9.30.155 TO REPEAL REFERENCE TO I/M CERTIFICATION; AND AMENDING THE FINE SCHEDULE AT SECTION 14.60.030.**

Sponsor: **MAYOR**
Preparing Agency: Department of Health and Human Services
Others Impacted:

CHANGES IN EXPENDITURES AND REVENUES: **(In Thousands of Dollars)**

	FY09	FY10	FY11	FY12	FY13
Operating Expenditures					
1000 Personal Services	$0	$0	$0	$ (670)	$ (690)
2000 Non-Labor	$0	$0	$0	$ (370)	$ (370)
3900 Contributions	$0	$0	$0	$ (323)	$ (323)
4000 Debt Service	$0	$0	$0	$ -	$ -
TOTAL DIRECT COSTS:	**$0**	$0	$0	**$ (1,363)**	**$ (1,383)**
Add: 6000 Charges from Others	$0	$0	$0	$ (430)	$ (420)
Less: 7000 Charges to Others	$0	$0	$0	-	-
FUNCTION COST:	$0	$0	$0	**$ (1,793)**	**$ (1,803)**
REVENUES:	$0	$0	$0	**(1,550)**	**(1,550)**
CAPITAL:	$0	$0	$0		
POSITIONS: FT/PT and Temp	***0.00***	***0.00***	***0.00***	***(7.00)***	***(7.00)***

PUBLIC SECTOR ECONOMIC EFFECTS:

The ordinance will exempt all vehicles from I/M testing requirements when it becomes effective, which is projected to be sometime in 2012. Program revenue supports the Municipal I/M program in it's entirety at $1,227,000 and the remaining $323,000 of this revenue supports the MOA Air Quality Program.

PRIVATE SECTOR ECONOMIC EFFECTS:

Currently the I/M program directs approximately $8.5M in I/M test and repair revenues to the 64 I/M test and repair stations. However, It is difficult to predict the private sector economic effects of I/M program ellimination, as vehicle owners will still have regular maintenance and repairs performed on their vehicles that may or may not be I/M related. The same situation makes it very difficult to predict the private sector employent effects of program termination, because we do not have a good feel for how much the automotive maintenance and repair industry as a whole will be impacted. There are 144 certified I/M mechanics that are involved at least part time in the I/M test and repair industry. They will be performing approximately 90,000 tests per year by 2011. Assuming that the average test involves 45 minutes of labor, this means that approximately 67,500 hours (equivalent to 32 full-time positions) are devoted to I/M testing each year.

Prepared by: Diane Ingle, Director DHHS Telephone: 343-6460

MUNICIPALITY OF ANCHORAGE

ASSEMBLY MEMORANDUM

No. AM 225-2010(A)

Meeting Date: April 27, 2010

From: **MAYOR**

Subject: **AN ORDINANCE REPEALING ANCHORAGE MUNICIPAL CODE CHAPTERS 15.80 AND 15.85, RELATING TO MOTOR VEHICLE EMISSIONS INSPECTION AND MAINTENANCE (I/M) PROGRAM; AMENDING CHAPTER 15.80 AND 15.85 IN THE INTERIM TO REVISE EXISTING FEES AND PROGRAM ADMINISTRATION; AMENDING SECTION 9.30.155 TO REPEAL REFERENCE TO I/M CERTIFICATION; AND AMENDING THE FINE SCHEDULE AT SECTION 14.60.030.**

The Department of Health and Human Services (DHHS) is requesting the Anchorage Municipal Assembly repeal Anchorage Municipal Code chapters 15.80 and 15.85 relating to the Vehicle Inspection and Maintenance (I/M) Program.

In July of 1985, the I/M Program was implemented in Anchorage to comply with federal air quality standards for carbon monoxide (CO). Prior to implementation of the Program, Anchorage exceeded national standards for CO as many as 50 times a year. Thanks in part to the I/M Program, there has been a marked drop in ambient CO levels in Anchorage that continues today. Anchorage has not had a CO violation since 1996. New vehicle technologies and fewer old polluting vehicles on the roads help assure that we will be able to maintain the quality of air that citizens and visitors alike expect and enjoy. Projections show that air quality will continue to improve even after the I/M Program is terminated.

The I/M Program has been successful thanks to the efforts of the I/M Program staff and the private sector who provided testing and repair of vehicles for the past 25 years. DHHS is happy to recognize that now, having completed the task, we can end a program that is no longer necessary. We should congratulate the program staff and industry partners for helping us with this achievement.

Federal regulations require that a revised Air Quality Plan be submitted to the Alaska Department of Environmental Conservation, for inclusion in the State Implementation Plan for Air Quality. The Plan then must go to the Federal EPA before I/M can be terminated. This process is currently underway, therefore passage of this ordinance is recommended.

In the interim, the DHHS is requesting the Anchorage Municipal Assembly pass language that changes the way station fees, directed by AO 2008-84(S), are collected. The current language ties the fees to station recertification, and does not allow the program to collect a steady revenue stream over the remaining time of the program's existence.

The suggested changes will allow existing stations to pay a fee every 6 months if they wish to continue testing. This gives them more flexibility in determining how long they would like to participate in the program with an uncertain termination date.

THE ADMINISTRATION RECOMMENDS APPROVAL OF AN ORDINANCE REPEALING ANCHORAGE MUNICIPAL CODE CHAPTERS 15.80 AND 15.85, RELATING TO MOTOR VEHICLE EMISSIONS INSPECTION AND MAINTENANCE (I/M) PROGRAM; AMENDING CHAPTER 15.80 AND 15.85 IN THE INTERIM TO REVISE EXISTING FEES AND PROGRAM ADMINISTRATION; AMENDING SECTION 9.30.155 TO REPEAL REFERENCE TO I/M CERTIFICATION; AND AMENDING THE FINE SCHEDULE AT SECTION 14.60.030.

Prepared by:	Department of Health & Human Services
Approved by:	Diane Ingle, Director DHHS
Concur:	Dennis A. Wheeler, Municipal Attorney
Concur:	George J. Vakalis, Municipal Manager
Respectfully submitted:	Daniel A. Sullivan, Mayor

AO 2010-35(S)

Content ID: 008967

Type: Ordinance - AO

Title: AO NO. 2010-35(S), AN ORDINANCE REPEALING ANCHORAGE MUNICIPAL CODE CHAPTERS 15.80 AND 15.85, RELATING TO MOTOR VEHICLE EMISSIONS INSPECTION AND MAINTENANCE (I/M) PROGRAM; AMENDING CHAPTER 15.80 AND 15.85 IN THE INTERIM TO REVISE EXISTING FEES AND PROGRAM ADMINISTRATION; AMENDING SECTION 9.30.155 TO REPEAL REFERENCE TO I/M CERTIFICATION; AND AMENDING THE FINE SCHEDULE AT SECTION 14.60.030.

Author: taplina

Initiating Dept: HHS

Date Prepared: 4/23/10 7:14 AM

Director Name: Diane Ingle

Assembly Meeting Date: 4/27/10

Public Hearing Date: 5/11/10

Workflow Name	Action Date	Action	User	Security Group	Content ID
Clerk_Admin_SubWorkflow	4/23/10 1:19 PM	Exit	Nina Pruitt	Public	008967
MuniManager_SubWorkflow	4/23/10 1:19 PM	Approve	Nina Pruitt	Public	008967
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OMB_SubWorkflow	4/23/10 11:33 AM	Approve	Cheryl Frasca	Public	008967
HHS_SubWorkflow	4/23/10 9:29 AM	Approve	Diane Ingle	Public	008967
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HHS_SubWorkflow	4/23/10 7:39 AM	Reject	Diane Ingle	Public	008967
AllOrdinanceWorkflow	4/23/10 7:25 AM	Checkin	Angela Taplin	Public	008967

CONSENT AGENDA - **INTRODUCTION**

Chapter 15.80 VEHICLE INSPECTION AND MAINTENANCE PROGRAM*

*Editor's note: It should be noted that § 2 of AO No. 2008-84(S), effective July 15, 2008, provides, "Anchorage Municipal Code Chapter 15.80, Vehicle Inspection and Maintenance Program, is reinstated."

Cross references: Vehicles and traffic, Tit. 9; motorcycles and motor-driven cycles, Ch. 9.40; off-highway vehicles, Ch. 9.42; vehicle equipment, Ch. 9.44; business licenses and regulations, Tit. 10; transportation, Tit. 11; motor vehicle noise emission standards, § 15.70.090.

15.80.010 General provisions.
15.80.020 Referee station.
15.80.030 Presumption of violation.
15.80.040 Enforcement of chapter.
15.80.050 Penalties.
15.80.060 Waiver for seasonal use vehicles.
15.80.070 Waiver for show cars. (Repealed)
15.80.080. Fine schedule.

15.80.010 General provisions.

A. Inspection and maintenance required. Every motorist operating a vehicle registered, principally located or principally used within the municipality shall have each such vehicle inspected and maintained in accordance with the requirements specified in the I/M program design as amended by AO 96-154, AO 99-160 and AO 2008-84(S).

Note: Text of sections indexed available from the department of health and human services.

B. Vehicle fleets. Every owner of more than ten vehicles which are primarily used in the municipality shall have such vehicles inspected and maintained in accordance with the requirements of the I/M program design, regardless of whether such vehicles are registered with the state.

C. Certificate of inspection. The certificate of inspection shall be:

1. A windshield sticker which is affixed to the lower left side portion of the interior front windshield.

2. A certificate of inspection windshield sticker issued in accordance with the procedures specified in this chapter, not more than ninety (90) days previous, shall be required prior to vehicle registration or vehicle registration renewal with the state division of motor vehicles for all vehicles subject to the requirements of this chapter.

D. Responsibility for administration. The director of the department of health and human services shall have principal responsibility for the implementation and enforcement of the I/M program and shall designate one employee of the department as the I/M program administrator. With approval of the director, the I/M program administrator may delegate I/M program responsibilities to other municipal employees.

E. Certification of inspection stations. The I/M program administrator shall certify mechanics, vehicle test and repair facilities (stations) and testing, equipment as necessary to meet all certification requirements specified in the I/M program design.

1. Beginning January 1, 2010, the I/M administrator shall charge a fee for inspection station certification in accordance with Section 15.85.400.

F. Conduct of inspections. All inspections and repairs required under the I/M program design shall be done in a manner consistent with the requirements of the I/M program design when performed by certified I/M mechanics at certified I/M stations.

G. Suspension or revocation of certification. Certifications shall be suspended or revoked by the I/M program administrator for repeated or serious violations of procedures or requirements specified in the I/M program design.

H. False advertising regarding certification. No facility may advertise itself as a certified I/M station unless it is certified as such by the I/M program administrator.

I. Sale of certificates to inspection stations; use of fees. The program administrator shall sell certificate of inspection stickers to certified I/M stations for a fee of $18.00 each. The same fee shall be charged for certificate of inspection stickers issued by the program administrator to vehicles qualifying for a waiver and for vehicles which are registered in, but not used in, the municipality unless a current I/M certificate from another I/M area is provided, in which case no fee is charged. There will be no charge for certificate of inspection stickers for exempt vehicles such as new vehicles and diesels. The certificate of inspection sticker fees shall be for the cost of operating the I/M and related air quality programs and may from time to time be modified to reflect changes in the program operating costs.

J. Referee required repair form. Within 60 days of receiving an official referee required repair form the vehicle owner and operator if operator is not the registered owner shall be jointly responsible for repair, re-inspection and certification or otherwise bringing the vehicle into compliance with this chapter. Compliance with this paragraph shall require a return of the vehicle to the referee facility for re-inspection or submittal of documents proving compliance. Submittal of documents may be by certified mail, return receipt requested, if posted within 60 days of receipt of official referee required repair form. However, any party submitting documents by mail is required to retain the postal return receipt for two years as proof of timely submittal.

K. Registration renewal. DMV registration renewals may be accepted and processed through the department of health and human services, environmental services counter. In addition to other applicable fees, a $10.00 transaction processing fee shall be charged for DMV vehicle owner registration renewals made at the department of health and human services, environmental services division.

(AO No. 84-110; AO No. 85-8; AO No. 87-27; AO No. 87-35; AO No. 88-154(S); AO No. 88-184; AO No. 93-216(S), § 1, 2-15-94; AO No. 94-195, § 1, 10-25-94; AO No. 96-137(S), §§ 1--6, 1-2-97; Ord. No. 96-154, § 1, 1-2-97; AO No. 99-160, § 1, 1-11-00; AO No. 2000-92, § 1, 8-15-00; AO No. 2003-44, § 1, 3-18-03; AO No. 2006-13, § 1, 2-14-06; AO No. 2008-84(S), § 6, 7-15-08)

Editor's note: The February 14, 2006 effective date of AO 2006-13 was subject to State of Alaska approval of the I/M program amendments pursuant to 18 AAC 52.035, and the state approved on May 15, 2006.

15.80.020 Referee station.

The I/M program referee station shall be offered for operation either directly or by the private sector.

(AO No. 84-110; AO No. 99-160, § 2, 1-11-00; AO No. 2006-13, § 2, 2-14-06)

Editor's note: The February 14, 2006 effective date of AO 2006-13 was subject to State of Alaska approval of the I/M program amendments pursuant to 18 AAC 52.035, and the state approved on May 15, 2006.

15.80.030 Presumption of violation.
The failure of an owner of a vehicle to display current certificate plates with expiration stickers and an I/M program windshield sticker on a vehicle is prima facie evidence of failure to inspect and maintain the vehicle in accordance with this chapter. Unless rebutted, evidence of a failure to display current certificate plates with expiration stickers and an I/M program windshield sticker is sufficient to sustain a violation of Section 15.80.010.A or B.

(AO No. 92-28; AO No. 99-160, § 3, 1-11-00; AO No. 2000-92, § 2, 8-15-00)

Editor's note: AO 2000-92 (amended and approved 8-15-00) contains changes to this section conditioned and effective upon State approval.

15.80.040 Enforcement of chapter.
A sworn police officer, the director, or an employee or agent of the municipality specifically designated by the director, is authorized to enforce the provisions of this chapter by issuance of a citation. The director or the director's designee may also issue a notice of violation, deliver it to the owner of a vehicle or affix it to the vehicle if it is unattended at the time of issuance. The notice of violation or citation shall identify the vehicle, the nature of the violation and the means of resolving it. Vehicles identified by citation or notice of violation as being out of compliance with this chapter shall be I/M tested and certified or otherwise brought into compliance by the owner and/or operator by the date specified on the citation or notice of violation.

(AO No. 92-28; AO No. 96-137(S), § 7, 1-2-97; AO No. 99-160, § 4, 1-11-00)

15.80.050 Penalties.
A. Except as otherwise provided in this section, a person who receives a notice of violation and fails to resolve the notice of violation and provide evidence of resolution to the department of health and human services within 30 days from the date of such notice shall be subject to a civil penalty of $75.00 separate from any fine or other penalty for violation of Section 15.80.010.A. or B. The civil penalty shall be incurred for each 30-day period for which the notice of violation remains unresolved until a citation is issued for the violation. Accrued civil penalties will remain until satisfied.
B. A person who violates Section 15.80.010.A. or B. and who, within the preceding six months, has been adjudicated by a court or in an administrative hearing conducted pursuant to Chapter 3.60 of this code to have previously violated one of those subsections or who has failed to timely resolve a notice of violation of one of those subsections shall be subject to a fine of not less than $200.00 and not more than $300.00.
C. The fine for a violation of Section 15.80.010.A or B shall be $200.00 except in the circumstances specified in paragraph B of this section. A person receiving a citation for such violation may submit the fine amount without a court appearance.
D. A conviction for any violation of this chapter other than a violation of Section 15.80.010.A or B, shall be punished by a fine as provided in this chapter or if no fine is provided for conviction of a violation, a fine of not more than $300.00.

E. Every act prohibited by this chapter is declared unlawful and violation shall also be punishable by a civil penalty as set forth in Section 14.60.030, or, if such violation is not listed in the fine schedule set forth in Section 14.60.030, a civil penalty as set forth in Section 1.45.010.

(AO No. 92-28; AO No. 96-137(S), § 8, 1-2-97; AO No. 99-132, § 1, 11-9-99; AO No. 99-160, § 5, 1-11-00)

15.80.060 Waiver for seasonal use vehicles.

A. Vehicles which are not operated in the municipality from November 1 through March 31 do not require an I/M inspection.

B. An application for a seasonal use waiver may be completed at the I/M program office and shall be signed by the applicant and notarized. Upon approval by the I/M program administrator's office of the seasonal use waiver application, the applicant shall be issued an I/M certificate of inspection seasonal waiver windshield sticker.

C. Failure to affix the seasonal use tab issued by the Alaska Department of Motor Vehicles to the certificate plate and/or failure to affix the windshield sticker issued by the I/M program administrator's office shall constitute a violation of this chapter. Operation of vehicles with seasonal use tabs during the months of November, December, January, February and March is prohibited. A vehicle owner or operator cited by state or local enforcement agencies for violation of the seasonal use waiver requirements shall be assessed a fine of $300.00, the seasonal waiver will be permanently revoked, and such owner or operator shall be ineligible to receive a subsequent seasonal use waiver for the same vehicle. A subsequent owner of a vehicle with a void seasonal use waiver is eligible for a future seasonal use waiver provided that the subsequent owner is not a member of the immediate family or does not live in the same household as the former owner or operator who violated this code. The owner or operator of a vehicle found to be in violation of this chapter may not operate the vehicle until a valid I/M test has been performed and a certificate of inspection has been issued for the vehicle.

D. Vehicles with seasonal waiver tabs may be operated on special occasions or at special events during the period between November 1 and March 31 only in accordance with a special event permit issued by the I/M program administrator's office. Special events permits may be issued after application by the vehicle owner or the event sponsor not less than ten business days, not including municipal holidays, prior to the event for which operation is requested. The application and the special events permit shall specify the vehicle, vehicle owner, the name, date, time and place of the special event, special event operator of the vehicle, the dates and hours of permitted operation and such other information as may be relevant to the application or required by the I/M program administrator. Where possible, event sponsors may apply for permits for multiple events or multiple vehicles on one application.

(AO No. 93-222(S), § 1, 8-1-94; AO No. 95-118, § 1, 9-1-95; AO No. 99-132, § 2, 11-9-99; AO No. 99-160, § 6, 1-11-00; AO No. 2006-13, § 3, 2-14-06)

Editor's note: The February 14, 2006 effective date of AO 2006-13 was subject to State of Alaska approval of the I/M program amendments pursuant to 18 AAC 52.035, and the state approved on May 15, 2006.

15.80.070 Waiver for show cars. (Repealed)
(AO No. 93-222(S), § 1, 8-1-94; AO No. 95-118, § 2, 9-1-95)

15.80.080. Fine schedule.

In accordance with AS 28.05.151 and AS 29.25.070, citations for the following offenses may be disposed of as provided in AS 12.25.195-.230, without a court appearance, upon payment of the fine listed below:

TABLE INSET:

Code Section	Offense	Penalty/Fine
15.80.010.A	Failure to have current I/M inspection	$200.00
15.80.010.B	Failure to have current I/M inspection--Vehicle fleet	$200.00
15.80.060.C	Operation of a motor vehicle with seasonal use tabs out of season	$300.00

(AO No. 99-132, § 3, 11-9-99)

Chapter 15.85 REQUIREMENTS, SPECIFICATIONS, AND PROCEDURES FOR MOTOR VEHICLE EMISSIONS INSPECTION AND MAINTENANCE (I/M) PROGRAM*

*Editor's note: It should be noted that § 3 of AO No. 2008-84(S), effective July 15, 2008, provides, "Anchorage Municipal Code Chapter 15.85, Requirements, Specifications, and Procedures for Motor Vehicles Emissions Inspection and Maintenance (I/M) program, is reinstated."

15.85.100 Summary.
15.85.200 General I/M program requirements and terminology.
15.85.210 Certificate of inspection.
15.85.220 Vehicles requiring certificate of inspection.
15.85.230 Initial inspections.
15.85.235 Special waivers.
15.85.240 Repairs.
15.85.250 Reinspection.
15.85.260 Fees.
15.85.270 Definitions.
15.85.300 Program administration and enforcement.
15.85.310 I/M program administration.
15.85.315 Powers of the program administrator.
15.85.320 Certified I/M station monitoring.
15.85.330 Disputes and complaints.
15.85.340 Certification and enforcement.
15.85.345 Mechanic and station point system.
15.85.350 Program evaluation and reporting.
15.85.360 Revenues.
15.85.370 Public information.
15.85.380 Certificates of inspection.
15.85.390 Referee facility.
15.85.400 Certification procedures.
15.85.410 Mechanic certification.
15.85.420 I/M station.
15.85.430 Equipment certification.
15.85.440 Mechanic training courses.
15.85.500 Certified I/M station requirements.
15.85.600 Inspection station procedures.
15.85.610 Vehicles to be inspected.
15.85.620 Preliminary inspection and safety check.
15.85.630 Inspection fee quotation.
15.85.640 Test abort conditions.
15.85.650 Beginning official I/M test.
15.85.660 Maintenance and calibration.
15.85.670 Personnel.
15.85.680 Record keeping, etc.
15.85.700 Inspection standards.
15.85.710 Visual and functional checks.
15.85.720 Exhaust emission standards.
15.85.730 Vehicle types.
15.85.740 List of aftermarket parts.
15.85.100 Summary.

A. This chapter contains the requirements, specifications, and procedures for a motor vehicle emissions inspection and maintenance (I/M) program administered by the municipality under Chapter 15.80. The information contained herein is relatively technical in nature and is principally intended for use by the operators of certified I/M stations, certified mechanics, and departmental or contractor staff involved in administering the I/M program. Separate publications are available from the I/M program administration office that describes more concisely the requirements of the program for the general public. The basis for these requirements can also be found in state regulations under 18 AAC 52.

B. Under the I/M program, owners or operators of non-exempt vehicles are required to have their vehicles inspected for emissions problems at least biennially, upon initial registration of a used vehicle in the state, or upon change of ownership if the vehicle is not currently in compliance. Vehicles must be I/M certified prior to the initial registration or renewal of registration by the state department of administration, division of motor vehicles (DMV).

1. Inspections required under the I/M program must be made at a certified I/M station, except under special circumstances. A fee may be charged for the inspections, and vehicles that fail the inspection because of excessive emissions and/or defects in their ECS must be repaired and then retested by a certified I/M station.

2. Repairs required under the I/M program may be performed by anyone, including vehicle owners; however, incentives are provided for the repair of vehicles by certified I/M mechanics working at certified I/M stations. Except for fleet-owned vehicles, vehicles covered by a manufacturer's warranty, and repairs covered by insurance claims, all vehicles are guaranteed to either pass the after-repair test or receive a waiver if they have repairs performed at a certified I/M station. In addition, there are certain specific minimums on the cost of repairs required for all work done by certified I/M stations on vehicles other than those mentioned above. Work done or parts purchased and installed by vehicle owners or at uncertified facilities shall not count toward this cost minimum.

C. The following sections of this document describe in detail how the I/M program is to be conducted.

1. Section 15.85.100 is a summary of this document.

2. Sections 15.85.200 through 15.85.270 describe the general requirements of the program and defines terms that are frequently used in the program.

3. Sections 15.85.300 through 15.85.390 describe the organization and responsibilities of the I/M program administrator and office. This office may be administered by municipal staff, a contractor retained by the municipality for this purpose, or some combination of the two. Included in Sections 15.85.300 through 15.85.390 are the procedures to be used for dispute resolution, program enforcement, public information, program evaluation, and quality control.

4. Sections 15.85.400 through 15.85.440 describe the requirements and procedures used by the I/M program administrator and office for the certification of I/M stations, mechanics and equipment required under the I/M program.

5. Section 15.85.500 contains the detailed requirements that must be met by certified I/M stations.

6. Sections 15.85.600 through 15.85.680 describe all of the vehicle inspection, quality control, and repair procedures that are to be used at certified I/M stations.

7. Sections 15.85.700 through 15.85.740 contain the standards to be used during the inspection of vehicles at certified I/M stations.

D. Modification to the information and requirements contained herein may be made periodically by the I/M program administrator to the extent that such changes are necessary:

1. to reflect changes in state or federal law, or

2. to reflect changes in the specifications of available equipment or vehicles, and

3. to make improvements in inspection and repair procedures that are developed based on I/M program experience.

4. In the event that instrumentation specifications are changed so as to affect the software that is acceptable for use, the manufacturers of EIS used in the I/M program may be required, within the period specified herein, to make software changes to previously certified equipment.

(AO No. 99-160, § 7, 1-11-00; AO No. 2008-84(S), § 7, 7-15-08)

15.85.200 General I/M program requirements and terminology.

A. Sections 15.85.200 through 15.85.270 identify the vehicles which must be tested under the Anchorage I/M program design, the allowable fees for such testing, and which vehicles are exempt from testing. These sections further describe how frequently tests or inspections must be conducted on specific types of vehicles, and the minimum repairs required for vehicles failing tests conducted under this chapter. Section 15.85.270 states the definitions of terms or phrases used throughout this chapter.

B. Citations within this chapter to Section 15.85.200 are intended as a general citation to Sections 15.85.200 through 15.85.270.

(AO No. 99-160, § 7, 1-11-00)

15.85.210 Certificate of inspection.

A. All vehicles requiring a certificate of inspection under Section 15.85.220 shall obtain a certificate of inspection at least biennially. A certificate of inspection required under this chapter may be issued only by the I/M program administrator, the referee facility, or a station certified under Section 15.85.420.

The certificate of inspection shall be a windshield sticker affixed to the lower left side portion of the interior front windshield of a vehicle that has passed an I/M test or has received an I/M waiver or I/M exemption.

B. Visual identification of certificate of inspection

1. The certificate of inspection:

a. must be easy to observe from outside a vehicle;

b. must be of a quality that is difficult to counterfeit, difficult to remove without destroying it, and durable enough to last until the next inspection without fading, peeling, or otherwise deteriorating;

c. shall be affixed on a vehicle at the time of inspection by the certified mechanic who performs the inspection and correspond to the valid electronic record; and

d. may not replace the vehicle registration requirements of state law.

2. The I/M program administrator shall:

a. hold each certified station accountable for all certificates of inspection that were issued to that station by the municipality; and

b. establish procedures in this chapter for appropriate enforcement action to be taken against a station for any windshield certificates of inspection that are missing and cannot be accounted for.

(AO No. 99-160, § 7, 1-11-00; AO No. 2000-92, § 4, 8-15-00; AO No. 2006-13, § 4, 2-14-06)

Editor's note: The February 14, 2006 effective date of AO 2006-13 was subject to State of Alaska approval of the I/M program amendments pursuant to 18 AAC 52.035, and the state approved on May 15, 2006.

15.85.220 Vehicles requiring certificate of inspection.

A. Program area. Vehicles subject to this I/M program are passenger cars and trucks registered, principally used, or principally located, within the following zip codes or any other zip codes assigned to the Municipality of Anchorage by the U.S. Postal Service:

TABLE INSET:

99501	99506
	99511
	99516
	99521
	99567

99502	99507	99512	99517	99522	99577
99503	99508	99513	99518	99523	99587
99504	99509	99514	99519	99524	
99505	99510	99515	99520	99540	

1. A person, including a person in military service, who temporarily resides in Alaska for more than 30 days and who owns or leases a vehicle that is principally located or operated in this I/M area, shall obtain a valid certificate of inspection for that vehicle, even if the vehicle is not required to be registered in Alaska. A temporary resident shall obtain the certificate of inspection within 30 days after entering the state. In addition to the requirements of this section, a motorist who lives in an area where a vehicle emissions inspection and maintenance program (I/M program) is implemented or administered, a motorist whose vehicle is principally located or operated in an I/M area, and a motorist who commutes into the municipality shall use specific maintenance practices for the motor vehicle ECS to reduce air pollution, including the practices described in this chapter.

2. Motorists operating vehicles not subject to the provisions of this section are encouraged to obtain an emission inspection, sticker and repairs as part of the regular maintenance performed on their vehicles.

3. Vehicles powered by diesel engines are required to have a windshield sticker only.

4. New vehicles as defined by B.4. of this section, are required to have windshield stickers

B. Exemptions. Notwithstanding the requirements of Section 15.85.220.A, the following vehicles are exempt from the requirements of the I/M program:

1. any 1967 model year or older vehicle;

2. any vehicle not principally used or located in the municipality and not certificated by the state;

3. motorcycles, golf carts, ATV vehicles, snow machines, and mopeds;

4. a model year 2004 or newer vehicle, except these vehicles shall have their first I/M inspection when the current calendar year equals the vehicle model year plus four years, and subsequent inspections every two years thereafter.

5. all vehicles above 12,000 pounds unladen weight.

6. vehicles that are not registered in the municipality and not operated or located in the municipality for more than 30 cumulative days during the vehicle's registration period.

7. any vehicle solely powered by electric battery.

C. Frequency of inspections. All non-exempt vehicles are required to be inspected in accordance with this chapter.

1. Motorists operating non-exempt vehicles shall obtain a certificate of inspection not more than ninety (90) days prior to initial registration with DMV. Unless specifically approved by the program administrator, non-exempt vehicles shall obtain a certificate of inspection not more than ninety (90) days prior to the registration expiration date.

2. Motorists operating non-exempt vehicles shall have their vehicles inspected at a certified station by a certified mechanic and shall obtain a valid certificate of inspection within thirty (30) days of entering the municipality.

3. Failure to comply with these emission inspection requirements may result in a fine of $50.00 to $1,000.00 as provided under Section 15.05.120A of this title.

D. Transfer of ownership. Sellers of non-exempt vehicles are required to provide buyers of said vehicles with current I/M certificates of inspection or noncompliance. Specifically:

1. Prior to the delivery of the vehicle to the buyer, the seller of a non-exempt vehicle shall provide to the purchaser of the vehicle either:

a. A current I/M certificate of inspection issued not more than two years prior to the date of sale and/or date of delivery to the purchaser; or

b. A certificate of noncompliance, issued pursuant to AS 45.45.400, to provide for a transfer of title only. Certificates of noncompliance are available at the I/M program office. A certificate of noncompliance costs $18.00.

2. Sellers of vehicles sold through an impound sale in accordance with AS 28.10.502, or Sections 9.28.026 and 9.50.020 of this code, are exempt from the above I/M requirement provided:

a. Vehicles are sold without license plates; and

b. Buyers are informed that these vehicles cannot be registered by the DMV until each complies with current I/M requirements and qualifies for a valid certificate of inspection.

3. Failure of sellers to comply with this section requirement may result in a fine of $50.00 to $1,000.00 as provided under Section 15.05.120.A of this code.

(AO No. 99-160, § 7, 1-11-00; AO No. 2000-92, § 5, 8-15-00; AO No. 2006-13, § 5, 2-14-06)

Editor's note: Effective January 1, 2010, pursuant to AO 2008-84(s), § 8, subsection B of this section is amended to read as follows"

A. Program area. Vehicles subject to this I/M program are passenger cars and trucks registered, principally used, or principally located, within the following zip codes or any other zip codes assigned to the Municipality of Anchorage by the U.S. Postal Service:

TABLE INSET:

99501	99506	99511	99516	99521	99567
99502	99507	99512	99517	99522	99577
99503	99508	99513	99518	99523	99587
99504	99509	99514	99519	99524	
99505	99510	99515	99520	99540	

1. A person, including a person in military service, who temporarily resides in Alaska for more than 30 days and who owns or leases a vehicle that is principally located or operated in this I/M area, shall obtain a valid certificate of inspection for that vehicle, even if the vehicle is not required to be registered in Alaska. A temporary resident shall obtain the certificate of inspection within 30 days after entering the state. In addition to the requirements of this section, a motorist who lives in an area where a vehicle emissions inspection and maintenance program (I/M program) is implemented or administered, a motorist whose vehicle is principally located or operated in an I/M area, and a motorist who commutes into the municipality shall use specific maintenance practices for the motor vehicle ECS to reduce air pollution, including the practices described in this chapter.

2. Motorists operating vehicles not subject to the provisions of this section are encouraged to obtain an emission inspection, sticker and repairs as part of the regular maintenance performed on their vehicles.

3. Vehicles powered by diesel engines are required to have a windshield sticker only.

4. New vehicles as defined by B.4. of this section, are required to have windshield stickers.

B. Exemptions. Notwithstanding the requirements of Section 15.85.220A., the following vehicles are exempt from the requirements of the I/M program:

1. Any 1967 model year or older vehicle;

2. Any vehicle not principally used or located in the municipality and not certificated by the state;

3. Motorcycles, golf carts, ATV vehicles, snow machines, and mopeds;

4. A model year 2004 or newer vehicle, except these vehicles shall have their first I/M inspection when the current calendar year equals the vehicle model year plus six years, and subsequent inspections every two years thereafter.

5. All vehicles above 12,000 pounds unladen weight.

6. Vehicles that are not registered in the municipality and not operated or located in the municipality for more than 30 cumulative days during the vehicle's registration period.

7. Any vehicle solely powered by electric battery.

8. Any vehicle with valid historic vehicle or custom collector plates issued by the Alaska Department of Motor Vehicles under AS 28.10.181."

15.85.230 Initial inspections.

A. Vehicles requiring a certificate of inspection that do not qualify for a waiver under Section 15.85.235, or qualify for a waiver and require a prior inspection, shall be inspected at a certified I/M station.

1. All inspections shall be conducted only by certified I/M mechanics and in accordance with the requirements of Sections 15.85.600 and 15.85.700. All vehicles inspected at a certified I/M station shall be issued a vehicle inspection report indicating whether the vehicle passed or failed.

2. Vehicles that meet the inspection standards specified in Section 15.85.700 shall be issued a certificate of inspection.

B. Vehicles that qualify for a waiver under Section 15.85.235 shall be issued a certificate of inspection only by the program administrator or the municipality's referee station.

C. An initial inspection shall be performed at a certified I/M station on a vehicle scheduled for an I/M test or within 90 days of license or registration expiration before the vehicle is subjected to any emission-related repairs for which the charge is more than $30.00.

(AO No. 99-160, § 7, 1-11-00; AO No. 2006-13, § 6, 2-14-06)

Editor's note: The February 14, 2006 effective date of AO 2006-13 was subject to State of Alaska approval of the I/M program amendments pursuant to 18 AAC 52.035, and the state approved on May 15, 2006.

15.85.235 Special waivers.

The following waivers may be issued by either the program administrator or the referee facility:

A. Diesels. No diesel-powered vehicles shall be inspected for emissions defects until such time as the program administrator determines that emissions inspections are necessary and feasible. Upon an initial one-time inspection to ensure that a vehicle is powered by a diesel engine, the program administration office shall notify DMV that the vehicle is exempted from this I/M program and a certificate of inspection is not required for the vehicle for the current and subsequent registration cycles. An exemption issued under this subsection shall be valid until transfer of vehicle ownership. Visual verification that a vehicle with a diesel engine has received a waiver, as required under this paragraph, will be by windshield sticker as defined, where applicable, in Section 15.85.210(A);

B. Special circumstances. Whenever a vehicle cannot be tested due to electrical problems that affect the EIS, or whenever the vehicle is a legally imported or custom-manufactured vehicle that is not recognized by the EIS, a waiver may be approved and a certificate of inspection may be issued for the vehicle by the referee facility. The referee facility may also approve a waiver and issue a certificate of inspection for a vehicle not expected to achieve emission reductions as a result of restoration to manufacturer's specifications. A waiver issued under this subsection shall be valid for one inspection cycle.

C. Outside use. Upon receipt of required documentation, the I/M program administrator may approve a waiver and issue a certificate of inspection for a vehicle registered in, but not operated or located in, the I/M program area. A windshield sticker shall not be issued in conjunction with an outside use waiver. A waiver issued under this subsection shall be valid for one inspection cycle.

1. To qualify for a waiver under this subsection, an applicant shall submit the following information:

a. a notarized application form signed by the applicant;

b. adequate proof that the vehicle is operated or is located in an area outside of the I/M program area.

2. If a vehicle for which an outside use waiver has been obtained returns to the municipality, the waiver becomes immediately void and the vehicle owner shall have the vehicle inspected and certified by a certified I/M station within 30 days of return.

3. The certificate obtained upon return to the municipality and the certificate issued by the I/M program administrator shall both be kept with the vehicle registration in the vehicle.

D. Clean fuel vehicles.

1. Upon inspection to ensure that a vehicle has been modified to use only a clean fuel, which is defined to include natural gas, a fuel that is principally methane, liquefied petroleum gas, or a fuel that is principally propane, a waiver shall be approved and a certificate of inspection issued if the following conditions are met:

a. no ECS devices, other than those approved by the program administrator, have been disconnected or removed from the vehicle;

b. emissions test data are presented at the time of application for the waiver that indicate the vehicle has an idle and part throttle air-fuel ratio that is not richer than stoichiometric; and

c. the vehicle is not a dual-fuel vehicle, as indicated by the absence of a gasoline fuel tank.

2. A waiver issued under this subsection shall be valid for one inspection cycle.

E. Parts unavailability. Upon receipt of required documentation, supplied by the station performing the I/M test and producing the estimate of repairs, the referee may approve a waiver and issue a certificate for a vehicle that cannot be repaired due to the unavailability of parts to repair the vehicle. A waiver issued under this subsection shall be valid for one inspection cycle. For a vehicle to qualify for a waiver under this subsection, the vehicle shall be referred to the referee facility by means of a properly completed referee referral form.

1. The following documentation shall be submitted to the referee facility:

a. A signed and notarized application form completed by the vehicle owner.

b. If available, station-provided proof of parts unavailability. Adequate proof of parts unavailability is:

i. a failed initial I/M test VIR;

ii. an itemized estimate of repairs, excluding the price of the unavailable part;

iii. three sources of information, one of which must be the vehicle dealer, showing that:

iv. the part is no longer available, locally or by order;

v. the names of the parts suppliers queried, one of which must be, and only one may be, the vehicle dealer;

vi. the names of the individuals spoken to at the parts suppliers, and;

vii. the full name and full part number of the unavailable part, if known.

2. The referee facility shall ensure that the documentation submitted is correct, inspect the vehicle, and issue a waiver certificate, as is appropriate.

F. Parts on order. A waiver may also be granted for a vehicle for which repair parts have been ordered through a certified I/M station. A vehicle owner wishing to apply for such a waiver shall submit to the I/M program administrator a signed and notarized application form and;

1. a failed initial I/M test VIR.

2. an itemized estimate of repairs.

3. an itemized work order or invoice and receipt showing full payment for parts and labor paid in advance.

4. This waiver shall be issued by the I/M program administrator. Under no circumstances shall the station refund any funds paid for this purpose without the consent of the I/M office. Within 30 days of receipt of the ordered parts the vehicle owner shall return the vehicle to the I/M station for completion of repairs and an emissions test.

G. Economic hardship. Upon receipt of required documentation, the program administrator may approve a waiver and issue a certificate of inspection for a vehicle that cannot be repaired due to the economic hardship on the vehicle owner. A waiver issued under this subsection shall be valid for one

inspection cycle, and may only be issued once for a vehicle, as specified under 18 AAC 52.060(d)(1). For a vehicle to qualify for a waiver under this subsection, a signed and notarized application form must be submitted by the vehicle owner, along with adequate proof of economic hardship. A waiver may be granted upon verification of economic hardship.

H. Gray market vehicles. Repair cost minimums for vehicles imported into the U.S. and not manufactured specifically for import into the U.S. nor retrofitted to U.S. standards (referred to as gray market vehicles) shall be the same as vehicles manufactured in the U.S. However, these vehicles are not always required to have the ECS required for U.S. vehicles. All I/M tests on gray market vehicles shall be performed by the referee facility and repairs performed as required by the referee facility.

(AO No. 99-160, § 7, 1-11-00; AO No. 2000-92, § 6, 8-15-00; AO No. 2006-13, § 7, 2-14-06)

Editor's note: The February 14, 2006 effective date of AO 2006-13 was subject to State of Alaska approval of the I/M program amendments pursuant to 18 AAC 52.035, and the state approved on May 15, 2006.

15.85.240 Repairs.

A. Repairs. Emission repairs performed at a certified I/M station are required to be performed in accordance with the procedures specified in Section 15.85.600.

1. Except for certain vehicles as specified in Section 15.85.240.D, repairs done at a certified I/M station shall be performed until the total cost of emission-related repairs meet or exceed the repair cost minimum criteria for non-tampered vehicles specified in Section 15.85.240.B.

2. Except as specified in Section 15.85.240.C, additional repair work done at a certified I/M station is voluntary. There shall be no credit towards the repair cost minimum on repairs done at a non-certified I/M station. Vehicles that qualify for a waiver under Section 15.85.240.B shall be issued a certificate of inspection only by the program administrator or the referee facility.

B. Repair cost minimum criteria for non-tampered vehicles. Except for those vehicles listed in Section 15.85.240.C, the cost minimum criteria for emissions repairs shall be $450.00 for the correction of all non-tampering emissions-related defects. The program administrator or the referee facility shall approve a repair waiver and issue a certificate of inspection for a non-tampered vehicle upon presentation of valid evidence showing that:

1. Emissions repairs were done at a certified I/M station and

2. The last increment of repair work performed caused the total cost of all emissions repairs to exceed $450.00. A minimum of $450.00 must be spent.

3. If a certified I/M mechanic determines that parts are unavailable for one or more repairs, the motorist shall complete those repairs for which parts are available up to the repair cost minimum. If all repairs have been made except for those repairs for which parts are unavailable, the motorist may apply for a part unavailable waiver as prescribed in 15.85.235.E.

C. Vehicles subject to full repair. Notwithstanding the repair cost minimum criteria contained in Section 15.85.240.B, all emissions repairs must be made on the following categories of vehicles, regardless of cost:

1. a vehicle subject to tampering;

2. a vehicle owned by a fleet operator of ten or more vehicles;

3. a vehicle whose repair is covered by either an insurance claim or a manufacturer's warranty; and

4. a vehicle held by a motor vehicle dealer for retail sale.

(AO No. 99-160, § 7, 1-11-00)

15.85.250 Reinspection.

A. All failed vehicles must be reinspected after repairs are performed. Except for the vehicles listed in Section 15.85.240.C, a vehicle that passes the reinspection or that fails the reinspection after having repairs performed at a certified I/M station that cost at least as much as the applicable repair cost minimum criteria specified in Section 15.85.240.B shall be issued a certificate of inspection.

B. Vehicles listed in Section 15.85.240.C shall require all repairs necessary to pass the reinspection.

(AO No. 99-160, § 7, 1-11-00)

15.85.260 Fees.

A. Inspection fees.

1. The total fee charged the owner for an emissions inspection shall not exceed $50.00, not including the cost of the certificate of inspection, unless the program administrator has adjusted the $50.00 limit to reflect changes in the consumer price index that have occurred since the adoption of the BAR-90 I/M program by the municipality.

2. A certified I/M station shall not charge a fee in excess of $18.00 for a certificate of inspection, unless the program administrator has adjusted the cost of the certificate of inspection to reflect changes in the cost of administering the I/M program.

B. Allowable fees. In general, a fee may be charged by a certified I/M station whenever a vehicle is inspected for the first time at the certified station during an inspection cycle. Except as provided in Section 15.85.260.C, a certified I/M station may charge for the following inspections:

1. an initial inspection performed by the certified station;

2. a subsequent initial inspection performed at the certified station on a vehicle that has had a previous initial inspection performed at a different certified station; and

3. a subsequent initial inspection performed at the certified station on a vehicle that has had an initial inspection, and on which emission-related repairs have been performed by the vehicle owner or a non-certified mechanic, or at a non-certified station.

C. Prohibited fees. Notwithstanding the provisions of Section 15.85.260.B, no fee shall be charged for the following inspections:

1. an inspection performed at a certified I/M station after repairs have been performed on the vehicle at that facility;

2. an inspection of a documented vehicle brought to a certified I/M station by program administration staff or other individuals designated by the program administrator for an overt performance audit of the certified I/M station or a certified I/M mechanic; and

3. an aborted test, unless the test has been requested by the customer for purposes other than obtaining a certificate of inspection.

(AO No. 99-160, § 7, 1-11-00)

15.85.270 Definitions.

ADEC means State of Alaska, Department of Environmental Conservation.

After market part means a part that is not manufactured by the original equipment manufacturer.

After-repair test or A test means an I/M test performed after an I/M repair.

Alaska 2000 means the state's inspection and maintenance program beginning in year 2000, incorporating:

A. an EIS to test vehicles and vehicle on-board diagnostic (OBD) systems,

B. an electronic transmission (ET) system to capture, process, and transmit vehicle and test data, and

C. windshield stickers as a visual cue that the vehicle has passed an inspection or has received a waiver; "alternate fuel" means a fuel other than gasoline or diesel fuel used to power a motor vehicle; "alternate fuel" does not include an oxygenated fuel approved for use under 18 AAC 53; "Anchorage I/M Program Design" means this document containing the procedures, specifications, requirements, and standards for a motor vehicle inspection and maintenance (I/M) program administered by the municipality.

BAR means California Bureau of Automotive Repair.

CARB means California Air Resources Board.

Certificate of inspection means a windshield sticker or an electronic file version of the certificate automatically transferred to DMV for registration of the vehicle by phone or internet, issued to a motorist whose vehicle has received a waiver; or whose vehicle passed the required I/M test. The windshield sticker shall be affixed to the vehicle passing an I/M test or receiving a waiver.

Certified I/M mechanic means a mechanic who has met all of the program administrator's requirements for certification and who has been issued a certificate by the program administrator.
Certified I/M station means a facility certified by the program administrator for the performance of emission tests and other inspections related to determining whether a vehicle passes or fails the inspection standards contained in the I/M program design. Certified I/M stations are also certified for the performance of emission repairs.
Commute means to travel between a person's residence and an I/M area for purposes of work or school.
Compliance rate means the number of vehicles that obtain initial inspections under an I/M program during one year, divided by the estimated number of vehicles that should have been inspected during the year.
Cost minimum means the amount paid by a motorist for emissions-related repairs, performed by a certified mechanic to program manual specifications, as the result of an I/M test required under this chapter.
Covert performance audit means an undercover audit conducted by the municipality or its contractor to evaluate the performance of a certified I/M mechanic or certified I/M station without the knowledge of the mechanic or station.
Documented vehicle means a vehicle whose state of emission repair has been verified by referee facility staff, and which is taken to a certified I/M station for an overt or covert performance audit of the certified I/M station or a certified I/M mechanic.
Dual fuel vehicle means a vehicle that is capable of operating on gasoline as well as on propane or some other alternate fuel.
Emission control system (ECS) means any element of either the air pollution control system or other mechanism of a motor vehicle that affects release of air pollutants from the vehicle.
Emission inspection means a vehicle inspection performed at a certified I/M station, which includes a visual and functional check of certain emission control systems, an OBD II check, and the measurement of tailpipe emission concentrations.
Emission inspection system (EIS) means the system approved by ADEC and used at a certified I/M station to measure and record vehicle exhaust emissions. Elements of the EIS include exhaust gas sampling, conditioning, OBD II testing and analysis equipment and computer control for such equipment.
Emission repairs means I/M repairs done only for the purpose of correcting emissions problems.
EPA means the United States of America, Environmental Protection Agency.
Federal test procedure means the emission testing procedure used by the EPA to certify new motor vehicles to applicable federal emission standards.
Fleet operator means the owner of ten or more vehicles that are subject to the I/M program.
I/M program means a program conducted in accordance with the I/M program design under which all non-exempt motor vehicles registered or principally used or located in the Municipality of Anchorage must be inspected for compliance with the inspection standards specified in the I/M program design and repaired if the standards are not met or if illegal modifications to the ECS have been made.
I/M program administration office, program administrator's office and I/M office mean the office within the department of health and human services under the direct supervision of the program administrator that is responsible for the administration and enforcement of all aspects of the I/M program.
I/M program administrator means that municipal employee assigned responsibility by the director of the department of health and human services for enforcement of chapters 15.80 and 15.85.
I/M repair means all maintenance of and repairs to motor vehicles performed for the purpose of satisfying the requirements of the I/M program.
I/M test means a vehicle emissions inspection, performed at a certified station, which includes a visual and function inspection of the ECS, an inspection of the vehicles' OBD system, where applicable, and the measurement of tailpipe emissions.
Initial inspection means the first emission inspection performed on a vehicle at all certified I/M stations during an inspection cycle. A vehicle would have only one initial inspection per inspection cycle, that being the inspection that occurred at the certified I/M station that first inspected the vehicle.
Inspection cycle means the complete sequence a vehicle undergoes from an initial inspection through the issuance of a certificate of inspection.

Kit car or custom manufactured vehicle means a vehicle built for personal use, that is not intended for resale purposes, and that has not been certified by either the EPA to meet federal motor vehicle emission standards or the CARB to meet California motor vehicle emission standards.
Certificated (vehicle) means a vehicle assigned unique certificate plates (two) issued by DMV with a matching registration that includes a record of a current or expired certificate plate year tab number.
Licensed (vehicle) means a vehicle assigned a unique license plate issued by DMV with a matching registration including a record of a current or expired license plate year tab number.
Loaded mode mass emissions test procedure means a standard test cycle in which a chassis dynamometer is used to subject the vehicle's engine to increased load that simulates the vehicle's performance under actual in-use operating conditions, while measuring the weight of pollutants emitted per mile of travel.
Malmaintenance means the failure to maintain a vehicle's ECS or emissions-related parts according to manufacturer specifications, as required under 18 AAC 52.030. This may include the failure to maintain a part whose malfunction causes an emissions-related part to fail.
Motor vehicle dealer means a person engaged in buying, selling or dealing in new or used motor vehicles, trailers, or semi-trailers in the State of Alaska, that is required under 08 AAC 66.010 to register biennially with the state department of public safety.
Municipality or MOA means the Municipality of Anchorage.
Nonattainment area means an area that does not meet the national ambient air quality standard for carbon monoxide.
OBD Test means an I/M inspection on a 1996 or newer model year vehicle equipped with a manufacturer-installed on-board diagnostic system.
Overt performance audit means an audit conducted by the municipality or its contractor to evaluate the performance of a certified I/M mechanic or certified I/M station during which the mechanic and station owner are told they are being audited.
Person means any individual, firm, partnership, association, or corporation.
Prescreening means to visually, functionally or otherwise inspect a vehicle before initiating an I/M test and without recording and reporting the results of the inspection to the I/M office but does not include a pre-test safety check.
Principally located means a vehicle, regardless of where it is registered, that is located or operated within the Municipality of Anchorage for more than 30 cumulative days during the vehicle's registration period.
Principally used means a vehicle used within the Municipality of Anchorage, regardless of where it is registered. This definition would include a vehicle used to regularly travel from a residence address outside of the municipality to within the municipality for work or school purposes.
Program administrator means the head of the municipality's Inspection and Maintenance (I/M) Program Administration Office.
Referee facility means a vehicle test facility operated by the municipality or its contractor for the purpose of resolving disputes between motorists and certified I/M stations, issuing I/M program waivers, or performing other tasks as delegated by the I/M program administrator.
Registration or Registered (vehicle) means a registration record, computer or hard copy, issued by the State of Alaska Division of Motor Vehicles (DMV) from an application submitted by the vehicle owner. The record discloses information on the specific vehicle including, but not limited to, the license number, vehicle identification number, the registered owner(s) name, residence and mailing address and the expiration date of the license plates.
Repair cost minimum means the minimum amount of money motorists are required to spend on emissions repairs under the I/M program, before they can apply for a repair waiver, provided the repairs are performed by a certified I/M mechanic at a certified I/M station after the completion of an initial inspection. There is no repair cost minimum that applies when repairs are performed by someone who is not certified by the I/M program administrator. The cost of repairs necessary to correct safety problems does not count toward the repair cost minimum.

Safety repairs means I/M repairs done to correct safety-related defects, such as fuel leaks, that prevent a vehicle from being safely inspected or safety defects that are specifically prohibited under the inspection procedures and standards established for the program.

Tampering means using leaded gasoline in a vehicle originally equipped with catalytic converters; failing to maintain a vehicle's ECS or emission-related parts according to manufacturer specifications, including the failure to maintain a part, the malfunction of which causes an emissions-related part to fail; or to remove, disconnect, or modify any ECS or emissions control component that affects exhaust emissions that is not specifically authorized by manufacturer service bulletins or the program administrator; causes the vehicle to be different from its EPA-certified configuration.

Unauthorized or illegal modifications means the use of leaded gasoline in a vehicle originally equipped with a catalytic converter; to remove, disconnect, modify or tamper with an ECS or components; the use of a replacement emissions-related part that is not functionally equivalent to the original equipment part being replaced; or the use of any added part or system unless that part or system has been specifically approved for use by the EPA, the CARB, or by the municipality.

Unladen weight means the shipping weight (in pounds) of a vehicle as initially manufactured with fuel tanks and cargo area empty. DMV lists this weight, when available, on the vehicle registration. Unladen weight is not the same as gross vehicle weight (GVW), which is the maximum amount the vehicle may weight when loaded.

U.S. means the United States of America.

Vehicle inspection report (VIR) means the computer-generated form that contains the results of the inspection and is given to each motorist whose gasoline-powered vehicle is tested at the certified I/M station.

Voluntary repair means emissions or safety repairs that are not required under the I/M program but that a motorist chooses to have performed anyway.

Waiver means an exemption to the requirements of the I/M program that may be issued to a vehicle by the program administrator or the referee facility. A waiver is valid for one inspection cycle.

(AO No. 99-160, § 7, 1-11-00; AO No. 2000-92, § 7, 8-15-00; AO No. 2006-13, § 8, 2-14-06)

Editor's note: The February 14, 2006 effective date of AO 2006-13 was subject to State of Alaska approval of the I/M program amendments pursuant to 18 AAC 52.035, and the state approved on May 15, 2006.

15.85.300 Program administration and enforcement.

A. Sections 15.85.300 through 15.85.390 describe how the municipality will implement and enforce the Anchorage I/M program design. This section sets out the authority of the I/M program administrator to enforce compliance with this chapter, the manner in which the program administrator will determine when sanctions are required and the nature of such sanctions. and the manner in which an appeal of a decision by the program administrator may be taken.

B. Citations within this chapter to Section 15.85.300 are intended as a general citation to Sections 15.85.300 through 15.85.390.

(AO No. 99-160, § 7, 1-11-00)

15.85.310 I/M program administration.

A. There is in the municipality an I/M program administration office under the supervision and control of the I/M program administrator. The program administrator shall report to the mayor through the department of health and human services, which is assigned responsibility for the implementation of the I/M program.

B. The duty of enforcing and administering the I/M program is vested in the program administrator.

1. Any appeals of the I/M program administrator decision(s) shall be to the municipal administrative hearings officer and shall be in accordance with Chapter 3.60.

2. Appeals of the hearing officer's decisions shall be taken to the state superior court in Anchorage.

C. A voluntary I/M task force shall be appointed by the director of the department of health and human services. The purpose of the I/M task force is to:

1. Support and promote I/M industry participation in the air quality planning process and submit recommendations on planning proposals developed by the air quality planning staff that affects the I/M industry.

2. Provide input and comments to the I/M program office on proposed enhancements to the I/M program design document other operational changes aimed to improve the effectiveness of the I/M program.

D. Bylaws governing the scope and duties of the task force shall be submitted by the task force to the director for approval.

(AO No. 99-160, § 7, 1-11-00)

15.85.315 Powers of the program administrator.

The I/M program administrator is delegated all powers described in this I/M program design, including but not limited to those powers specifically enumerated in this chapter. Every power granted to or duty imposed upon the program administrator in this chapter may be exercised or performed in the name of the program administrator by other municipal I/M staff members or contractor personnel, subject to such conditions and limitations as the program administrator may prescribe and the director approve.

(AO No. 99-160, § 7, 1-11-00)

15.85.320 Certified I/M station monitoring.

A. The I/M program administrator is the representative of the municipality for the purposes of monitoring and enforcing the requirements for certified I/M stations.

B. The program administrator shall routinely conduct inspections of the certified I/M stations to ensure that all program requirements are being met.

1. The program administrator may, within the appropriated I/M program budget, spend such moneys as required to send vehicles (e.g., those used for overt and/or covert performance audits) through certified I/M stations to determine whether they are being properly inspected and repaired.

2. The program administrator may perform such other inspections (e.g., taxi inspections at the referee facility), quality control checks and monitoring of performance as the program administrator believes necessary, including, but not limited to, statistical analyses and reporting of inspection data, monthly, quarterly, annual, and/or other special audits at each station. Audits to meet EPA requirements including annual overt and/or covert mechanic and station performance audits, and quarterly EIS gas calibration audits. Work in progress performance audits, and tests in progress performance audits may include review of I/M documentation packages, I/M documentation filing and storage procedures, and inventory of certificates.

3. The program administrator may contract for the analysis of data received from the certified I/M stations, and for such other assistance as the program administrator deems to be in the best interest of the MOA.

C. Access to station. Persons designated by the I/M program administrator shall be allowed to conduct I/M related investigations in certified I/M stations at any time during normal business hours, subject to I/M program procedures. The station shall provide required documentation as soon as reasonably possible. In any case, such documentation shall be provided within 24 hours or one business day from the time requested.

D. Access to EIS. Except when a test or repair using the EIS is in progress, the owner or operator of a certified station or a certified mechanic shall provide immediate access to the EIS to a representative of the I/M program to perform any check, reprogramming, disk change, or other system related inspection, modification or service. If a test or repair is in progress, the owner, operator or mechanic shall provide access to the EIS when the test or repair is completed, or within one hour of the request for access, whichever occurs first.

(AO No. 99-160, § 7, 1-11-00)

15.85.330 Disputes and complaints.

A. The program administrator shall, on his or her own initiative or in response to complaints, investigate on a continuous basis and gather evidence of violations of the requirements of the I/M program by any certified I/M station or by any employee, partner, officer, or member of a certified I/M station.

B. The program administrator shall establish procedures for accepting complaints from the public against I/M stations or employees of the stations.

C. The program administrator may suggest measures that, in the program administrator's judgment, would compensate for any damages suffered as a result of an alleged violation. If the parties accept the suggestions and perform accordingly, such fact shall be given due consideration in any subsequent disciplinary proceeding.

(AO No. 99-160, § 7, 1-11-00)

15.85.340 Certification and enforcement.

A. The I/M program administrator is responsible for the management and supervision of the mechanic, equipment, and I/M station certification procedures contained in Section 15.85.400 of the I/M program design document.

1. The program administrator shall keep a complete record of all certified I/M stations showing the names and addresses of all such facilities. A copy of the roster shall be made available to any person requesting it.

2. The program administrator shall send to each certified I/M station, at least quarterly, a newsletter which may describe recently adopted ordinances, procedure changes, disciplinary hearings, and any other information that the program administrator shall determine will assist the municipality in its administration of the I/M program.

3. The I/M program administrator shall maintain a list of the manufacturers of all equipment certified for use in the I/M program and shall make such list available to the public at the I/M program administration office. This office shall also provide information to the public regarding the location and schedules of certified training courses.

B. The program administrator may conduct such investigations and hearings as he or she believes are necessary to enforce the requirements imposed upon certified I/M mechanics and certified I/M stations under the I/M program design.

1. Such investigations may include both overt and covert performance audits of certified stations and mechanics by I/M program administration staff or other individuals designated by the program administrator.

2. Program administration staff or other individuals designated by the program administrator are under no obligation to identify themselves during covert investigations or audits of certified stations or certified mechanics.

C. Suspension or revocation of certification.

1. The program administrator may suspend or revoke the certification of any I/M mechanic, I/M station, or EIS (emissions analyzer) upon a determination that program requirements are repeatedly or egregiously being violated.

2. The program administrator may also suspend or revoke the certification of any I/M mechanic or I/M station for flagrant violations of program requirements observed during overt or covert performance audits.

3. Such violations may include intentionally omitting required inspection or repair procedures, telling a vehicle owner that repairs not required by the I/M program must be made to the vehicle to pass the I/M test, or using excessive time in inspecting a vehicle brought in for emission testing by program administration staff or other individuals designated by the program administrator.

4. An inspection time in excess of 60 minutes shall be considered excessive for the purposes of this section.

5. The program administrator shall also suspend or revoke the certificate of any mechanic who, in any 24-month period, accumulates 12 or more misconduct points.

6. The program administrator shall also suspend or revoke the certificate of any station which employs only one I/M certified mechanic and, in any 24-month period, accumulates 12 or more misconduct points. Stations that employ more the one I/M certified mechanic shall be allowed an additional four points per I/M mechanic employed, up to a limit of 24 points.

D. Unintentional violations.

1. If the program administrator determines that violations of program requirements are the result of misunderstandings, he or she shall provide a written notice of the violation but shall not suspend or revoke certification unless similar violations continue to occur subsequent to such written notice.

2. Continued violation of program requirements may result in a monetary fine as provided under Sections 15.05.120.A and 15.05.120.B. If continued violation of program requirements occurs subsequent to such written notices and/or fines, the program administrator may suspend certification for a period of 30 days.

3. If similar violations re-occur after the suspension period, certification may again be suspended for a period of up to one year, or revoked. Revocation of certification shall be for a period of one year, after which period, certification may be reinstituted upon a finding by the program administrator that the violations are unlikely to continue.

E. Compensatory measures.

1. If the program administrator determines that violations of program requirements are the result of misunderstandings, he or she may, in addition to or in lieu of suspending or revoking the certification of a certified I/M mechanic or certified I/M station, require the mechanic or station to implement certain measures that, in the program administrator's judgment, would compensate for any damages suffered by the Municipality or individual motorists as a result of a violation of program requirements.

2. The program administrator may immediately suspend the certification of a certified mechanic or certified station for a period of 30 days upon a determination that the measures prescribed under this section are not being implemented in an expeditious manner.

3. The program administrator may revoke certification for a period of one year if the prescribed measures are not implemented during or immediately after the suspension period.

F. Intentional violations.

1. If the program administrator determines that violations of program requirements are intentional, he or she shall immediately suspend certification of a certified I/M mechanic or a certified I/M station for a period of 30 days.

2. The program administrator shall revoke certification of a mechanic or station for a period of one year if deliberate violations of program requirements continue after the suspension period.

G. Certificate surrender.

1. Upon suspension or revocation of certification, the individuals or organizations whose certification has been suspended or revoked shall cease doing business as certified individuals or organizations. In the event the suspension or revocation of the certification of an I/M station is for more than a 30-day period,

a. the station shall surrender all unused certificates of inspection to the program administrator, and

b. the program administrator shall refund the money initially paid for the certificates in accordance with the standard financial procedures used by the MOA.

2. The station shall also remove any sign indicating that the station is a certified I/M station.

(AO No. 99-160, § 7, 1-11-00)

15.85.345 Mechanic and station point system.

The mechanic and station point system is established for tracking and improving the performance of mechanics and stations.

A. The I/M program administrator shall assess points against mechanics and/or stations based on the following graduated system of misconduct points, assessing increasing points for more severe violations of program requirements.

TABLE INSET:

TYPE OF VIOLATION	MECHANIC	STATION
Documentation	2 points	2 points
Equipment	2 points	2 points
Procedural	2 points	2 points
Testing	4 points	4 points
Repair	4 points	4 points
Unintentional violations	4 points	4 points
Fraud	12 points	24 points
Intentional violations	12 points	24 points
Distributing or appropriating certificate(s) of inspections without testing the vehicle.	12 points	24 points

1. Station violations of "Allowing or failing to prevent mechanic violations" shall result in the following points assessed against the station:
   a. On the first violation by the mechanic, no station points shall be assessed.
   b. On the second and third violation by the mechanic, station points shall be assessed in the amount of half those assessed against the mechanic.
   c. On the fourth and subsequent violations by the mechanic, station points shall be assessed in the amount equal to those assessed against the mechanic.
2. The administrator shall suspend or revoke the certificate of any mechanic or station in accordance with Sections 15.85.340.C.5 and 15.85.340.C.6 above.
3. Points assessed on a violation of a covert audit on a documented vehicle shall not exceed four points except when fraud is involved.

B. Fines. A monetary fine of $75.00 may be imposed for a violation of program requirements, in addition to points assessed, as provided under Section 15.05.010.F and Section 14.60.020.

C. Notification. Each mechanic and/or station against which misconduct points or fine is assessed shall be notified in writing by the program administrator. The assessment notice shall include but shall not be limited to:

1. the name and I/M mechanic number or station number,
2. an explanation of the offense,
3. the authority for assessing the points,
4. the number of points and/or the amount of the fine(s) being assessed,
5. the total number of points accumulated,
6. point suspension warning,
7. notice of possible point redemption,
8. effective date of assessment, and
9. the name and I/M administration office telephone number of the inspector who issued the assessment.

D. Term(s) of suspension(s) and revocation.

1. The program administrator shall suspend the certificate of a mechanic or station for up to:
   a. 30 days for the first suspension;

b. 90 days for the second suspension;

c. one year for third and subsequent suspensions.

2. The program administrator shall consider second and subsequent suspensions as a first suspension if the violation being considered is more than 24 months since the effective date of the previous suspension.

3. Any mechanic or station having their certificate revoked shall not be issued a new certificate by the I/M program administrator for at least one year after the effective date of revocation.

4. Any mechanic or station which has had an I/M program certificate revoked at any time, shall not be issued a new certificate by the program administrator unless the mechanic or station qualifies for certification under Section 15.85.400 through 15.85.440 based solely upon tests and/or inspections after the date of revocation, and posts a performance bond in value and with terms satisfactory to the I/M program administrator, but in no case less than:

a. $10,000.00 for mechanics seeking a certificate within five years of the effective date of a revocation;

b. $25,000.00 for stations seeking a certificate within five years of the effective date of a revocation.

5. The performance bond requirement of Section 15.85.345.D.4 shall be set aside by the I/M program administrator if the mechanic or station receiving a certificate under that section performs I/M program inspections and/or repairs for a period of at least one year without more than two points being assessed for violations of this chapter.

E. Redeeming points. The I/M program administrator shall remove points from a mechanic's or station's records in the following circumstances:

1. a 24-month period has passed since the points were assessed;

2. if the mechanic or station certificate is suspended, one-half of the accumulated points;

3. if the program administrator has not notified the mechanic or station of a proposed suspension within 30 days of the mechanic or station becoming eligible for suspension, one-half of the points;

4. if the mechanic successfully completes a training class approved by the program administrator, two points, to a maximum of four points per year;

5. at the discretion of the program administrator, fine(s) may be assessed in lieu of points;

6. an appropriate number of points resulting from a successful appeal;

7. if a station sponsors a program administrator-approved training class for I/M mechanics, two points, to a maximum of four points per year shall be removed from the station total;

8. if a station has an employee involved in a station violation, two points per attendee to a maximum of eight points for the station, shall be removed if the employee successfully completes a class approved by the program administrator; or

9. if a mechanic or station successfully completes a covert audit on a documented vehicle, the mechanic shall have two points removed and the station shall have one point removed.

F. Appeal. An NOV, citation, and/or assessment shall be effective ten days from date of service on the station or mechanic either by physical delivery to the certified I/M station where the alleged violation occurred, or by mailing to that station via certified mail, return receipt requested. The mechanic and/or station may appeal by responding in writing to the I/M program administrator within ten days of the date of receipt. The appeal process may consist of an informational inspector conference, an office conference with the program administrator, and/or an administrative hearing pursuant to Chapter 3.60 before the municipal administrative hearing officer. Appeals of the hearing officer's decisions shall be taken to State of Alaska Superior Court in Anchorage. The mechanic and/or station appealing is encouraged to begin the appeal process with an informational inspector conference. For further information on appeals, see Section 15.85.310.B.

G. Suspension and revocation. The I/M program administrator shall use the following procedures to suspend or revoke the certificate of a mechanic or station:

1. The document(s) appropriate to the disciplinary action taken, the notice of violation (NOV), notice of NOV appeal rights, notice of misconduct points assessment, notice of fine assessment, notice of fine assessment appeal rights, notice of certificate suspension, notice of suspension appeal rights, notice of certificate revocation, and/or notice of certificate revocation appeal rights, as appropriate, shall be delivered to the station and/or mechanic by certified mail with return receipt requested to the station where the alleged noncompliance occurred, or personally delivered by a person designated to do so by the I/M program administrator.

2. All indicated disciplinary actions (points, fines, suspension, and/or revocation) shall be effective ten days from date of mailing or delivery as required above, except for suspension or revocation pursuant to Section 15.85.345.L.2. If an appeal is filed prior to the effective date, the indicated disciplinary action shall be held in abeyance until the appeal process is completed.

H. Records. The I/M program administrator shall keep records of:

1. points assessed and date assessed for each mechanic and station for all disciplinary actions;

2. such records shall be kept in the appropriate mechanic and/or station file, for a minimum period of two years.

I. Hearing. The I/M program administrator shall not suspend a mechanic's or station's certificate without providing notice and an opportunity for a hearing as required above.

J. Notification. The I/M program administrator shall notify the mechanic and/or station 30 days before a scheduled hearing to suspend or revoke a certificate, the notice to the mechanic and/or station shall include, but is not limited to:

1. the name and address of the mechanic or station;

2. the reason(s) for the proposed suspension or revocation, including how and when points were assessed;

3. the date of the hearing;

4. the length of the proposed suspension; and

5. an explanation of the mechanic's or station's appeal rights and appeal procedures.

K. Reasons for suspension or revocation. In determining whether or not to suspend or revoke a certificate, the program administrator shall consider:

1. the number of points accumulated and the time it took to accumulate the points;

2. the nature of the offenses and the damage that the offenses could cause to the public, the environment, and/or the program; and

3. any mitigating circumstances.

4. In addition to the other basis for revocation set out in this chapter, the program administrator shall revoke a certificate upon finding that the disciplinary action of suspension is inadequate to protect the public or meet the goals of the I/M program. Such finding, and the factual basis supporting it shall be made in writing, a copy of which will be provided to the certificate holder with the notice of certificate revocation.

L. Effective date.

1. If the mechanic or station does not timely respond and file a request for a hearing, the suspension or revocation shall take effect ten days from the date of delivery of the notice.

2. If the mechanic or station requests a hearing but does not attend the hearing and, after the hearing, the I/M program administrator or administrative hearing officer decides to suspend the certificate, the suspension shall take effect five days after the date of the hearing.

(AO No. 99-160, § 7, 1-11-00)

15.85.350 Program evaluation and reporting.

A. The I/M program administrator shall routinely evaluate the effectiveness of the I/M program through the analysis of data obtained from certified I/M stations and through special studies. The program administrator, with the approval of the director of health and human services and in a manner consistent

with Title 7, may contract for the analysis of data necessary to prepare the program evaluation reports required under this section.

B. The program administrator shall prepare and submit a report to the mayor and the assembly on the status and the effectiveness of the I/M program not less than once per year. A copy of this report shall be retained by the program administrator for at least two years after submission to the mayor and be made available at the I/M program administration office for review by the general public.

C. The program administrator shall prepare and submit an annual report to the ADEC consistent with the reporting requirements of 18 AAC 52.037.

(AO No. 99-160, § 7, 1-11-00; AO No. 2006-13, § 9, 2-14-06)

Editor's note: The February 14, 2006 effective date of AO 2006-13 was subject to State of Alaska approval of the I/M program amendments pursuant to 18 AAC 52.035, and the state approved on May 15, 2006.

15.85.360 Revenues.

All fees and revenues collected pursuant to this chapter and Chapter 15.80 shall be deposited into a municipal account. The program administrator shall report the amount and source of all fees and revenues received according to general municipal financial reporting procedures, through the municipal financial information system.

(AO No. 99-160, § 7, 1-11-00)

15.85.370 Public information.

The I/M program administrator shall provide information materials to assist the public in understanding and complying with the requirements of the I/M program. At a minimum, these materials will be made available at the I/M program administration office.

(AO No. 99-160, § 7, 1-11-00)

15.85.380 Certificates of inspection.

A. The I/M program administrator shall sell certificates of inspection stickers to certified I/M stations in quantities of 25 or multiples thereof. The amount charged for the certificates shall be sufficient to support the activities of the I/M program plus related air quality programs as proposed by the director of health and human services and approved by the assembly. The I/M program administrator shall issue a refund to a certified I/M station for each replacement sticker sold and installed according to 15.85.380.E below.

B. Authorization form. An authorization form furnished by the municipality, allowing an individual(s) to purchase stickers for a station must be completed and on file at the I/M office prior to any actual request for stickers. This authorization form must include the printed name, the signature, and the Alaska drivers license number of the person(s) designated. All entries on the authorization form must be clearly legible in the opinion of the I/M program administrator, or the form may be rejected and sales refused.

C. Each sticker shall contain a unique serial number and the program administrator shall keep track of the serial numbers of certificates that are sold to each certified I/M station. Stickers shall be printed using such paper, colors, or patterns as necessary to minimize the risk of forgery. The design of the stickers shall be determined in consultation with other I/M program administrators in Alaska and DMV. The design and/or color of the stickers shall be changed from time to time as may be necessary in the opinion of the I/M program administrator to minimize the use of forged certificates.

D. Whenever the design or color of a sticker is changed, certified I/M stations shall be able to exchange unused stickers for new stickers at no charge, or moneys shall be refunded for unused stickers.

E. Certified I/M stations shall sell replacement stickers for vehicles that have had the current sticker destroyed. The certified I/M station shall require proof that the current sticker has been destroyed. This proof may include pieces of the sticker with identifying numbers or a receipt showing the windshield has been replaced. After receiving satisfactory proof the mechanic shall follow the instructions on the EIS, issue the new sticker, and install the sticker on the windshield.

(AO No. 99-160, § 7, 1-11-00; AO No. 2000-92, § 8, 8-15-00; AO No. 2006-13, § 10, 2-14-06)

Editor's note: The February 14, 2006 effective date of AO 2006-13 was subject to State of Alaska approval of the I/M program amendments pursuant to 18 AAC 52.035, and the state approved on May 15, 2006.

15.85.390 Referee facility.

A. The I/M program administrator, either directly or through a contractor, shall maintain and operate a vehicle test facility, hereinafter referred to as the referee facility.

1. The referee facility shall be used to determine if a repair cost waiver or other special waiver should be issued for a vehicle, and to assist in the resolution of disputes between motorists and certified I/M stations.

2. The referee facility shall also be used to inspect vehicles that have been rejected from testing at certified I/M stations because of engine or fuel changes, and to provide other services to the general public as delegated by the program administrator. Subject to the approval of the program administrator, the referee facility may charge a fee of up to $50.00 plus the cost of a certificate, if issued, for inspecting a vehicle not previously inspected.

3. The facility shall be equipped with instrumentation and other equipment and supplies necessary to determine whether a vehicle passes or fails an inspection test performed in accordance with Section 15.85.600.

4. A motorist referred to the referee facility may call the facility to make an appointment for an emission inspection. Inspections may also be performed without appointment on a time-available basis.

B. Repair cost waiver. Upon referral by a certified I/M station, a motorist may apply to the referee facility for approval of a repair cost waiver for a vehicle, subject to the provisions of Section 15.85.240.B. Upon verification that all applicable requirements have been met, the referee facility shall approve a waiver and issue a certificate of inspection for the vehicle. The referee facility shall monitor the yearly status of a vehicle receiving a repair cost waiver until the vehicle is brought into full compliance with I/M program requirements. The waiver is valid for one inspection cycle.

C. Special waiver. A motorist may apply to the referee facility for approval of a special waiver for a vehicle, subject to the provisions of Section 15.85.235.B. Upon verification that all applicable requirements have been met, the referee facility shall approve a waiver and issue a certificate of inspection for the vehicle. The waiver is valid for one inspection cycle.

D. Motorist-disputed test results.

1. In the case of a dispute between a motorist and a certified I/M station or certified I/M mechanic, the motorist should make an appointment to bring a vehicle to the referee facility for an emission inspection, to verify the results of an inspection performed at a certified I/M station.

a. If the referee facility is unable to perform an inspection on the vehicle, a special circumstances waiver may be issued for the vehicle, as provided in Section 15.85.235.B.

b. No waiver shall be issued to a vehicle that is untestable due to correctable defects such as a repairable water pump, fuel leak, or noisy engine condition. The motorist shall be required to repair such defects before the referee facility performs an emission inspection on the vehicle.

2. If the vehicle passes the inspection, the referee facility shall collect a fee to pay for the certificate of inspection and the cost of the inspection, if applicable, and issue a certificate of inspection for the vehicle to the motorist.

3. If the vehicle fails the inspection and does not meet the applicable requirements for a repair cost waiver, the referee facility shall provide the motorist with a required repair form that describes the repairs necessary to meet the applicable program requirements.

E. Referee/motorist disputes.

1. If the motorist disputes the results of a failing inspection performed by the referee facility, the referee facility may perform additional functional tests to verify the reason for failure. The motorist shall be responsible for the cost of any such additional tests.

2. If the referee facility is unable to resolve the complaint, the motorist shall be given a referee facility comment/complaint form.

a. The motorist may complete the form and deliver or mail it to the I/M program administrator, or leave it with the referee facility for delivery to the I/M program administrator.

b. If the form is left with the referee facility, the referee facility shall submit the form to the I/M program administrator with their referee facility action report for review.

F. Fuel system modifications.

1. Upon motorist application, the referee facility or a certified station that has been approved by ADEC to test dual-fuel or alternate fuel vehicles shall issue a certificate of inspection for a vehicle that has been converted to dual fuel use if the conversion system meets the EPA guidelines enumerated in the September 4, 1997 addendum to Mobile Source Enforcement Memorandum 1-A, or in such subsequent memoranda, and if the vehicle meets the emission standards adopted by the I/M program for the vehicle in its unmodified configuration, when tested on all fuels that the vehicle has been modified to burn. Where documentation is provided that a conversion system was installed prior to September 4, 1997 and the system met the criteria for certification by the EPA, CARB, or the State of Colorado at the time of installation, the system shall be accepted. Copies of the current EPA guidelines shall be kept available for public inspection at the I/M administration office.

2. If the vehicle was originally catalyst-equipped, the original catalytic converter, or a replacement catalytic converter approved by the I/M program administrator, must still be on the vehicle and be fully functional.

3. If the vehicle fails the tailpipe test and the inspector finds no other faults, the inspector may request the referee to evaluate the catalytic converter for efficiency.

G. Engine switching.

1. Upon motorist application, the referee facility shall issue a certificate of inspection for a vehicle that has been retrofitted with a replacement gasoline engine if the following requirements are met:

a. the resulting engine-chassis configuration has been certified by either the EPA or the CARB to have the same or lower emissions as the make and model year of the engine-chassis configuration originally installed in the vehicle;

b. all emission controls originally installed on the resulting engine-chassis configuration, as certified by EPA or CARB, are retained;

c. if the vehicle was originally equipped with one or more catalytic converters, the retrofitted vehicle must be equipped with either

(1) the catalytic converter(s) certified by EPA or CARB for the resulting engine/chassis combination; or

(2) a replacement catalytic converter approved by the I/M program administrator; and

d. if the vehicle was originally equipped with an O2 sensor and an evaporative ECS and/or an EGR system, the evaporative ECS and the EGR system must remain functional on the retrofitted vehicle.

2. In lieu of meeting these requirements, a motorist may submit the results of an emissions test performed on a retrofitted vehicle using the federal test procedure or an alternate loaded mode mass emissions test procedure previously approved by the program administrator. The program administrator shall issue a certificate of inspection upon the submittal of adequate proof that the retrofitted vehicle has the same or lower mass emission rate as the engine-chassis configuration originally installed in the vehicle.

3. When the I/M program referee facility cannot show that a vehicle has a non-direct replacement engine, the I/M program administrator shall assume that the vehicle has the original engine or a direct replacement engine and not a switched engine. When such an assumption is made the vehicle shall be tested in accordance with Section 15.85.600.

H. Engine modifications.

1. Engine modifications, including the use of aftermarket parts, are allowed provided that they are included on a list of approved parts or engine modifications adopted by the program administrator. A current copy of this list will be kept available for public review at the I/M program administration office. This list includes all modifications approved for use by the CARB, except those deleted by the program administrator due to cold temperature operational issues.

2. Application for the approval of modifications not included on the list can be made to CARB, subject to the approval of the I/M program administrator.

I. Kit cars and custom-manufactured vehicles.

1. All kit cars and custom-manufactured vehicles registered prior to January 1, 1993, are subject to the emission cutpoints for 1974 model year vehicles.

2. All such vehicles first registered after December 31, 1992, but before January 1, 1998, are required to use engines and evaporative ECS from vehicles of the same class (e.g., passenger car) certified to meet federal emission standards applicable to 1988 model year vehicles.

3. All such vehicles first registered after December 31, 1997, are required to use engines and evaporative ECS from vehicles of the same class (e.g., passenger car) certified to meet federal emission standards, including cold temperature CO standards, applicable to 1996 model year vehicles.

a. All exhaust emission controls originally intended to be used with the engine (including the computer and feedback control system) must be installed.

b. The vehicle must also use the same catalyst used with the engine in a certified vehicle or an aftermarket catalyst approved by the I/M program administrator for the certified vehicle.

J. Gray market vehicles.

1. Except as otherwise provided in this section the referee facility will:

a. inspect a gray market vehicle in accordance with importation documents issued by EPA or the manufacturers' emission decal; and

b. issue a certificate of inspection if the gray market vehicle passes the visual and functional inspection and the tailpipe emissions standards as required by Part IV of the state I/M program manual as referenced in 18 AAC 52.005(e)(1), and

c. the referee may place a decal on the vehicle to allow it to be tested in the field in the future.

d. A copy of Part IV of the state I/M program manual referenced 18 AAC 52.005(e)(1) will be made available at the I/M program administration office for public review.

2. If the importation documents or the manufacturers' emissions decal are not available, but the gray market vehicle has a U.S. title and has not been modified to comply with EPA emissions requirements the referee facility will,

a. inspect the vehicle according to the model year of the vehicle and the ECS present on the vehicle at manufacturing; and

b. issue a certificate of inspection if the vehicle passed the tailpipe emissions standards as required by Part IV of the program manual as referenced in 18 AAC 52.005(e)(1), and

c. the referee facility may place a decal on the vehicle to allow it to be tested in the field in the future.

3. If the importation documents or the manufacturers' emissions decal are not available, but the gray market vehicle has a U.S. title and has been modified to comply with EPA emissions requirements the referee facility will;

a. inspect the vehicle according to the model year of the vehicle and the ECS present on the vehicle at inspection; and

b. issue a certificate of inspection if the vehicle passed the tailpipe emissions standards as required by Part IV of the program manual as referenced in 18 AAC 52.005(e)(1), and

c. the referee facility may place a decal on the vehicle to allow it to be tested in the field in the future.

1. If the importation documents or the manufacturers' emission decal are not available, and the gray market vehicle does not have a U.S. title the referee facility will not inspect the vehicle.

2. This section does not relieve a motorist from any duty to obtain importation documents issued by EPA and the U.S. Department of Transportation.

K. Repair of non-complying vehicles.

1. Based on guidance issued by the program administrator, the referee facility shall specify repair procedures for a vehicle that does not comply with the requirements above. (For a gray market vehicle, repair of defective emission control components may be required, but retrofit of emission control components not originally installed on the vehicle shall not be required by the municipality.)

2. The referee facility shall issue a certificate of inspection when a vehicle has been modified so as to comply with the above requirements, or when an applicable repair cost minimum criteria, as specified in Sections 15.85.240.B or 15.85.240.C, has been violated.

3. If a vehicle fails the inspection and does not meet the requirements for a repair cost waiver, the referee facility may provide the motorist with an official referee facility required repair form that describes the repairs that must be made within 60 days. If so directed by the referee facility, the motorist shall return the vehicle to the referee facility for verification of the repairs.

L. Documented vehicles.

1. At the discretion of the I/M program administrator, the referee facility may verify and document the status of a vehicle's ECS and emission levels prior to the vehicle being taken by program administration staff or other individuals designated by the program administrator to a certified I/M station for an overt or covert performance audit of the certified I/M station or a certified I/M mechanic.

2. At the discretion of the program administrator, the referee facility may also determine the results of emission repairs made on a documented vehicle at a certified I/M station. A copy of the description of the alterations performed by the referee facility shall be given to the certified station/mechanic at the completion of the overt or covert audit.

M. Warranty assistance.

1. A vehicle that fails an emission inspection at a certified I/M station, and that is covered by a manufacturer's emission warranty, as provided under Sections 207(a) or 207(b) of the Clean Air Act (42 U.S.C.A. § 7541(a) and (b)), may, at the vehicle owner's option, be inspected at the referee facility for verification and documentation of the inspection failure.

2. The vehicle owner may, at his or her option, subsequently return to the referee facility for verification that I/M-related repairs were performed properly.

(AO No. 99-160, § 7, 1-11-00)

Editor's note: Effective January 1, 2010, pursuant to AO 2008-84(S), § 9, this section is repealed and re-enacted to read as follows:

"A. The I/M program administrator shall provide referee services. These services shall be provided directly, through I/M program staff or through one or more service providers. These services shall include but are not limited to:

1. Determination of whether a repair cost waiver or other special waiver should be issued for a vehicle;

2. Assistance in the resolution of disputes between motorists and certified I/M stations;

3. Inspection of vehicles rejected from testing at certified I/M stations because of engine or fuel changes; and

4. Other services to the general public as delegated by the program administrator.

B. Subject to the approval of the program administrator, a facility contracted to perform referee services may charge a fee of up to $100.00 plus the cost of a certificate, if issued, for referee services.

C. The program administrator shall establish procedures for facilities certified to provide referee services.

1. Facilities shall be equipped with instrumentation and other equipment and supplies necessary to determine whether a vehicle passes or fails an inspection test performed in accordance with Section 15.85.600.

2. Facilities shall be required to re-certify at intervals not more than two years.

3. The I/M administrator shall regularly review the performance of certified referee service providers and may withdraw certification for unsatisfactory performance.

D. The program administrator shall require certification procedures for mechanics performing referee services.

1. Certification procedures may require mechanics to attend training and pass certification tests.

2. Mechanics shall be required to re-certify at intervals not more than two years.

3. The I/M administrator shall regularly review the performance of mechanics certified to provide referee services and may withdraw certification for unsatisfactory performance.

E. Repair cost waiver. Upon referral by a certified I/M station, a motorist may apply to a certified referee services provider for approval of a repair cost waiver for a vehicle, subject to the provisions of Section 15.85.240B. Upon verification that all applicable requirements have been met, the I/M administrator

or certified referee service provider shall approve a waiver and issue a certificate of inspection for the vehicle. The I/M administrator shall monitor the yearly status of a vehicle receiving a repair cost waiver until the vehicle is brought into full compliance with I/M program requirements.

1. A repair cost waiver is valid for one inspection cycle.

F. Special waiver. A motorist may apply to a certified referee services provider for approval of a special waiver for a vehicle, subject to the provisions of Section 15.85.235B. Upon verification that all applicable requirements have been met, the I/M administrator or certified referee service provider shall approve a waiver and issue a certificate of inspection for the vehicle.

1. A special waiver is valid for one inspection cycle.

G. Motorist disputed results.

1. In the case of a dispute between a motorist and a certified I/M station or certified I/M mechanic, the motorist may schedule an appointment within to bring a vehicle to the I/M administrator to verify the results of an inspection performed at a certified I/M station.

a. The I/M administrator may utilize the services of a certified referee service provider not involved in the dispute to re-inspect and test the vehicle to verify the results of the initial inspection.

b. If an inspection on the vehicle cannot be performed, the I/M administrator may issue a special circumstances waiver for the vehicle, as provided in Section 15.85.235B.

c. No waiver shall be issued to a vehicle that is untestable due to correctable defects, such as a repairable water pump, fuel leak, or noisy engine condition. The motorist is required to repair such defects before a certified referee services provider performs an emission inspection on the vehicle.

H. Fuel system modifications.

1. Upon motorist application, a certified referee service provider shall issue a certificate of inspection for a vehicle converted to dual or alternate fuel use, if the conversion system:

a. Meets the EPA guidelines enumerated in the September 4, 1997 addendum to Mobile Source Enforcement Memorandum 1-A, or any subsequent EPA guidelines; and

b. If the vehicle meets the emission standards adopted by the I/M program for the vehicle in its unmodified configuration, when tested on all fuels that the vehicle has been modified to burn.

c. Where documentation is provided that a conversion system was installed prior to September 4, 1997 and the system met the criteria for certification by the EPA, CARB, or the State of Colorado at the time of installation, the system shall be accepted.

d. Copies of the current EPA guidelines shall be available for public inspection at the I/M administration office.

2. If the vehicle was originally catalyst-equipped, the original catalytic converter, or a replacement catalytic converter approved by the I/M program administrator, must still be on the vehicle and be fully functional.

I. Engine switching.

1. Upon motorist application, a certified referee service provider shall issue a certificate of inspection for a vehicle retrofitted with a replacement gasoline engine if the following requirements are met:

a. The resulting engine-chassis configuration has been certified by either the EPA or the CARB to have the same or lower emissions as the make and model year of the engine-chassis configuration originally installed in the vehicle; and

b. All emission controls originally installed on the resulting engine-chassis configuration, as certified by EPA or CARB, are retained; and

c. If the vehicle was originally equipped with one or more catalytic converters, the retrofitted vehicle must be equipped with either:

i. The catalytic converter(s) certified by EPA or CARB for the resulting engine/chassis combination; or

ii. A replacement catalytic converter approved by the I/M program administrator; and

d. If the vehicle was originally equipped with an O2 sensor and an evaporative ECS and/or an EGR system, the evaporative ECS and the EGR system must remain functional on the retrofitted vehicle.

2. In lieu of meeting the above requirements, a motorist may submit the results of an emissions test performed on a retrofitted vehicle using the federal test procedure or an alternate loaded mode mass emissions test procedure previously approved by the program administrator. The program administrator shall issue a certificate of inspection upon the submittal of adequate proof the retrofitted vehicle has the same or lower mass emission rate as the engine-chassis configuration originally installed in the vehicle.

3. When a certified referee service provider is unable to show a vehicle has a non-direct replacement engine, the I/M program administrator shall assume the vehicle has the original engine or a direct replacement engine and not a switched engine. When such an assumption is made, the vehicle shall be tested in accordance with Section 15.85.600.

J. Engine modifications.

1. Engine modifications, including the use of aftermarket parts, are allowed provided the modifications are included on a list of approved parts or engine modifications adopted by the program administrator. A current copy of this list shall be available for public review at the I/M program administration office. This list includes all modifications approved for use by the CARB, except those deleted by the program administrator due to cold temperature operational issues.

2. Application for the approval of modifications not included on the list may be made to CARB, subject to the approval of the I/M program administrator.

K. Kit cars and custom-manufactured vehicles.

1. All kit cars and custom-manufactured vehicles registered prior to January 1, 1993, are subject to the emission cutpoints for 1974 model year vehicles.

2. All vehicles first registered after December 31, 1992, but before January 1, 1998, are required to use engines and evaporative ECS from vehicles of the same class (e.g., passenger car) certified to meet federal emission standards applicable to 1988 model year vehicles.

3. All vehicles first registered after December 31, 1997, are required to use engines and evaporative ECS from vehicles of the same class (e.g., passenger car) certified to meet federal emission standards, including cold temperature CO standards, applicable to 1996 model year vehicles.

a. All exhaust emission controls originally intended to be used with the engine (including the computer and feedback control system) must be installed.

b. The vehicle must also use the same catalyst used with the engine in a certified vehicle, or an aftermarket catalyst approved by the I/M program administrator for the certified vehicle.

L. Gray market vehicles.

1. Except as otherwise provided in this section, a certified referee service provider shall:

a. Inspect a gray market vehicle in accordance with importation documents issued by EPA or the manufacturers' emission decal; and

b. Issue a certificate of inspection, if the gray market vehicle passes the visual and functional inspection and the tailpipe emissions standards as required by Part IV of the state I/M program manual as referenced in 18 AAC 52.005(e)(1); and

c. A certified referee service provider may place a decal on the vehicle to allow it to be tested in the field in the future.

d. A copy of Part IV of the state I/M program manual referenced 18 AAC 52.005(e)(1) shall be available at the I/M program administration office for public review.

2. If the importation documents or the manufacturers' emissions decal are not available, but the gray market vehicle has a U.S. title and has not been modified to comply with EPA emissions requirements a certified referee service provider shall:

a. Inspect the vehicle according to the model year of the vehicle and the ECS present on the vehicle at manufacturing; and

b. Issue a certificate of inspection, if the vehicle passed the tailpipe emissions standards as required by Part IV of the program manual as referenced in 18 AAC 52.005(e)(1); and

c. A certified referee service provider may place a decal on the vehicle to allow it to be tested in the field in the future.

3. If the importation documents or the manufacturers' emissions decal are not available, but the gray market vehicle has a U.S. title and has been modified to comply with EPA emissions requirements a certified referee service provider shall:

a. Inspect the vehicle according to the model year of the vehicle and the ECS present on the vehicle at inspection; and

b. Issue a certificate of inspection, if the vehicle passed the tailpipe emissions standards as required by Part IV of the program manual as referenced in 18 AAC 52.005(e)(1); and

c. A certified referee service provider may place a decal on the vehicle to allow it to be tested in the field in the future.

1. If the importation documents or the manufacturers' emission decal are not available, and the gray market vehicle does not have a U.S. title, a certified referee services provider shall not inspect the vehicle.

2. This section does not relieve a motorist from any duty to obtain importation documents issued by EPA and the U.S. Department of Transportation.

M. Repair of non-complying vehicles.

1. Based on guidance issued by the program administrator, a certified referee service provider shall specify repair procedures for a vehicle that does not comply with the requirements above.

a. For a gray market vehicle, repair of defective emission control components may be required, but retrofit of emission control components not originally installed on the vehicle shall not be required by the municipality.

2. A certified referee service provider shall issue a certificate of inspection when a vehicle has been modified so as to comply with the above requirements, or when an applicable repair cost minimum criteria, as specified in Sections 15.85.240B. or 15.85.240C., has been violated.

3. If a vehicle fails the inspection and does not meet the requirements for a repair cost waiver, a certified referee services provider may provide the motorist with an official referee repair form, describing the repairs that must be made within 60 days. If so directed by a certified referee services provider, the motorist shall return the vehicle to a certified referee services provider for verification of the repairs.

N. Documented vehicles.

1. At the discretion of the I/M program administrator, a certified referee service provider may verify and document the status of a vehicle's ECS and emission levels prior to the vehicle being taken by program administration staff or other individuals designated by the program administrator to a certified I/M station for an overt or covert performance audit of the certified I/M station or a certified I/M mechanic.

2. At the discretion of the program administrator, a certified referee service provider may also determine the results of emission repairs made on a documented vehicle at a certified I/M station. A copy of the description of the alterations performed by a certified referee services provider shall be given to the certified station/mechanic at the completion of the overt or covert audit.

O. Warranty assistance.

1. A vehicle that fails an emission inspection at a certified I/M station, and is covered by a manufacturer's emission warranty, as provided under Sections 207(a) or 207(b) of the Clean Air Act (42 U.S.C.A. § 7541(a) and (b)), may, at the vehicle owner's option, be inspected at a certified referee service provider for verification and documentation of the inspection failure.

2. The vehicle owner may, at the owner's option, subsequently return to a certified referee service provider for verification that I/M-related repairs were performed properly.

15.85.400 Certification procedures.

A. This section describes the requirements and procedures associated with the certification of I/M stations, EIS's, and mechanics. Repair facilities and mechanics are not required to be certified in order to repair vehicles that fail the inspection test given at certified I/M stations. Incentives, however, are provided to vehicle owners to have repairs performed by certified mechanics working in certified facilities.

B. The basic requirement for becoming a certified I/M mechanic is to pass a test administered by the I/M program administrator, or designee, as discussed in Section 15.85.410.B, or a training course and test certified by the ADEC.

C. The basic requirements for obtaining certification as a certified I/M station are to comply with the requirements contained in Section 15.85.500, to use only certified I/M mechanics in the performance of inspections and I/M repairs, and to ensure that the repair and quality control procedures specified in Section 15.85.600 are used.

D. The basic requirement for the certification of an EIS for use in certified I/M stations is to demonstrate that the equipment specifications contained in 18 AAC 52.420 have been met.

E. The program administrator shall have the authority to issue certifications for I/M stations, mechanics and test equipment, and shall issue such certificates when all certification requirements have been met. I/M station certificates shall be valid for two years. The initial I/M mechanic certificate shall expire one or two years as appropriate from the date of issue, and shall subsequently require annual or biennial renewal. Certificates may be renewed upon application if the application for renewal is made at least 30 days and not more than 90 days prior to the date of expiration. Persons or stations whose certificates have expired shall immediately cease the activity requiring a certificate, but the program administrator shall accept applications for renewal during the 30-day period following the date of expiration. If the application for renewal is submitted more than 30 days after the date of expiration the applicant must fulfill the requirements of Section 15.85.410.B.

F. Applications for certification shall be made upon a form furnished by the program administrator. Applications for certification shall contain such information concerning the applicant's background and experience as the program administrator may prescribe. No certifications under the I/M program shall be issued or renewed unless the applicant has demonstrated the experience and qualifications necessary to meet the applicable requirements of the I/M program design.

(AO No. 99-160, § 7, 1-11-00)

Editor's note: Effective January 1, 2010, pursuant to AO 2008-84(S), § 12, a new subsection G is amended to this section and will read:

"G. The I/M administrator shall charge a $10,000 fee for the initial certification of a new inspection facility or location. The fee for recertification shall be based on the volume of tests conducted in the preceding two-year certification period in accordance with the following schedule:

TABLE INSET:

Number of Tests Conducted by I/M Test Facility in Preceding Two-Year Certification Period (every 2 years)	Certification Fee
10,000 or more	$10,000
More than 2,000 and less than 10,000	$5,000
2,000 or less	$2,000"

15.85.410 Mechanic certification.

A. I/M mechanic certificate.

1. The program administrator may certify auto repair mechanics as "Certified I/M mechanics" when they are demonstrated to have met the following requirements:

a. they have a minimum of two years experience in the automotive repair industry, or equivalent educational experience;

b. they have received required training in vehicle inspection and repair procedures; and

c. they have passed an approved test demonstrating competency in the use of such procedures.

2. The program administrator shall issue a certificate bearing the seal of the municipality to mechanics who meet the requirements for certification contained in this subsection.

3. Upon separate application, the program administrator may issue a one-year "probationary" certified I/M mechanic certificate for those individuals who have received the training and passed the tests described below, but who do not meet the education or experience criteria listed above.

B. The examination process.

1. A person wishing to become a certified I/M mechanic shall first pass a comprehensive examination established by the program administrator.
2. The examination shall consist of three elements:
a. a comprehensive mechanic competency test (referred to as the challenge test);
b. a program rules and regulations test;
c. and a hands-on test.
3. Successful completion of all three elements of the examination shall be required before a person can apply for certification as an I/M mechanic. Once each month examinations shall be held at a place and time designated by the program administrator.
4. The program administrator shall prepare and maintain an annual schedule of the dates and locations for taking the written examinations. Upon written request received by the program administrator not less than ten days prior to a scheduled examination, special testing accommodations may be made for qualified individuals that are unable to take the normal examination.
5. If the applicant fails the examination, no certificate shall be issued. The program administrator shall issue instructions and forms for application to re-take the examination; however, a waiting period of 30 days is required before the exam can be taken again.
C. Mechanic competency (challenge) test.
1. Roughly three hours shall be allowed for completing the mechanic competency portion of the test, with the first portion for orientation and instructions. A minimum two and one-half hours shall be scheduled for the written competency examination. Applicants requesting additional time to complete the examination shall notify the program administrator at least ten days in advance of the scheduled examination, so that special testing arrangements can be made. Any such request for additional time shall specifically state all reasons why the additional time is being requested, plus any other accommodations which the applicant believes may be required to ensure that the applicant is provided an opportunity to show competency reasonably consistent with the opportunity provided applicants who do not require special accommodation.
2. The competency examination shall cover the following topics:
a. basic internal combustion engine operation;
b. fuel systems and emission control devices; and
c. engine diagnosis and test equipment usage.
d. The passing score of the competency examination shall be that score that indicates the level of knowledge expected of a well-qualified mechanic in the area of ECS maintenance and repair. Specific areas of expected knowledge for the examination include a thorough understanding of the following items:
i. the role of motor vehicles as sources of air pollution, particularly the problem of cold weather vehicle operation causing high carbon monoxide (CO) emissions;
ii. the combustion processes that occur in an engine to form hydrocarbon (HC), CO and nitrogen oxide (NO) emissions;
iii. the responsibilities of vehicle manufacturers, the service industry, and individual mechanics in the areas of federal exhaust emission standards, ECS warranties, and tampering;
iv. the function and effect on exhaust emissions of all motor vehicle ECS's, including the positive crankcase ventilation (PCV) system, the exhaust gas recirculation (EGR) system, air injection systems, the catalytic converter, the thermostatic air cleaner (TAC), the early fuel evaporation (EFE) system, and the evaporative ECS;
v. the use of infrared (IR) exhaust gas analyzers in the diagnosis and repair of vehicles;
vi. the symptoms and causes of excessive HC emissions, and their diagnosis and correction, including ignition system malfunctions, the effects of ignition system malfunctions, the effects of ignition timing advance and retard, the effect of intake air leaks and their detection, causes and symptoms of lean misfire, EGR system malfunction, and engine wear and mechanical problems;
vii. The symptoms and causes of excessive CO emissions, and their diagnosis and correction, including plugged air filter, improper choke operation, malfunctioning heated-air intake systems, PCV system malfunction (plugged PCV or fuel-diluted engine oil), improper carburetor adjustments (idle speed, idle air-fuel mixture), and internal carburetor malfunctions;

viii. The diagnosis and correction of concurrent excessive HC and CO emissions;

ix. proper carburetor adjustment procedures, including the correct procedures for determining whether carburetor adjustment is needed. Steps to be taken before adjusting carburetor idle mixture or idle speed include warming the engine to normal operating temperature; eliminating ignition system malfunctions; verifying proper ignition timing, dwell, and advance system operation; replacing the air filter if necessary; verifying transmission in proper position per manufacturer's specifications; and verifying that all vacuum hoses are properly connected per manufacturer's specifications;

x. the proper adjustment and the cleaning of choke mechanisms;

xi. the sophisticated fuel control and catalytic converter systems on 1981 and later model year vehicles, including three-way catalysts and exhaust oxygen sensors in closed-loop fuel control systems.

D. Rules and regulations.

1. The rules and regulations portion of the test shall include a lecture, and question and answer period of approximately four hours, with a test time of roughly one hour. The test shall cover Anchorage I/M program requirements and procedures, with emphasis on these points:

a. certification of mechanics and facilities;

b. tailpipe emission standards;

c. waiver procedures;

d. quality control; and

e. program administration and enforcement.

2. In order to pass the test, an applicant must demonstrate a detailed knowledge of the I/M program requirements, procedures, and repair cost minimums.

E. Challenge test.

1. The mechanic competency portion of the test may be given as a screening or challenge test for competency in the area of ECS maintenance and repair. Passage of the screening test shall qualify a person for an abbreviated course that concentrates more on the details of the I/M program requirements and procedures than on basic ECS theory, maintenance, and repair.

2. However, to pass the abbreviated course, the same demonstration of hands-on proficiency is required as for the longer course.

F. Hands-on test.

1. Upon successful completion of both the mechanic competency examination and the rules and regulations test, a demonstration of hands-on proficiency is required in order to complete the examination process.

2. The hands-on examination requires approximately 30 minutes.

G. Application for certificate.

1. A person who wants to become a certified I/M mechanic

a. must take the challenge test and if the mechanic passes, the I/M office shall mail the applicant an application form; or

b. if the mechanic is currently certificated in another Alaska I/M program or has taken and passed an ADEC certified mechanic training course then the applicant may obtain an application form by contacting the I/M program administrator. The address of the program administrator is:

Municipality of Anchorage
Department of Health and Human Services
I/M Program Administrator
825 "L" Street
Box 196650
Anchorage, AK 99519-6650

2. Application procedure. The applicant must fill in the applicant's portion of the application, printing or typing name and address, and sign and date the application at the bottom. The signature shall be notarized. The program administrator shall reject any application upon which any entry is not clearly legible.

a. The completed application should be submitted to the referee facility prior to taking the rules and regulation test and the hands-on test, as required. The referee facility shall review the application and complete their portion. After the applicant passes the required tests, the referee facility shall forward the application to the program administrator. The program administrator shall issue a certificate for I/M mechanic certification upon receipt of a valid application and proof of successful completion of the examination process described under Section 15.85.410.B. However, the program administrator may refuse certification if the application is inadequate or inaccurate, or if the applicant has previously violated any provisions of the I/M program design or had a repair facility or mechanic certificate revoked by the program administrator.

b. Applicants who provide evidence that they have successfully passed a mechanics training course that is certified by the ADEC shall not be required to take the mechanic competency examination, unless the applicant has previously violated any provisions of the I/M program design or had a repair facility or mechanic certificate revoked by the program administrator.

H. Renewal procedure.

1. The I/M mechanic certification expires two years from the date of issue. A probationary certificate will expire one year from the date of issue.

2. To renew a certificate, the certified mechanic must submit an application for renewal to the program administrator at least 30 days but no more than 90 days before certificates expires and pass a recertification examination, including both written and hands-on portions, within 30 days after certificate expiration. The written recertification exam shall include sections on both mechanic competency and I/M program rules and regulations.

3. The mechanic shall bring a notarized application for renewal, along with the current valid certificate, to the recertification examination. The dates and locations of scheduled examinations may be obtained from the I/M program referee facility.

4. If a passing score is achieved on the written exam, the mechanic shall then take the hands-on test. If the mechanic fails either the mechanic competency or program rules and regulations sections of the written examination, or the hands-on test, the old certificate shall expire on the expiration date. The mechanic must then pass all sections to become re-certificated.

5. The mechanic may perform the certificated service only while he or she is currently certificated. If a certified I/M mechanic fails to renew the certificate before it expires, he or she no longer has the right to perform the certificated activity.

I. Lost, destroyed or mutilated certificate.

1. In the event of a lost, destroyed, or mutilated certified mechanic certificate, the person to whom it was issued may obtain a duplicate from the program administration office upon furnishing satisfactory proof of such fact.

2. Any certified mechanic who loses a certificate and who, after obtaining a duplicate, finds the original certificate shall immediately surrender the original certificate.

3. Duplicates of a certificate may be obtained if the certified mechanic to whom it was issued is employed at more than one certified I/M station.

J. Change of employer or home/mailing address. Any change in a certified I/M mechanic's home or mailing address or place of employment, or any change in the I/M-related status of the mechanic, shall be reported to the program administrator within ten days of such change by both the certified mechanic and the certified I/M station employing the mechanic. This information is needed so that changes in repair procedures and bulletins can be sent to each certified I/M mechanic.

K. Suspension or revocation of certificate. The program administrator may suspend, revoke, or refuse to renew the I/M mechanic's certificate of any mechanic who fails to comply with the procedures specified in the I/M program design. The following are some examples of actions that can result in suspension or revocation:

1. Making or authorizing in any manner or by any means whatever any statement regarding the I/M program, written or oral, that is untrue or misleading, and that is known, or that by the exercise of reasonable care should be known, to be untrue or misleading.

2. Causing or allowing a customer to sign any work order that does not list all I/M-related work authorized by the customer and the vehicle's odometer reading at the time of repair. Verbal approval for I/M repairs received over the telephone from the customer must be documented on the work order with the name of the customer, his or her telephone number, and the time and date of the approval, and be signed by the I/M mechanic or other station representative. The customer shall be requested to initial the work order when he or she picks up the vehicle to acknowledge that he or she authorized the I/M repairs performed on the vehicle.
3. Failing or refusing to give to a customer a copy of any document requiring his or her signature, as soon as the customer signs such document.
4. Engaging in any other conduct that constitutes fraud.
5. Engaging in conduct constituting gross negligence.
6. Failing to follow the inspection and repair procedures specified in Section 15.85.600 of the I/M program design.
7. Willfully departing from or disregarding accepted trade standards for good and workmanlike repair in any material respect, in a manner that is prejudicial to another without consent of the owner or his or her duly authorized representative.
8. Making false promises of a character likely to influence, persuade, or induce a customer to authorize the repair, service or maintenance of motor vehicles.
9. Entering false data into an EIS.
10. Performing repairs that are represented to the customer as being required to remedy the cause of an inspection failure or obtain a certificate of inspection when in fact they are not required.
11. Performing, or representing to the customer as necessary, repairs in excess of those necessary to meet the repair cost minimum criteria specified in Section 15.85.240.B.
12. Adjusting or modifying a vehicle subject to the I/M program in a manner that would cause the vehicle to fail an emissions inspection. This conduct is prohibited regardless of when the vehicle is scheduled for an I/M test.
13. Charging for performing an emissions inspection that is represented to the customer as being required for the vehicle when in fact it is not required.
14. Failing to maintain the confidentiality of a mechanic's access code for the EIS.
15. Failing to maintain a current home mailing address, and place and status of I/M employment on file at the I/M program administration office.

L. Surrender of certificate. The surrender of an I/M mechanic's certificate is subject to the following provisions:

1. If a mechanic decides to give up an I/M mechanic's certificate, the program administrator shall have the right to complete any ongoing investigative or disciplinary proceedings against the mechanic or the repair facility in which the mechanic was working.
2. A mechanic holding an I/M mechanic's certificate who habitually fails to comply with I/M regulations shall surrender the certificate issued by the program administrator and shall stop performing I/M tests and emissions repairs to vehicles that have failed the I/M emissions test.

(AO No. 99-160, § 7, 1-11-00)

15.85.420 I/M station.

A. Station certificate and shield. The program administrator may certify auto repair facilities as "certified I/M stations" when they are equipped in accordance with the requirements of Section 15.85.500 and when they use only certified I/M mechanics to perform inspections and emissions repairs in accordance with the procedures specified in Section 15.85.600. The program administrator shall issue a certificate bearing the seal of the municipality to the operators of repair facilities who meet the requirements for certification contained in this subsection. Separate certification shall be required for each inspection location, with multiple test bays at one location requiring a single certificate. Each certificate shall be valid for a single address. The program administrator shall not certify a mobile inspection station. However, subject to the prior approval of the program administrator, remote testing of vehicle fleets may be allowed.

B. Display of certificates. A certified I/M station shall prominently display, in its customer service area, and in a manner clearly legible to customers in the normal course of completing a work order, the certificate issued by the program administrator for the station itself and for each certified I/M mechanic employed by the certified I/M station.

C. Facilities that are certified by the program administrator may display a sign or shield bearing the inscription, "Certified I/M Station, Test and Repair."

1. The sign shall be bordered and lettered in light chrome yellow and the background shall be royal blue. The word "CERTIFIED" shall appear in two and one-fourth inch high gothic letters at the top of the sign. "I/M" shall appear where indicated in Figure 4-1 in four-inch high gothic letters below the word "CERTIFIED". The word "STATION" shall appear where indicated in Figure 4-1 in two and one-fourth-inch high gothic letters below "I/M". The words "TEST AND REPAIR" shall appear on two lines at the bottom of the sign as indicated in Figure 4-1 in one and one-half-inch high gothic letters.

2. All dimensions of the sign may be increased or decreased in uniform proportion, at the option of the operator of the certified I/M station.

3. The sign shall conform to the design shown in Figure 4-1 below.

GRAPHIC LINK: Click here

D. Application for certification.

1. A person who wants to obtain certification for an I/M station may obtain an application form by contacting the I/M program administrator. The address of the program administrator is:

Municipality of Anchorage
Department of Health and Human Services
I/M Program Administrator
825 "L" Street
Box 196650
Anchorage, AK 99519-6650

2. The application shall require sufficient information to identify the facility, including name, business and street address, and other identifying data that are prescribed by the program administrator. A separate application shall be submitted for each inspection location.

3. If the business is to be carried on under a business alias, such alias shall be stated. If the facility is operated as a partnership, identifying data prescribed by the program administrator shall be stated for each partner. If the facility is a corporation, identifying data prescribed on the station application by the program administrator shall be included for each of the officers and directors of the corporation as well as for the individual in charge of each place of the facility's business in this state. Any change in this information shall be reported by the I/M station to the program administrator within ten days of such change.

4. The application shall list the names and certification numbers of all certified I/M mechanics employed by the applicant. The application shall also list all equipment and supplies that the facility operator intends to have on premises and use to meet the requirements of Section 15.85.500 of the I/M program design.

E. Certification requirements.

1. Upon receipt of the properly completed application, the program administrator shall check to determine whether the information contained on the application is valid and sufficient to warrant certification. The program administrator may conduct an on-site inspection of the proposed facility to determine whether the necessary equipment is present and in proper operating condition.

2. The program administrator may refuse certification if the application is illegible, inadequate or inaccurate, or if the applicant or any employee of the applicant has previously violated any provisions of the I/M program design or had an I/M station or mechanic certification revoked by the program administrator.

F. Recertification.

1. Every certificate shall cease to be valid two years after the date of issuance unless the certified I/M station has applied for renewal of certificate on a form prescribed by the program administrator.

2. Applications for renewal must be filed with the program administrator at least 30 but not more than 90 days prior to the date of certificate expiration.

G. Revocation of certification.

1. A certificate shall cease to be valid when the program administrator finds that any of the information provided on the application for certification that the program administrator deems material, ceases to be current.

2. In cases where the certified I/M station cannot show there was a bona fide error, the program administrator may refuse to validate or may temporarily or permanently invalidate the certificate of a repair facility for any of the following acts or omissions related to the conduct of business by the certified I/M station, any mechanic, employee, partner, officer, or member of the certified I/M station:

a. Making or authorizing in any manner or by any means whatever any statement regarding the I/M program, written or oral, that is untrue or misleading, and that is known, or that by the exercise of reasonable care should be known, to be untrue or misleading.

b. Causing or allowing a customer to sign any work order that does not include the vehicles' owners name, address, vehicle make, model, model year, odometer reading and state all I/M-related work authorized by the customer. Verbal approval for I/M repairs received over the telephone from the customer must be documented on the work order with the name of the customer, his or her telephone number, and the time and date of the approval, and be signed by the I/M mechanic. The customer shall be requested to initial the work order when he or she picks up the vehicle to acknowledge that he or she authorized the I/M repairs performed on the vehicle.

c. Failing or refusing to give to a customer a copy of any document requiring his or her signature, as soon as the customer signs such document.

d. Engaging in any other conduct that constitutes fraud.

e. Engaging in conduct constituting gross negligence.

f. Failing to follow the inspection and repair procedures specified in Section 15.85.600 of the I/M program design.

g. Failing to maintain compliance with the certified I/M station requirements contained in Section 15.85.500 of the I/M program design.

h. Willfully departing from or disregarding accepted trade standards for good and workmanlike repair in any material respect that is prejudicial to another without consent of the owner or his or her duly authorized representative.

i. Making false promises of a character likely to influence, persuade, or induce a customer to authorize the repair, service or maintenance of motor vehicles.

j. Entering false data into an EIS.

k. Having repair work done by someone other than the repair facility operator or his or her employees without the knowledge or consent of the customer unless the dealer can demonstrate that the customer could not reasonably have been notified.

l. Allowing any employee, whether a certified I/M mechanic or not, to adjust or modify any vehicle, whether subject to the I/M program or not, in a manner that would cause the vehicle to fail an emissions inspection. This conduct is prohibited regardless of when the vehicle is scheduled for an I/M test.

m. Performing repairs that are represented to the customer as being required to remedy the cause of an inspection failure or obtain a certificate of inspection when in fact they are not required.

n. Performing, or representing to the customer as necessary, repairs in excess of those necessary to meet the repair cost minimum criteria specified in Sections 15.85.240.B.

o. Charging for performing an emissions inspection that is represented to the customer as being required for the vehicle when in fact it is not required.

p. Failing to maintain the confidentiality of a mechanic's access code for the EIS.

q. Failing to keep the information on an application for certification of an I/M station current.

3. Upon refusal to issue a certificate, the program administrator shall notify the applicant thereof, in writing, by personal service or certified mail addressed to the address of the applicant set forth in the application. The applicant shall be given a public hearing under the jurisdiction of the program administrator if, within 30 days thereafter, the applicant files with the program administrator a written request for hearing, otherwise the refusal is deemed affirmed.

4. Where a certified I/M station operator has more than one place of business, the program administrator, pursuant to this subsection, shall only refuse to validate, or shall only temporarily or permanently invalidate, the certificate of the specific place of business that violated any of the provisions of this section. Such violation, or such action by the program administrator, shall not affect in any manner the right of such an operator to operate his or her other places of business.
5. No facility whose certification is denied, suspended, or revoked, shall advertise that it is a certified I/M station.
(AO No. 99-160, § 7, 1-11-00)

15.85.430 Equipment certification.
Emissions analyzers to be used in the Anchorage I/M program are an Alaska version of the California BAR97 certified EIS or equivalent. Only EIS's approved by the ADEC that meet the equipment specifications contained in 18 AAC 52.420 shall be used.
(AO No. 99-160, § 7, 1-11-00)

15.85.440 Mechanic training courses.
A. The program administrator shall only approve those training classes determined to be appropriate for the purposes of removing station and mechanic misconduct points as described in Section 15.85.345.E.
B. The municipality does not certify mechanic's training courses designed for mechanic certificate certification or recertification. However, applicants who submit evidence of successful completion of such a training course certified by the ADEC shall not be required to take a mechanic competency examination. (Such applicants would, however, be required to pass a rules and regulations test, and a hands-on test.)
C. Institutions wishing to obtain such certification should contact the ADEC for information on the state's requirements for course.
(AO No. 99-160, § 7, 1-11-00)

15.85.500 Certified I/M station requirements.
A. This section specifies the facility and equipment requirements that must be met by a certified I/M station. Other requirements and procedures for becoming a certified I/M station are contained in Section 15.85.400, certification procedures.
B. Facility requirements.
1. A certified I/M station shall be constructed and equipped so as to comply with all federal, state, and municipal requirements including, but not limited to, land use zoning, building safety and fire codes, unless an exception from such requirements has been granted by the proper authorities. All emissions inspections and emissions-related repair work shall be performed at the location certified as a certified I/M station by the program administrator.
2. A certified I/M station shall be heated and cooled as necessary to maintain the temperature operating range specified for the EIS, and to prevent excessive temperature fluctuations.
C. Reference materials.
1. A copy of this chapter, Chapter 15.80, and all updates, shall be kept on the premises and made available to all certified I/M mechanics employed by a certified I/M station.
2. In addition, the station shall maintain an updated source of acceptable emission control repair data for all imported and domestic passenger cars and light-duty trucks for all 1968 and later model year vehicles.
D. Tools.
1. Each certified I/M test and repair station shall have available for use by its employees, all tools and test equipment necessary for any emission inspections of vehicles done by the station. If the program administrator specifies that special tools or testing equipment must be used to perform emission inspections on certain vehicles, the certified station must have available such equipment, or its equivalent, whenever inspections are being performed on those vehicles. This requirement does not apply to specific EIS's, other than meeting the general requirements contained in Section 15.85.430.

2. A certified I/M test and repair station shall have available for use by its employees, all tools and test equipment necessary for any repair of vehicles done by the station. These shall include all wrenches, socket sets, screwdrivers, thickness gauges, pliers, and other tools necessary to perform tune-up related repairs. If a vehicle manufacturer specifies that special tools or testing equipment must be used to perform certain repairs on certain vehicles, the test and repair station must have available such equipment, or its equivalent, whenever such repairs are being performed on those vehicles.

E. Inspection and repair equipment. A certified I/M station must have, as a minimum, all the equipment listed below on-site, operational, and well-maintained. The meters, gauges, etc. listed may be furnished either as separate items or as components of a complete system such as an engine analyzer.

1. High impedance digital ohmmeter.
2. Voltmeter.
3. Tachometer.
4. Vacuum pump with pressure gauge.
5. Ignition timing light.
6. Compression test gauge.
7. Exhaust emissions analyzer meeting the specifications of Section 15.85.430 that has been certified by the program administrator.
8. Calibration gases meeting the requirements of the Alaska I/M program manual part 1, Section 6.4 California gases that have been purchased from a gas blender approved by the program administrator.
9. Scan tool(s), supplemental analyzer provisions, or detailed reference materials sufficient to allow the extraction and interpretation of computer fault codes from any vehicle being repaired that is equipped with an exhaust oxygen sensor and malfunction indicator light.

(AO No. 99-160, § 7, 1-11-00)

15.85.600 Inspection station procedures.

A. Each owner or operator of a certified I/M station shall ensure that all vehicles subject to the I/M program are tested in accordance with the procedures contained herein, that all equipment used is properly maintained and calibrated, and that the public is always dealt with in a courteous manner by I/M station employees.

B. All procedures contained in this section shall be interpreted in conjunction with Section 15.85.500, certified I/M station requirements.

(AO No. 99-160, § 7, 1-11-00)

15.85.610 Vehicles to be inspected.

A. Certified I/M stations may inspect any vehicle, deemed to be safe, that is not equipped with an engine different from the engine originally installed in the vehicle, and that is not designed or has not been modified to run on a fuel other than gasoline. Vehicles equipped with an engine different from the engine originally installed in the vehicle, diesel-fueled vehicles, gray market vehicles and vehicles designed or modified to run on an alternative fuel shall be referred to the referee facility, except that certain fleet service I/M stations have been approved by the I/M program administrator and ADEC to test the dual fuel and alternate fuel vehicles in their fleet.

B. I/M stations shall inspect all other vehicles subject to the I/M program as defined in Section 15.85.200.

C. Vehicle prescreening, as defined in this document, is strictly prohibited.

D. Provided that no pre-screening occurs, stations may refuse to inspect any vehicle.

E. Vehicles for which an inspection fee is quoted by the station and accepted by the customer shall be inspected in accordance with the procedures set forth in this document.

(AO No. 99-160, § 7, 1-11-00)

15.85.620 Preliminary inspection and safety check.

A. The certified I/M station shall first determine whether the vehicle is subject to the I/M program. Motorists who bring vehicles to a certified I/M station that are exempt from the I/M program shall be informed by the I/M station operator or employees that inspections are not required.

B. The owner or operator of the certified station, or a certified mechanic employed by the station shall inform the motorist that an inspection is not required for

1. a vehicle that is exempt under 15.85.220B.;

2. a vehicle with a registration renewal date more than 90 days in the future; and

3. a vehicle that does not require an I/M test unless requested by the motorist or required by the I/M program administrator because of a pending enforcement action.

C. The owner or operator of an I/M station, or a certified I/M mechanic employed by the station, shall refer the following vehicles to the referee facility for inspection, or to verify qualification for a waiver under Section 15.85.235:

1. a diesel-fueled vehicle;

2. a grey market vehicle;

3. a vehicle designed or modified to run on an alternate fuel; the referee facility or certified stations approved by the I/M program administrator and ADEC to test dual fuel and alternate fuel vehicles shall inspect a vehicle in this category to ensure that all required equipment is present and operable in accordance with Section 15.85.390.F;

4. a dual-fuel vehicle shall be I/M-tested by the referee facility or by certified stations approved by the I/M program administrator and ADEC to test dual fuel and alternate fuel vehicles, and shall receive one I/M test and VIR in the gasoline mode and one I/M test and VIR in the alternate fuel mode. The vehicle shall be inspected in accordance with the following procedure;

a. Gasoline mode test: Verify that the vehicle is in gasoline mode. Enter the vehicle information, using the standard procedure for a gasoline vehicle test. Then, first, perform all visual tests as directed by these regulations. Enter "disconnected," "modified," "missing" or "fail" as appropriate for any vehicle emission system that has been modified to allow for an approved CNG retrofit. Second, perform all functional tests as directed by these regulations. Again, enter "disconnected," "modified," "missing" or "fail" as appropriate for any vehicle emission system that has been modified to allow for an approved CNG retrofit. Third, perform a tailpipe test. If the vehicle fails any part of the test and the failure is not related to an approved CNG retrofit modification, diagnose and repair the vehicle and perform an after-repairs test. If the vehicle passes the test, abort the test. Depending on the software version being used, the EIS may require an abort code. If the EIS asks for a code, use 99.

b. CNG mode test: Verify that the vehicle is in CNG mode. Enter the vehicle information, using the standard procedure for a gasoline vehicle test, except that the letters "NG" shall precede the certificate number entry. Then, first, make the same visual test entries as are made for the gasoline mode test with the exception that one must enter "pass" for any vehicle emission system that has been modified to allow for an approved CNG retrofit. Second, make the same functional test entries as are made for the gasoline mode test with the exception that one must enter "pass" for any vehicle emission system that has been modified to allow for an approved CNG retrofit. Third, perform the tailpipe test. If the vehicle fails the test, diagnose and repair the vehicle and perform an after-repairs test. An after-repairs test includes both a gasoline mode test and a CNG mode test. If the vehicle passes the test issue a certificate.

5. a vehicle equipped with an engine other than the engine originally installed in the vehicle, except that:

a. a vehicle with a vehicle inspection program underhood emissions label affixed to the vehicle by the referee facility may be I/M-tested to the specifications in the label;

b. an engine of the same size remanufactured for the correct application is not considered a different engine for purposes of this paragraph, and a vehicle containing such an engine may be I/M-tested;

c. for a 1974 or earlier model year vehicle with a different engine, that vehicle may be I/M-tested;

6. a vehicle is incompatible with the EIS.

D. The certified I/M station shall also conduct a pre-test safety check determine whether the vehicle is safe for testing. The following situations may preclude proper completion of an inspection/test:

1. major oil system leak;
2. major transmission leak;
3. major coolant system leak;
4. fuel system leak;
5. excessive exhaust system leak;
6. unable to hold steady engine RPM;
7. unusual engine noises;
8. engine warning light on; and/or
9. other safety problem(s) on the vehicle that the certified I/M station believes makes the vehicle unsafe for testing.

E. There shall be no charge for the preliminary inspection.

(AO No. 99-160, § 7, 1-11-00; AO No. 2006-13, § 11, 2-14-06; AO No. 2008-84(S), § 10, 7-15-08)

Editor's note: The February 14, 2006 effective date of AO 2006-13 was subject to State of Alaska approval of the I/M program amendments pursuant to 18 AAC 52.035, and the state approved on May 15, 2006.

15.85.630 Inspection fee quotation.

A. A certified I/M station shall post a clearly legible sign in its customer service area that states:

1. the total cost for an I/M test, including the price of the certificate if the vehicle passes; or
2. the cost for an I/M test and the cost for a certificate of inspection if the vehicle passes the inspection, listed separately.
3. If different prices are charged for different vehicles or circumstances, each must be listed on the sign.
4. The I/M station shall also provide an individual cost quotation to each customer that brings his or her vehicle in for an inspection. The quotation shall be prepared by an employee of the certified I/M station and agreed to by the customer before the inspection or emissions test is conducted.

B. The customer shall be informed that the inspection cost prepared in paragraph A of this section covers only 1) the inspection of the vehicle; 2) the I/M certificate, if the vehicle passes the inspection; and 3) for test and repair stations only, a written itemized repair estimate, if the vehicle fails the inspection. However, a written repair estimate is not required to be prepared for a vehicle for which there is no charge for the initial "I" test, such as, no pass/no pay policies. The customer shall also be told that any necessary repairs are not included, and may result in an additional charge. In addition, the customer shall be informed that repairs may be performed at another facility if the customer chooses to have only the inspection test performed. The customer shall also be told that another inspection fee may be charged if he or she takes the vehicle to another facility for repairs.

(AO No. 99-160, § 7, 1-11-00)

15.85.640 Test abort conditions.

A. If a vehicle becomes untestable during an inspection, the certified I/M mechanic may abort the inspection/test at any time. The EIS shall allow the operator to abort, during either the data entry or the emissions test. The EIS shall automatically request the reason for the abort and print two copies of any inspection/test results.

B. The customer shall not be charged for aborted tests. The mechanic should normally be able to determine that a vehicle is not in a testable condition during the preliminary inspection and should reject such vehicles prior to beginning the inspection/test.

C. If the condition that caused an abort appears to be due to a problem involving compatibility between a particular vehicle and the EIS, the vehicle owner should be referred to the referee facility.

D. Vehicles rejected from testing for excessive smoke shall be repaired to a testable condition before testing. If the motorist disagrees with the mechanics' determination of excessive smoke, the motorist shall be referred to the referee facility.

(AO No. 99-160, § 7, 1-11-00)

15.85.650 Beginning official I/M test.

The certified I/M mechanic must follow the I/M test as identified in the Alaska I/M Program Manual as referenced in 18 AAC52.005(e)(1), except as modified below. A copy of the Alaska I/M Program Manual will be available at the I/M program administration office.

A. General procedures. Listed below is a summary of the general steps that must be followed during the inspection and repair of gasoline-powered vehicles brought to a certified station for I/M testing. Perform all steps in the order set out in this program manual. The steps summarized here are described in detail in following sections of this document. The certified mechanic shall

1. properly complete a cost quotation and obtain an authorizing signature from the motorist;

2. perform a preliminary inspection to determine if the vehicle is safe to test;

3. perform an initial ("I") test on the vehicle;

4. if the vehicle passes the "I" test, adhere the validation sticker to the validation space provided on the paper certificate of inspection, adhere the copy sticker to the station copy of the paper certificate of inspection. Adhere the EIS insert to the windshield sticker and install the windshield sticker to the windshield and provide the motorist with a Vehicle Inspection Report (VIR);

5. if the vehicle fails the "I" test and if the motorist is charged for the test, provide the motorist with an itemized estimate of repairs. If the vehicle is computer controlled the station may charge for this estimate. The estimate will include:

a. the cost to the motorist of the parts for each repair;

b. the cost to the motorist of the labor for each repair; and

c. a quotation showing which repairs the certified station can perform for an amount that satisfies the current cost minimums;

B. Early fuel evaporation (EFE).

1. For vehicles with a bi-metal spring operated EFE, it the EFE is present on the vehicle it must be operational to pass. If the EFE is not present the mechanic shall enter "N" in the EIS.

2. For vehicle with a vacuum-operated EFE, check the EFE to ensure that it operates freely, that it moves from fully closed (at rest) to fully open when vacuum is applied, that the vacuum motor does not leak, and that the flapper freely returns to the closed position when vacuum is removed. Enter the appropriate code into the EIS.

3. EFE grids. The mechanic shall use a high impedance digital ohmmeter to check a vehicle with an EFE grid. With the engine off disconnect the EFE grid at the connector nearest to the carburetor and hook up a high impedance digital ohmmeter to the wires connected to the EFE. If the resulting ohmmeter reading, rounded to the nearest tenth, is between 0 and 3.0 Ohms enter "Pass" in the EIS, and any other reading enter as "Fail".

C. Vehicles FAILING the initial test: If a vehicle fails an "I" test, the motorist must be told that

1. repairs must be made before the vehicle can pass the test and a certificate of inspection can be issued so that the vehicle registration can be renewed by DMV;

2. repairs may be performed by anyone, but if the vehicle is not repaired by a certified mechanic at a certified station, the cost minimum does not apply to those repairs; any additional repairs that are required must be made; and

3. repairs performed at a certified station may not exceed the repair cost minimum as stated in Section 15.85.240.B; if the vehicle fails after the certified station makes required repairs up to the repair cost minimum as stated in Section 15.85.240.B, the motorist will be referred to the referee facility.

4. Present estimate to motorist. Station personnel shall present the repair cost estimates to the motorist and advise that emissions repairs are required at least up to the applicable cost minimum, as stated in 15.85.240.B, but that additional emissions repairs are voluntary and must be authorized in writing. If the motorist agrees to have repairs performed and all of the necessary emissions-related parts are available, you should follow the repair procedures set out in this chapter. If the motorist does not agree that certain repairs should be performed, inform the motorist that the referee facility is available to review the results of I/M tests.

(AO No. 99-160, § 7, 1-11-00; AO No. 2000-92, § 9, 8-15-00)

Editor's note: AO 2000-92 (amended and approved 8-15-00) contains changes to this section conditioned and effective upon State approval.

15.85.660 Maintenance and calibration.

A. A certified I/M station operator shall ensure all equipment used in the performance of emission repairs is properly maintained. EIS's shall be maintained and serviced by the vendor of the system or a third party approved by the vendor of the system.

B. Each EIS will undergo an automatic electrical zero and span check before the testing of each vehicle. Zero gas and span gas calibration will be required not less than every 72 hours, or the EIS will lock itself out from further I/M tests.

(AO No. 99-160, § 7, 1-11-00; AO No. 2006-13, § 12, 2-14-06)

Editor's note: The February 14, 2006 effective date of AO 2006-13 was subject to State of Alaska approval of the I/M program amendments pursuant to 18 AAC 52.035, and the state approved on May 15, 2006.

15.85.670 Personnel.

A. Certified I/M stations shall use only certified I/M mechanics for the performance of emissions repairs and inspections required under the I/M program.

B. At the conclusion of both an initial and an after repairs I/M test, the VIR must be completely explained to the motorist. The municipality recommends that the mechanic who performs the test explain the VIR. However, the station may designate an employee to explain the VIR. The employee so designated shall sign the VIR, thus certifying that the VIR was properly explained to the motorist. Each section of the VIR must be separately pointed out to the motorist and separately explained, both for content and meaning. The state I/M program manual as referenced in 18 AAC 52.0005(e)(1) shall be used as a guide.

(AO No. 99-160, § 7, 1-11-00)

15.85.680 Record keeping, etc.

A. Each certified I/M station shall maintain true and correct legible copies at the station of all work orders, repair estimates, VIRs, or invoices used to document the performance of I/M inspections or repairs for a period of at least two years from the date of the inspection or the repair work. Such records shall be open for inspection by the program administrator or other I/M office personnel.

B. Upon request of the customer at the time a work order is taken, the certified I/M station shall return replaced parts to the customer at the time of completion of I/M repair work excepting such parts as the certified I/M station is required to return to the manufacturer or distributor under a warranty or exchange arrangement. If such parts must be returned to the manufacturer or distributor, the customer shall be offered the opportunity to inspect such parts upon completion of the work, except that the facility shall not be required to show a replaced part when no charge is being made for the replacement part.

C. In the event of a failed emission test, the certified I/M station shall give to the customer a written estimated price for labor and parts necessary for all I/M repair work or an estimate for extended diagnosis required to complete the written estimate. (The only exception to this is that a written repair estimate is not required to be prepared for a failed test for which there was no charge.) No work shall be done and no charges shall accrue before authorization to proceed is obtained from the customer. No charge shall be made for work done or parts supplied in excess of the estimated price without the oral or written consent of the customer, which shall be obtained at some time after it is determined that the estimated price is insufficient and before the work not estimated is done or the parts not estimated are supplied. If such consent is oral, certified I/M station employees shall make a notation on the work order/invoice of the date, time, name of person authorizing the additional repairs and telephone number called, if any, together with a specification of the additional parts and labor and the total additional cost. Upon completion of repairs, certified I/M station employees shall obtain the customer's signature or initials to an acknowledgment of notice and consent, in the following language:

"I acknowledge notice and oral approval of an increase in the original estimated price"

_____

(signature or initials (date)

D. Nothing in this section shall be construed as requiring a certified I/M station to give a written estimated price if the station does not agree to perform the requested repair.

E. The certified I/M station shall include in the written estimated price a statement of any automotive repair service that, if required to be done, will be done by someone other than the station. No service shall be done by someone other than the certified I/M station without the consent of the customer, unless the customer cannot reasonably be notified. Stations shall be responsible, in any case, for any such service in the same manner as if they or their employees had done the service.

(AO No. 99-160, § 7, 1-11-00)

15.85.700 Inspection standards.

A. This section specifies the visual and functional checks and tailpipe emission standards that shall be used in the I/M program. The inspections and standards described in this section shall be performed using the test procedures specified in Section 15.85.600. The standards are set at a level that ensures at least 95 percent of the failing vehicles will have excessive emissions in stop-and-go driving. The stringency of standards applicable to each class of vehicles is set based on the relationship between the idle and 2500 rpm modes used during I/M testing and actual emissions in stop-and-go driving. Because of the imperfect correlation between idle or 2500 rpm and stop-and-go driving, certain visual and functional defects known to cause excessive emissions are also a basis for failure.

B. Based on an analysis completed in December 1991, the tailpipe emission standards are projected to result in an initial failure rate of ten to 12 percent. Visual and functional failures are projected to increase the overall failure rate to 12 to 15 percent.

(AO No. 99-160, § 7, 1-11-00)

15.85.710 Visual and functional checks.

A. 1975 through 1995 model-year vehicles for which emission inspections are specified under Section 15.85.720 shall be visually inspected to determine whether vehicles that were originally factory-equipped with the following ECS components have such components properly installed and unmodified:

1. air injection system
2. catalytic converter
3. vacuum hoses and wires
4. fuel metering system (carburetor or fuel injection)
5. manifolds and ignition
6. positive crankcase ventilation (PCV) system
7. intake air heating (thermostatic air cleaner) system
8. evaporative ECS
9. exhaust gas recirculation (EGR) system
10. oxygen sensor
11. early fuel evaporation (EFE) system

B. In addition, 1975 through 1995 model-year vehicles for which emission inspections are specified under Section 15.85.720 shall be functionally checked to determine whether the following components are correctly operating on those vehicles that were originally factory-equipped with such components:

1. Emission control warning lights
2. Major vacuum leaks
3. Positive crankcase ventilation (PCV)
4. Intake air heater
5. Early fuel evaporation (EFE)
6. Air injection system (AIS)

C. Except as provided in Section 15.85.650, any vehicle 1975 through 1995 on which any of the above systems are removed, disconnected, modified, or defective, shall fail the visual and/or functional inspections.

(AO No. 99-160, § 7, 1-11-00; AO No. 2008-84(S), § 11, 7-15-08)

15.85.720 Exhaust emission standards.
The exhaust emission standards that apply to vehicles subject to the program are referenced in 18 AAC 52.050. A copy of these standards will be available for public inspection at the I/M program administration office.
(AO No. 99-160, § 7, 1-11-00)

15.85.730 Vehicle types.
Vehicle Type Definition
LDGV light-duty gasoline-fueled vehicles (passenger cars) not exceeding 8,500 lbs. GVWR
HDGV heavy-duty gasoline-fueled vehicles over 8,500 lbs. GVWR (heavier commercial trucks, buses and motorhomes)
LDGT1 light-duty gasoline-fueled trucks not exceeding 6,000 lbs.
GVWR (lighter pick-up trucks and vans)
LDGT2 light-duty gasoline-fueled trucks over 6,000 lbs. GVWR and not exceeding 8,500 lbs. GVWR (heavier pick-up trucks and vans, and many commercial trucks)
(AO No. 99-160, § 7, 1-11-00)

15.85.740 List of aftermarket parts.
A. Parts listed in the latest version of the CARB list of approved modification to Motor Vehicle Engine and ECS Exempted Under Vehicle Code Section 27156 have been evaluated by CARB and are approved for use in the Anchorage I/M program area unless specifically disapproved by the I/M program administrator.
B. Certified stations should use approved aftermarket catalysts in any case where replacement of a defective catalyst with an original equipment catalyst would result in the repair cost minimum criteria being violated and repairs not being completed.
C. The use of other approved aftermarket parts is allowed but not encouraged. Many of the parts contained on the CARB list have been approved only because they have been shown to have no effect on vehicle emissions or fuel economy. Their approval for installation on vehicles subject to the I/M program should not be considered an endorsement by either the CARB or the I/M program administrator.
D. In addition to the listed aftermarket parts, certified I/M stations may use other aftermarket replacement parts that are functionally identical to the original equipment parts in all respects that in any way affect emissions. An example of such a part would be a replacement engine hose. Explicit approval of such a replacement part by either the CARB or the I/M program administrator is not required, although the CARB does require the manufacturers of such parts to maintain records such as test data to substantiate that the replacement parts are functionally identical to the original equipment parts.
E. Dual fuel conversion systems shall be accepted for use in the Anchorage I/M program area provided they meet the requirements of Section 15.85.390 and are allowed by the EPA, Office of Mobile Sources June 25, 1974 Mobile Source Enforcement Memorandum No. 1A, Addendum to Mobile Source Enforcement Memorandum 1A and current updates.
(AO No. 99-160, § 7, 1-11-00; AO No. 2006-13, § 13, 2-14-06)
Editor's note: The February 14, 2006 effective date of AO 2006-13 was subject to State of Alaska approval of the I/M program amendments pursuant to 18 AAC 52.035, and the state approved on May 15, 2006.

Alaska Department of Environmental Conservation

Amendments to:

State Air Quality Control Plan

Vol. III: Appendices

Appendix III.B.10

"Estimation of Background Carbon Monoxide Concentrations for Anchorage Project-Level Conformity Analyses"

Public Review Draft

June 28th, 2010

[Editor's note: The following documents are proposed for inclusion in Volume III (Appendices to the State Air Quality Control Plan), Appendix III.B.10, after the close of the public comment process.]

Placeholder for:

ADEC Affidavit of Oral Hearing

&

ADEC Response to Oral and Written Public Comments on the Anchorage Carbon Monoxide Maintenance Plan, dated {*Insert Date of Document*}

Appendix to III.B.10

Note: In addition to the document below, the State of Alaska will include Appendix III.B.10 containing the Anchorage Assembly Resolution (AR) adopting the revised CO Maintenance Plan and an affidavit of an oral hearing to be held by the State of Alaska. The AR and oral hearing are expected to occur in spring or early summer 2009.

Estimation of Background CO Concentration for Anchorage Project-Level Conformity Analyses

Most project-level conformity analyses involve modeling expected CO concentrations from projects related to major intersections with high traffic volumes. CAL3QHC modeling assumes that CO concentrations predicted at roadway receptors are the sum of two sources: (1) emissions from the roadway(s) and/or intersections being modeled; or (2) "background CO" from other roadways and emissions sources not directly accounted for in the model.

Typically, background CO is estimated from background or neighborhood-scale monitors in the vicinity. For example, a background CO estimate might be taken from measurements from a nearby residential neighborhood. Although this might make sense initially, this approach to estimating background CO is not appropriate in Anchorage.

In Anchorage, CO concentrations in some residential areas are substantially *higher* than those near major roadways. A CO monitoring study conducted in 1997-98 showed that CO concentrations measured at the Turnagain and Garden sites, which are located on relatively low volume residential streets were 20% to 50% higher than concentrations measured near major roadway intersections such as the Seward Highway & Benson Boulevard, Old Seward & Dimond, or Lake Otis & Tudor. CO concentrations along these major arterials were lower even though their traffic volumes were an order of magnitude higher than the neighborhood sites.[‡‡]

Thus, using CO values obtained from residential sites like the Garden or Turnagain site yields a background concentration estimate that is unrealistically high for modeling major roadway projects in Anchorage. Because most project level analyses involve major roadways where mechanical turbulence is important in reducing CO concentrations, it is inappropriate to use data from residential sites to estimate the background value.

In order to better determine an appropriate background value for CAL3QHC modeling, CO data from two monitors near the intersection of Seward Highway and Benson Boulevard were examined. The first site, known as the *Seward Highway* site, was located on the southwest corner of the intersection of Seward Highway & Benson Boulevard.[§§] (See Figure 1.) It collected data from this location between 1987 and 2004. Monitoring was also conducted at a second site, approximately 80 meters to the west on Benson Boulevard during the winter of 1997-98. For the purposes of this discussion this monitor will be called *Benson Mid-block*. Because this second monitor was setback further from the

[‡‡] As noted in Section III.B.5, mechanical turbulence from vehicle traffic is believed to provide some localized atmospheric mixing and thus reduce CO levels on days when natural atmospheric mixing is very limited. Because traffic levels are low in residential area, less mechanical mixing occurs and higher CO concentrations result.

[§§] The intersection of Seward Highway and Benson Boulevard is the highest volume intersection in Anchorage. The 1997-98 CO Saturation Monitoring Study showed that concentrations at this intersection were the highest of all intersections monitored. Other monitored intersections included Lake Otis & Tudor, Northern Lights & Boniface, Old Seward & Dimond, and Spenard & Minnesota.

Seward Highway, it was less affected by the emissions from idling traffic queued up on Benson waiting for the red light at Seward Highway.

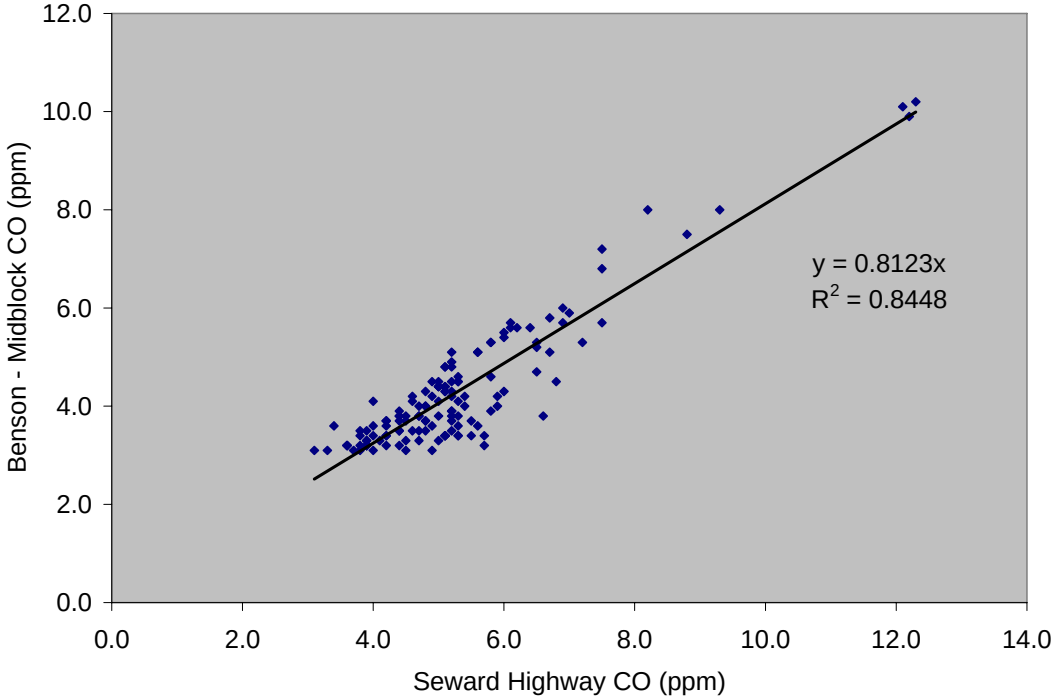
Figure 1

Aerial Photo of Intersection of Seward Highway and Blvd
Seward Highway Monitor was located approximately 80 meters east of the Benson Mid-block Monitor

CO concentrations were approximately 19% lower at *Benson Midblock* than the *Seward Highway* site. The scatter plot in Figure 2 shows the relationship between paired hourly concentrations measured at these two locations. (Hourly values below 3 ppm were disregarded.)

Figure 2

Relationship between hourly CO concentrations measured at the Seward Highway Station and a midblock location 80 meters west (1997-98 data)

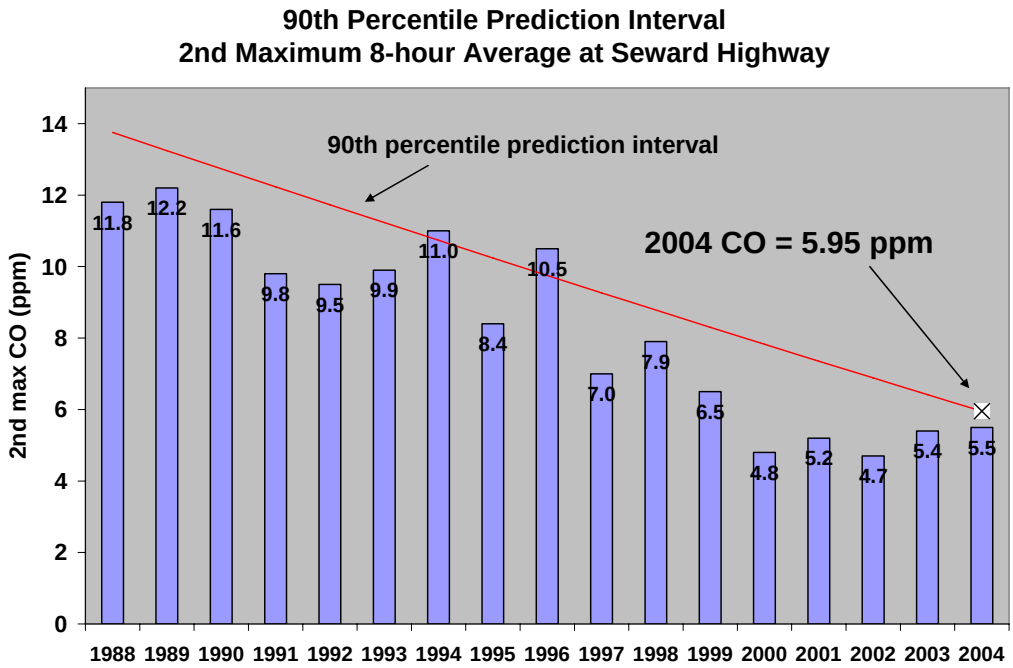


Although concentrations at the *Benson Mid-block* site were lower than those at the *Seward Highway* site, concentrations there were still probably unduly influenced by the heavy traffic on Benson Boulevard to be considered a good background site. The probe for *Benson Mid-block* was located just 10 meters south of nearest traffic lane. If the probe for *Benson Mid-block* were to have been setback 50 or 100 meters from Benson Boulevard a more realistic background value for this busy midtown area might have been obtained. Nevertheless, concentrations at *Benson Mid-block* offer a more reasonable (and lower) estimate of the "true" background concentration near major arterials than values obtained from monitors in Anchorage residential areas.

The *Benson Mid-block* monitor therefore provides a conservative or high estimate of background CO for CAL3QHC modeling. CO monitoring at *Benson Mid-block* was discontinued in the late 1990's. Nevertheless, the present-day background value can be estimated using the regression relationship between the *Seward Highway* and *Benson Mid-block* sites.

The methodology used to estimate the background CO value for 2008 is described below. A statistical approach, relying on the 90th percentile prediction interval, was used to compute the background concentration for 2008 from data collected from the *Seward Highway* and *Benson Mid-Block* monitors. This methodology is similar in many ways to the probabilistic approach used in the Anchorage maintenance demonstration.

1. Use the 90th percentile prediction interval to compute the 90th percentile value of the 2nd maximum 8-hour average at Seward Highway in 2004. (Monitoring was discontinued in December 2004.)



2. Compute the corresponding 90th percentile 8-hour concentration at *Benson Midblock* in 2004 using the slope of the regression relationship shown in Figure 2.

   Benson Midblock 2004 (90th percentile) = (5.95 ppm) x 0.8123 = 4.8 ppm
   (This value is the computed background CO concentration for 2004.)

3. Use MOBILE6 to project the background concentration in 2008 from the 2004 level.***

	MOBILE6 emission factor @ 2.5 mph	8-hour CO (ppm)	1-hour CO** (ppm)
2004	45.307	**4.8**	**6.9**
2005	42.525	4.5	6.5
2006	37.043	4.0	5.6
2007	35.537	3.8	5.4
2008	**33.722**	**3.6**	**5.1**

** In accordance with guidance, persistence factor of 0.7 was used to compute the 1-hr concentration from the 8-hr. i.e., 1 hr bkg CO (2008) = 3.6 ppm/0.7 = 5.1 ppm

The computed background CO concentration is therefore:

Background 8-hour CO = 3.6 ppm

Background 1-hour CO = 5.1 ppm

*** CAL3QHC guidance suggests that the background CO concentration should be adjusted downward over time in proportion to the decline in idle emissions projected by MOBILE6. The MOBILE6 emission factor at 2.5 mph is used as a surrogate for idle emissions.

Alaska Department of Environmental Conservation

Amendments to State Air Quality Control Plan

Vol. III: Appendix III.D.2.2

"Anchorage Assembly Resolution AR 2010-4 Adopting the Eagle River PM-10 Limited Maintenance Plan"

Public Review Draft

June 28th, 2010

Submitted by: Chair of the Assembly at the Request of the Mayor
Prepared by: Department of Health and Human Services
For Reading: January 12, 2010

CLERK'S OFFICE
APPROVED
Date: 1-12-10

ANCHORAGE, ALASKA
AR NO. 2010-4

A RESOLUTION OF THE MUNICIPALITY OF ANCHORAGE ADOPTING THE EAGLE RIVER PM-10 LIMITED MAINTENANCE PLAN.

THE ANCHORAGE ASSEMBLY RESOLVES:

WHEREAS, in 1991 the Anchorage Assembly approved the Eagle River PM-10 Control Plan which called for paving and resurfacing gravel roads in Eagle River as a means of controlling PM-10 emissions and eliminating violations of the air quality standard; and

WHEREAS, over twenty two miles of gravel roads in the Eagle River PM-10 nonattainment area were paved or surfaced with recycled asphalt by 1993; and

WHEREAS, no violations of the air quality standard for PM-10 have been measured in Eagle River since the road paving and surfacing program was completed; and

WHEREAS, before Eagle River can be redesignated as an attainment area, the U.S. Environmental Protection Agency requires the submission of a maintenance plan demonstrating that PM-10 control measures put in place are permanent and that Eagle River will continue to comply with the air quality standard for the foreseeable future; and

WHEREAS, the Eagle River PM-10 Limited Maintenance Plan was prepared in accordance with the transportation planning process required under Section 114 of Title 23 of the United States Code and Section 110 of the Clean Air Act; and

WHEREAS, the amended Maintenance Plan was released for public comment, and recommended for approval by the AMATS Air Quality Advisory Committee and the AMATS Technical Advisory Committee; and

WHEREAS, the AMATS Policy Committee approved the Eagle River PM-10 Limited Maintenance Plan on November 19, 2009; now, therefore,

Section 1. This resolution shall be effective immediately upon passage and approval by the Assembly

PASSED AND APPROVED by the Anchorage Assembly this 12th day of January, 2010.

Chair

ATTEST:

Municipal Clerk

Alaska Department of Environmental Conservation

Amendments to State Air Quality Control Plan

Vol. III: Appendix III.D.2.5

"PM_{10} Design Values for Eagle River and Qualification for Limited Maintenance Plan"

Public Review Draft

June 28th, 2010

Appendix to Volume II., Section III.D.2.5

PM_{10} design values for Eagle River and qualification for Limited Maintenance Plan

Computation of 24-hr Design Value

Computational methods for determining the 24-hour design value (DV) are outlined in the *PM_{10} SIP Development Guideline (EPA-450/2-86-001, June 1987).* The empirical frequency distribution approach (see Section 6.3.3. of the guideline) was used to determine the site-specific PM_{10} concentration that would be expected to be exceeded at a frequency of once every 365 days.

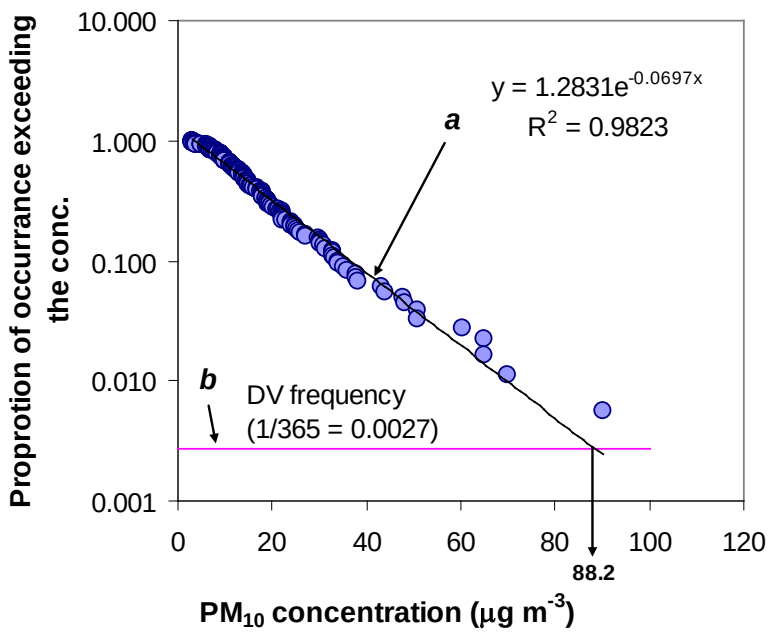
To do so, we first ranked all observations by PM_{10} concentration for each 3-yr block during the 1998 – 2007 period in descending order. Because PM_{10} concentrations were monitored generally on a one-in-six-days basis, each 3-yr block had approximately 180 observations (thus the lowest concentration measured in each 3-yr block had a rank order ≈ 180).

Next, for a concentration ranked (*i*), the proportion of PM_{10} observations that exceed that concentration is calculated as:

i / total number of observations

The empirical frequency distribution for each 3-yr block was then graphed by plotting the proportion of occurrence against PM_{10} concentrations (an example of 2004-2006 period is shown in Figure 1, Line ***a***). Because by definition the DV is a concentration that corresponds to an exceedance frequency of 1/365 (Line ***b***), the DV was graphically determined as the intersecting point of Lines ***a*** and ***b*** in the Figure 1.

Figure 1
Example - Determination of 24-hr DV for 2004-2006.



Line ***a*** = the empirical frequency distribution for all the observations during the 2004-2006 period. Line ***b*** = DV frequency by definition (1/365). Total number of observations = 181. For this particular period, DV was determined to be 88.2 µg/m^3.

Table 1 below shows calculated DV's for the last decade, all eight 3-yr blocks, to demonstrate that there is no increasing trend in DV's over this period. The average DV during the last 5-yr period (2003-2007) was 92.3 µg/m^3. This is under 98 µg/m^3 and therefore meets the qualification for the LMP option.

Table 1
Computation of Average DV for Parkgate Site in Eagle River

3-yr Period	Equation of Line Describing Empirical Frequency Distribution ++	R^2	DV (computed from previous 3 years data using empirical frequency distribution) (µg/m^3)
1998-2000	$y = 1.4749e^{-0.0744x}$	0.960	84.5
1999-2001	$y = 1.28522e^{-0.0643x}$	0.962	95.5
2000-2002	$y = 1.41446e^{-0.0697x}$	0.984	89.7
2001-2003	$y = 1.1840e^{-0.0562x}$	0.944	108.0
2002-2004	$y = 1.3124e^{-0.0656x}$	0.968	94.1
2003-2005	$y = 1.1248e^{-0.0586x}$	0.969	102.7
2004-2006	$y = 1.2831e^{-0.0697x}$	0.982	88.2
2005-2007	$y = 1.3049e^{-0.0717x}$	0.979	86.0
		Average DV 2003-2007 =	**92.3** µg/m^3
		LMP Qualification Criteria	**< 98** µg/m^3

++ In this equation *y* is the proportions of concentrations exceeding a particular PM_{10} concentration and *x* is the concentration of interest. If *y* is set = 1/365 = 0.0027, the equation can be used to solve for *x*, the concentration that would be expected to be exceeded once per year.

Computation of a Site-Specific Design Value

Attachment A of the Limited Maintenance Plan guidance (Wegman memo, EPA, August 9, 2001) outlines a procedure for computing a *site-specific* value (called a critical design value or CDV) that may serve as alternative to the 98 µg/m^3 value used to determine whether an area qualifies for the LMP option or meets the Motor Vehicle Regional Emissions Analysis Test. The computation is described below:

$$\mathbf{CDV = NAAQS/(1+t_c CV)}$$

Where:

CDV = the critical design value

CV = the coefficient of variation of the annual design values (the ratio of standard deviation divided by the mean design value in the past)

$\mathbf{t_c}$ = the critical one-tail t-value corresponding to a given probability of exceeding the NAAQS in the future and the degree of freedom in the estimate for the CV.

EPA Region 10 staff has recommended that a probability of 5% be assumed to determine the appropriate critical one-tail t value (t_c) in the computation.

Table 2
24-hour CDV (µg/m^3) for Eagle River.

Parameter	24hr-CDV (µg/m^3)
Average DV	92.3
SD	9.1
CV	0.098
n	3
df	2
t_c (5%, one-tail)	2.920
CDV	**116.6**

The computed CDV for Eagle River is 116.6 µg/m^3. This means that, based on the magnitude of the eight annual DV's computed for Eagle River between 2000 and 2007 and their year-to-year variability, there is only an expected 5% probability that the average DV would be higher than 116.6 µg/m^3 at the Parkgate site. The site-specific criterion is considerably higher than the "default" value of 98 µg/m^3. This higher site-specific value was used as a margin of safety (MOS) value in the Motor Vehicle Regional Emissions Analysis Test.

Alaska Department of Environmental Conservation

Amendments to State Air Quality Control Plan

Volume III: Appendix III.D.2.6

"2007 and 2020 PM_{10} Emission Inventories for the

Eagle River Limited Maintenance Area"

Public Review Draft

June 28th, 2010

Appendix to Volume II., Section III.D.2.6

2007 and 2020 PM_{10} Emission Inventories for the Eagle River Limited Maintenance Area

Overview

This document describes the assumptions and methods used to develop the 2007 base year PM_{10} attainment inventory and the projected inventory for year 2020. The 1987 inventory is also shown for illustrative purposes. Emissions from significant sources within the 9 km^2 area were estimated using standard methodologies outlined in AP-42 for fugitive PM_{10} sources. MOBILE6.2 was used to estimate the contribution of motor vehicle exhaust, tire and brake wear emissions to PM_{10}.

As will be shown in the inventory, the large majority of PM_{10} emitted in the maintenance area is of "crustal" or geological origin. The emission inventory will show that the two most significant sources of this crustal material are the "dust" stirred up by vehicle traffic travelling on paved roadways and wind-lofted dust from roads, parking lots and un-vegetated areas within the maintenance area. This finding is consistent with past source apportionment studies that have consistently shown that the vast majority of PM_{10} in Eagle River and Anchorage consists of crustal material.[1]

In 1991, when the attainment plan for Eagle River was prepared, the most important source of PM_{10} was unpaved roads. Since that time, however, all of the roads in the area have been paved so unpaved road emissions are no longer included in the inventory. For this maintenance plan, the five PM_{10} source categories were identified and inventoried within the Eagle River maintenance area. These include (1) dust from paved roads; (2) wind-generated dust from roads, parking lots and un-vegetated areas; (3) fireplaces and woodstoves; (4) natural gas combustion; and (5) exhaust, tire and brake wear emissions from motor vehicles.

AP-42, "Compilation of Air Pollution Emissions Factors," is an EPA publication that provides guidance on the estimation of emissions on a large variety of air pollution emission sources. AP-42 was used to estimate emissions for all of the above sources except exhaust, tire and brake wear emissions. These emissions were estimated using the EPA MOBILE6.2 emission factor model. The methods and assumptions used to estimate emissions from each of these sources is described in the next five sections.

[1] Four studies have been performed to characterize the sources of particulate and Anchorage and Eagle River. These include two chemical mass balance/source apportionment studies (Pritchett & Cooper, 1985, Cooper & Vodovinos, 1988) and two studies that used microscopy (Crutcher, 1994, R.J. Lee, Inc., 1995) to identify and quantify the types (and probable sources) of particulate.

(1) Dust from Paved Roads

Dust from paved roads is a major source of PM_{10} in Eagle River and Anchorage. Roads are often laden with large amounts of "sediment" and other fine-grained minerals left over from winter sanding operations, material abraded from the road surface itself by traffic (especially from vehicles equipped with studded tires), and spillage from hauling activities. Roads tend to be dirtiest during the spring break-up period which generally occurs between mid-March and the end of April. Although the grain size of most of the sediment on the roads is too large to be PM_{10}, some of this material has been pulverized to a grain size less than 10 microns. When these very fine grained particles are re-entrained into the air by turbulence from traffic travelling on the road, they become $PM_{10.}$

Section 13.2.1 of AP-42 outlines procedures for estimating PM_{10} emissions from paved roads. According to AP-42, emissions from a paved road are a function of how much fine-grained sediment or silt is on the road and the weight of vehicles using the road. [2] Paved road emissions increase in direct proportion to the amount of traffic or vehicle miles travelled (VMT) on the roads. Higher traffic volumes result in greater emissions.

VMT Estimation

The air quality conformity analysis for the 2007 Chugiak-Eagle River Long Range Transportation Plan (CE/LRTP) included VMT estimates for analysis years 2007, 2017, and 2027. These VMT estimates served as the basis for the 2007 and 2020 inventories presented here. The CE/LRTP VMT estimates for 2007 in the 2007 base year attainment inventory and 2020 was estimated by interpolating between CE/LRTP projections for analysis years 2017 and 2027.

In the conformity analysis for the CE/LRTP, the FHWA-approved Anchorage Transportation Model was used to estimate VMT on arterials and freeways in the Eagle River Maintenance area. The model did not provide VMT estimates for local roads, however. VMT on local roads was estimated by assuming that each household within the maintenance area makes seven home-based trips per day, each involving 0.62 miles of travel on local roads.[3] Each household was assumed to generate 4.34 miles *(7 trips x 0.62 m)* of local road VMT each day.

Table 1 shows VMT estimates by roadway type.

[2] Silt is defined as the finer-grained soil particles that pass a #200 mesh sieve; these are particles nominally 75 microns and smaller.
[3] For example, a trip from home to the local grocery store and back would count as two home-based trips.

Table 1.
Estimated and Projected VMT in Eagle River PM_{10} Maintenance Area
Base Year 2007 and End of 10-Year Maintenance Planning Period 2020

	Local Road VMT (based on housing Stock)					Arterial and Freeway VMT (Anchorage Transportation Model estimates)	
	Housing Stock	Local Unpaved VMT	Paved (RAP)± VMT	Paved (SP/CG)** VMT		Arterials	Glenn Hwy
2007	**4,548**	**0**	**7,659**	**12,079**		**68,664**	**77,532**
2017	4,908	0	8,264	13,034		83,370	107,640
2020	**5,015**	**0**	**8,446**	**13,321**		**87,782**	**116,672**
2027	5,267	0	8,870	13,989		98,076	137,748

± RAP = recycled asphalt pavement
** SP/CG = strip paved or curb and gutter

Paved Road Emission Factor

Section 13.2.1 of AP-42 (updated November 2006) outlines recommended procedures for estimating PM_{10} emissions from paved roads. The paved road emission factor, the amount of PM_{10} generated in pounds per vehicle mile travelled (VMT), is a function of the "silt loading" on the road and the average weight of the vehicles travelling on the road.

The AP-42 paved road emission factor equation is:

$$E = k(sL/2)^{0.65} \times (W/3)^{1.5} - C$$

where

E = *PM_{10} emissions in lbs/VMT*
k = *0.016 (AP-42 specified particle size multiplier for PM_{10})*
sL = *road surface silt loading (varies by roadway type)*
W = *mean vehicle weight in tons (assumed to be 2 tons)*
C = *vehicle exhaust, tire and brake wear emissions (AP-42 recommendation = 0.00047 lbs/VMT)*

Data collected in Anchorage in 1996 (Montgomery-Watson, 1996) showed that silt loading varied by roadway type. (For this inventory Eagle River was assumed to have silt loadings identical to Anchorage.)

The Municipality of Anchorage maintains a detailed inventory of the surface treatment of roads in the Chugiak – Eagle River area. While the majority of the roads in the area are paved with "traditional" hot asphalt paving (HAP) about one-third of the local roads in the maintenance area are constructed with recycled asphalt paving or RAP. Although air quality monitoring data suggest RAP treatment has proven to be an effective means in reducing PM_{10} from gravel roads in Eagle River, the surface of these roads is less durable and more erodible than those constructed using HAP. Because roadway abrasion is a significant source of silt on roads, it seems reasonable to assume that the silt loadings on RAP roads are higher than those surfaced

with HAP.[4] For the purpose of this inventory, RAP-constructed roads were assumed to have silt loadings twice those constructed with HAP.

Table 2 shows average silt loading measurements and the computed AP-42 PM_{10} emission factor for each roadway type for the spring and fall PM_{10} seasons.

Table 2
Typical Silt Loadings and PM_{10} Emission Factors by Season for Paved Roads in Eagle River

	Spring Break-up Period		Fall Freeze-up Period	
	Silt loading (g/ m^2)	Spring PM_{10} Emission Factor (lbs/VMT)	Silt loading (g/ m^2)	Fall PM_{10} Emission Factor (lbs/VMT)
Arterial Paved Roads	6.7	0.0207	1.1	0.0061
Freeways (Glenn Hwy)	20.4	0.0433	2.6	0.0110
Local Paved Roads (hot asphalt paving)	18.4	0.0404	4.7	0.0164
Local Paved Roads (recycled asphalt)	36.8#	0.0637	9.4#	0.0260

Silt loading estimated to be double those of local roads constructed with hot asphalt paving.

Using AP-42 Emission Factors and VMT Estimates to Compute Paved Road PM_{10} Emissions

Paved road PM_{10} emissions can be readily computed from the emission factor and VMT on each roadway type. Table 3 shows estimated emissions for the spring and fall periods for base year 2007 and for the end of the maintenance period in 2020.

Table 3
Estimated PM_{10} Emissions from Paved Roads in the Eagle River Maintenance Area
2007 and 2020

	2007			**2020**		
Roadway Type	**VMT**	**Spring Emissions (tons/day)**	**Fall Emissions (tons/day)**	**VMT**	**Spring Emissions (tons/day)**	**Fall Emissions (tons/day)**
Arterial Paved Roads	68,664	0.71	0.21	87,782	0.91	0.27
Freeways (Glenn Hwy)	77,532	1.68	0.43	116,672	2.52	0.64
Local Roads (hot asphalt paving)	12,111	0.24	0.10	13,356	0.27	0.11
Local Roads (recycled asphalt)	7,627	0.24	0.10	8,411	0.27	0.11
TOTAL	**165,934**	**2.88**	**0.83**	**226,221**	**3.97**	**1.13**

[4] The Municipality of Anchorage recently completed a study that suggests that roadway abrasion is the source of about 25% of the "dirt" on the road surface during spring break-up.

(2) Wind Generated Dust from Roads, Parking Lots and Un-Vegetated Areas

Although EPA guidance allows the flagging of PM_{10} exceedances that occur as a result of extreme wind events such as those that occurred on March 12, 2003 and December 2, 2007 in Eagle River, PM_{10} observations resulting from commonly occurring, less energetic wind-related events are considered valid data and are not excluded when determining the design value for an area or determining whether the area is in compliance with the NAAQS. Monitoring data suggest that wind-generated dust frequently contributes to elevated PM_{10} concentrations in Eagle River.

Estimating the Amount of Area Covered by Roads, Parking Lots and Un-vegetated Areas

Wind-generated dust generally originates from paved surfaces laden with dirt and silt. These paved surfaces include roadways and parking lots in the maintenance area. There are also some cleared, un-vegetated areas that are unpaved.

Estimates of the amount of area available for the generation of windblown dust are shown in Table 4. The area amount of roadway was estimated by the length of each type of roadway and the average width of that type of roadway. For example, there are 6.2 miles of arterial roadway in the maintenance area and arterial roadways have an average paved width of approximately 60 feet.

The surface area of the arterial roadways in the maintenance area is therefore:

$$(6.2 \text{ miles length})(5{,}280 \text{ ft/mi})(60 \text{ ft width}) = 1{,}964{,}160 \text{ ft}^2$$

$$1{,}964{,}160 \text{ ft}^2 / 43{,}560 \text{ ft}^2/\text{acre} = 45.1 \text{ acres}$$

The amount of acreage covered by parking lots, paved school playgrounds, and similar areas was estimated by inspecting Google satellite photos of the maintenance area. The acreage of un-vegetated, cleared areas was estimated in like manner. The Google map utility includes a distance key that allows the dimensions and acreage of a particular surface feature to be estimated. For example, a parking lot with dimensions of 250 feet by 500 feet is approximately 3 acres in size. Because parking areas, particularly those serving retail establishments serve the local population, we assumed that the total area covered by parking lots and the like would increase in direct proportion with housing stock. Housing stock is projected to increase by 10.3% between 2007 and 2020; paved parking areas were assumed to increase by a like proportion.

The total amount of paved or cleared area in the maintenance area in base year 2007 was estimated to be 289 acres. This constitutes about 12.5% of the land surface in the maintenance area.

Table 4
Estimated Surface Area Coverage of Roads, Parking Lots and Un-vegetated Areas in Eagle River PM_{10} Maintenance Area

	2007		2020	
	Roadway Length (miles)	**Estimated Area (acres)**	**Roadway Length (miles)**	**Estimated Area (acres)**
Glenn Highway	1.1	13	1.1	13
Arterials	6.2	45	6.2	45
Local Roads	45.6	165	45.6	165
Parking Lots	----	55	----	62
Un-vegetated Areas	----	10	----	10
TOTAL		**289**		**296**

Note: To compute the total paved area of roadways, a paved width of 100 feet was assumed for the Glenn Highway, 60 feet for arterials, and 30 feet for local roads.

Wind Blown Dust Emission Factor Estimation

AP-42 does not provide an emission factor methodology specific to estimating PM_{10} emission from roads, parking lots and un-vegetated areas. However, it does outline a methodology (see AP-42 Section 13.2.5.1) for estimating emissions from aggregate storage piles and open areas within an industrial facility. After examining other alternatives, the methodology recommended for estimating wind-generated PM_{10} emissions from open areas in industrial facilities seemed to offer the best fit available for estimating wind-generated PM_{10} in Eagle River.

The AP-42 Section 13.2.5.1 outlines a step-by-step procedure for estimating wind generated PM_{10} emission factor for open areas in industrial facilities. This methodology was applied to the estimation of emissions from open areas in Eagle River.

AP-42 provides the following equation for estimating PM_{10} emissions from wind blown dust:

Equation 1

$$EF_{wind} = 0.5(58(u^* - u_t^*)^2 + 25\,(u^* - u_t^*))$$

where:

u^* = *friction velocity (m/s)*
u_t^* = *threshold friction velocity (m/s)*

The next two sub-sections will describe how the variables u_t^* and u^* were determined.

Determining u_t^*

AP-42 outlines a field procedure and lab test (sieve analysis) for estimating the threshold friction velocity (u_t^*). The mode of the aggregate size distribution is determined and can be related empirically (see AP-42 Table 13.2.5-1) to u_t^*. In order to estimate u_t^* for the aggregate material in the Eagle River maintenance area, existing sieve analysis data from street sediment collected in Anchorage was used.[5] Over 300 street sediment samples were collected and sieved. Although the sieves used in this analysis did not correspond exactly to those prescribed in Table 13.2.5-1, they were similar enough so that a reasonable estimate of u_t^* could be made.[6] The mode size was determined from the average of all 300+ sieve analysis results. On average, 24.9% of the total street sediment was "captured" between sieves #40 (0.42 mm) and #100 (0.149 mm). The midpoint size between these two sieves is 0.285 mm (See Figure 1).

Figure 1
Sieve Analysis Results for Anchorage Street Sediment Data

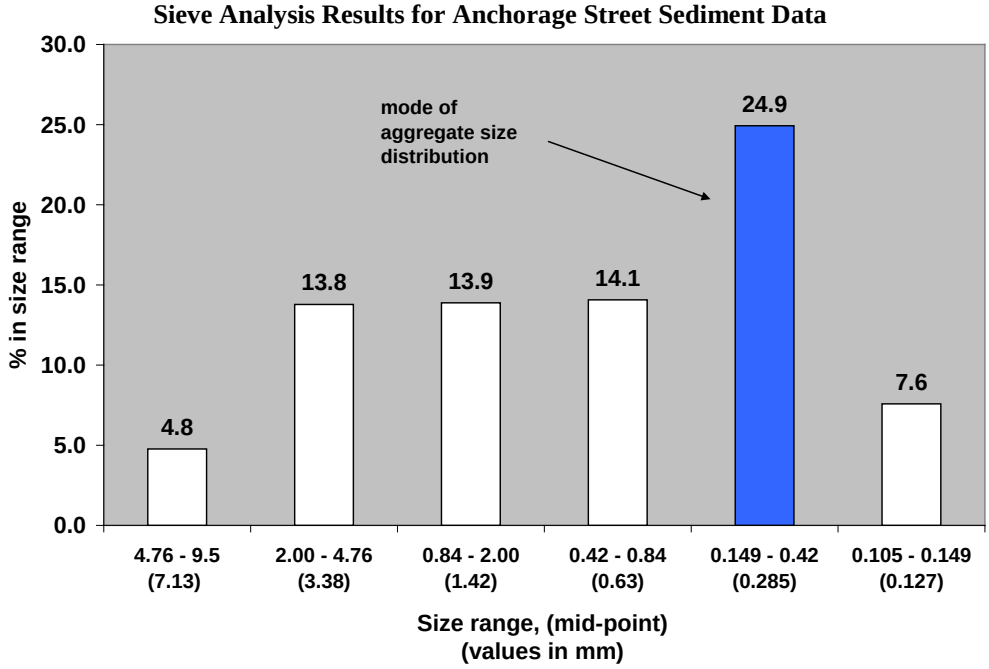


Table 13.2.5-1 recommends a value for u_t^* = 0.43 m/s for a midpoint size range of 0.375 mm. Again, because different sieves were used to characterize the size distribution of Anchorage road sediment than prescribed by AP-42, our midpoint value is slightly different. Nevertheless the data suggest that 0.43 m/s is a reasonable assumption of u_t^* for Eagle River road sediment.

*Determining u**

[5] These data were collected in spring of 1996 by Montgomery-Watson, Inc. for the MOA Watershed Management Section as part of an analysis of street sediment impacts on streams and lakes in Anchorage.
[6] The sieves used in the Anchorage street sediment testing were #4, #9, #20, and #100. The method recommends using sieves #5, #9, #16, #32, and #60.

The friction wind velocity (u^*) is the estimated wind velocity at the ground surface where street sediment and other fine materials lay available for re-entrainment by the wind. Wind speed measurements are taken at 10 meters above the ground (u_{10}^+), however. The actual wind speed at the ground surface is significantly lower. AP-42 recommends the following equation to estimate u^*:

$$u^* = 0.053\, u_{10}^+ \text{ (expressed in m/sec)}$$

In order to estimate the contribution of wind blown dust to PM_{10}, we identified the five highest PM_{10} days during spring break-up (March, April) and fall freeze-up (October, November) over the 10-year period 1998-2007. We excluded the two designated exceptional events that resulted from wind/dust storms occurred on March 12, 2003 and December 2, 2007.[7] We examined local climatological data and determined the maximum wind speed (maximum 2-minute observations) that occurred on each of those days.[8] The friction velocity was selected from the spring and fall days with the highest wind speed.

Results of this analysis are shown in Table 5.

Table 5
Equivalent Friction Wind Velocities on High PM_{10} Days
During Spring Break-up and Fall Freeze-up (1998-2007)

Date	PM_{10} (µg/m^3)	Max 2-min Wind Spd u_{10}^+ (mph)	Equivalent Friction Wind Velocity u^* (m/s)		Date	PM_{10} (µg/m^3)	Max 2-min Wind Spd u_{10}^+ (mph)	Equivalent Friction Wind Velocity u^* (m/s)
3/10/2003	**92**	**23**	**0.55**		11/13/2006	65	16	0.38
3/17/2005	90	15	0.36		11/7/1998	55	7	0.17
3/4/2003	82	23	0.55		**10/21/2000**	**52**	**20**	**0.47**
4/15/2004	70	8	0.19		10/31/2005	51	14	0.33
3/14/2001	69	13	0.31		11/7/2006	48	20	0.47
		Selected value for u^* =	**0.55**				**Selected value for u^* =**	**0.47**

[7] The highest two-minute wind speed measured on March 12, 2003 was 52 mph and on December 2, 2007 two-minute winds reached 48 mph.
[8] Because there are no comprehensive wind data available for Eagle River, local climatological data from the Ted Stevens Anchorage International Airport were used.

Computing the Wind Blown Dust Emission Factor from Equation (1)

Now that the threshold friction velocity u_t^* and equivalent wind friction velocity u^* have been determined for the spring and fall PM_{10} seasons, we can use Equation 1 to compute the PM_{10} emission factor for wind blown dust.

$$\text{(Equation 1)} \qquad EF_{wind} = 0.5(58(u^* - u_t^*)^2 + 25\,(u^* - u_t^*))$$

Substituting values for $u_t^* = 0.43$ m/sec and $u^* = 0.55$ m/s (spring) and 0.47 m/s (fall), the resultant spring and fall wind blown dust PM_{10} emission factor are:

Spring Windblown Dust PM_{10} Emission Factor = 1.9 g/m^2/day = 17 lbs/acre/day

Fall Windblown Dust PM_{10} Emission Factor = 0.5 g/m^2/day =5 lbs/acre/day

Estimated Wind blown PM_{10} Emissions for 2007 and 2020

Now that the emission factor and the amount of cleared acreage in the Eagle PM_{10} maintenance area have been estimated, PM_{10} emissions can be readily calculated. Computed emissions are shown in Table 6.

Table 6
Estimated Windblown Dust PM_{10} Emissions

		Spring Break-up		Fall Freeze-up	
Year	**Cleared Areas: Roadways, Parking Lots, Miscellaneous (total acres)**	**Wind blown Dust PM_{10} Emission Factor (lbs/acre)**	**Total PM_{10} Emissions (tons/day)**	**Wind blown Dust PM_{10} Emission Factor (lbs/acre)**	**Total PM_{10} Emissions (tons/day)**
2007	289	17	2.47	5	0.70
2020	296	17	2.53	5	0.72

(3) Fireplaces and Woodstoves

Basic assumptions regarding fireplace and wood stove were obtained from a telephone survey conducted by ASK Marketing and Research in 1990. This survey asked Anchorage residents how many hours per week they burned wood in their fireplace or wood stove. Because the AP-42 emission factors for fireplaces and wood stoves (See AP-42, Sections 1.9 and 1.10) are based on the amount of wood (dry weight) burned, hourly usage rates from the survey had to be converted into consumption rates. Based on discussions between MOA and several reliable sources (OMNI Environmental Services, Virginia Polytechnic Institute, Colorado Department of Health), average burning rates (in wet weight) of 11 pounds per hour for fireplaces and 3.5 pounds per hour for wood stoves were assumed.

Residential wood burning assumptions are detailed in Table 7.[9]

[9] Assumptions regarding wood burning activity levels (i.e. the number of households engaging in wood burning on a winter season design day) were corroborated by a more recent telephone survey conducted by In 2003 Ivan Moore Research (IMR) asked approximately 600 Anchorage residents whether they had used their fireplace or woodstove

Table 7
Estimation of Residential Wood Burning PM_{10} Emission Factors for Eagle River

Device	Average use per weekday (hours per household per day)	Average dry weight of wood consumed (lbs per hour)*	Average amount of wood burned per household (dry lbs / day)	AP-42 Emission Factor for PM_{10} (g/dry lb wood burned)	Estimated PM_{10} emissions per household (g/day)
Fireplaces	1.04	7.15 lbs/hr	7.44	7.9	58.8
Wood Stoves	0.85	2.275 lbs/hr	1.94	5.4**	10.5
TOTAL Fireplaces + wood stoves	**1.89**	**------**	**9.38**	**------**	**69.3**

* The moisture content of wood burned was assumed to be 35%. Thus, dry burning rates were 65% of wet rates.

** The wood stove emission factor was determined by assuming that the wood stove population in Eagle River is comprised of equal proportions of conventional, catalyst, and non-catalyst stoves. The emission factor above was calculated as the weighted average of the AP-42 emission factors for each stove type. AP-42, 5th Edition (Oct 1996)

PM_{10} emissions from residential wood burning can be estimated from the emission factor computed above and the estimated number of households. Table 8 shows estimated PM_{10} emissions from residential wood burning for base year 2007 and for year 2020. Wood burning rates per household were assumed to be the same in 2007 and 2020.

Table 8
Estimated PM_{10} Emissions from Residential Wood Burning in Eagle River Maintenance Area 2007 and 2020

Year	Housing Stock in Inventory Area	AP-42 PM_{10} Wood Burning Emission Factor for Eagle River (g/household/day)	Estimated PM_{10} Emissions from Fireplaces and Woodstoves (tons/day)
2007	4,548	64.5	0.32
2020	5,015	64.5	0.36

during the preceding day. The survey was conducted when the preceding day had a minimum temperature between 5 and 15 ºF. Although the IMR survey did not provide as detailed information as the ASK survey, its results were roughly consistent with the assumptions used in this inventory.

(4) Natural Gas Combustion

Natural gas is the main fuel source for space heating in the Municipality of Anchorage, including Eagle River. Survey information suggests that the vast majority of households use natural gas as their primary source of heat. Average household natural gas consumption during a peak heating day in the winter in the Anchorage area has been estimated to be 658 ft^3/day.[10] We, however, were interested in estimating natural gas consumption (and consequent PM_{10} emissions) during spring break-up and fall freeze-up when temperatures are warmer. Estimates of peak household natural gas consumption were estimated for a day when the average ambient temperature was approximately -10 ºF while the typical average daily temperature during the spring and fall PM_{10} seasons is approximately +30 ºF. Natural gas consumption for a +30 ºF day can be estimated from consumption on a -10 ºF day by assuming that consumption is proportional to heating degrees.[11] The computation is as follows.

Peak-day natural gas consumption per household = 658 ft^3/day

Ambient temperature on day of peak natural gas consumption = -10 ºF, heating degrees = 75

Ambient temperature on typical fall or spring day in PM_{10} season = +30 ºF, heating degrees = 35

Assume natural gas consumption is proportional to heating degree days, then

Natural gas consumption during fall or spring PM_{10} day = 658 ft^3/day x (35/75) = ***307 ft^3/day***

The Eagle River maintenance area is predominantly residential. While there are some commercial natural gas users, there is little if any industrial or utility usage. Because "non-residential use" is relatively small within the maintenance area, it seemed reasonable to assume that combined commercial and industrial use would be no more than 50% of residential. Thus, for the purpose of this inventory, total natural gas use was assumed to be 150% of estimated residential use.

The emission factor for "total" particulate matter (see AP-42 Section 1.4, July 1998) is estimated to be 7.6 lbs per 10^6 ft^3 of natural gas consumed. PM_{10} emissions from natural gas combustion in the Eagle River maintenance area can be readily computed from the amount of gas consumed and this emission factor. Table 9 shows the results of this computation.

[10] For details see "Anchorage 2007 CO Emission Inventory and 2007-2023 Projections," Municipality of Anchorage, January 2008.

[11] Heating degrees are computed as the difference between 65 ºF and the average ambient temperature. For example, if the average temperature is 30 ºF, heating degrees = 65 -30 = 35.

Table 9
Estimation of PM_{10} Emissions from Natural Gas Combustion in Eagle River Maintenance Area

	Natural Gas Consumption per Household (ft^3)	Housing Stock	Total Residential Natural Gas Consumption (ft^3)	Estimated Commercial and Industrial Natural Gas Consumption (ft^3)	Combined Residential, Commercial and Industrial Natural Gas Consumption (ft^3)	AP-42 PM_{10} Emission Factor (lbs per 10^6 ft^3)	Estimated PM_{10} Emissions (tons/day)
2007	307	4,548	1.39×10^6	0.7×10^6	2.08×10^6	7.6	**0.008**
2020	307	5,015	1.54×10^6	0.7×10^6	2.31×10^6	7.6	**0.009**

(5) Exhaust, Tire and Brake Wear Emissions from Motor Vehicles

In addition to the PM_{10} that vehicles stir-up as they travel along dirty roadways, motor vehicles are also responsible for some "direct" PM_{10} emissions. These include tail pipe exhaust emissions, and the emissions that result from tire and break wear. These emissions can be estimated by using the EPA mobile source emission factor model called MOBILE6.2. MOBILE6.2 allows the vehicle fleet characteristics of a particular area such as the proportion of diesels in the fleet, age distribution of the fleet and the stringency of the vehicle inspection and maintenance program to taken into account when estimating emissions. Fuel characteristics such as gasoline and diesel fuel sulfur content are also accounted for in the modeling process.

MOBILE6.2 was used to estimate the PM_{10} emission factors for exhaust, tire and brake wear emissions for the Anchorage fleet in base year 2007 and in 2020, the end of the maintenance planning period. The model produces emission factor estimates in grams per VMT. Thus, if VMT is known, emissions can be readily computed as the product of the emission factor and VMT estimate. Table 10 shows the results of the MOBLE6.2 emission factor modeling and consequent estimates of PM_{10} emissions. As can be seen in the Table, exhaust, tire and break wear emissions are small. For example, road dust emissions are more than 100 times greater than the combined contribution of exhaust, tire and brake wear emissions.

Table 10
Estimated PM_{10} Emissions from Motor Vehicle Exhaust, Tire Wear and Brake Wear in Eagle River Maintenance Area - 2007 and 2020

	2007			2020		
	MOBILE6.2 Emission Factor (g/mi)	**VMT**	**PM_{10} Emissions (tons/day)**	**MOBILE6.2 Emission Factor (g/mi)**	**VMT**	**PM_{10} Emissions (tons/day)**
Tail Pipe Exhaust	0.0046	165,934	0.0008	0.0037	226,221	0.0009
Brake Wear	0.0125	165,934	0.0023	0.0125	226,221	0.0031
Tire Wear	0.0085	165,934	0.0016	0.0085	226,221	0.0021
TOTAL COMBINED			**0.0047**			**0.0061**

Eagle River PM_{10} Emissions Inventory Summary

The Eagle River PM_{10} emissions inventories for 2007 and 2020 are summarized in Table 11. Separate inventories are provided for the two peak PM_{10} periods, fall freeze-up and spring break-up.

As can be seen in the Table, the most significant sources of PM_{10} in the Eagle River maintenance area are paved roads, wind blown dust, and fireplaces and wood stoves.

Table 11
Eagle River Limited Maintenance Area PM_{10} Emissions Inventory
All Emissions in tons/day with % of Total

	Spring Break-up (March, April)		Fall Freeze-up (October, November)	
Source Category	**2007**	**2020**	**2007**	**2020**
Paved Roads	2.88 (50.6%)	3.97 (57.8%)	0.83 (44.4%)	1.13 (50.8%)
Wind blown Dust from Paved Roads, Parking Lots and Un-Vegetated Areas	2.47 (43.5%)	2.53 (36.8%)	0.70 (37.6%)	0.72 (32.5%)
Fireplaces and Wood Stoves	0.32 (5.7%)	0.36 (5.2%)	0.32 (17.3%)	0.36 (16.1%)
Natural Gas Combustion	0.008 (0.1%)	0.009 (0.1%)	0.008 (0.4%)	0.009 (0.4%)
Exhaust, Tire and Brake Wear Emissions from Motor Vehicles	0.005 (0.1%)	0.006 (0.1%)	0.005 (0.3%)	0.006 (0.3%)
TOTAL	**5.69 (100%)**	**6.87 (100%)**	**1.87 (100%)**	**2.22 (100%)**

Alaska Department of Environmental Conservation

Amendments to State Air Quality Control Plan

Vol. III: Appendix III.D.2.11

"Natural Events Action Plan for Windblown Dust Events

in Anchorage, Alaska"

Public Review Draft

June 28th, 2010

Natural Events Action Plan for Windblown Dust Events in Anchorage, Alaska

Municipality of Anchorage

Department of Health and Human Services

Environmental Services Division

Environmental Quality Section

September 2002

Natural Events Action Plan for Windblown Dust Events in Anchorage, Alaska

Introduction

On March 18, 2001 the 24-hour average PM-10 concentration measured at the Muldoon monitoring station in east Anchorage was 180 $\mu g/m^3$ (micrograms per cubic meter), exceeding the national ambient air quality standard of 150 $\mu g/m^3$. These elevated levels of PM-10 were attributed to blowing dust generated by high winds. Sustained winds of 30 to 35 miles per hour, and peak gusts of up to 60 miles per hour were recorded at National Weather Service monitoring stations in Anchorage. The Municipality of Anchorage (MOA) has requested the Environmental Protection Agency (EPA) exclude the data from this event because the high PM-10 concentrations measured have been attributed to an uncontrollable natural event as defined in the EPA Natural Events Policy[1].

The Natural Events Policy allows EPA to exercise its discretion under Section 107(d)(3) of the Clean Air Act not to designate area as nonattainment if the State develops and implements a plan to respond to the health impacts of natural events. The Municipality of Anchorage Department of Health and Human Services (DHHS) is submitting this Natural Events Action Plan to the EPA through the Alaska Department of Environmental Conservation in conformance with this policy.

Required Elements of a Natural Events Action Plan

In addition to documenting the validity of an exceedance as a natural event, the EPA natural events policy requires a natural events plan include commitments to:

1. Establish public notification and education programs.
2. Minimize public exposure to high concentrations of PM-10 due to future natural events.
3. Abate or minimize appropriate contributing controllable sources of PM-10.
4. Identify, study and implement practical mitigating measures as necessary.
5. Periodically reevaluate: (a) the conditions causing violations of a PM-10 NAAQS in the area, (b) the status of implementation of the NEAP, and (c) the adequacy of the actions being implemented.

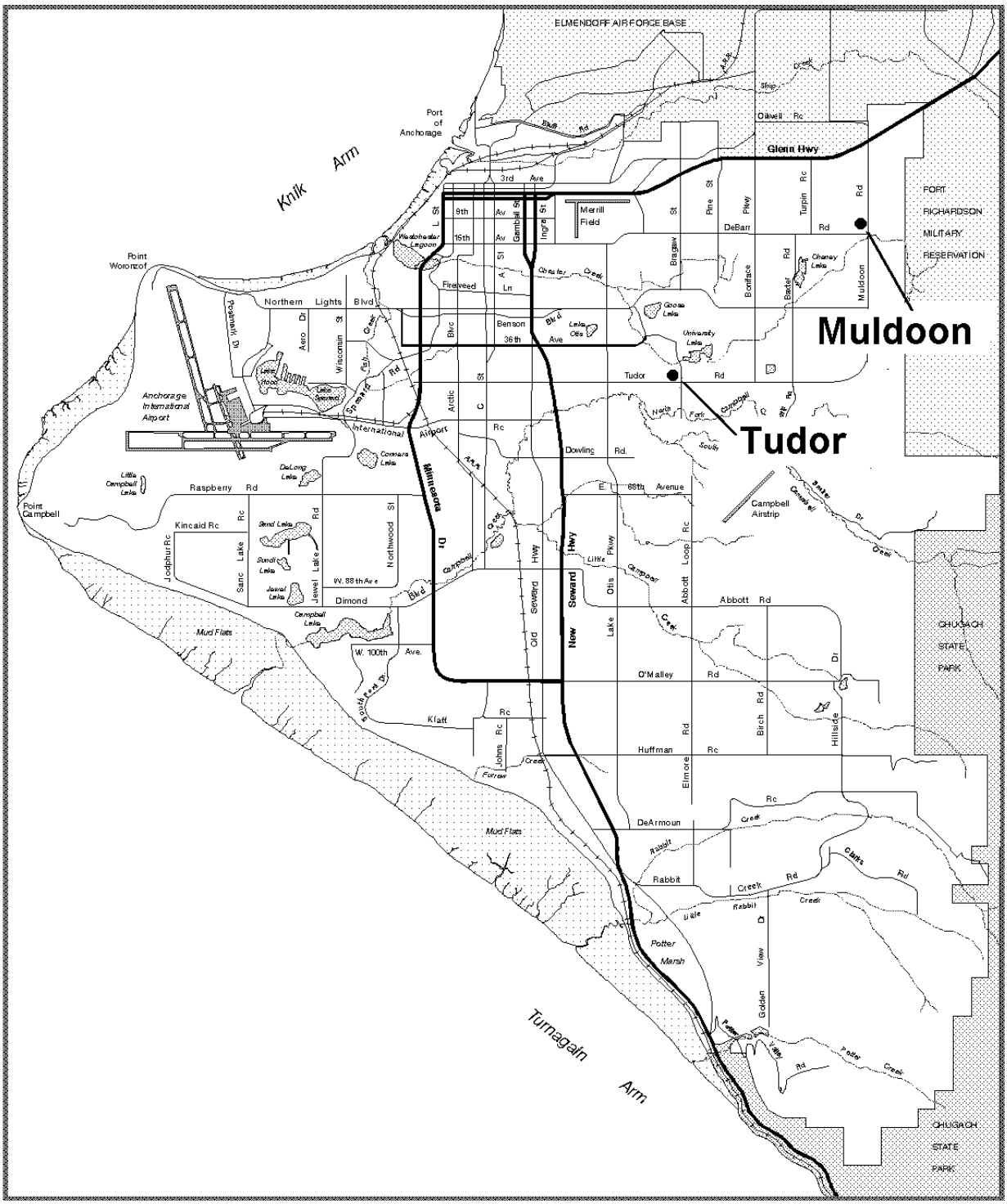
This plan will document the validity of the March 18, 2001 exceedance as a natural event and address the five required elements listed above.

Documentation of March 18, 2001 Exceedance as a Natural Event

The 24-hour average PM-10 concentration measured on March 18, 2001 at the Muldoon station (AIRS Code 02-020-043) in east Anchorage was 180 $\mu g/m^3$, exceeding the national ambient air quality standard for PM-10. The Tudor monitoring station was also in operation on that day. It recorded elevated PM-10 concentrations

but did not exceed the NAAQS.[i] The locations of the Muldoon and Tudor sites are shown in Figure 1.

Figure 1. Location of Muldoon and Tudor PM-10 Monitoring Stations

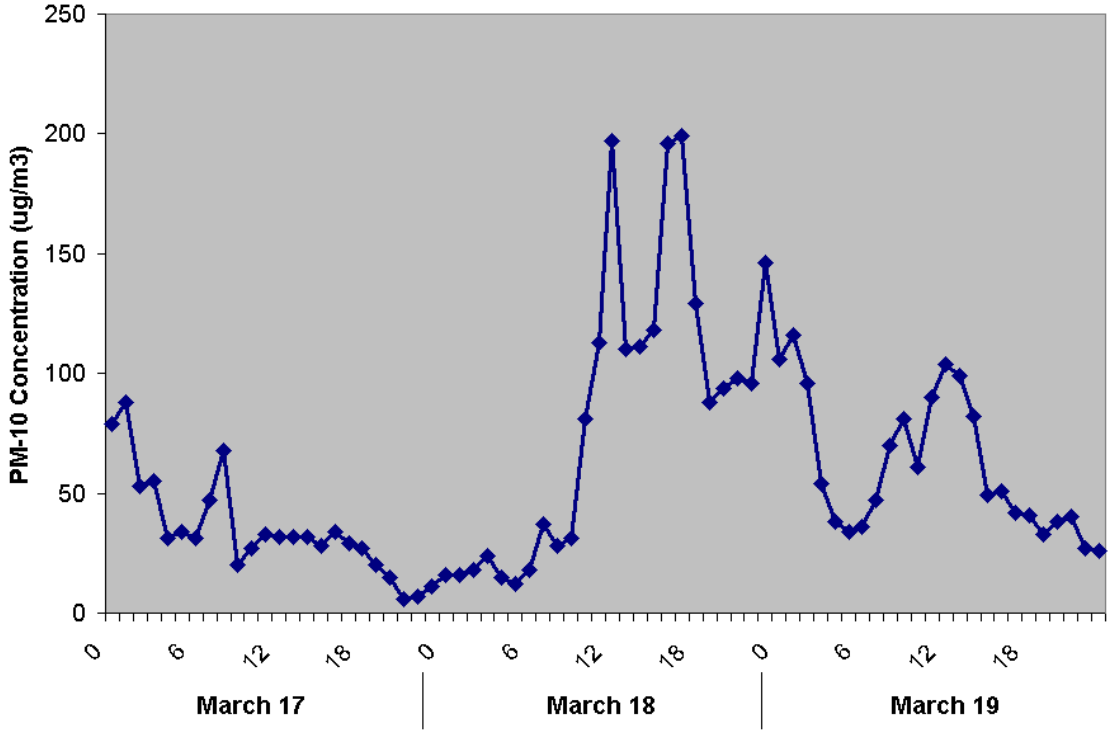


[i] The 24-hour PM-10 concentration measured at the Tudor Road site (AIRS 02-020-0044) on March 18, 2001 was 150 μg/m^3. The EPA considers a value of 155 μg/m^3 or higher an exceedance.

Local Climatological Data from Point Campbell in West Anchorage indicate that strong, northerly winds began late on March 17 and persisted through March 18 and most of the day of March 19. The 24-hour average windspeed recorded at Point Campbell was 16 mph (miles per hour) with a peak gust of 33 mph. Weather observations also note blowing dust on March 18 and 19. Data from other stations to the east of Point Campbell suggest that winds were stronger on the eastside of town. In a report prepared specifically for this event, the National Weather Service noted sustained winds ranging from 30 to 35 mph and peak gusts ranging from 40 to 60 mph. The winds recorded on March 18, 2001 meet the definition of a high wind event as defined in EPA's July 1986 exceptional events guidance.[2] This guidance defines a wind-caused exceptional event as one with "an hourly wind speed of greater than or equal to 30 mph or gusts equal to or greater than 40 mph…"

Hourly beta attenuation monitor data available from the Tudor site indicate that elevated PM-10 was directly associated with this wind event. Figure 2 shows that the PM-10 concentration increased dramatically at approximately 11 AM, March 18 and remained elevated into March 19. Although BAM data are not available from the Muldoon site, the pattern there is assumed to have been similar.

Figure 2. Hourly PM-10 Concentrations at the Tudor Station March 17, 18, and 19, 2001



It should also be noted that the exceedance measured on March 18, 2001 was the first ever recorded in seven years of monitoring at the Muldoon station. The highest value previously measured at the Muldoon site was 125 $\mu g/m^3$. This value was measured on March 17, 1997 and it was also associated with high winds.

Additional documentation supporting the March 18, 2001 exceedance as a natural event is included in Appendix A.

Public Notification and Education Program

The Anchorage Municipal Code (AMC 15.30.060) and the Alaska State Implementation Plan require that the director of the DHHS declare an air pollution episode when 24-hour average PM-10 concentrations reach or are predicted to reach 150 $\mu g/m^3$. The director is also required to publish an air pollution episode plan that describes the curtailment actions, communication and public notification procedures employed during episodes. A copy of stadnard operating procedures employed by DHHS along with the episode plan, published in 1993, is included in Appendix B. These procedures will continue to be followed when air pollution episodes occur. No distinction is made between natural events and "man-caused" episodes.

The public notification procedures outlined in the episode plan were followed during the windblown dust event of March 18, 2001. Even though this event occurred on a Sunday, when municipal personnel were not at work, an air quality advisory was declared and local media were notified. The advisory was declared at approximately 2 PM in the afternoon after staff reviewed BAM data and determined that an exceedance of the 24-hour PM-10 NAAQS was possible if windy conditions persisted.[ii] At the time the advisory was declared, the most recent 24-hour average PM-10 concentration had not yet exceeded the NAAQS. In accordance with existing standard procedure, staff consulted with the DHHS medical officer prior to issuing the advisory.

DHHS immediately reported the advisory to local television and print media and updated the telephone message line to report the air quality index and information regarding the health advisory.[iii] The Sunday evening newscast and Monday morning newspaper contained information regarding the air quality advisory. A copy of the newspaper article from the March 19, 2001 Anchorage Daily News is included in Appendix C.

[ii] In addition to conducting PM-10 sampling with reference method samplers, the DHHS operates two Graseby-Anderson beta attenuation monitors (BAMs) to collect hourly PM-10 information. These are operated in order to obtain timely information on PM-10 concentrations not available from reference method samplers. DHHS utilizes the information from the BAMs to report timely air quality index information to the public and to assess whether a health advisory should be declared during a PM-10 episode. The usefulness of the BAMs has been proven in past experience with volcanic eruptions, forest fires, and other wind blown dust events.

[iii] DHHS maintains a telephone message line to report the air quality index and other pertinent air quality information. The telephone number for the air quality index (AQI) report is advertised in the municipal section of the local Anchorage phone directory under "frequently called numbers." Information is updated at least once daily on normal workdays and, if conditions warrant, it is updated on weekends and holidays. The phone line is utilized by the general public and the news media for updates on air quality. It has been in use for over 15 years and is routinely used to issue air quality health advisories.

Minimizing Public Exposure to Elevated PM-10 Concentrations during Natural Events

The EPA natural events policy states that a natural events action plan should (a) identify the people most at risk, (b) notify the at-risk population that a natural event is imminent or currently taking place, (c) suggest actions to be taken by the public to minimize their exposure to high concentrations of PM-10, and (d) suggest precautions to take if exposure cannot be avoided.

Local epidemiological studies have been conducted by the DHHS in collaboration with other researchers that help identify the people most at risk from PM-10 exposure.[3,4] This research suggests that elevated PM-10 concentrations are associated with an increased incidence of bronchitis, upper respiratory illness, and in one study, asthma. This is generally consistent with information contained in the EPA criteria document for particulate matter.[5] It is also consistent with the Air Quality Index guideline for reporting air quality that identifies people with respiratory disease among those at most risk.[6]

Health advisories issued by DHHS in response to PM-10 events advise those with respiratory diseases such as asthma and emphysema to avoid areas where PM-10 levels are likely to be the highest. Those with severe lung disease are advised to remain indoors if possible.

In some events, DHHS is able to identify the particular areas that are likely to have the highest PM-10 levels. Monitoring data have shown that areas near major roadways often have the highest PM-10 concentrations during most PM-10 episodes. If information regarding the areas likely to have the highest concentrations is available, it is contained in the health advisory.

A sample health advisory is included in Appendix D. As stated earlier, the DHHS medical officer is consulted prior to the issuance of a health advisory. The specific language included in the advisory is dependent on the nature of the event.

Abatement or Minimization of Contributing Controllable Sources of PM-10

In order for an exceedance to be flagged as a high wind-caused natural event, the EPA natural events policy requires that (1) the dust originated from nonanthropogenic sources, or (2) the dust originated from anthropogenic sources controlled with best available control measures (BACM). Based on observations made during this event and other similar high wind events in Anchorage, some portion of the PM-10 is assumed to be anthropogenic or “man-caused.”

PM-10 concentrations in Anchorage typically peak in the late March and early April.[7] Relatively warm daytime temperatures melt ice and snow from roadsides and gutters. As melting occurs, large amounts of dirt and silt from five or six months of winter road sanding and roadway abrasion become exposed along roadway margins. This material, previously locked under ice and snow now becomes available for re-entrainment into the air by passing vehicle traffic or by high winds. This process is illustrated in the two photographs below, taken six days apart on March 16th and March 22nd of 2000.

Figure 3(a). Minnesota Drive, March 16, 2000. Ice covers most of roadway margin.

Figure 3(b). Minnesota Drive, March 22, 2000. Receding ice reveals accumulated silt along roadway margin.

The photographs show conditions typical for the late winter. (These photos were taken about the same time of the year as the Muldoon PM-10 exceedance but one-year earlier.) Unless there has been a recent snowfall, the majority of the road surface is bare pavement with margins covered in ice. While the traveled portion of the road is relatively clean, large quantities of sand and silt can be found along roadway margins. This material becomes available for re-entrainment as the ice recedes and the exposed silt and dirt dry out.

A number of source apportionment studies have been conducted in Anchorage in an effort to distinguish natural sources like windblown glacial silt and volcanic ash from anthropogenic sources like applied winter traction sand and roadway aggregate.[8, 9,10] Because the natural and anthropogenic sources of PM-10 are chemically and morphologically similar, these studies have not been very successful in quantifying their relative contribution in past exceedances. For this reason, filter analysis was not performed for the March 18, 2001 event. Nevertheless, given the amount of road silt available for re-entrainment prior to the exceedance, it seems likely that this anthropogenic source was contributory to the exceedance.[iv] As such, the natural events policy states that this source must be controlled by BACM. The EPA has not defined BACM for this source, however. In this case, because BACM is undefined, the natural events policy requires that "practical mitigating measures" be identified, studied and implemented. The next section of this plan discusses the identification,

[iv] Other potential anthropogenic sources like wind blown dust from unvegetated vacant lots and gravel pits were excluded as significant contributors because they were covered in snow during the exceedance. According to observations at the NWS Station at Point Campbell, two inches of snow were on the ground during the exceedance.

study and implementation of measures designed to control PM-10 emissions from accumulated silt along major roadways in Anchorage.

Identification, Study and Implementation of Practical Mitigating Measures

The time sequence of the two photographs in Figure 3(a) and (b) illustrates the difficulty Anchorage faces in developing effective and economical strategies to control PM-10 during the late-winter and early spring "break-up" period. These two figures show that large amounts of roadway silt, previously covered by ice and snow, can be made available for re-entrainment into the air as PM-10 in a matter of a few days through daily melting. Under high winds and/or very dry, low humidity conditions, re-entrainment of this material can result in exceedances of the PM-10 standard. The challenge is to develop strategies that can remove or stabilize this material promptly after it is exposed so that it cannot be re-entrained.

As noted in the previous section, Anchorage experiences its highest PM-10 concentrations during this three or four-week break-up period, typically occurring in late-March and early-April. Although high winds sometimes contribute to the elevated PM-10 concentrations during this break-up period, high PM-10 is more commonly associated with calm and dry conditions when fast moving vehicular traffic along major roadways stirs up accumulated silt on roadway margins.

In late 1995 the Municipality of Anchorage, the Alaska Department of Environmental Conservation and Department of Transportation and Public Facilities (ADOT&PF) entered into a Memorandum of Understanding (MOU) to cooperatively address the PM-10 problem in Anchorage.[11] Prior to the MOU, Anchorage had experienced a number of exceedances of the PM-10 NAAQS. In the MOU the municipality agreed to evaluate potential PM-10 control measures. Over the past six years, DHHS has worked with municipal and state street maintenance and private consultants in an effort to identify and study appropriate control measures. Although this effort has focused on controlling PM-10 generated by vehicular traffic, study results are likely applicable in high wind events like that of March 18, 2002. Over the past six years, efforts have focused on the evaluation of three potential PM-10 control strategies. These three strategies are:

1. Street sweeping;
2. Changes to winter sanding specifications and application methods;
3. Use of chemical deicing compounds as dust palliatives to reduce re-entrainment of roadway silt material.

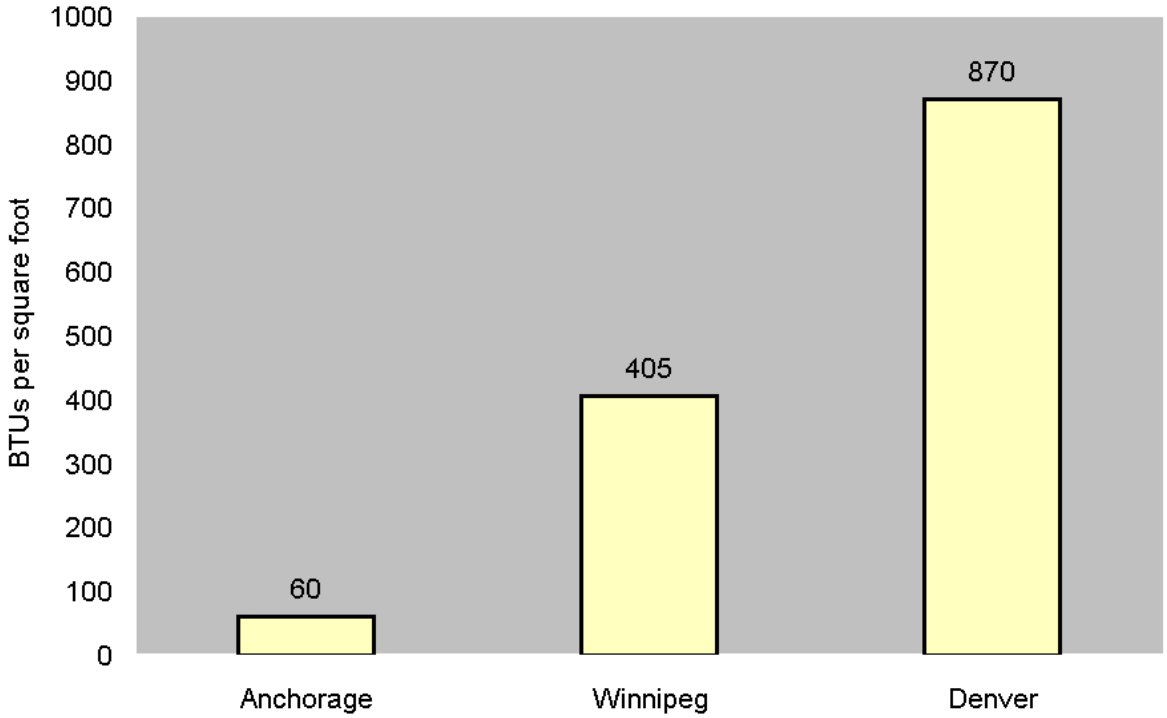
A brief discussion of each of these strategies follows.

<u>Street Sweeping</u>

In the "lower-48," street sweeping is probably the most commonly adopted control strategy for controlling PM-10 emissions from paved roads. Many communities adopt winter-long sweeping programs to prevent the accumulation of the roadway silt as a source of PM-10.

Because of its proximity to Cook Inlet, Anchorage experiences relatively mild winter temperatures, similar to many of the colder "snow belt" communities in the lower-48. However, despite similar or colder temperatures, these lower-48 communities, because of their lower latitude, receive *ten to fifteen* times more solar energy per day than Anchorage.

Figure 4. Solar Insolation in Anchorage, Winnipeg and Denver in December



In lower-48 communities, because of the relatively higher intensity of the solar radiation received, wintertime sunny periods result in significant melting. During these melting periods, accumulated silt is washed off the roadway, reducing the overall silt loading. Moreover, the ice and snow along roadway shoulders and margins are largely eliminated, allowing the roadway to be completely swept.

Mid-winter melt–off periods are rare in Anchorage. Sunny days result in little or no melting. Ice and snow remain on roadway shoulders and margins making effective sweeping difficult. Large amounts of traction sand and silt accumulate in the ice along the roadway margins throughout the winter until March, when solar intensity is sufficient to generate melting.[v] When this occurs, large amounts of material are made available in a very short time for
PM-10 generation.

Sub-freezing temperatures make sweeping in winter very difficult.[vi] Most sweeping equipment requires pre-wetting of the road surface to minimize the amount of dust created during the sweeping operation. Moreover, water flushing of the road surface is necessary after sweeping to eliminate residual fines leftover from the sweep. Without flushing, sweeping may actually *increase* PM-10 emissions in the short term

[v] In Anchorage, the amount of solar insolation increases by a factor of 20 between December and March.
[vi] In March, the average daily maximum temperature is 33 °F; the minimum is 18 °F.

because material located in roadway margins is redistributed to the traveled portion of the road.[12] Water flushing in sub-freezing temperatures is inadvisable.

Despite obstacles to sweeping created by sub-arctic winter climate, sweeping is performed in the downtown Anchorage central business district (CBD). Winter sweeping in the CBD is viable because of the intensive use of roadway deicers that prevent the buildup of ice and snow in gutters that would otherwise prevent effective sweeping. Moreover, in order to perform sweeping in winter months, municipal road crews wet sweep using potassium acetate brine to prevent freezing. Extending this sweeping program to all roads in Anchorage would be cost prohibitive, however.

In 1997 the ADOT&PF purchased an EnviroWhirl™ sweeper with baghouse technology that allows sweeping without the pre-wetting required with most other sweeping technologies. Although this sweeper has been successfully operated in the middle of winter, its effectiveness as a PM-10 control strategy in Anchorage is limited because most of the accumulated silt on the road cannot be removed by sweeping because it is locked within a thick layer of ice along the roadway margins. The ADOT&PF recently decommissioned the EnviroWhirl because they found it to be inefficient and resulted in high operating costs.

Despite the practical limitations alluded to above, the Municipality of Anchorage and the ADOT&PF have begun work on an agreement that would expedite street sweeping on major roadways in the early spring. Early sweeping of major roadways could be effective means of reducing the severity of PM-10 episodes during the peak of the spring break-up in April. If some sweeping of major roadways can be accomplished in February and March through the use of deicing compounds, it may also be possible to reduce the magnitude of PM-10 episodes resulting from late-winter windstorms like the one that occurred on March 18, 2000.

Changes to Winter Sanding Specifications and Application Methods

In response to commitments in the MOU with the EPA, the Municipality of Anchorage and the ADOT&PF made significant changes to winter sanding specifications and application methods. The amount of fines or silt (amount passing 200 sieve) allowed in traction sand dropped from about 5% to 1% or less. Municipal and state street maintenance departments also made changes to reduce the amount of sand applied during the winter. Work crews apply traction sand together with a magnesium chloride brine to help the traction sand melt into the ice or snow pack and reduce its tendency to be thrown off the road by passing traffic. This reduces the need for reapplication and presumably reduces the amount of material accumulated along roadway margins. Supervisors have also discouraged the excessive use of sand by work crews. PM-10 concentrations dropped significantly after these changes were implemented. Whether this was the effect of the sanding specifications or other factors cannot be definitively determined. Nevertheless, the municipality and ADOT&PF are committed to retaining the new, cleaner sanding specifications and will continue with the judicious application of sand.

As stated earlier, in the downtown or CBD, the municipality is using potassium acetate deicers in lieu of traction sand throughout the winter. In 1998, DHHS worked

with the ADOT&PF to evaluate whether a similar deicing program on state roads would provide a

PM-10 reduction benefit. The hope was that by applying deicing compounds instead of sand, spring break-up silt loadings and hence PM-10, would be reduced. However, when ambient PM-10 concentrations near roads where deicing compounds were used were compared to roads where traction sand was applied, no differences were observed. [13]

The testing of magnesium chloride was continued to see whether its use instead of traction sand would decrease the accumulation of roadway silt. Curiously, the study indicated that there was no significant difference in silt loadings between roads that received deicing compounds versus roads where traction sand was applied. While the testing did not show a decrease in silt accumulation on deicer treated roads, laboratory evaluation suggested that the silt material left on the deicer treated road was less prone to re-entrainment, presumably due to the palliative effect of applying hygroscopic magnesium chloride on the accumulated silt. Dustiness tests showed that the material along the treated roads was 75% less dusty than the untreated roads.[14]

These studies suggest that the value of deicing compounds lies more in their dust palliative effect than in reducing the amount of traction sand applied to the road. The next section discusses the DHHS effort to evaluate the use of deicers as dust palliatives to control the emission of dust from accumulated silt on paved roadways.

Use of Chemical Deicing Compounds as Dust Palliatives to Reduce PM-10 Emissions on Paved Roads

Over the past few years, DHHS has focused efforts on the use of deicing compounds like magnesium chloride and potassium acetate as dust palliatives during PM-10 episodes. Local studies have suggested that it may be possible to chemically stabilize accumulated roadway silt by applying deicing compounds. Magnesium chloride and potassium acetate are both hygroscopic meaning they tend to bind with moisture. A local study conducted by DHHS in April 1999 suggested that a single application of magnesium chloride brine reduced ambient PM-10 concentrations near the roadway for approximately three days.[15]

DHHS is continuing its testing of dust palliatives. While initial test results look promising, a number of important questions remain unanswered. The effectiveness of dust palliatives in a high wind event is unknown. DHHS observations suggest that when dust palliatives are applied to dry silt along a paved roadway, the liquid brine penetration is superficial, perhaps just a few millimeters. Significant mechanical disturbance from a high wind may be sufficient to overwhelm the thin stabilized outside layer of the silt pile. Once the surface layer is eroded, the remainder of the material is untreated and prone to re-entrainment.

Investigation into the use of hygroscopic chemicals as dust suppressants is ongoing. A section of parking lot with accumulated traction sand has been cordoned off, divided into three sections, and the pavement cleaned between the sections. Magnesium chloride will be applied to one section, potassium acetate to another, and the third will be treated with water as a control. A leaf blower will be used to simulate a high wind/blowing dust event on the dried control section and observers will

compare the dust raised there to the sections where the deicing compounds have been applied. This testing has been hampered so far by rain this spring and is expected to be completed by November 10, 2002, when cold dry weather mimics spring conditions. The intent of the test is to determine whether the application of magnesium chloride or potassium acetate on accumulated silt in the gutters and roadway margins will suppress dust from that source until the streets are free of ice and can be effectively swept.

Other researchers have questioned the safety of applying deicing compounds to dry pavement. Under low humidity conditions, application can create a slippery condition that could compromise traffic safety.[16] Indeed, in the April 1999 test of magnesium chloride, DHHS received reports of a “greasy” condition on the road. A motorcyclist was reported to have had a near miss when attempting a stop at a treated intersection. The slippery conditions may have arisen because of over-application of the magnesium chloride brine. The brine was reportedly applied at three times the recommended rate. It was also applied across the entire roadway rather than just the roadway margins where the silt had accumulated. Whether these potential problems are real and/or can be overcome by special deicer application methods (e.g. applying deicers only to the roadway margins) is yet to be determined. Further investigation is required before the municipality can commit to the use of chemical palliatives as a PM-10 control measure on paved roads.

Periodic Reevaluation of the Natural Events Action Plan

The EPA natural events policy requires periodic reevaluation of the conditions causing violations of the PM-10 NAAQS, the implementation status of the NEAP, and the adequacy of the actions being implemented. Upon completion of the control measure evaluation discussed in the preceding section, DHHS in cooperation with ADEC, will update this plan to reflect the results of the evaluation. Subsequently, this plan will be reviewed every five years or as-required to reflect new information and new understanding regarding the nature of the PM-10 problem and the effectiveness of the strategies used for control.

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[15] "Evaluation of Liquid Magnesium Chloride for Paved Roadway Control in Anchorage," Air Quality Program, Department of Health and Human Services, Municipality of Anchorage, October 1999

[16] "The Effect of Magnesium Chloride as an Anti-icing Agent on Tire/Road Friction Coefficient," Timothy S. Leggett, Eric Brewer, March 24, 1999

Alaska Department of Environmental Conservation

Adoption of the

"Quality Assurance Project Plan for the State of Alaska Air Monitoring & Quality Assurance Program", dated February 23, 2010

Public Review Draft

June 28th, 2010

QUALITY ASSURANCE PROJECT PLAN

for the

STATE OF ALASKA

AIR MONITORING & QUALITY ASSURANCE PROGRAM

February 23, 2010

State of Alaska
Department of Environmental Conservation
410 Willoughby Ave. Suite 303
PO Box 111800
Juneau, Alaska 99811-1800

A. PROJECT MANAGEMENT ELEMENTS

1. QA PROJECT PLAN IDENTIFICATION & APPROVAL

Title: ***Quality Assurance Project Plan for the State of Alaska Ambient Air Quality Monitoring Program***

The attached Quality Assurance Project Plan for the State of Alaska Ambient Air Quality Monitoring Program is hereby recommended for approval and commits the Alaska Department of Environmental Conservation to follow the elements described within.

Alaska Department of Environmental Conservation

Alice Edwards, Acting Director
Division of Air Quality

Phone: (907) 465-5109
email: alice.edwards@alaska.gov

Signature: _____ Date: _____

Barbara Trost, Program Manager
Air Monitoring & Quality Assurance Program

Phone: (907) 269-6249
email: barbara.trost@alaska.gov

Signature: _____ Date: _____

Daniel Fremgen, QA Officer
Air Monitoring & Quality Assurance Program

Phone: (907) 465-5111
email: daniel.fremgen@alaska.gov

Signature: _____ Date: _____

Gina Grepo-Grove, R10 QA Manager
USEPA Region 10

Phone: (206) 553-1632
email: grepo-grove.gina@epamail.epa.gov

Signature: _____ Date: _____

Keith Rose, Air Monitoring Program Manager
USEPA Region 10

Phone: (206) 553-1949
email: rose.keith@epamail.epa.gov

Signature: _____ Date: _____

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ABBREVIATIONS, TERMS AND DEFINITIONS

AAQP - Anchorage Air Quality Program- Air quality monitoring in Anchorage is the responsibility of the Air Quality Program. This program is part of the Environmental Services Division of the Department of Health and Human Services, Municipality of Anchorage.

ADEC - Alaska Department of Environmental Conservation - The department of state government with primary responsibility for management and oversight of provisions of the Clean Air Act, including EPA's National Ambient Air Quality Standards.

Air Quality Index (AQI) - The AQI is an index for reporting daily air quality and what associated health concerns the public should be aware of. The AQI focuses on health effects that might happen within a few hours or days of breathing polluted air. The AQI rates the air quality in 6 steps from good to hazardous.

AM&QA – Air Monitoring and Quality Assurance Program of ADEC - Responsible for coordinating all aspects (quality assurance, data collection, and data processing) with respect to ambient air quality and meteorological monitoring of the ADEC Division of Air Quality.

BAM 1020 - Met-One Inc. Beta Attenuation Monitor model 1020 continuous monitoring sampler - This sampler can sample for course and fine particulate matter.

Criteria Pollutant - Any air pollutant for which the EPA has established a National Ambient Air Quality Standard for regulation under the Clean Air Act.

Coarse particulate matter - PM10 - Particulate matter less than or equal to 10 microns in size.

Fine particulate matter - PM2.5 - Particulate matter less than or equal to 2.5 microns.

Performance Audit - An audit of one or more monitors within a monitoring network using certified calibration standards to evaluate monitor accuracy. Performance audits are conducted by an independent auditor using calibration standards provided by the auditor rather than those that are used for routine precision and accuracy checks. ADEC provides regular performance audits for each criteria pollutant monitored by the AAQP.

NAMS - National Air Monitoring Station - The NAMS are a subset of the SLAMS network with emphasis on urban and multi-source areas. There are no current NAMS-designated monitors in the monitoring network.

National Performance Audits - A type of audit in which quantitative data generated in a measurement system are obtained independently and compared with routinely obtained data to evaluate the proficiency of an analyst or laboratory or measurement system. EPA conducts these audits through the National Performance Audits Program for the purpose of establishing nationally comparable measurements.

QAPP - Quality Assurance Project Plan- A plan which identifies data quality goals and identifies pollutant-specific data quality assessment criteria.

QAMP - Quality Assurance Management Plan - A plan which describes the roles and responsibilities for maintaining a Quality System within a program or organization.

SLAMS - State and Local Monitoring Station - The SLAMS consist of a network of roughly 4000 monitoring station nationwide. Distribution depends largely on the needs of the State and local air pollution control agencies to meet their respective State Implementation plan (SIP) requirements. The SIPs provide for the implementation, maintenance and enforcement of the NAAQS in each air quality control region with in a state. The State of Alaska monitoring network currently has 13 SLAMS sites for carbon monoxide and PM.

SPMS - Special Purpose Monitoring Station - Special Purpose monitoring stations are not permanently established and can be adjusted to accommodate changing needs and priorities for special studies needed by the State and local agencies. The SPMS are used to supplement the fixed monitoring network as circumstances require.

System Audit- An evaluation of an entire monitoring program including guidance documents, policies and procedures, data and site records, and components of the monitoring network.

TEOM – FDMS - Thermo Election Inc. Tapered Element Oscillating Microbalance Filter Dynamic Measurement System continuous monitoring sampler - This sampler can sample for coarse or fine particulate matter.

$\mu g/sm^3$ - microgram per standard cubic meter.

3. DISTRIBUTION LIST

A hardcopy of this Quality Assurance Project Plan for the State of Alaska $PM_{2.5}$ Ambient Air Quality Monitoring Program has been distributed to the individuals listed in Table A1. The document is also available via the Department's Division of Air Quality, Monitoring & Quality Assurance Program web page (http://www.state.ak.us/dec/air/am).

Table A1: Distribution List

NAME	POSITION	AGENCY	DIVISION/BRANCH	CONTACT INFORMATION
Alice Edwards	Acting Division Director	ADEC-AQ	Division Air Quality	907-269-5109 alice.edwards@alaska.gov
Barbara Trost	Program Manager	DEC-AM&QA	Air Monitoring & Quality Assurance Program	907-269-6249 barbara.trost@alaska.gov
Robert Morgan	Section Manager	DEC-AM&QA	Air Monitoring	907-269-3070 bob.morgan@alaska.gov
Daniel Fremgen	Air QA Officer	DEC-AM&QA	Quality Assurance	907-465-5111 daniel.fremgen@alaska.gov
Cynthia Heil	Acting Program Manager	DEC-ANPMS	Air Non-Point Mobile Sources	907-269-7579 cindy.heil@alaska.gov
John Kuterbach	Program Manager	DEC-AP	Air Permits	907-465-5103 john.kuterbach@alaska.gov
Steve Morris	Program Manager	MOA-DHHS	Air Quality Programs	907-343-6976 morrisss@ci.anchorage.ak.us
Dr. James Conner	Division Manager	FNSB-DOT	Air Quality Division	907-459-1325 jconner@co.fairbanks.ak.us
Chris Hall	Air QA Lead	EPA-Region 10	Office of Environmental Assessment	206-553-0521 hall.christopher@epamail.epa.gov
Keith Rose	Project Officer	EPA-Region 10	Office of Air, Waste & Toxics	206-553-1949 rose.keith@epamail.epa.gov
Gina Grepo-Grove	QA Manager	EPA-Region 10	Office of Environmental Assessment	206-553-1632 grepo-grove.gina@epamail.epa.gov

4. PROJECT/TASK ORGANIZATION

This document presents the Quality Assurance Project Plan (QAPP) for the Ambient Air Monitoring and Quality Assurance Program that has been implemented by the State of Alaska. The monitoring program is being administered by the Alaska Department of Environmental Conservation (ADEC). The major responsibility of the ADEC is the implementation of a satisfactory monitoring program which includes an appropriate quality assurance program. It is the responsibility of the ADEC to ensure that the quality assurance programs for the field, laboratory, and data processing phases of the monitoring program are implemented.

The ADEC is organized into five main divisions: Division of Administrative Services (DAS), Air Quality (AQ), Environmental Health (EH), Water Quality (WQ) and Spill Prevention and Response (SPAR). The Commissioner of the ADEC has the overall responsibility for managing these divisions according to stated ADEC policy. The Commissioner delegates the responsibility of QA development and implementation in accordance with ADEC policy to the Division Directors. The responsibility for assuring data quality rests with these Directors and the line management under them.

The organizational structure of the ADEC Division of Air Quality for the implementation of the Ambient Air Quality Monitoring Program is shown in **Figure A1**. **Table A2** lists the specific responsibilities of each significant position within the ADEC Ambient Air Quality Monitoring Program.

Figure A1: Organizational Structure of the ADEC Air Monitoring & Quality Assurance Program

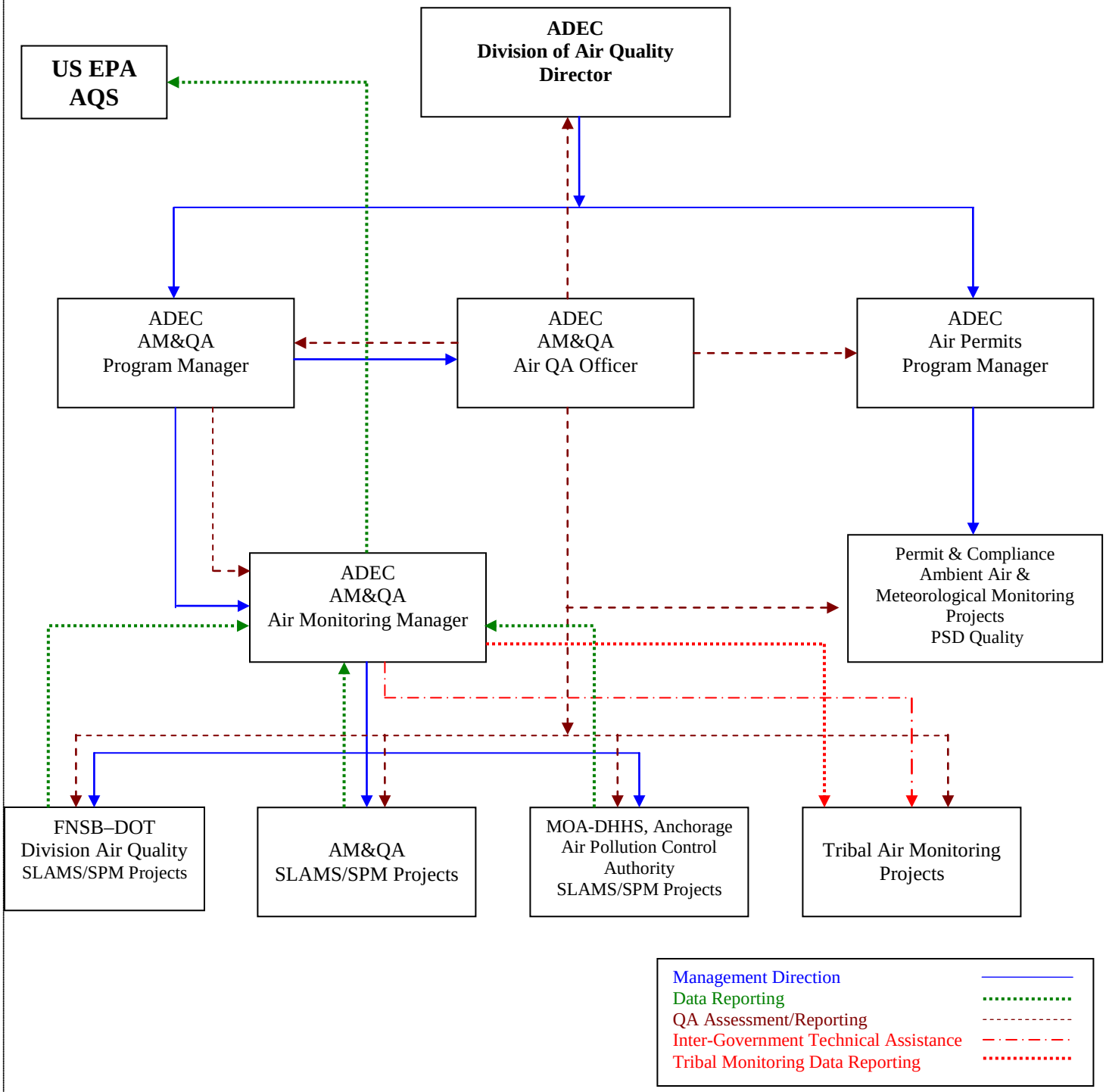


Table A2: ADEC Division of Air Quality – Air Monitoring & Quality Assurance Organizational Responsibilities

Agency	Division	Program	Position Title	Responsibilities
ADEC	Air Quality		Director	The Division of Air contains the Air Monitoring & Quality Assurance (AM&QA) Program. The AM&QA Program is responsible for coordinating all aspects (quality assurance, data collection, and data processing) with respect to ambient air quality and meteorological monitoring of the ADEC Division of Air Quality. The Division Director has direct access to the Commissioner on all matters relating to the Division's operation. The Division Director's duties include: • Maintains oversight of QA activities of AM&QA; • Maintains overall responsibility for monitoring network design & review; • Maintains overall responsibility for certifying and approving data submitted to AQS; and • Reviews budgets, contracts, grants and proposals.
ADEC		AM&QA	Program Manager	The Air Monitoring Program Manager reports directly to the AQ Division Director and has the overall responsibility for the development and maintenance of the Quality Assurance activities for the AM&QA program. Responsibilities include: • Directs the monitoring network design and review process; • Ensures that reviews, assessments and audits are scheduled and completed at the appropriate times; • Ensures that environmental data collection activities are covered by appropriate QA planning documentation; • Directs and assists in the implementation of QAPPs, work plans, contracts, reports and resource allocation, and ensures that monitoring personnel follow the QAPPs; • Ensures that a QAPP is in place for all environmental data collection activities and that it is up to date; • Communicates with EPA Project Officers and EPA QA personnel on issues related to routine sampling and QA activities; • Provides program costs necessary for EPA allocation activities; • Purchasing equipment and issuance of contracts necessary for the implementation of monitoring programs; • Ensures that all personnel involved in environmental data collection have access to any training or QA information needed to be knowledgeable in QA requirements, protocols and technology; and • Recommends required management level corrective action.

Table A2: ADEC Division of Air Quality – Air Monitoring & Quality Assurance Organizational Responsibilities

Agency	Division	Program	Position Title	Responsibilities
ADEC	AQ	AM&QA	Environmental Program Specialist – EPS IV (Meteorologist)	Under general direction s of the AM&QA program manager, the EPS IV (Meteorologist) position functions as the sole staff meteorologist for ADEC enabling management to fulfill its duty to advise the public of air quality threats due to natural or man-made pollution events that may have a broad scale geographical impact for Alaska's health and environment. Responsibilities include: • Routinely evaluate weather and air pollution conditions around the state and, as needed, forecast, transport of air pollution to project how, where and when pollution will be transported from one part of the state to another. Pollution events that may require forecasting and subsequent issue of health advisories include; broad scale forest fires, volcanic eruptions, prescribed burns of large tracks of land, high wind events generating high concentrations of wind-blown dust, and international incidents that transport pollution to Alaska from abroad; • Works in partnerships with federal, state land management agencies, communities and tribal organizations to assess local, regional and multi-national scales of air pollution; • Provides technical expertise to Air Permits Compliance staff in regard to when meteorological conditions are appropriate for issuance of open burn approvals; and • Reviews/recommends/rejects approval (in coordination with the Air QA Officer) of PSD ambient air quality and meteorological monitoring project plans and data reports;
ADEC	AQ	AM&QA	Air QA Officer (Chemist IV)	Regarding matters of quality assurance, the Air Quality Assurance Officer (Air QA Officer) reports directly to the Air Quality Division Director. All other directives and reporting responsibilities are managed by the Air Monitoring & Quality Assurance Program Manager. Responsibilities include: • Conducts QA performance and systems audits of NCore/SLAMS/SPM monitoring networks in Alaska; • Develops and/or recommends for approval procedures for establishing and assuring data quality, use and control of ambient air quality data; • Recommends modifications to the Alaska Ambient Air Monitoring Quality Assurance Project Plan (QAPP) and to Alaska's Ambient Air Monitoring Quality Management Plan; • Provides guidance and assists in the development of QAPPs; • Recommends rejection/approval of ambient air and meteorological monitoring QAPPs; • Provides training and certification to field and laboratory personnel; • Recommends actions to be taken in response to unsatisfactory operation or maintenance of ambient monitors; and • Assists air monitoring community in developing QA documentation and provides answers to technical questions.

Table A2: ADEC Division of Air Quality – Air Monitoring & Quality Assurance Organizational Responsibilities

Agency	Division	Program	Position Title	Responsibilities
ADEC	AQ	AM&QA	Air Monitoring Section Manager (Environmental Program Manager 1)	Under the general direction of the AM&QA program manger, the Air Monitoring Manager is responsible for the state-wide development, management and supervision of the field monitoring and laboratory section of the Air Monitoring and Quality Assurance Program. The primary focus of this position is to determine compliance with the national ambient air quality standards. To do this the manager and her/his staff: • Develop air quality monitoring plans to assess community-wide air pollution levels on a pollutant/multi-pollutant basis; • Evaluate regional air pollution (visibility, wild fire smoke impacts, regional haze); • Oversee local air monitoring projects • Conduct air quality studies to determine pollutant levels; • Provide emergency monitoring of man-made and/or natural air quality impacts (e.g., wild fires, volcanic eruptions); • Assist in development of air quality control plans and State Implementation Plan control strategies; and • Manage budgetary, fiscal, accounting, procurement and personnel responsibilities necessary for successful implementation of the section.
ADEC	AQ	AM&QA	Environmental Program Specialists (EPS), Chemists, Electronics Technician	Under the supervision of the Air Monitoring Section Manager, these positions perform all of ADEC's field monitoring and air laboratory operations. Specific duties include, but are not limited to: • Collects, calculates and reviews of environmental data; • Participates in training and certification activities; • Verifies that required monitoring QA activities are performed and that measurement quality objectives are met as prescribed in the QAPP; • Documents deviations from established procedures and methods; • Reports all problems and corrective actions to the AM section manager and the Air QA officer; • Assesses data quality and flagging suspect data; • Prepares data reports for submission to the Air Quality System (AQS) database manager. • Maintains QA records, flagging suspect data, and assessing and reporting data quality; and • Performs and documents maintenance of field and laboratory equipment.

Table A2: ADEC Division of Air Quality – Air Monitoring & Quality Assurance Organizational Responsibilities

Agency	Division	Program	Position Title	Responsibilities
ADEC	AQ	AM&QA	AQS Data Base Manager	Under the supervision of the AM section manager, the AQS data base manager is responsible for: • Coordinating the information management activities for NCore/SLAMS/SPM data entry; • Verifying/reviewing data reliability prior to submission of AQS data to EPA; and • Timely reporting and interpretation and ensuring timely delivery of all required NCore/SLAMS/SPM data to the AQS system.
MOA	DHHS	AAPCA	Air Quality Programs Manager	Structure - The Municipality of Anchorage (MOA) maintains the Anchorage Air Pollution Control Agency (AAPCA) which conducts ambient air monitoring within the boundaries of the MOA. This agency is within the Department of Health and Human Services. Responsibilities and Authority – The State of Alaska has delegated responsibilities to MOA for air quality monitoring. A Memorandum of Understanding between authorities of both agencies formally delineates the responsibilities of each agency. It is the responsibility of AAPCA to conduct ambient air quality monitoring within the physical boundaries of the Municipality of Anchorage in accordance with the methods, procedures and criteria established within this document. Specifically, the AAPCA responsibilities include, but are not limited to: • Monitor site preparation; • Instrument installation, operation, maintenance; corrective action(s); • Data reduction, data validation and data reporting; • Database management; • Site de-installation; • Instrument inventory control and repair; and • Contract management. In addition, the AAPCA will assist the ADEC in site selection/network reviews and quality assurance oversight auditing for ambient monitoring activities performed in the MOA.

Table A2: ADEC Division of Air Quality – Air Monitoring & Quality Assurance Organizational Responsibilities

Agency	Division	Program	Position Title	Responsibilities
FNSB-	DOT	Air Quality	Division Manager	Structure - Fairbanks North Star Borough (FNSB) maintains the Air Quality Division within the Department of Transportation. The ADEC has delegated responsibilities for air quality monitoring to the FNSB. A Memorandum of Understanding between authorities of both agencies has formally delineated the responsibilities of each agency. Responsibilities and Authority – Responsibilities and Authority of the Air Quality Division are identical to those listed for the Municipality of Anchorage.
Tribal Air Monitoring Organizations				Tribal Air Monitoring Support – The ADEC Division of Air Quality provides monitoring assistance to Tribal Villages as funding allows in the same fashion as it does to other non-tribal communities in Alaska (e.g., Anchorage, Fairbanks, and Juneau). The Department provides direct monitoring assistance to villages receiving air monitoring funding through EPA Region 10 Air Tribal Programs. Technical assistance may include any of the following: • Development of project specific air monitoring QAPPs, • Air monitoring equipment operations training, • Air monitoring station site selections, • Installation of monitoring sites, • Instrument maintenance and repairs, • Instrument calibrations and operations, • Instrument performance and systems audits, • Laboratory analysis of air monitoring samples, • Equipment loans, • Data analysis.

Table A2: ADEC Division of Air Quality – Air Monitoring & Quality Assurance Organizational Responsibilities

Agency	Division	Program	Position Title	Responsibilities
Independent Projects by Industry and Others				Ambient air quality and meteorological monitoring is performed throughout the state by a variety of private and academic concerns. Monitoring projects directed by a Title I and/or Title V permit must meet the respective PSD quality criteria as set forth in the ADEC AM&QA QAPP and in the Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD) EPA-450/4-87-007. Other monitoring projects beyond the direct review authority of the Department are not required to comply with the criteria set out in this document. Prior to initiation of an independent monitoring project, a Quality Assurance Project Plan (QAPP) must be submitted to the Department for review and approval. The QAPP must follow QAPP criteria as defined in, *"Elements for Ambient Air Monitoring Quality Assurance Project Plan, Revision 1.1."* This document prescribes the required QAPP format and content for a Department approved QAPP and is available via the Department's Division of Air Quality, Monitoring & Quality Assurance Program web page (http://www.dec.state.ak.us/air/am). The Department also prescribes the format, acceptance criteria and reporting frequencies for all data collected/reported in support of PSD quality ambient air and/or meteorological monitoring projects. These web-linked documents are: http://www.dec.state.ak.us/air/am/Elements_Ambient_Air_Monitoring_QAPP_rev1-1.pdf http://www.dec.state.ak.us/air/am/Ambient_Air_Monitoring_QAPP_cklst_9-04.pdf http://www.dec.state.ak.us/air/am/PSD_Met_annual.pdf http://www.dec.state.ak.us/air/am/PSD_Met_qrtly.pdf
EPA	OAQPS			Responsibilities and Authority – The Office of Air Quality Planning and Standards (OAQPS) is charged under the authority of the Clean Air Act (CAA) to protect and enhance the quality of the nation's air resources. OAQPS sets standards for pollutants considered harmful to public health or welfare and, in cooperation with EPA's Regional Offices and the States, enforces compliance with the standards through state implementation plans (SIPs) and regulations controlling emissions from stationary sources. The OAQPS evaluates the need to regulate potential air pollutants and develops national standards; works with the State, local agencies and Tribes to develop plans for meeting these standards; monitors national air quality trends and maintains a database of information on air pollution and controls; provides technical guidance and training on air pollution control strategies; and monitors compliance with air pollution standards.
EPA	Region 10			Responsibilities and Authority – EPA Regional Offices have been developed to address environmental issues related to the states within their jurisdiction and to administer and oversee regulatory and congressionally mandated programs. The major QA responsibilities of EPA's Region 10 Office are the coordination of quality assurance matters at the Regional level with state, local agencies and Tribes. This is accomplished by the designation of EPA Regional Project Officers who are responsible for the technical aspects of the program.

5. PROBLEM DEFINITION AND BACKGROUND

5.1 Problem Statement and Background

Between the years 1900 and 1970, the emission of six principal ambient air pollutants increased significantly. The principal pollutants, also called criteria pollutants, are: particulate matter (PM), sulfur dioxide (SO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3) and lead (Pb). In 1970 the Clean Air Act (CAA) was signed into law. The CAA and its amendments provide the framework for all pertinent organizations to protect air quality. This framework provides the structure for pertinent organizations to protect air quality and for the monitoring for these criteria pollutants by State and local organizations.

Air quality samples are generally collected for one or more of the following purposes:

- To judge compliance with and/or progress made towards meeting the National Ambient Air Quality Standards (NAAQS) and Alaska Ambient Air Quality Standards (AAAQS).
- To develop, modify or activate control strategies that prevent or alleviate air pollution episodes.
- To observe pollution trends throughout the region, including non-urban areas.
- To provide a database for research and evaluation of effects of air pollution.

With the end use of the air quality samples as a prime consideration, various networks can be designed to meet one of six basic monitoring objectives listed below:

- Determine the highest concentration to occur in the area covered by the network.
- Determine representative concentrations in areas of high population density.
- Determine the impact of significant source or source categories on pollution levels.
- Determine general background concentration levels.
- Determine the extent of regional pollutant transport among populated areas, and in support of secondary standards.
- Determine the welfare-related impacts in more rural and remote areas.

5.2 Alaska's Air Monitoring Network

The State of Alaska's monitoring network consists of three major categories of monitoring stations that measure the criteria pollutants. These types of stations are described below:

1. Secondary National Core (**NCore Level 2**) Multi-Pollutant Monitoring Station. Alaska will have one NCore Level 2 that will be sited to meet NCore Level 2 monitoring station criteria. The monitoring site is expected to be located in Fairbanks; however, a specific site has not been selected yet. The site will be selected, sited and installed after sufficient federal monies are allocated and made available to the AM&QA program.

2. The State and Local Air Monitoring Stations (**SLAMS,** NCore Level 3) network consists of monitoring stations with size and distribution largely determined by the needs of State and local pollution control agencies to meet their respective SIP requirements.

3. The Special Purpose Monitoring Stations (**SPMS**) network provides for special studies needed by the State and local agencies to support their State Implementation Plan (SIPs) and other air program activities. The SPMS are not permanently established and can be adjusted easily to accommodate changing needs and priorities. The SPMS are used to supplement the fixed monitoring network as circumstances require and resources permit. If the data are used for SIP purposes, the data must meet all QA and methodology requirements for SLAMS monitoring.

This Quality Assurance Plan focuses on the QA activities of the NCore Level 2, SLAMS and SPM network and the objectives of this network, which include any air monitor/s used for comparison to the NAAQS and AAAQS. Since there is more than one objective for this data, the quality of the data will be based on the highest priority objective, which is identified as the determination of violations of the NAAQS and AAAQS.

6. PROJECT/TASK DESCRIPTION

6.1 Description of Work to be performed

The Department is responsible for maintaining the quality of ambient air to protect the health and welfare of Alaskans. To facilitate the protection of public health and welfare from the effects of air pollution, the Department adopted the Alaska Ambient Air Quality Standards (AAAQS 18AAC50.010) which are equal to or more restrictive than the NAAQS. The AAAQS parameters and regulated concentrations are listed in **Table A3**. **Table A4** lists meteorological parameters the Department may monitor in support of characterizing the air quality of selective monitoring networks.

TABLE A3--ALASKA AMBIENT AIR QUALITY STANDARDS (18 AAC 50.010)

Parameter	1-hour		3-hour		8-hour		24-hour		Quarterly	Annual	
	(mg/m^3)	(ppm)	(mg/m^3)	(ppm)	(mg/m^3)	(ppm)	(mg/m^3)	(ppm)	(mg/m^3)	(mg/m^3)	(ppm)
Ammonia (NH_3)					2.1	3.0					
Carbon Monoxide (CO)	40	35			9.0	10					
Nitrogen Dioxide (NO_2)										0.100	0.053
Ozone (O_3)					4th high 3-yr annual avg.						
					0.041	0.075					
Sulfur Dioxide (SO_2)			1.300	0.497			0.365	0.139		0.080	0.031
							(µg/m^3) 3-year 98%		(µg/m^3)	(µg/m^3)	
Lead (Pb)									0.15		
PM_{10}							150				
$PM_{2.5}$							35			15.0	

TABLE A4--METEOROLOGICAL PARAMETERS								
Wind Speed (WS)	Wind Direction (WD)	Ambient Temperature (T)	Temperature Difference (ΔT)	Solar Radiation (SR)	Ambient Pressure (P)	Dew Point Temperature	Relative Humidity (RH)	Precipitation

With the end use of the air quality samples as a prime consideration, various networks can be designed to meet one of the basic monitoring objectives listed below:

- Determine/document the highest concentrations to occur in the area covered by the network;
- Determine/document representative concentrations in areas of high population density;
- Determine/document the impact on ambient pollution levels of significant source or source categories;
- Determine/document general background concentration levels;
- Determine/document the extent of regional pollutant transport among populated areas, and in support of secondary standards;
- Determine/document the welfare-related impacts in more rural and remote areas;
- Document existing air quality and air quality trends at selected locations of interest;
- Evaluate compliance with the NAAQS, AAAQS and increment standards after the start up of new air pollution sources;
- In response to citizen complaints, investigate air quality degradation to determine the level of action required.
- Judge compliance with and/or progress made towards meeting the NAAQS and AAAQS;
- Maintain or improve the existing ambient air quality of Alaska;
- Develop, modify or activate control strategies that prevent or alleviate air pollution episodes;
- Observe pollution trends throughout the region, including non-urban areas; and
- Provide a data base for research and evaluation of effects.

When the Department or other entity determines that an air quality monitoring project is to occur, the responsible party will:

- Survey the impacted area to identify the pollutant source/s.

- Survey the impacted area to identify the aerial extent of the problem.
- Utilize appropriate dispersion modeling tools or other scientific or engineering principles to identify the zone/s of potential impact.
- Evaluate meteorological data to identify maximum impact zones.
- Survey potential maximum impact areas to identify appropriate monitoring site locations.
- Conduct air quality monitoring to reliably assess air quality conditions.

6.2 Field Activities and Measurements

Field activities and measurements include all field activities performed that support the collection of valid samples to assess air quality within Alaska's ambient air quality network. This includes but is not limited to problem identification, site selection, site installation/deinstallation, equipment calibration, sample and data collection and shipping.

6.3 Laboratory Activities

The AM&QA program includes an air quality laboratory that supports field monitoring activities throughout Alaska. Laboratory activities include repair of equipment, calibration and certification of various air quality standards and gravimetric analysis of particulate matter (PM) sample filters.

Gravimetric analysis of PM_{10} and $PM_{2.5}$ samples includes preparing the filters for the routine field operator, which includes the following:

- Pre-Sampling Weighing
- Shipping/Receiving
- Post-Sampling Weighing
- Filter storage/archival.

Standard Operating Procedures (SOPs) for particulate sample filter analyses are described in the respective ADEC Laboratory PM SOP and are available on the internet at http://www.dec.state.ak.us/air/am/index.htm.

6.4 Project Assessment Techniques

An assessment is an evaluation process used to measure the performance or effectiveness of a system and its elements. As used here, assessment is an all-inclusive term used to denote any of the following: audit, performance evaluation, management systems review, peer review, or inspection. **Table A5** presents a schedule of these assessments. Section 18 discusses the details of these assessments.

Table A5 Assessment Schedule

Assessment Type	Assessment Agency	Frequency
Technical Systems Audit	EPA Region 10/ADEC	1 every 3 years
Network Review	EPA Region 10/ADEC	Annual
Data Qualifiers/Flags Review	ADEC	Annual
SOP Review	ADEC	Every 3 years
Performance Evaluations	EPA Region 10	5 valid audits/yr for primary QA orgs with ≤ 5 sites 8 valid audits/yr for primary QA orgs with > 5 sites All samplers in 6 years
Performance Audits	ADEC	SLAMS/SPM each site monitor every 6 months
Data Quality Assessment	ADEC	Annual

6.5 Project Records

Table A6 Critical Documents and Records

Categories	Record/Document Types
Site Information	Network description Site characterization file Site maps Site pictures
Environmental Data Operations	QA Project Plans Standard operating procedures (SOPs) Field and laboratory notebooks Sample handling/custody records Inspection/maintenance records
Raw Data	Any original data (routine and QC data) including data entry forms
Data Reporting	Air quality index report Annual NCore/SLAMS/SPM air quality information Data/summary reports
Data Management	Data algorithms Data management plans/flowcharts Air monitoring data Data management systems
Quality Assurance	Network reviews Control charts Data quality assessments QA reports System audits Response/Corrective action reports Site audits

7. QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

The ADEC will meet the QA/QC requirements outlined in 40 CFR Parts 50 and 58 or, where different, as described within this QAPP.

7.1 Data Quality Objectives (DQOs)

DQOs are qualitative and quantitative statements derived from the DQO Process that:

- Clarify the monitoring objectives.
- Define the appropriate type of data.
- Specify the tolerable levels of decision errors for the monitoring program.

By applying the DQO Process to the development of a quality system the Air Quality Program guards against committing resources to data collection efforts that do not support a defensible decision.

Data Quality Objectives are being developed by the EPA for a determination of whether or not a particular location meets the national ambient air quality standards. These data quality objectives are still in draft form. EPA decided that there should be a 5% (or less) chance of being wrong about whether a site meets or does not meet the standard. For example, if the true concentration is below the NAAQS but the measured value is above. This may be due to measurement bias, imprecision, or incomplete data. The other possibility is that the true concentration is above the NAAQS but the measurement is below. The general goal is to keep the rate of these decision errors (whether or not the standard has been met) to below 5%. In order to do this, EPA looked at all the data from the past few years in terms of bias and imprecision, and calculated that if each site keeps bias and precision under the pollutant specific values listed in **Table 7**, these overall goals of limiting the decision error rate will be met. The DQO subsequently were translated into the measurement quality objective (MQO) for each parameter **(Table 7)**. This document does not describe how they have been translated into MQOs.

7.2 Clarify Monitoring Objectives

The monitoring objectives for implementing the Air Quality Program are to:

- Determine ambient concentrations of criteria pollutants.
- Determine compliance with the NAAQS for the criteria pollutants.

7.3 Define Appropriate Type of Data

In order to accomplish the monitoring objectives, the appropriate type of data needed is defined by the NAAQS. For criteria pollutants, compliance with the NAAQS is determined by specific measurement requirements. The measurement system is designed to produce criteria pollutant concentration data that are of the appropriate quantity and quality necessary to determine compliance with these standards.

7.4 Specify Tolerable Levels of Decision Errors for the Monitoring Program

DQOs for criteria pollutant monitoring are based on data requirements of the decision maker(s). Regarding the quality of the measurement system, the objective is to control precision and bias in order to reduce the probability of decision errors.

7.5 Measurement Quality Objectives (MQOs)

Once a DQO is established, the quality of the data must be evaluated and controlled to ensure that it is maintained within the established acceptance criteria. MQOs are designed to evaluate and control various phases (sampling, preparation, and analysis) of the measurement process to ensure that total measurement uncertainty is within the range prescribed by the DQOs. MQOs can be defined in terms of Precision, Bias, Representativeness, Detectability, Completeness and Comparability.

Bias – Bias is the systematic or persistent distortion of a measurement process that causes uncertainty in one direction. (e.g., results are either higher than or lower than they should be). It is estimated by evaluating the instrument measured result against a known standard used as the "true" value. It is expressed as a positive or negative percentage of the "true" value. In this program, the manual quality control (QC) checks with a known concentration done every two weeks for gaseous pollutants, or monthly for particulate pollutants, will be the major estimate of bias on an ongoing basis, and the performance audits will provide another estimate of bias. Performance audits of the monitoring equipment will be performed with personnel and equipment/standards completely independent from the standards used to calibrate the monitoring equipment and the personnel responsible for site operations. In this program, bias is estimated using the calculations found in **Table C1**.

Precision - Precision is a measure of mutual agreement among individual measurements of the same property usually under prescribed similar conditions, or how well side-by-side measurements of the same thing agree with each other. It is important that the measurements be as similar as possible, using the same equipment or equipment as similar as possible. Precision represents the random component of uncertainty. This random component is what changes randomly high or low, and which cannot be controlled with the equipment and the procedures used. Precision is estimated by various statistical techniques using the standard deviation or, if you only have two measurements, the percent difference. In this program, precision is estimated using the calculations found in **Table C2.**

Accuracy – Accuracy has been a term frequently used to represent closeness to truth and includes a combination of precision and bias uncertainty components. This term has been used throughout the CFR. In general, ADEC AM&QA will follow the conventions of the NIST and, more recently, of EPA (ref. NIST Report 1297 and EPA G-9) and will not use the term accuracy, but will describe measurement uncertainties as precision, bias, and total uncertainty (total uncertainty is the combination of both precision and bias). In this program, total error is estimated using the calculations found in **Tables C1 and C2**.

Representativeness - Representativeness is defined as a measure of the degree which data really represent some characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. The representativeness of measurements made in this program is ensured by following EPA siting guidelines, and is fully explained in element 10. The goal is to measure the pollutant concentrations representative of what most people breathe in our many diverse population centers--microclimates throughout Alaska.

Detectability – Defined as the lowest value that a method procedure can reliably discern a measured response above background noise. In other words, detectability is the level below which the instrument cannot reliably discriminate from zero. Because there is always variation in any measurement process (precision uncertainty), the level of detectability depends on how much precision error is in the process. Detection limits for ADEC-M&QA air quality instruments are consistent with the requirements listed in 40 CFR 53. For Federal Reference Methods (FRM) and Federal Equivalent Methods (FEM), the detection limits are specified with the respective EPA FRM/FEM designation.

Completeness - Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct, normal conditions. Data completeness requirements are included in the reference methods (40 CFR 50) and 40 CFR 58 Appendix A.

Comparability – Comparability is a measure of confidence with which one set of data can be compared to another. Comparability is important so that data sets within one part of the country can be compared with another area or data from another year.

Various parts of 40 CFR have identified acceptance criteria for some of these attributes as well as U.S. EPA Quality Assurance Guidance Documents and additional DEC ambient air regulatory monitoring methods. These Ambient Air Quality parameter MQOs are listed in **Table A7**. **Table A8** lists MQOs for meteorological parameters. More detailed descriptions of these MQO's and how they will be used to control and assess measurement uncertainty are described in method specific data validation tables. Method specific data validation tables may be found in **Appendix A**.

Table A7 Alaska Ambient Air Quality Monitoring MQOs

Parameter	Comparability		Completeness			Bias	Precision	Representativeness	
	Equipment	Reference/ Method	Hourly	Daily	Quarter			Sampling Frequency	Siting
$PM_{2.5}$ FRM	EPA $PM_{2.5}$ FRM sampler,	EPA QA Handbook Vo II method 2.12, ADEC $PM_{2.5}$ QAPP		24-hr ± 1hr	SLAMS ≥ 75% all sample days PSD ≥ 80%	**Flow audit** Design Flow: ≤±5% Δ (16.7lpm), Accuracy Flow: ≤±4% Δ	CV≤ 10% for paired values≥3 ug/m^3	1/3 day, 1/12 collocated 15% of sites	EPA siting guidelines for PM_{10} and $PM_{2.5}$
$PM_{2.5}$and PM_{10} Continuous Methods	R&P TEOM 1400a, Met One BAM 1020, EPA PM_{10} continuous FEM	ADEC M&QA Met One 1020 BAM SOP, EPA QA guidance criteria for continuous PM	≥75 %	≥ 75% aggregate hours/day	SLAMS ≥ 75% all sample days PSD ≥ 80%	**Flow audit** **$PM_{2.5}$ Design Flow**: ≤±5% Δ (16.7lpm) **PM_{10} Design Flow**: ≤±5% Δ (16.7lpm) PM_{10} **PM_{10} & $PM_{2.5}$ Accuracy Flow:** ≤±4% Δ		Continuous, hourly average, collocated 1/12 with like continuous PM	
$PM_{2.5}$ Aethalometer Continuous Method	Magee Scientific Aethalometer		≥75 %	≥ 75% aggregate hours/day	SPM ≥ 75% all sample days	**Flow audit** Design Flow: ≤±7.5% Δ (5.0 lpm), Accuracy Flow: ≤±10% Δ			
PM_{10} FRM/FEM HiVol Method	EPA FRM/FEM sampler	EPA QA Handbook Vol II Method 2.11, ADEC method 4.2		24-hr ± 1hr	SLAMS≥ 75% all sample days PSD ≥ 80%	**Flow audit** Design Flow: ≤±10% Δ (1.13m^3/min) Accuracy Flow: ≤±7% Δ	CV≤ 10% for paired values≥15 ug/m^3	1/3 day, 1/12 collocated 15% of sites	
PM_{10} –FRM Low Volume Method	EPA FRM/FEM sampler			24-hr ± 1hr	≥ 75% all sample days PSD ≥ 80%	**Flow audit** Design Flow: ≤±10% Δ (16.7lpm), Accuracy Flow: ≤±7% Δ	CV≤ 10% for paired values≥15 ug/m^3	1/3 day, 1/12 collocated 15% of sites	
EPA $PM_{2.5}$ Speciation Method	Met One SSASS	EPA $PM_{2.5}$ Speciation QAPP http://www.epa.gov/ttn/amtic/files/ambient/pm25/spec/finlqmp.pdf		24-hr ± 1hr	SLAMS≥ 75% all sample days	**Flow audit** Design Flow: ≤±10% Δ (6.7lpm), Accuracy Flow: ≤±10% Δ		1/3 day,	
Lead on TSP	EPA FRM/FEM sampler and analytical method	EPA QA Handbook Vol II method 2.8, ADEC method 4.4		24-hr ± 1hr	SLAMS≥ 75% all sample days PSD ≥ 80%	**Flow audit** 1.1 m^3/min≥ Design Flow≤1.7m^3/min Accuracy Flow: ≤±10%Δ	CV≤ 10% for paired values0.15≥ ug/m^3	1/3 day, 1/12 collocated 15% of sites	EPA siting guidelines for Pb on TSP,ADEC method 4.4.1
CO	EPA FRM/FEM	EPA QA Handbook Vol II method 2.6 ADEC method 4.05	≥75 %		SLAMS≥ 75% all hours PSD ≥ 80%	Mean absolute Δ ≤± 15%, Linear regression criteria: Slope ≤± 15%, Y intercept ≤±3% FS, and .995 ≥ r^2 ≤ 1.000	90% CL CV ≤± 15%	Continuous	EPA siting criteria for CO, ADEC CO method 4.05.1

Table A7 Alaska Ambient Air Quality Monitoring MQOs

Parameter	Comparability		Completeness			Bias	Precision	Representativeness	
	Equipment	Reference/ Method	Hourly	Daily	Quarter			Sampling Frequency	Siting
NH_3	NO_2 EPA FRM/FEM approved analyzer with NH_3 converter	ADEC NH_3 method (4.10)	≥75 %		≥75% all hours	Mean absolute Δ ≤±15% Linear regression criteria: Slope ≤± 15%, Y intercept ≤±3% FS, and $.995 \geq r^2 \leq 1.000$ NO_2 converter efficiency ≥96 % NH_3 converter efficiency ≥90%	90% CL CV ≤± 15%	Continuous	ADEC NH_3 method 4.10.1
$NO\text{-}NO_x\text{-}NO_2$	EPA FRM/FEM	EPA QA Handbook Vol II method 2.3 ADEC method 4.07	≥75 %		SLAMS≥ 75% all hours PSD ≥ 80%	Mean absolute Δ ≤± 15%, Linear regression criteria: Slope ≤± 15%, Y intercept ≤±3% FS, and $.995 \geq r^2 \leq 1.000$ NO_2 converter efficiency ≥96 %	90% CL CV ≤± 15%	Continuous	EPA siting guidelines for NO_2, ADEC method 4.07.1
O_3	EPA FRM/FEM	EPA QA Handbook Vol II http://www.ecy.wa.gov/pubs/95201g.pdf	≥75 %		SLAMS≥ 75% all hours PSD ≥ 80%	Mean absolute Δ ≤± 10%, Linear regression criteria: Slope ≤± 10%, Y intercept ≤±3% FS, and $.995 \geq r^2 \leq 1.000$	90% CL CV ≤± 10%	Continuous	EPA siting criteria for O_3
SO_2	EPA FRM/FEM	EPA QA Handbook Vol II method 2.9 ADEC method 4.06	≥75 %		SLAMS≥75% all hours PSD ≥ 80%	Mean absolute Δ ≤± 15%, Linear regression criteria: Slope ≤± 15%, Y intercept ≤±3% FS, and $.995 \geq r^2 \leq 1.000$	90% CL CV ≤± 15%	Continuous	EPA siting guidelines for SO_2 , ADEC method 4.06.1

Table A8 Alaska Meteorological Monitoring MQOs

Parameter	Comparability			Completeness			Bias	Representativeness	
	Method & Measurement Resolution	Equipment	Reference/ Method	Hourly	Daily	Quarter		Sampling Frequency	Siting
WS	Cup or Sonic Anemometer 0.25 m/s	WS Range 0.5m/s – 50 m/s VWS Range -25.0 m/s – 25.0 m/s WS Threshold ≤ 0.5 m/s Accuracy.≤ (0.2m/s+5% obs) Dist Const. ≤ 5m/s at 1.2kg/m^3	Meets minimum specs per EPA-454/R-99-005 Section 5.1, Table 5.1 and appropriate for range of site environmental conditions	≥75 %		**NCore and SLAMS:** ≥ 80% all sample days **PSD:** ≥ 90% all sample days for 4 consecutive quarters	± 0.2 m/s	Continuous, 1 min sample interval, hourly avg	EPA-454/R-99-005 Section 3.1 EPA QA Handbook Vol IV
Vertical WS	Cup or Sonic Anemometer 0.1 m/s						± 0.2 m/s	Continuous, 1 min sample interval, hourly avg	
WD	Vane or sonic anemometer 1.0 m/s	1 – 360° (540°) Threshold ≤ 0.5 m/s Accuracy.≤ 3° from sensor mount .≤ 5° absolute error Delay Disrt. ≤ 5m/s at 1.2kg/m^3 Damping Ratio 0.4 at 1.2kg/m^3 or Overshoot ≤ 25% at 1.2kg/m^3					± 5° includes ± 3° from sensor mount	Continuous, 1 min sample interval, hourly avg	
Vector Data WS WD Sigma Theta (σθ) Sigma W (σΦ)	DAS Calculation 0.1 m/s 1.0 degree 1.0 degree 0.1 m/s	Range 0 – 50.0 m/s, Range 0° – 360° Range 0° – 105° Range 0 – 10 m/s					Vector Data WS ± 0.2 m/s WD ± 5° σθ ± 5° σΦ ± 0.2 m/s	Continuous, 1 min sample interval, hourly avg	
Ambient Temperature	Thermistor 0.1°C	Range -40°C - +40°C Meas. Resolution ≤ 0.1°C Accuracy ≤ ±0.5°C					± 0.5° C	Continuous, 1 min sample interval, hourly avg	
Vertical Temperature Difference	Thermistor 0.02°C	Motor aspirated Range -3°C to +7°C Relative Accuracy ≤ 0.1°C					± 0.1° C Relative Accuracy	Continuous, 1 min sample interval, hourly avg	
Temperature Radiation Shield	Motor aspirated	Range -100 to 1300W/m^2 Flow Rate ≥ 3 m/s Radiation error < 0.2°C							
Relative Humidity	Psychrometer/ Hygrometer 0.5 %RH	Range 0 – 100% Accuracy ± 7%					± 7% RH	Continuous, 1 min sample interval, hourly avg	
Dew Point	Psychrometer/ Hygrometer 0.1°C	Range -30° to +30°C Accuracy ± 1.5°C					± 1.5°C	Continuous, 1 min sample interval, hourly avg	
Barometric Pressure	Aneroid Barometer	Range -600 to 100 Mb Accuracy ± 3Mb					± 3 Mb (0.3 kPa)	Continuous, 1 min interval Hourly avg.	

Table A8 Alaska Meteorological Monitoring MQOs

Parameter	Comparability			Completeness			Bias	Representativeness	
	Method & Measurement Resolution	Equipment	Reference/ Method	Hourly	Daily	Quarter		Sampling Frequency	Siting
	0.5 Mb								
Precipitation	Tipping bucket 0.2 mm/hr	Range 0 - 50 mm/hr Accuracy ± 5% of input volume					≤± 10%Δ	Continuous, 5/min sample interval Hourly avg	
Solar Radiation	pyranometer 10 W/m^2	Range 0 to 1300 W/m^2 Accuracy ± 5% of mean observed interval					± 5% Δ of observed	Continuous, 1 min sample interval, Hourly avg	

8. TRAINING

Air monitoring personnel will be recruited and screened to ensure they are experienced and qualified. Air monitoring personnel will meet the educational, work experience, responsibility, personal attributes, and training requirements for their respective positions. Training will be available to employees supporting the Ambient Air Quality Monitoring Program, commensurate with their assigned duties and sufficient to contribute to the reporting of complete and high quality data.

Primary responsibility for training will rest with the individual's supervisor. Records on personnel qualifications and training will be maintained in personnel files. Training may consist of courses, workshops, classroom lectures, teleconferences, and on-the-job-training. The following groups provide training: U.S. EPA's Air Pollution Training Institute (http://www.epa.gov/air/oaqps/eog/course_topic.html), U.S. EPA Quality Assurance Division (QAD), U.S.EPA Office of Air Quality Planning and Standards (OAQPS), American Society for Quality Control (ASQC) and Air & Waste Management Association (AWMA). **Table A9** suggests a list of training courses for all air monitoring personnel. **Table A10** suggests a sequence of specific training courses for the respective air monitoring responsibility (e.g. field personnel, lab personnel, monitoring supervisor, QA officer, etc).

Table A9 Suggested Core Ambient Air Monitoring Training Courses

Sequence	Course Title	Course	APTI Type			Source
			Self Instruction	classroom	web	
1	Air Pollution Control Orientation Course	422	X		X	APTI
2	Principles and Practices of Air Pollution Control,	452		X		APTI
3	Mathematics Review for Air Pollution Control	100	X		X	APTI
4	Orientation to Quality Assurance Management	QA1				EPA QAD
5	Introduction to Ambient Air Monitoring, PM2.5 Monitoring Update,	434			X	APTI
6	General Quality Assurance Considerations for Ambient Air Monitoring	471	X		X	APTI
7	Basic Air Pollution Meteorology	409	X		X	APTI
8	Data Quality Objectives Workshop	QA2				QAD
9	Chain of Custody Procedures for Samples and Data	443	X		X	APTI
10	Quality Assurance Project Plan	QA3				QAD
11	Atmospheric Sampling	435		X		APTI
12	Network Design for Monitoring $PM_{2.5}$ & PM_{10} in Ambient Air	433	X		X	APTI
13	Analytical Methods for Air Quality Standards	464		X		APTI
14	Beginning Environmental Statistical Techniques	473A	X		X	APTI
15	Quality Assurance for Air Pollution measurement Systems	470		X		APTI
16	Site Selection for Monitoring SO_2	436	X		X	APTI
17	AQS Training (annual AQS conference)					OAQPS
18	Data Quality Assessment	QA4				QAD
19	Management Systems Review	QA5				QAD
20	Introduction to Environmental Statistics, SI	473B	X			APTI
21	Quality Audits for Improved Performance	QA6				AWMA
22	Statistics for Effective Decision Making	STAT 1				ASQC

Table A10 Suggested Training Courses for Air Monitoring Personnel

Course #	Air Monitoring Position						
	Field Personnel	Laboratory Personnel	QC Supervisor	Data Management	Monitoring Supervisor	QA Personnel	QA Management
422	x	x	x		x	x	x
452	x		x		x	x	x
100	x	x					
QA1					x	x	x
434	x	x	x	x	x	x	x
471	x	x	x	x	x	x	x
409	x		x		x	x	x
QA2					x	x	x
443	x	x	x	x	x	x	
QA3			x		x	x	x
435	x	x	x		x	x	
433			x		x	x	
464		x	x		x	x	
473A	x	x	x	x	x	x	x
473B					x	x	x
470			x		x	x	x
436	x		x		x	x	
QA4					x	x	x
QA5					x	x	x
473B	x	x	x	x	x	x	x
QA6						x	x
AQS Conf.				x			
STAT1			x		x	x	x

9. DOCUMENTS AND RECORDS

ADEC's Quality Management Plan for Ambient Air Monitoring describes document and records procedures for the Ambient Air Monitoring Program. This document may be found at http://www.dec.state.ak.us/air/doc/aq_qmp_sep06.PDF.

As indicated in 40 CFR Part 58, the Air Quality Program shall submit to the EPA Administrator, through the Region 10 Office, an annual summary report of all the air quality monitoring data from monitoring stations designated as SLAMS. The report will be submitted by July 1 of each year for the data collected from January 1 to December 31 of the previous year. The AM&QA Program Manager will certify that the annual summary is accurate to the best of his/her knowledge. This certification will be based on the various assessments and reports performed by the organization. Documents and records required to support concentration data reported to EPA, which includes all data required to be collected as well as data deemed important by the ADEC are listed in **Table A11**.

Table A11 Reporting Package Information

Categories	Record/Document Types	File Locations
Management and Organization	State Implementation Plan Reporting agency information Organizational structure Personnel qualifications and training Training Certification Quality management plan Document control plan EPA Directives Grant allocations Support Contract	ADEC-AM&QA Anchorage/Juneau
Site Information	Network description Site characterization file Site maps Site Pictures	ADEC-AM&QA Anchorage/Juneau
Environmental Data Operations	QA Project Plans Standard Operating Procedures (SOPs) Field notebooks Inspection/Maintenance records Laboratory notebooks Sample handling/custody records	ADEC-AM&QA Anch.&Juneau/FNSB/MOA " ADEC-AM&QA Anch.&Juneau/FNSB/MOA/ADEC AM&QA Laboratory (Juneau)
Raw Data	Any original data (routine and QC data) including data entry forms	ADEC AM&QA Laboratory (Juneau)/Anch/FNSB/MOA
Data Reporting	Air quality index report Annual SLAMS air quality information Data/summary reports Journal articles/papers/presentations	ADEC-AM&QA Anch.&Juneau/FNSB/MOA ADEC-AM&QA Anchorage/Juneau ADEC-AM&QA Anch.&Juneau/FNSB/MOA
Data Management	Data algorithms Data management plans/flowcharts Data Management Systems	ADEC AM&QA Laboratory (Juneau) ADEC-AM&QA Anchorage ADEC AM&QA Anch/Juneau Lab
Quality Assurance	Network reviews Control charts Data quality assessments QA reports System audits Response/Corrective action reports Site Audits	ADEC-AM&QA Anchorage/Juneau " " ADEC-AM&QA Anch.&Juneau/FNSB/MOA " "

B. MEASUREMENT AND DATA ACQUISITION

10. SAMPLE PROCESS AND DESIGN

The purpose of this section is to describe the relevant components of the State of Alaska's National Core Level 2 and 3 (SLAMS), SPM monitoring network as well as monitoring conducted to support PSD quality monitoring objectives. The network design components comply with the regulations stipulated in 40 CFR Part 58 Section 58.13, Appendix A, and Appendix D. In addition, **Table B1** lists criteria pollutant and other parameter specific siting guidance documents available from EPA's AMTIC web site. These documents are listed as a resource to those parties considering air quality and meteorological monitoring projects as an aid in identifying areas of air quality concern as well as selecting the best available monitoring site.

Table B1 Air Quality & Meteorological Sample Process & Design Documents

Parameter	Document Title	Source	Location
Criteria & Non-Criteria Pollutants	SLAMS/NAMS/PAMS Network Review Guidance	EPA AMTIC	http://www.epa.gov/ttnamti1/files/ambient/criteria/reldocs/netrev98.pdf
Criteria & non-Criteria Pollutants	QA Handbook for Air Pollution Measurement Systems, Vol 2: Part 1, Section 6.0 Sampling Process Design	EPA AMTIC	http://www.epa.gov/ttn/amtic/files/ambient/qaqc/redbook.pdf
Criteria & non-Criteria Pollutants	40CFR Part50	EPA AMTIC	http://www.epa.gov/ttn/amtic/40cfr50.html
Criteria & non-Criteria Pollutants	40CFR Parts 53 and 58	EPA AMTIC	http://www.epa.gov/ttn/amtic/40cfr53.html
CO	Selecting Sites for Carbon Monoxide Monitoring	EPA AMTIC	http://www.epa.gov/ttnamti1/files/ambient/criteria/reldocs/3-75-077.pdf
NO_2, O_3	Site Selection for the Monitoring of Photochemical Pollutants	EPA AMTIC	http://www.epa.gov/ttnamti1/files/ambient/criteria/reldocs/3-78-013.pdf
NH_3	Method for the Determination of Ammonia (NH_3) by Chemiluminescence	ADEC Method 4.10	ADEC Ambient Air Quality Method 4.10
O_3	Guidance on Ozone Monitoring Site Selection	EPA AMTIC	http://www.epa.gov/ttnamti1/files/ambient/criteria/reldocs/r-98-002.pdf
O_3	Guideline on Modification to Monitoring Seasons for Ozone	EPA AMTIC	http://www.epa.gov/ttnamti1/files/ambient/criteria/reldocs/modozsea.pdf
SO_2	Optimum Site Exposure Criteria for SO_2 Monitoring	EPA AMTIC	http://www.epa.gov/ttnamti1/files/ambient/criteria/reldocs/3-77-013.pdf
PM_{10}, $PM_{2.5}$	Network Design and Optimal Site Exposure Criteria for Particulate	EPA AMTIC	http://www.epa.gov/ttnamti1/files/ambient/criteria/reldocs/4-87-009.pdf

Table B1 Air Quality & Meteorological Sample Process & Design Documents

	Matter		
PM_{10}	Guideline for PM_{10} Episode Monitoring Methods	EPA AMTIC	http://www.epa.gov/ttnamti1/files/ambient/criteria/reldocs/4-83-005.pdf
Pb on TSP	Guidance for Siting Ambient Air Monitors Around Stationary Lead Sources	EPA AMTIC	http://www.epa.gov/ttnamti1/files/ambient/criteria/reldocs/pbgde997.pdf
Pb on TSP	Optimum Sampling Site Exposure Criteria for Lead	EPA AMTIC	http://www.epa.gov/ttnamti1/files/ambient/criteria/reldocs/4-84-012.pdf
Pb on TSP	Guideline for short-Term Lead Monitoring in the Vicinity of Point Sources	EPA AMTIC	http://www.epa.gov/ttnamtic/files/ambient/criteria/reldocs/oa12-122.pdf
Meteorological Measurements	Meteorological Monitoring Guidance for Regulatory Modeling Applications, Section 3.0 Siting & Exposure	EPA SCRAM	http://www.epa.gov/scram001/guidance/met/mmgrma.pdf
Meteorological Measurements	QA Handbook for Air Pollution Measurement Systems, Vol 4, Meteorological Measurements Version 1.0 (Draft)	EPA AMTIC	http://www.epa.gov/ttn/amtic/files/ambient/met/Volume%20IV_Meteorological_Measurements.pdf
PSD Criteria and Non Criteria Pollutants	Ambient Monitoring Guidelines for Prevention of Significant Deterioration	EPA AMTIC	http://www.epa.gov/ttn/amtic/files/ambient/criteria/reldocs/4-87-007.pdf

10.1 Network Objectives

NCore Level 2 Monitoring Objectives The ADEC NCore Level 2 Monitoring site will be one of 75 nation-wide multi-pollutant sites focusing on community-wide air quality assessment. Assuming EPA provides adequate funding, the ADEC's plan for a Level 2 NCore monitoring site will be submitted to EPA by July 1, 2009 and operational by January 1, 2011. The NCore parameters to be measured are listed in **Table B2**. The intent of the NCore monitoring site will be to:

- Represent ambient concentrations over a neighborhood scale representative of many similar neighborhoods;
- Represent an area impacted by mobile source emissions;
- Represent an area not impacted by unique local emission sources;
- Remain a long-term site with reasonable assurance of 5+ year "permission" period;
- Be collocated with an STN or NATTS site, if possible; and
- Have room for multiple gas monitors and associated equipment, integrated samples, meteorology.

NCore Level 3 (SLAMS) and SPM Monitoring Objectives Alaska's SLAMS/SPM Monitoring Network is designed to:

- Determine compliance or non-compliance with the NAAQS/AAAQS;
- Best represent the exposure of populations that may be affected by elevated criteria and non-criteria pollutant concentrations; and
- Meet EPA objectives. The design of the SLAMS/SPM network must achieve one of six basic monitoring objectives as described in 40 CFR Part 58, Appendix D. These are:
  - Determine the highest concentrations expected to occur in the area covered by the network;
  - Determine representative concentrations in areas of high population density;
  - Determine the impact on ambient pollution levels of significant sources or source categories;
  - Determine general background concentrations levels;
  - Determine the extent of regional pollution transport among populated areas, and in support of secondary standards; and
  - Determine the welfare-related impacts in more rural and remote areas (such as visibility impairment and effects on vegetation.

10.2 Selection of Monitoring Areas

The ADEC ambient air quality monitoring network is designed to protect the health and welfare of its residents and visitors. To meet this objective, monitoring sites are installed at locations specifically selected to evaluate public impacts of air quality pollutants in areas with the highest potential for exceeding the NAAQS/AAAQS. Where problems exist, priority will be given to communities with high population density. Where impacts are seasonal, monitoring studies will be designed to examine seasonal impacts on local residents.

Alaska does not meet many of the traditional concepts of population centers envisioned in the guidance documents for the criteria pollutant standards. Instead, Alaska's "population centers" closely resemble the supply centers of the 1800's used to explore the West. Alaska has only five communities over 15,000 people: Anchorage, Fairbanks, Juneau, Wasilla/Palmer and Ketchikan. Each of these areas must be considered separately and independent from the others when considering air quality impacts and influences on neighboring communities. Alaska's long-term goals are split between using SPM monitors to help characterize the most representative SLAMS sites and evaluating potential microscale impacts on the public.

Table B2 describes the representative measurement scales appropriate for Alaska's state-wide monitoring network.

Table B2 Description of Representative Measurement Scale

Measurement Scale	Description
Micro	Concentrations ranging in area from several meters to 100 meters.
Middle	Concentrations typical of areas of several city blocks in size with dimensions ranging from 0.1 to 0.5 kilometers.
Neighborhood	Concentrations within an extended area of the city that has relatively uniform land use with dimensions ranging from 0.5 to 4.0 kilometers.
Urban	Overall, city-wide conditions with dimensions ranging from 4 to 50 kilometers.
Regional	Rural area of reasonably homogenous geography ranging from tens to hundreds of kilometers

Table B3 summarizes relationships among monitoring objectives and appropriate scales of representativeness.

Table B3 Relationship Among Monitoring Objectives and Scales of Representativeness	
Monitoring Objective	**Appropriate Siting Scale**
Max Concentration	Micro, middle, neighborhood, sometimes urban
Population	Neighborhood, urban
Source Impact	Micro, middle, neighborhood
General/Background	Neighborhood, regional
Regional Transport	Urban, regional
Welfare-Related	Urban, regional

Table B4 summarizes spatial scales for appropriate NCore Level 2, SLAMS and SPM monitoring sites.

Table B4 Spatial Scales Appropriate for NCore Level 2, SLAMS, SPM Monitoring Sites

Spatial Scale	Scales for NCore Level 3 (SLAMS and SPM)							Scales for NCore Level 2						
	CO	NO_2	O_3	SO_2	Pb	PM_{10}	$PM_{2.5}$	CO	NO_2	O_3	SO_2	Pb	PM_{10}	$PM_{2.5}$
Micro	•				•	•	•	•				•	•	•
Middle	•	•	•	•	•	•	•					•	•	•
Neighborhood	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Urban		•	•	•	•	•	•		•	•				•
Regional			•	•	•	•	•							•

10.3 Sampling Schedule

Sampling schedules for criteria pollutants, NH_3 and meteorological parameters are continuous, except for the 24-hour integrated gravimetric methods PM_{10}, $PM_{2.5}$, and Pb-TSP. All continuous monitors are required to report hourly values. Continuous PM methods are required to sample continuously and report hourly as well as 24-hr values.

All integrated PM_{10} and Pb-TSP monitors used to collect NCore and SLAMS quality criteria data must sample 24-hours from midnight (local standard time) to midnight. Minimum sampling frequency is every six days following the EPA national sampling schedule. Every 3rd day sampling is encouraged to adequately represent PM concentrations. In cases where PM concentrations approach the NAAQS/AAAQS, every day sampling is required.

All integrated $PM_{2.5}$ monitors used to collect NCore and SLAMS quality criteria data must sample 24-hours from midnight (local standard time) to midnight. Minimum sampling frequency is every third day following the EPA national sampling schedule. In some cases the sampling frequency may be reduced to every 6th day with EPA regional office

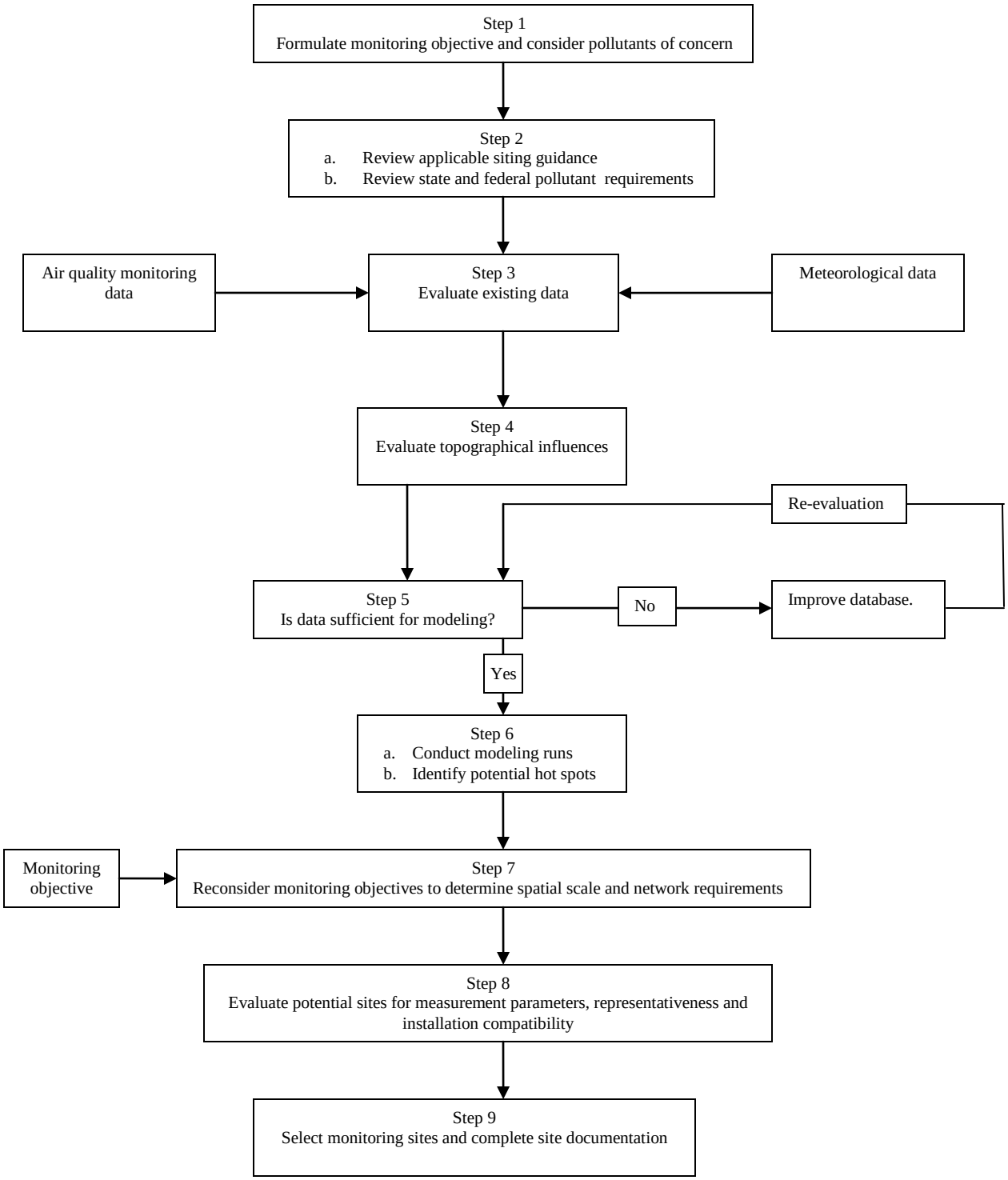
waiver. In cases where $PM_{2.5}$ concentrations are within 85 – 115% of the NAAQS/AAAQS, every day sampling is required.

The EPA National Sampling Schedule is updated yearly and is available from the following web link: http://www.epa.gov/ttn/amtic/calendar.html.

10.4 Selection of Monitoring Sites

Monitoring site locations will be based on the State's present understanding of local sources and their potential contributions to the NAAQS/AAAQS. Alaska's monitoring network will contain one NCORE site as well as a mix of SLAMS and SPM monitoring locations to address neighborhood-scale, micro-scale and associated gradients where necessary to develop effective control strategies. Final selection of the NCORE site has not yet been determined. Installation and operation of the site will be dependent upon receipt of federal monies and man power to operate the site. SLAMS and SPM sites are selected to meet as much as possible guidance documents listed in **Table B1**. Siting criteria not met are documented with sufficient reasons to justify the selection. Flow Chart**, Figure B1**, depicts the overall monitoring site selection process.

Figure B1 Monitoring Site Selection Process



10.5 Monitoring Network Description

The configuration of ADEC's monitoring network, based on the site selection criteria described above is summarized in **Table B5**. Detailed site information, including the rationale for each site selection, is available in Alaska's Ambient Air Monitoring Network Plan (http://www.dec.state.ak.us/air/am/index.htm).

Table B5 ALASKA NCore Level 2 and SLAMS/SPM MONITORING NETWORK

Network	Site ID		Ambient Air Quality Parameters Monitored											
			CO	NO_2	O_3	Pb	SO_2	$PM_{2.5}$ FRM	PM_{10} FRM	$PM_{2.5}$ Speciation	$PM_{2.5}$ Continuous	$PM_{2.5}$ Continuous FEM	PM_{10} Continuous FEM	$PM_{10-2.5}$ Continuous FEM
Anchorage-MOA	16th & Garden	SLAMS/ SPM	■		■+			■	■					■
	Turnagain	SLAMS	■											
	Parkgate-Eagle River	SLAMS/ SPM	■		■+				■					■
	Allstate Bldg.-Tudor Road	SLAMS							■*				■	
	8th & L Street	SPM	■											■
Fairbanks-FNSB	To be selected Δ	NCore Level 2	■	■	■	■	■	■*		■				■
	State Office Bldg.	SLAMS						■*		■		■		
	Peger Rd	SPM						■		■	■			
	2nd & Cushman (Old Post Office)	SLAMS	■											
	North Pole School	SPM						■		■	■			
ADEC - Kenai	Soldotna	SPM												■
ADEC - Juneau	Floyd Dryden School	SLAMS						■	■*			■		
ADEC - MatSu	Butte (Harrison Court)	SPM						■	■				■	
	Wasilla Fire Station	SPM												■
	Palmer	SPM						■						■
ADEC - Noatak	Noatak	SLAMS				■								

* collocated PM monitors + start-up April 2010 Δ start-up July 2011

11. SAMPLING METHODS

This Section describes the sample collection methods and continuous measurement methods for determining compliance with the primary and secondary NAAQS/AAAQS criteria pollutants and meteorological parameters.

11.1 Environmental Control

Monitoring stations should be designed for functionality and with the station operator in mind, considering safety, ease of access to instruments, optimal work space and security. **Table B6** lists recommended environmental control parameters for monitoring shelters. Continuous temperature measurement is strongly recommended inside monitoring shelters to ensure temperature is maintained within required shelter temperature criteria for all gaseous monitors (15° - 30°C, ±2°C SD/24-hrs.). Ambient air monitoring data collected outside this shelter temperature criteria needs to be flagged and evaluated regarding if acceptable data quality criteria has been met to validate the affected data.

Table B6 Environmental Control Parameters for Monitoring Shelters

Parameter	AQ method	Source of Specification	Method of Control
Instrument Vibration	All Equipment	Manufacturer's Specs	Design of Instrument housing's benches, per manufacturer's specs.
Light	Overhead light	Method Description or manufacturer's specs	Shield chemicals or instruments that can be affected by natural or artificial light.
All parameters	Sample lines for automated methods	Borosilicate glass, Teflon, laminar flow, moisture trap	See guidance on sample lines for automated methods http://www.epa.gov/ttn/amtic/files/ambient/qaqc/redbook.pdf , Section 7.2
Electrical Voltage	All Equipment	Method Description or manufacturer's specs	Constant voltage transformers or regulators; separate power lines, isolated high current drain equipment such as High-Vols, heating baths, pumps from regulated circuits
Temperature, Humidity	All gaseous monitoring equipment	Method description or manufacturer's specs. EPA monitoring shelter criteria unless otherwise specified.	Regulated temperature conditioning (EPA criteria 20° – 30°C ±2°C SD/24-hr). Alaska variance 15° – 30°C ±2°C SD/24-hr) system, continuous temperature recorder, electric cooling and heating only
Temperature	$PM_{2.5}$-FRM, if inside monitoring shelter	EPA-Alaska Modification	http://www.epa.gov/ttn/amtic/files/cfr/recent/akmod799.pdf Alaska Modification for operating $PM_{2.5}$ FRM within monitoring shelter with sample probe to outside shelter
Temperature	All PM continuous monitors	Alaska continuous PM method Requirement	Operated within temperature controlled monitoring shelter with sample inlet line sampling air at ambient temperature conditions.
Security	Shelter Security		Shelter secured with lock. Where monitoring equipment located outside shelter (e.g., met tower, PM monitors, etc.) monitoring equipment should be surrounded by locked chain link fence.
Safety	Cylinder gas		Cylinder gases secured upright in cylinder racks or otherwise secured upright against wall, instrument rack etc. Cylinders not in use capped with threaded cylinder gas cap.
	Venting exhaust/excess calibration gases		Excess calibration gas delivered to Gaseous monitors as well as exhaust gases vented outside shelter.
	Electrical	Local/state	Comply with local, State or national building codes.

Table B6 Environmental Control Parameters for Monitoring Shelters			
Safety	Shelter Construction	Local/state	Comply with local, State or national building codes. If monitors located on roof of shelter, safety railing required.
	Fire Safety	Local/state	Fire extinguisher mounted by door
	Basic First Aid Kit		
	Emergency light with battery back-up by door.		

11.2 Sampling Probes and Manifolds

Variables affecting sample manifold design are: diameter, length, flow rate, pressure drop, and construction materials. These variables must be taken into consideration when designing a sample delivery system. Sample probe manifold material for gaseous reactive gases may only be constructed with smooth, non-reactive and non-porous materials (i.e., FEP Teflon or borosilicate glass). Sample probe material for non-reactive gases (e.g., CO) should also utilize the same sample probe and manifold materials as used for reactive gases (e.g., SO_2, NO_2, O_3). Connective tube fittings must also be constructed of smooth non-reactive and non-porous materials (e.g. FEP Teflon, 316 or better stainless steel). Water traps should be configured into the sampling system to remove condensate that may accumulate in the sample line upstream of any monitoring equipment. Please see http://www.epa.gov/ttn/amtic/files/ambient/pm25/qa/QA-Handbook-Vol-II.pdf , Section 7.2 for recommended design configurations of sampling probes and manifolds

11.3 Sample Residence Time

The residence time of pollutants within the sample train is critical. Residence time is defined as the amount of time it takes for a sample of air to travel from the sample probe inlet to the sample inlet at the back of the analyzer. **For the reactive gases (NO_2, SO_2, NH_3 and O_3), sample residence must be < 20 seconds**. Sample residence time can be determined using the formula:

$$V = \pi * (d/2)^2 * L$$

Determine V separately for sample probe, manifold and line. Where :

V = volume
π = 3.14159
L = length
d = inside diameter

Add volume of various volume components together (V_{Total})

Determine sample residence time (R) using the formula:

$$R = V_{Total}/(\text{flow rate of all instruments})$$

If the sample residence time is found to be >10 seconds, it is strongly encouraged to install a blower motor (or other device) to decrease the sample residence time to within 10 seconds.

Sample residence times for CO should be minimized as much as possible. It is recommended that CO sample residence times also be kept to < 20 seconds.

11.4 Placement of Sample Probes and Manifolds

Careful consideration must be taken in the placement of sample probes and manifolds to avoid introducing bias to the sample collection process. Considerations such as probe height (above ground), length (distance from structures) and physical influences nearby are factors that can influence collection of a representative sample. **Table B7** lists some general guidelines for placement of sample probes and manifolds.

Table B7 Guidelines for Sample Probe & Manifold Placement
• Do not place probes next to air outlets (e.g., exhaust fan openings)
• Horizontal probes must extend beyond building overhangs
• Avoid placing probes near physical obstructions (e.g., chimneys) which can affect air flow in vicinity of the sample probe/inlet
• Sample probe/inlet height above ground dependent upon pollutant being measured

Table B8 summarizes probe and monitoring path siting criteria.

Table B8 Summary of Representative Probe and Monitoring Path Siting Criteria

Pollutant	Representative Scale	Height above ground to probe or 80% of monitoring path[A] (meters)	Horizontal and vertical distance to supporting structures[B] to probe or 90% monitoring path	Distance from trees to probe of monitoring path[A] (meters)
SO_2 [C, D, E, F]	Middle (300 m) Neighborhood, Urban, and Regional (1 km)	3 – 15	>1	>10
CO [D,E,G]	Micro, Middle (300 km) Neighborhood (1 km)	3 ± 0.5; 3 – 15	>1	>10
O_3 [C,D,E]	Middle (300 m) Neighborhood, Urban, and Regional (1 km)	3 – 15	>1	>10
NO_2 [C,D,E]	Middle (300 m) Neighborhood, and Urban (1 km)	3 – 15	>1	>10
NH_3 [C,D,E]	Middle (300 m) Neighborhood, and Urban (1 km)	3 – 15	>1	>10
Pb [C,C,E,F,H]	Micro, Middle, Neighborhood, Urban and Regional (1 km)	2 – 7 (micro); 2 – 15 (all other scales)	>2 (all scales, horizontal distance only)	>10 (all scales)
PM_{10} [C,D,E,F,H]	Micro, Middle, Neighborhood, Urban and Regional	2 – 7 (micro); 2 – 15 (all other scales)	>2 (all scales, horizontal distance only)	>10 (all scales)
$PM_{2.5}$ [C,D,E,F,H,I]	Micro, Middle, Neighborhood, Urban and Regional	2 – 7 (micro); 2 – 15 (all other scales)	>2 (all scales, horizontal distance only)	>10 (all scales)

[A] ≡ Monitoring path for open path analyzers is applicable only to middle or neighborhood scale CO monitoring and all applicable scales for SO_2, O_3, NO_2 and NH_3

[B] ≡ When probe is located on rooftop, this separation distance is in reference to wall, parapets, or penthouses located on roof.

[C] ≡ Should be >20 meters from drip line of tree(s) and must be ≥10 meters from the drip line when trees(s) act as an obstruction.

[D] ≡ Distance from sampler, probe, or 90% of monitoring path to obstacle, such as a building, must be at least twice the height of the obstacle that protrudes above the sampler, probe or monitoring path. Sites not meeting this criterion must be classified as middle scale.

[E] ≡ Must ≥ 270° unrestricted air flow around probe or sampler; 180° if the probe is located on the side of a building.

[F] ≡ The probe, sampler, or monitoring path should be away from minor sources, such as furnace or incineration flues. The separation distance is dependent on the height of the minor source's emission point (such as a flue), the type of fuel or waste bed, and the quality of fuel (sulfur, ash, or lead content). This criterion is designed to avoid undue influences from minor sources.

[G] ≡ For microscale CO monitoring sites, the probe must be >10 meters from a street intersection and preferably at a midblock location.

[H] ≡ For collocated Pb and PM_{10} samplers, a 2 – 4 meter separation distance between collocated Hi-Vol samplers and/or paired HiVol and Low-Vol samplers must be met. For collocated Low Volume samplers a 1 – 4 meter separation distance must be met.

[I] ≡ For collocated $PM_{2.5}$ samplers, a 1 – 4 meter separation distance must be met between samplers.

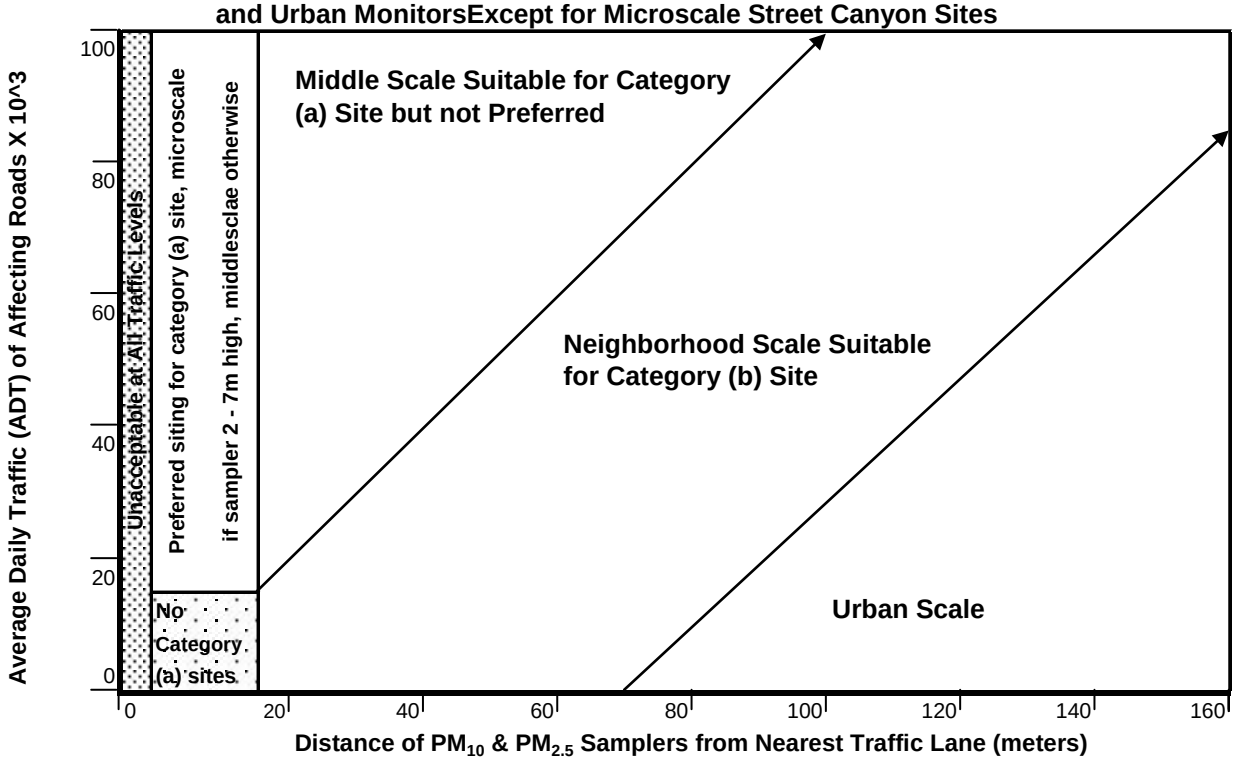
Table B9 summarizes spacing of probes from roadways. This information can be found in 40CFR part 58 Appendix E.

Table B9 Minimum Separation Distance Between Sampling Probes and Roadways

Roadway avg. daily traffic vehicles/day	Minimum separation distance between roadways and probes or monitoring paths at various scales (meters)					
	O_3 Neighborhood & Urban	NO_2 Neighborhood & Urban	CO Neighborhood	Pb		
				Micro	Middle	Neighborhood & Regional
≤10,000	10	10	10	5 – 15	>15 – 50	>50
15,000	20	20	25			
20,000	30	30	45	5 – 15	>15 – 75	>75
30,000			80			
≥40,000				5 – 15	>15 - 100	>100
40,000	50	50	115			
50,000			135			
≥60,000			150			
70,000	100	100				
≥110,000	250	250				

Figure B2 shows acceptable areas for locating PM_{10} and $PM_{2.5}$ monitors for the representative siting scales.

Figure B2 - Acceptable Areas for PM_{10} and $PM_{2.5}$ Micro, Middle, Neighborhood and Urban MonitorsExcept for Microscale Street Canyon Sites



11.5 Monitoring Methods

Federal Reference and Equivalent Methods

Monitoring methods used to support Level 2 NCore, Level 3 NCore (SLAMS), SPM and PSD monitoring must use EPA FRM, FEM or ARM (for continuous PM only) approved method analyzers and operated as specified within the EPA FRM/FEM and/or state method designations. For a list of EPA approved reference and equivalent criteria pollutant methods, please go to: http://www.epa.gov/ttn/amtic/criteria.html. The EPA QA Handbook for Air Pollution Measurement Systems, Volume II, Part II provides specific Federal Reference Method procedures for the measurement of the ambient air quality criteria pollutants. A list of these methods can be found under the EPA AMTIC web site: http://www.epa.gov/ttn/amtic/files/ambient/pm25/qa/QA-Handbook-Vol-II.pdf.

DEC Approved Monitoring Methods

DEC maintains an inventory of "DEC approved" Ambient Air Quality Monitoring Methods and Standard Operating Procedures. These methods, SOPs and other QA guidance documents can be found on the DEC M&QA web site: http://www.dec.state.ak.us/air/am/index.htm, and in Appendix A of this document. For those methods not yet developed, or under development by ADEC, the respective EPA method is the default criteria.

Meteorological Monitoring

Meteorological monitoring data collected to support NCore, SLAMS and PSD quality monitoring projects will follow EPA guidance criteria found in:

EPA QA Handbook Volume IV, Meteorological Monitoring, web link:
http://www.epa.gov/ttn/amtic/files/ambient/met/Volume%20IV_Meteorological_Measurements.pdf

- EPA Meteorological Monitoring Guidance for Regulatory Modeling Applications, EPA-454/R-99-005, web link: http://www.epa.gov/scram001/guidance/met/mmgrma.pdf; and
- Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD), EPA-450/4-87-007.

Additional meteorological monitoring criteria specific to Alaska can be found on the Meteorological Monitoring Data Validation Tables (**Appendix A**) and **Table A8, Alaska Meteorological Measurement Quality Objectives.**

Modifications to EPA/ADEC Method Analyzers and Procedures

If monitoring data is to be used to support NCore, SLAMS, SPM or PSD quality criteria pollutant monitoring, and design changes to the method equipment and/or method procedures are intended, prior approval must be received from the DEC's Air QA Officer (or designee) through the Quality Assurance Plan (QAPP) approval process before monitoring begins. Monitoring data collected without this approval may be rejected. Full responsibility for potential DEC non-acceptance of monitoring data rests solely on the primary organization/permittee/contractor collecting the data.

PM_{10} Continuous Method Analyzers and Procedures

Even though EPA has given federal equivalent method (FEM) approval to some continuous PM_{10} monitoring methods, ADEC requires that such monitoring methods must demonstrate in-situ comparability testing for one year with an approved EPA FRM PM_{10} monitor operating on a minimum every-6th-sampling day frequency. Comparability (least squares fit) between the PM_{10} FRM method and the continuous PM_{10} method must be:

- $0.90 \geq \text{slope} \leq 1.10$
- Intercept ≤ 5 ug/m^3
- Correlation coefficient (R^2) ≥ 0.95

The collected data must adequately represent sufficient density of data points that span the PM_{10} method measurement range of interest. Once approval is received, the continuous PM_{10} monitoring method may be used in a similar local/regional air shed pending ADEC M&QA concurrence. However, if meteorology, PM source characteristics, etc. change significantly, in-situ PM_{10} method comparability may be required for new locations. The following EPA document, *"Data Quality Objectives (DQOs) for Relating Federal Reference Method (FRM) and continuous $PM_{2.5}$ Measurements to Report an Air Quality Index (AQI),"* (http://www.epa.gov/ttn/amtic/files/ambient/monitorstrat/aqidqor2.pdf) provides guidance on developing acceptable inter-method comparability.

$PM_{2.5}$ Continuous Method Analyzers and Procedures

Even though EPA has given federal equivalent method (FEM) approval to some continuous $PM_{2.5}$ monitoring methods, ADEC requires that such monitoring methods must demonstrate in-situ comparability testing for one year with an approved EPA FRM $PM_{2.5}$ monitor operating on a minimum every-6th-sampling day frequency. Comparability (least squares fit) between the $PM_{2.5}$ FRM method and the continuous $PM_{2.5}$ method must be:

- $0.90 \geq$ slope ≤ 1.10
- Intercept ≤ 3 ug/m^3
- Correlation coefficient (R^2) ≥ 0.95

The collected data must adequately represent sufficient density of data points that span the $PM_{2.5}$ method measurement range of interest. Once approval is received, the continuous $PM_{2.5}$ monitoring method may be used in a similar local/regional air shed pending ADEC M&QA concurrence. However, if meteorology, PM source characteristics, etc. change significantly, in-situ $PM_{2.5}$ method comparability may be required for new locations. The following EPA document, *"Data Quality Objectives (DQOs) for Relating Federal Reference Method (FRM) and continuous $PM_{2.5}$ Measurements to Report an Air Quality Index (AQI),"* (http://www.epa.gov/ttn/amtic/files/ambient/monitorstrat/aqidqor2.pdf) provides guidance on developing acceptable inter-method $PM_{2.5}$ comparability.

11.6 Good Field Measurement Practices

Good Field Measurement Practices (GFMPs) refer to general practices that relate to many, if not all of the measurements made in the field (similar in scope and common sense as those referred to as Good Laboratory Practices (GLPs)). They are usually independent of SOPs and encompass subjects as:

- Facility maintenance
- Records
- Field sample management and handling
- Maintenance of monitoring equipment
- Cleanliness of sample collection equipment, manifolds, etc.
- Representative traceability of calibration/audit standards (certification/recertification of calibration/audit standards over their intended range of use)
- General principles for calibration of monitoring equipment
- Safe handling of hazardous and/or potentially hazardous materials
- Field safety
- Etc.

In many cases the activities may not be formally documented because they are considered common knowledge and common sense. However, not applying GFMPs can significantly affect the reliability of the collected data and may even be cause for data invalidation.

12. SAMPLE HANDLING & CUSTODY

Maintaining sample integrity through field collection, transit, storage and subsequent analytical phases is critical to establishing final sample data reliability. Careful documentation of the process ensures that proper handling, etc. occurred and is part of the custody record.

The State of Alaska does not follow strict Sample "Chain of Custody" for Alaska's NCore, SLAMS and SPM monitoring program. The State, however, does maintain sample/sample data integrity by tracking samples/sample data from sample collection through analysis, data reduction, data validation, data reporting and archiving of sample/sample data. These procedures can be found in the respective monitoring method.

For the Ambient Air Quality Monitoring Program, sample handling pertains only to the manual methods of particulates (PM_{10}, $PM_{2.5}$, $PM_{2.5}$ speciation) and Lead (Pb). Careful attention and consistency in the process of filter handling as specified in SOPs is critical to minimizing potential measurement errors. The phases of sample handling include:

- Sample labeling,
- Sample retrieval, and
- Sample transport.

12.1 Sample Labeling and Identification

Sample labeling and identification will follow the specific procedures in the respective method/SOPs to ensure positive identification throughout the testing and analytical procedures. In general each:

- Sample will have a unique identification label that is indelible and unaffected by gases and temperatures to which it will be subjected and does not impair the sample filter's capacity to function as designed.
- Sample transport container will have a unique identification to preclude the possibility of sample interchange.
- Sample will be properly handled to ensure there is no contamination and that the sample analyzed is actually the sample taken under the conditions reported.
- Sample collected will be accompanied by pertinent sample collection data as specified in the respective method/SOP (e.g., sample date, sample run time, sample begin/end flow rate, sample retrieval date, operator's initials, etc.).

If strip charts are used to record sample data from automated analyzers, they must be clearly identified. Information must be recorded so as not to interfere with any chart recorded data. If the strip chart is long, information should be placed at periodic intervals on the chart. Markings should be indelible and permanently affixed to each strip chart.

12.2 Sample Retrieval

In order to protect the integrity of each sample, samples need to be carefully removed from monitoring equipment/devices and place in sealed and non-reactive containers. Specific sample retrieval procedures may be found in the respective monitoring method/SOP.

12.3 Sample Transport

Precautions must be taken to eliminate the possibility of tampering, accidental destruction, and/or physical and chemical action on the sample. Attributes that can affect a sample's integrity include: temperature, air pressure, moisture, and physical handling of samples (packing, jostling, etc.). The practical aspects of sample transport can vary dependent upon the method. Specific handling procedures are addressed in the respective EPA and DEC monitoring methods and project-specific QAPPs and SOPs.

13. ANALYTICAL METHODS

Analytical methods for the Ambient Air Quality Monitoring Program are those methods requiring laboratory analysis of samples collected under field monitoring conditions, specifically the filter-based PM_{10}, $PM_{2.5}$ and Pb methods. These methods all have Federal Reference or Equivalent Methods designations. For a list of these methods, please go to: http://www.epa.gov/ttn/amtic/criteria.html. The EPA QA Handbook for Air Pollution Measurement Systems, Volume II, Part II provides specific Federal Reference Method procedures for the measurement of the ambient air quality criteria pollutants. These methods can be found on the EPA AMTIC web site http://www.epa.gov/ttnamti1/qabook.html.

ADEC AM&QA also maintains a set of ADEC approved analytical procedures for the analysis of PM_{10}, $PM_{2.5}$ and Pb-TSP filters. These methods, SOPs and other QA guidance documents can be found on the DEC M&QA web site: http://www.dec.state.ak.us/air/am/index.htm. A list of these methods/SOPs can be found in Appendix B of this document.

Since both specific field and analytical procedures for ambient air quality criteria pollutants are available in the above referenced documents, this section limits discussion to general concepts of Standard Operating Procedures (SOPs) and Good Laboratory Practices (GLPs) as they relate to EPA and DEC criteria pollutant monitoring methods.

13.1 Standard Operating Procedures (SOPs)

In order to perform sampling and analysis operations consistently, SOPs must be written as part of a QAPP. SOPs are written documents that detail the method for an operation, analysis, or action with thoroughly prescribed techniques and steps and are officially approved as the method for performing routine and repetitive tasks.

SOPs should ensure consistent performance with organizational practices, serve as training aids, provide ready reference and documentation of proper procedures, reduce work effort, reduce error occurrences in data, and improve data comparability, credibility, and defensibility. They should be sufficiently clear and written in a step-by-step format to be readily understood by a person knowledgeable in the general concept of the procedure. Elements to include in an SOP are:

1. Scope & Applicability
2. Summary of Method
3. Definitions
4. Health & Safety Warnings
5. Cautions
6. Interferences
7. Personnel Qualifications
8. Apparatus & Materials
9. Instrument or Method Calibration
10. Sample Collection
11. Handling and Preservation Sample Preparation & Analysis
12. Troubleshooting
13. Data Acquisition, Calculations & Data Reduction
14. Computer Hardware & Software (used to manipulate analytical results and report data)
15. Data Management & Records Management
16. Data Validation Table (predetermined criteria that defines limits to determine collected data quality)

SOPs should follow the guidance document, Guidance for the Preparation of Standard Operating Procedures EPA QA/G-6. This document is available through the EPA Quality System Homepage and web link, http://www.epa.gov/quality/qs-docs/g6-final.pdf.

It is the policy of ADEC that SOPs be written by the individual/s who are performing the procedures that are being standardized and subsequently reviewed by personnel that oversee the respective measurement operations. SOPs for the ambient air quality monitoring program must be included in QAPPs, either by reference or by inclusion of the actual method. If a method is referenced, it must be stated that the method is followed exactly or an addendum that explains changes to the method must be included in the QAPP. If a modified method will be used for an extended period of time, the method should be revised to include the changes to the appropriate sections. In general, approval of SOPs occurs during approval of the QAPP. QA personnel (or their designees) with appropriate training and experience review and approve the SOPs.

13.2 Good Laboratory Practices (GLPs)

GLPs refer to general practices that relate to many, if not all of the measurements made in a laboratory. They are usually independent of the SOP and cover subjects such as maintenance of facilities, records, sample management and handling, reagent control, and cleaning of laboratory glassware. In many cases the activities mentioned above may not be formally documented because they are considered common knowledge. Although not every activity in a laboratory needs to be documented, the activities that could potentially cause unnecessary measurement uncertainty, or have caused significant variance or bias, should be cause to generate a method.

In 1982, the Organization for Economic Co-operation and Development (OECD) developed principles of good laboratory practice. The intent of the GLP is to promote the quality and validity of test data by covering the process and conditions under which Environmental Data Operations (EDOs) are planned, performed, monitored, recorded and reported. The principles include:

- Test facility organization and personnel
- Quality assurance program
- Facilities
- Apparatus, material and reagents
- Test systems
- Test and reference substances
- Standard operating procedures
- Performance of the study
- Reporting of study results
- Storage and retention of records and material

13.3 Laboratory Activities

For ambient air samples to provide useful information or evidence, laboratory analyses must meet the four basic requirements:

1. Equipment must be frequently and properly calibrated and maintained.
2. Personnel must be qualified to make the analysis.
3. Analytical procedures must be in accordance with accepted practice.
4. Complete and accurate records must be kept.

These laboratory activities relate not only to the analysis of particulate matter and lead but also other activities necessary to collect and report measurement data such as:

- Certification of field and laboratory calibration standards,
- Certification of field and laboratory audit standards, and
- Preparation of standard reference materials.

Table B10 and **Table B11** List Laboratory Quality Control activities, their frequency of occurrence and criteria important to the analyses and data validation for PM_{10} and $PM_{2.5}$ sample filters.

Note: PM_{10} Low Vol filter analysis criteria same as $PM_{2.5}$ filter analysis, except no filter holding time criteria.

Table B10 Laboratory QC Criteria for Analysis of $PM_{2.5}$ & PM_{10} Low-Vol Filters

Requirement	Frequency	Acceptance Criteria	QA Guidance Document 2.12 Reference	Information Provided
Filter Checks				
Unexposed filter integrity check	Every filter	No defects	40CFR Part 50 App. L Sec. 10.2 2.12 Sec. 7.5	± Contamination of filter blanks from moisture gain/loss or other contaminants
Exposed filter integrity check				
Lot Blanks	9 filters/lot	< 15 µg between weighings	2.12 Sec. 7.7	
Exposure Lot Blanks	3 filters/lot	< 15 µg between weighings	2.12 Sec. 7.7	
$PM_{2.5}$ Filter Holding Times				
Pre-sampling Weighing	All filters	< 30 days before sampling	Part 50 App l Sec 8.3 2.12 Sec. 7.9	Controls established to minimize potential loss of volatile/sub-volatile components of particulate mass
Sample Recovery		≤ 177 hours (7 days & 7 hrs)	40CFR Part 50 App. L Sec.3.3 and http://www.epa.gov/ttn/amtic/files/ambient/pm25/filtere.pdf	
Post-sampling Weighing		≤ 10 days at 25°C from sample end date, or ≤ 30 days at 4°C from sample end date	40CFR Part 50 App. L Sec. 7.4.15	
Filter Conditioning Environment				
Time Range	All filters	24 hrs minimum	Part 50 App l Sec 8.2 2.12 Sec. 7.6 Summary of Guidance; Filter conditioning and Weighing Facilities and Procedures for $PM_{2.5}$ Reference and Class I Equivalent Methods (http://www.epa.gov/ttnamti1/files/ambient/pm25/qa/balance.pdf)	Controls established to minimize potential mass gain/loss contamination due to moisture
Temperature Range		24-hr mean, 20° – 23° C		
Temperature Control		± 2° C SD over 24-hr		
Humidity Range		24-hr mean 30% - 40% RH or < 5% sampling RH bu > 20% RH		
Humidity Control		± 5% RH SD over 24-hr		
Pre/Post Filter Conditioning RH		Difference in 24-hr means ≤ ± 5%RH	Part 50 App. L Section 8.3.2	
Balance		Located in filter conditioning environment	Part 50 App. L Section 8.3.3	
Calibration/Verification				
Micro Balance Readability	At purchase	1 µg	40CFR Part 50 App. L Sec 8.1 2.12 Sec 4.3.6	Required balance sensitivity
Micro Balance Repeatability	1/year	1 µg	2.12 Sec 4.3.6	Required balance precision
Balance Calibration	1/yr	Manufacturers spec.	2.12 sec 7.2	Verification of equipment operation
Lab Temp. Calibration	6 month	±2° C	2.12 Sec 3.3	Verification of equipment operation
Lab Humidity Calibration	6 month	±2% RH	2.12 Sec. 3.3	Verification of equipment operation

Table B10 Laboratory QC Criteria for Analysis of $PM_{2.5}$ & PM_{10} Low-Vol Filters

Requirement	Frequency	Acceptance Criteria	QA Guidance Document 2.12 Reference	Information Provided
Calibration standards				
Working Mass Stds.	3-6 month	25 µg	2.12 Sec 4.3 and 7.3	Working standards verification
Primary Mass Stds.	1/yr	25 µg	2.12 Sec 4.3 and 7.3	Transfer standards certification
Temperature Standards	1/yr	± 0.1 °C resolution, ± 0.5 °C accuracy	2.12 Section 4.2	Transfer standard certification
Humidity Standards	1/yr	±2% RH		Transfer standard certification
QC Checks				
Zero Balance Check	Prior to every weighing			Balance bias/stability
Balance Check (100 mg and 200 mg)	beginning, every 10th samples, end	≤3 µg	2.12 Sec. 7.9	
Field Filter Blank	10% or 1/weighing session	< 30 µg between weighings	40CFR Part 50 App. L,, Sec 8.3 2.12 Sec 7.7	Overall filter handling/contamination
Lab Filter Blank.	10% or 1/weighing session	< 15 µg between weighings	40CFR Part 50 App. L,, Sec 8.3 2.12 Sec 7.7	Contamination of lab blank due to moisture control, etc.
Duplicate Filter Weighing	1/weighing session	< 15 µg between weighings	2.12 Sec 7.11	Weighing repeatability/filter stability
Bias				
Balance Audit	1/yr	±15 µg for unexposed filters	2.12 Sec 10.2	Laboratory technician operation

Table B11 Laboratory QC Criteria for Analysis of PM_{10} Hi-Vol Filters

Requirement	Frequency	Acceptance Criteria	Fed Register & EPA QAQA Guidance Document	Information Provided
Filter Checks				
Unexposed filter integrity check	Every filter	No defects	2.11 Section 4.2	Filter integrity/damage
Exposed filter integrity check				
Filter Conditioning Environment				
Time Range	All filters	24 hrs minimum	2.11 Sections 1.2.3, 2 and 4	Environmental controls set to control moisture and static electricity contamination from net particulate analysis
Temperature Range		24-hr mean, 15° – 30° C		
Temperature Control		± 3° C SD over 24-hr		
Humidity Range		24-hr mean 20% - 45% RH		
Humidity Control		< ± 5% RH SD over 24-hr		
Pre/Post Filter Conditioning RH		Difference in 24-hr means ≤ ± 5%RH		
Calibration/Verification				
Analytical Balance Readability	At purchase	0.1 mg	2.11 Sections 2.0 and 4.5	Verification of equipment operation
Analytical Balance Repeatability	1/year	0.5 mg		
Analytical Balance Calibration	1/yr	Manufacturers spec.		
Lab Temp. Calibration	3 month	±0.5° C,	2.11 Section s 1.1.2	
Lab Humidity Calibration	3 month	±6% RH	2.11 Section s 2.0	
Unexposed filter integrity check	Every filter	No defects	2.11 Sections 4.0, 4.1, 4.2, 4.6	Sample contamination
Exposed filter integrity check	Every filter	No defects		
Calibration standards				
Working Mass Stds.	3-6 month	≤ ± 0.5 mg of NIST traceable	2.11 Sec 2 .14.3 and 4.5	Working standards verification
Mass Transfer Stds.	1/yr	ANSI/ASTM Classes 1, 1.1 or 2, indiv mass std accuracy ≤± 0.025mg from NIST accredited weights & measures lab or NVLAP accredited lab	2.11 sec 1.2.4, 9.0	Transfer standards certification
Temperature Standards	1/yr	± 0.1 °C resolution, ± 0.1 °C accuracy, NIST/ASTM traceable	2.11 Sections 1.12	Transfer standard certification
Humidity Standards	1/yr	±2% RH, NIST/ASTM traceable	2.11 Sections 2.0	Transfer standard certification
QC Checks				
Zero Balance Check	Prior to every weighing	≤ ± 0.1 mg	2.11 sections 4.4 and 4.5	Verification of analytical balance accuracy
Balance Checks (bracketing expected range of unexposed and exposed sample filters e.g., 1.0g - 5.0g)	beginning, every 10th samples, end	≤ ± 0.5 mg		
Field Blanks	10% of filters			Filter contamination
Filter Transport Blanks	1/batch of shipped filters			Integrity of filter shipments
Replicate un-exposed Filter Weighing	10% each of pre- and post-	< ± 2.8 mg difference	2.11 section 4.5.3	Lab technician filter handling

Table B11 Laboratory QC Criteria for Analysis of PM_{10} Hi-Vol Filters

Requirement	Frequency	Acceptance Criteria	Fed Register & EPA QAQA Guidance Document	Information Provided
Replicate un-exposed Filter Weighing	exposed filters/weighing session	< ± 5.0 mg difference		procedures
Bias				
Balance Audit	1/yr	≤ +5 mg of audit stds that bracket routine weights of un exposed and exposed sample filters (3g, 5g)		Laboratory technician operation

14. QUALITY CONTROL (QC)

14.1 Definitions

Care must be taken not to equate Quality Control (QC) with Quality Assurance (QA). Though the two are very similar, there are some basic differences: QC is concerned with the product, while QA is process–oriented. QC hence is a subset of QA.

Even with such a clear-cut difference defined, identifying the differences between the two can be hard. Basically, QC involves evaluating a product, activity and/or service. By contrast, QA is designed to make sure processes are sufficient to meet the end objectives. Simply put, QA ensures a product or service is manufactured, implemented, created, or produced in the right way; while QC evaluates whether or not the end result is satisfactory.

***Quality Assurance (QA)* –** QA for ambient air and meteorological monitoring operations is the overall systematic process of planning, implementation, monitoring, verifying and determining whether the collected data meets or exceeds the data quality objectives (DQOs) of NCore, SLAMS, SPM and/or PSD quality monitoring data.

***Quality Control (QC)* –** QC for ambient air and meteorological monitoring operations is the overall system of technical functions, technical processes and physical characteristics that measures the attributes and performance of the monitoring procedure to ensure quality data meets the NCore, SLAMS, SPM and/or PSD data criteria requirements and objectives

***Quality Assessments* –** Quality Assessments are independent measurements/reviews (verifications) made of the QC System (i.e., the technical functions, technical processes and physical characteristics that measure the attributes and performance of the monitoring procedure). Quality Assessments include such items as Technical Systems Audits, Performance Audits, Network Reviews, etc. (please see Section 20, Quality Assessments). As with Quality Control, Quality Assessments are also under the umbrella of Quality Assurance.

Figure B3 depicts the functional aspects of Quality Control, Quality Assessment and their relationship within the umbrella Quality Assurance Program for Ambient Air & Meteorological Monitoring Program.

Figure B3—Quality Control & Quality Assessment's Relationship within the Ambient Air & Meteorological Monitoring Quality Assurance Program

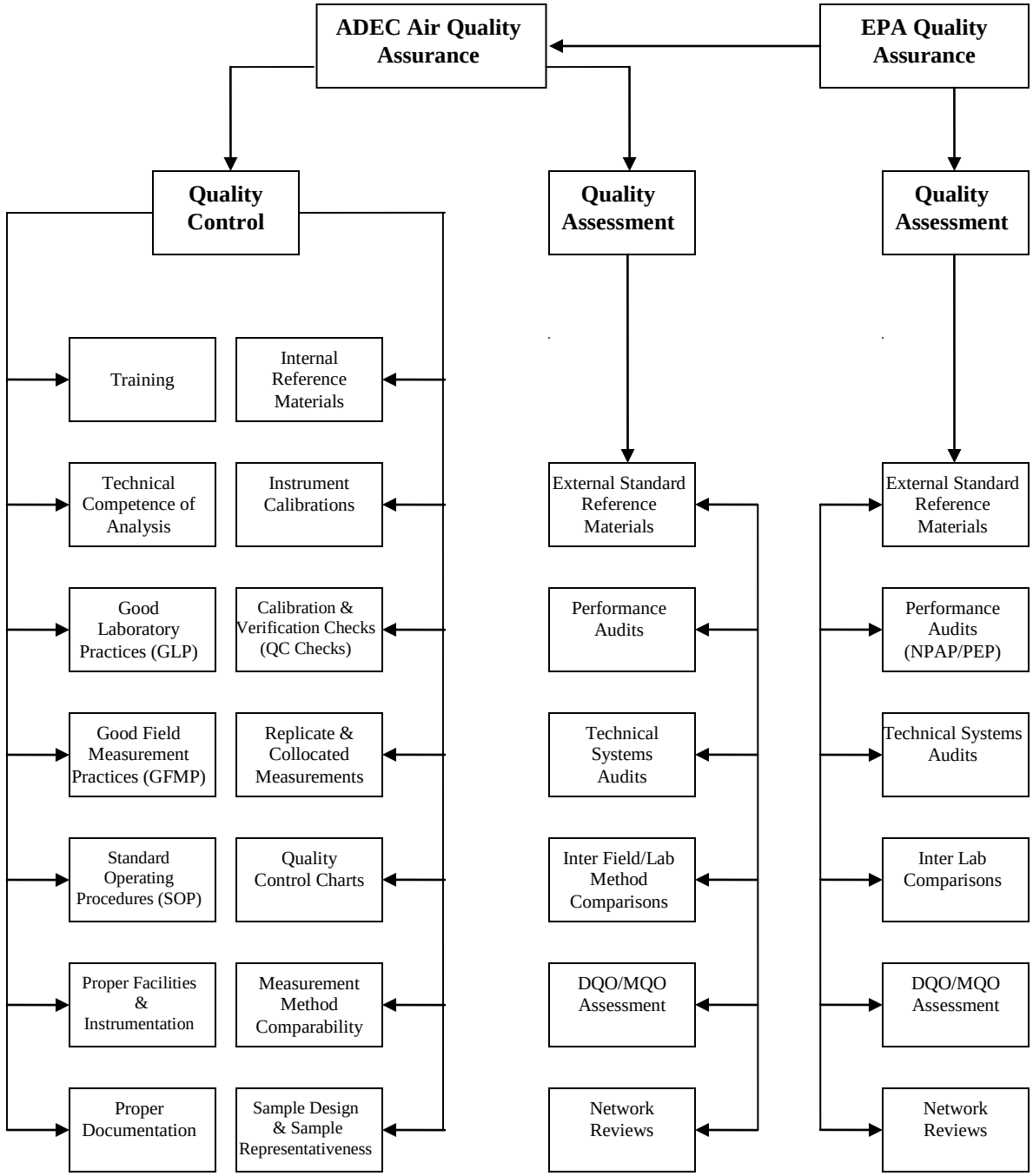
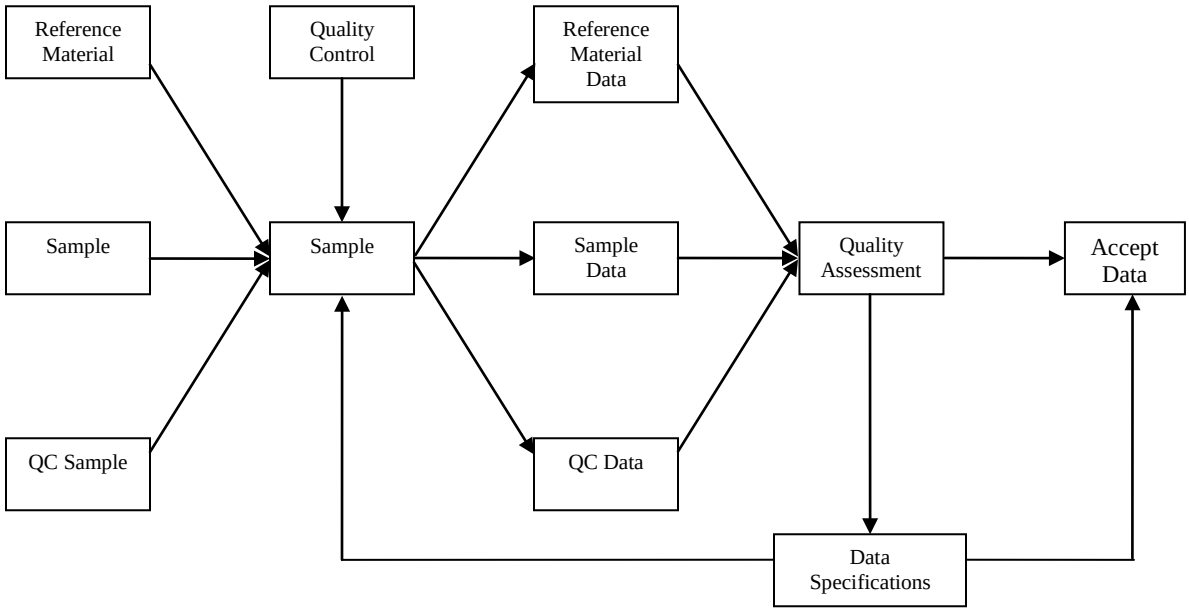


Figure B4 describes the overall process of accepting routine data.

Figure B4 Quality Control's Relationship to Routine Acceptance of Data



14.2 Measurement Quality Objectives and Quality Control

The Alaska Ambient Air Monitoring MQO Table (Table A7) and Alaska Meteorological Monitoring MQO Table (Table A8) list the most critical QC sample/criteria that must be met in order to validate/report reliable monitoring data.

14.3 Data Validation Tables and Quality Control

Method Specific Data Validation Criteria have been developed for the various ambient air quality and meteorological measurement methods. These criteria are ranked under three classes of "data acceptance criteria" for a measurement method and define how the criteria should/must be used to evaluate overall data quality. These method specific Data Validation Tables are located in Appendix A. These data quality criteria categories are:

1. ***CRITICAL CRITERIA TABLE*** - Criteria deemed critical to maintaining the integrity of a sample or group of samples reside in the Critical Criteria Table. Observations that do not meet each and every criterion on the Critical Table should be invalidated unless there are compelling reason and justification for not doing so. Basically, the samples for which one or more of these criteria are not met are invalid unless proven otherwise. The cause for not operating in the acceptable range for each violated criteria must be investigated and minimized to reduce the likelihood that additional samples will be invalidated.
2. ***OPERATIONAL EVALUATIONS TABLE*** - Criteria that are important for maintaining and evaluating the quality of the data collection system reside in the Operational Evaluations Table. Violation of a criterion or a number of criteria may be cause for invalidation. The decision should consider other quality control information that may or may not indicate the data are acceptable for the parameter being controlled. Therefore, the sample or group of samples for which one or more of these criteria are not met is suspect unless other quality control information demonstrates otherwise. The reason for not meeting the criteria **MUST** be investigated, mitigated and/or justified.

3. ***SYSTEMATIC ISSUES TABLE*** **-** Criteria important for the correct interpretation of the data but do not usually impact the validity of a sample or group of samples reside in the Systematic Issues Table. For example, data quality objectives are included in this table. If data quality objectives are not met, this does not invalidate any of the samples but it may impact the error rate associated with the attainment/non-attainment decision.

Other elements of this QAPP that contain related sampling and analytical QC requirements include:

- **Sample Process and Design (Section 10)** – discusses requirements/issues for determining if the collected sample(s) accurately represents population/area of interest;
- **Sample Method Requirements (Section 11)** – Identifies planned field QC samples and procedures for sample(s) preparation and handling, etc.;
- **Sample Handling & Custody (Section 12)** – discusses requirements/issues related to maintaining integrity of sample(s) during transport;
- **Analytical Methods (Section 13)** - discusses requirements/issues related to subsampling methods, preparation of QC samples (e.g., blanks and replicates); and
- **Instrument Calibration and Frequency (Section 15)** – defines prescribed criteria for triggering recalibration.

14.4 Use of Computers for Quality Control

Computers are used throughout the Ambient Air Monitoring and Quality Assurance Program for various aspects of Quality Control. Some analytical methods incorporate the use of a computer to control and semi-automate routine analytical measurement operations (i.e., DEC laboratory gravimetric analysis of PM_{10} and $PM_{2.5}$ sample filters). Other Computers are also routinely used to monitor/measure QC within the Ambient AM&QA Program to:

- Compute calibration equations
- Compute measures of linearity for calibrations (e.g., correlation coefficients, slope and intercept)
- Plot calibration curves
- Compute zero/span drift data
- Compute precision and accuracy results
- Plot and compute control limits
- Automatically flag out-of-control results
- Maintain and retrieve calibration and performance records.

15. PROCUREMENT, ACCEPTANCE TESTING AND MAINTENANCE REQUIREMENTS FOR INSTRUMENTS, SUPPLIES AND CONSUMABLES

This section details the procedures used for procuring, inspecting, testing, and accepting instruments, supplies and consumables that directly or indirectly affect data quality. By having documented inspection and acceptance criteria consistency can be assured.

15.1 Procurement and Acceptance Testing of Equipment

The Air M&QA Program Manager with support form the Air Monitoring Section Manager will be responsible for identifying air monitoring equipment needs and approving equipment purchases. The following protocol will be used in procurement of air monitoring equipment:

- Equipment evaluation and selection. Prior to purchase, the equipment's performance will be evaluated and other users queried in regard to the performance, dependability and ease of operation.
- Purchase specifications. The purchase contract will state the performance specifications that ensure only equipment of the desired quality is obtained, require a one year warranty, and indicate payment will not be made until the equipment has passed an acceptance test.
- Acceptance Testing. Prior to payment, the equipment should be tested to ensure that it meets the requirements listed in the purchase specifications. For analyzers, the minimum test consists of checking zero drift, span drift, voltage stability, temperature stability, and linearity. Acceptance test reports are to be prepared and archived by the Air Monitoring Section Manager or his/her designee.

15.2 Maintenance of Equipment

Utilizing the specifications in EPA's Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II and IV, preventive and remedial maintenance tasks, schedules, parts and supplies will be maintained by the AM&QA Program.

The Station Operators are responsible for performing routine preventive and corrective maintenance. They will prepare maintenance reports that will be reviewed and archived by the Air Monitoring Section Manager or his/her designee. Each monitoring site and/or laboratory will maintain a log book in which the Operator will record a brief description of the need for maintenance, the actions performed and the condition of the instrument after maintenance procedures were performed. Additionally, the date, time, shelter temperature, operator’s initials and any pertinent site observations will be recorded.

Major maintenance and repair will be performed by or under the direction of the AM&QA Section Electronic Technician. Equipment will be maintained according to frequencies developed by the Air Monitoring Section Manager, or as a default by the maintenance frequency recommended in the respective instrument manual or monitoring method/SOP.

15.3 Maintenance of Calibration/Audit Standards and Equipment

Calibration, Quality Control (QC) Check and Audit Standards will be maintained within the recommended certification time period. Calibration, QC and audit standards must be maintained within specified accuracy criteria for the method and must be calibrated/certified over the intended range of use. Upon receipt of a recertified or new standard, it should be compared against another standard of known quality and accuracy to ensure its reliability before routine use. Copies of all calibration/audit/QC check standards will be maintained by the respective monitoring agency.

16. INSTRUMENT CALIBRATION AND FREQUENCY

Calibration of an analyzer (or any other piece of measurement equipment) establishes the quantitative relationship between a calibration standard of known pollutant concentration input (in ppm, ppb, µg/m^3, etc.) and the analyzer's response (chart recorder reading, output volts, digital output, etc.). This relationship is subsequently used to convert an analyzer's response to corresponding pollutant concentrations. For these measured values to be considered reliable, the analyzer must be calibrated over its expected range of use with calibration standards of known accuracy (i.e., certified accurate over the calibration standard's intended range of use). Each analyzer shall be calibrated as directed by the analyzer's operation/instruction manual and in accordance with method specific SOPs and data validation templates. Calibration documentation shall be maintained with each analyzer in the field and in a central backup file. Documentation should be readily available for review and must include:

- Calibration data,
- Calibration equation(s),
- Analyzer identification,
- Calibration date,
- Analyzer location,
- Calibration standards used and their traceabilities (showing the standard's certified traceability over range of intended use),
- Identification of calibration equipment used, and
- Person conducting the calibration.

16.1 Calibration Standards

This section primarily addresses requirements for calibrating the equipment used to calibrate the field equipment, e.g., transfer standards and working standards. The requirements for calibrating the field and laboratory analyzers/equipment are listed in method specific **Data Validation Tables (section 14)** and **Tables B9 and B10 Laboratory QC Criteria for the Analysis of $PM_{2.5}$ & PM_{10} Filters (section 13).** Calibrations include adjusting the instrument or sensor to produce a response that is consistent with a standard. Calibration of a flow rate, for example, must consist of at least three separate flow rate measurements (a multipoint calibration, which is different than a multipoint verification) approximately evenly spaced within the range of the operational flow rate. Verifications, on the other hand, are made to verify that the operations of the instrument are within specified limits. Verifications do **NOT** include any adjustment to the sampler/analyzer, and are described in Section 14).

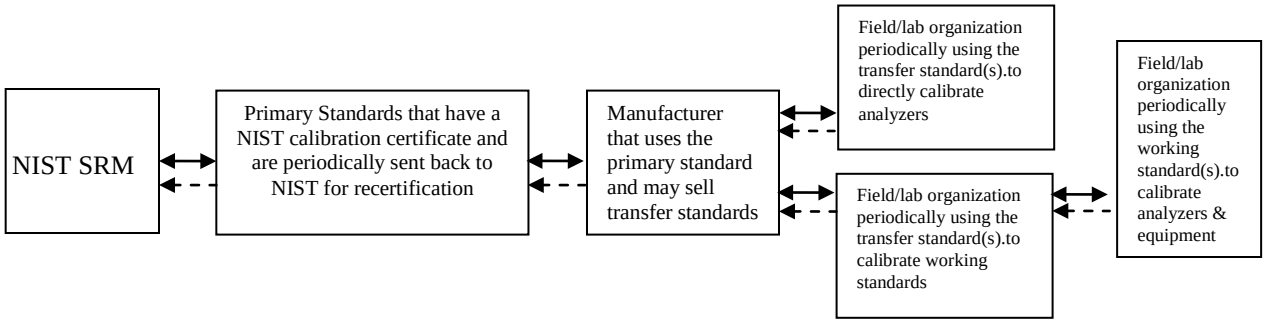
Calibration activities follow a two step process:

- Certifying the calibration standard (typical standards used by ADEC include flow rate instruments, thermometers, barometers and laboratory scale weights) against a NIST standard (usually done by sending the calibration standard to a weights and measures laboratory), and
- Comparing the calibration standard and/or transfer standard against the routine samplers or sensors.

16.2 Calibration Hierarchy

Figure B5, Hierarchy of Calibration Standard(s) depicts the hierarchy of calibration standards and their relationship to the field/lab equipment that they are used to calibrate.

Figure B5 Hierarchy of Calibration Standard(s)



Definitions

Primary Reference Standard - A primary reference standard can be defined as a homogenous material with specific properties, such as identity, unity, and potency that has been measured and certified by a qualified and recognized organization[36], such as the NIST standard reference materials (SRMs). NIST also describes a Primary Reference Standard as a standard that is designated or widely acknowledged as having the highest metrological qualities and whose value is accepted without reference to other standards of the same quantity. For example, NIST-F1 Atomic Clock is recognized as a primary standard for time and frequency. A true primary standard like NIST-F1 establishes maximum levels for the frequency shifts caused by environmental factors. By summing or combining the effects of these frequency shifts, it is possible to estimate the uncertainty of a primary standard without comparing it to other standards. NIST maintains a catalog of SRMs that can be accessed through the Internet *(http://www.nist.gov*). Primary reference standards are usually quite expensive and are often used to calibrate, develop, or assay working or secondary standards. In order to establish and maintain NIST traceability the policies posted at http://ts.nist.gov/traceability/ should be observed.

NIST Traceable Transfer Standard – is a standard that has been compared and certified either directly or via no more than one intermediate standard to a primary standard such as a NIST Standard Reference Material (NIST SRM) or a USEPA/ NIST approved Certified Reference Material (CRM). A NIST Traceable Reference Material™ (NTRM™) is a commercially produced reference material with a well-defined traceability linkage to existing NIST standards for chemical measurements. This traceability linkage is established via criteria and protocols defined by NIST to meet the needs of the metrological community to be served (NIST SP 260-136). Reference materials producers adhering to these requirements are allowed use of the NTRM trademark. A NIST NTRM may be recognized by a regulatory authority as being equivalent to a CRM.

Working Standard – A working standard is used to directly calibrate analyzers/equipment. Working standards may either be a NIST Traceable standard or a standard that has been directly certified against a NIST traceable standard. Certification of working standards may be established by either the supplier or the user of the standard. At a minimum, the certification procedure for a working standard:

- Establishes the concentration and accuracy tolerance of a working standard or calibrates/establishes the readout of an analog/digital meter (e.g., flow meter, thermometer, barometer, RH meter and meters used to calibrate meteorological sensors). For analog/digital meter outputs the certification range and accuracy tolerances must be specified;
- Certifies that the working standard is traceable to a NIST traceable standard that is "in-certification over the range of measurements over which the working standard is certified;"
- Includes a test of the stability of the working standard over several days; and
- Specifies a recertification interval for the working standard.

Note 1: For standards that are calibrated/certified meters (e.g., flow rate, volume, thermometers, hygrometers, pressure devices, etc.), the certified standard needs to have a measurement resolution greater than the minimum required

accuracy required by the monitoring method as well as to be at a minimum 2 to 4 times more accurate than the measurement method's required accuracy criteria. Typically Commercial Reference Method (CRM) certifications for these meters are valid for one year, or as specified by the CRM certification time frame. Flow rate certifications, verifications, calibrations, acceptance criteria, methods and frequencies are discussed in respective methods and method specific data validation tables found in Appendices A and B and in the EPA QA Handbook for Air Pollution Measurement Systems, Volumes 2 and 4.

Note 2: Test concentrations of ozone (O_3) must be traceable to a primary standard UV photometer as described in 40CFR Part 50 Appendix D.

Note 3: Test concentrations at zero concentration are considered valid standards. Although zero standards are not required to be traceable to a primary standard, care should be exercised to ensure that zero standards are free of all substances likely to cause a detectable response from the analyzer. Periodically, several different sources of zero standards should be inter-compared. The one that yields the lowest response can usually (but not always) be assumed to be the "best zero standard." If several independent zero standards produce the same response, it is likely that all the zero standards are adequate.

Note 4: All test gas concentrations (except zero) used for multi-point calibrations, zero/span, precision and one—point QC checks must be certified NIST traceable or EPA protocol as described earlier in this section.

16.3 Multi-point Calibrations

Gaseous Analyzer Multi-point Calibrations (e.g., CO, O_3, NH_3, NO_2, SO_2)- Multi-point calibrations consist of five test concentrations, including zero concentration, a span concentration (between 80% and 90%) of the full scale (FS) of the analyzer under calibration, and the remaining test concentrations equally distributed between zero and span. The zero/span test concentrations are to be introduced directly to the back of the analyzer's sample inlet port and analyzer response adjusted to match zero/span test concentrations. After the analyzer's zero/span has been adjusted, zero/span test concentrations shall again be repeated to verify analyzer response match the zero/span test gas concentrations.

Before generating the remaining test gas concentrations, the same zero/span test concentrations shall be introduced through as much of the sample train (sample probe/lines and manifold) as practicable prior to being introduced to the analyzer's sample inlet. The zero/span analyzer responses for both test gas configurations should be the same. If not, either there is a leak or obstruction in the sample introduction system or sample lines are contaminated. After verifying sample inlet configuration is not biasing calibration gas concentrations, complete the analyzer's multi-point calibration by supplying test gas concentrations directly to the back of the analyzer. Multi-point calibrations are used to establish or verify the linearity of analyzers upon initial installation, after major repairs, after failure of a zero/span or one-point QC check or performance audit, and at specified frequencies.

Most analyzers have zero and span adjustment controls, which are adjusted based upon zero and span test concentrations (80 – 90% FS), respectively to provide the desired scale range within the analyzers specifications. For analyzers in routine operation, unadjusted ("as is") analyzer zero and span response readings must be obtained and recorded prior to making any zero or span adjustments. Analyzer zero and span controls often interact with each other, so adjustments may have to be repeated several times to obtain the desired final adjustment. After analyzer adjustment, final post-adjusted zero and span analyzer response (using the same zero/span test gas concentrations) readings must be taken and recorded from the same calibrated output device (data acquisition system, chart recorder, etc.) that will be used for subsequent ambient air measurements.

The analyzer measured responses are plotted against the respective test gas concentrations, and the best fit linear (or non-linear if appropriate) curve fit is determined. Ideally, least squares regression analysis (with an appropriate transformation of the data for non-linear analyzers) should be used to determine the slope and intercept for the best fit calibration line of the form:

$$y = m \cdot x + b$$

Where: y = the analyzers response,
x = the value of the corresponding test gas concentration,
m = the slope, and
b = the x axis intercept of the best fit calibration line.

When this calibration relationship is subsequently used to compute concentration measurements (x) from the analyzer response readings (y), the formula is transposed to:

$$x = (y - b)/m$$

Specific calibration procedures and calibration criteria are found in the respective measurement methods/SOPs and data validation tables (see Appendices A and B).

As a quality control check on calibrations, the standard error or correlation coefficient must be calculated along with the regression calculations. A control chart of the standard error or correlation coefficient should be maintained to monitor the degree of scatter in the calibration points and limits of acceptability.

Calibrations of gaseous analyzers are generally required on a quarterly basis (see respective method SOPs and data validation templates for method specific calibration frequency criteria).

Particulate Monitor/Sampler Multi-point Calibrations - Multi-point flow rate calibrations consist of generating five evenly spaced calibration flows, including zero, that bracket the sampler's expected operating range.

Multi-point calibrations will be used by ADEC to establish or verify the linearity of particulate monitor flow rate responses to known flow rates upon initial installation, after major repairs, after failure of a one-point QC flow check or performance audit, and at specified frequencies.

Most particulate monitors have flow adjustment controls, which are adjusted based upon known flow rates generated to bracket the sampler's expected flow operating range. For particulate monitors in routine operation, unadjusted ("as is") flow readings must be obtained and recorded prior to making any adjustments. After adjustment, a final post-adjusted sampler flow shall be measured/recorded to verify that the particulate monitor's flow rate was set correctly.

The particulate monitor measured responses are plotted against the respective "known" flow rates, and the best fit linear (or non-linear if appropriate) curve fit is determined. Least squares regression analysis (with an appropriate transformation of the data for non-linear analyzers) shall be used to determine the slope and intercept for the best fit calibration line of the form:

$$y = m \cdot x + b$$

Where: y = the particulate sampler's flow rate response,
x = the value of the corresponding flow rate standard
m = the slope, and
b = the x axis intercept of the best fit calibration line

When this calibration relationship is subsequently used to compute concentration measurements (x) from the analyzer response readings (y), the formula is transposed to:

$$x = (y - b)/m$$

Specific calibration procedures and calibration criteria are found in the respective measurement methods/SOPs and data validation tables (see Appendices A and B).

As a quality control check on calibrations, the standard error or correlation coefficient must be calculated along with the regression calculations. A control chart of the standard error or correlation coefficient should be maintained to monitor the degree of scatter in the calibration points and limits of acceptability.

Calibrations of particulate monitor flow rate measurement systems are generally required on an annual basis (see respective method SOPs and data validation templates for method specific calibration frequency criteria).

16.4 Zero/Span Quality Control (QC) Checks for Gaseous Analyzers

A zero/span QC check is a simplified two-point analyzer calibration used when analyzer linearity does not need to be checked. For continuous gaseous analyzers, zero/span QC checks will be performed at least every 2 weeks (see specific method requirements), although more frequent zero/span checks are encouraged. Frequent 2-point calibration (zero/span) checks minimize the extent of analyzer drift by enabling earlier detection of drift and enables subsequent analyzer adjustment to be made before the analyzer breaches out-of-control criteria with subsequent loss of collected sample data.

The span concentration shall be within 70% to 90% of the analyzer's full scale (FS) range and must be certified traceable (as described in section 16.1). The zero/span gas should be introduced into as much of the sample train as practicable. Periodically the zero/span gas should be introduced into the sampling system as close to the outdoor sample inlet as possible as an integrity check of the entire sample inlet system (sample train). The analyzer's response to the zero/span gas at the sampler's outside inlet should mimic the analyzer's response to the zero/span gas as normally configured (either at the span port on the back of the analyzer or at the sample manifold).

Before any adjustment is made to the analyzer's zero or span settings, the "unadjusted" or "as found" measurement must be recorded. Subsequent adjustment to the analyzer's zero/span can then proceed. After completing analyzer adjustments, a post-adjusted (or "as left") zero/span measurement must be performed and recorded. These "as found" and "as left" zero/span measurements obtained prior to and after the calibration adjustment provides valuable information for:

- Confirming the validity of (or invalidating) the measurements obtained preceding the calibration,
- Monitoring the analyzer's calibration drift, and
- Determining the frequency of recalibration.

Zero/span QC checks are to be documented in chronological format. Documentation includes: analyzer ID, date, standard used and its traceability, equipment used, operator performing the zero/span QC check, unadjusted zero and span responses, and final adjusted zero/span responses. Documentation shall be maintained both with the analyzer onsite

as well as in a central file. The use of quality control (QC) charts will be used to graphically record and track level 1 zero/span results and analyzer drift.

For method specific zero/span procedures and acceptance criteria, please see the respective monitoring methods and data validation tables found in Appendices A and B and in the EPA QA Handbook for Air Pollution Measurement Systems, Volume ll, Part ll.

16.5 One-point QC Checks for Gaseous Analyzers

ADEC will employ a one-point QC check to monitor both precision and bias of gaseous measurement systems. A one-point QC check for gaseous measurement systems is the same as the precision gas introduced every two weeks to the back of the gaseous analyzer. One-point QC check results will be used to assess precision and bias over time of each gaseous analyzer. Gaseous one-point QC checks are required once every two weeks, though more frequent checks are encouraged. One-point QC check concentrations must be within 16% to 20% of an analyzer's calibrated full-scale measurement range.

For method specific one-point QC check acceptance criteria, please see the respective monitoring methods and data validation tables found in Appendices A and B.

One-point QC checks are not to be used as a basis for analyzer zero/span adjustments, calibration updates or adjustment of ambient data. They are to be used as a verification tool showing an analyzer's continued calibration status. Whenever a one-point QC check shows an analyzer is not within recommended calibration control, a subsequent zero/span (or a multi-point) calibration must be conducted before any corrective action is taken.

If a level 2 zero/span check is to be used in the quality control (QC) program, a reference response for the check must be obtained immediately following a level 1 zero/span (or multi-point) calibration while the analyzer's calibration relationship is accurately known. Subsequent level 2 zero/span check responses are compared to the most recent reference response to determine if a change in response has occurred. All level 2 zero/span checks are documented similar to level 1 zero/span checks.

16.6 Particulate Monitor One-point QC Checks

A one-point QC check of a PM monitor's flow measurement system is a simplified one-point calibration of the PM measurement system when the monitor's measurement linearity does not need to be evaluated. One-point QC checks of particulate monitors are used by ADEC when the linearity of the flow measurement range (temperature and pressure also included for $PM_{2.5}$ monitors and some PM_{10} monitors) does not need to be checked.

One-point QC checks of particulate monitors are conducted on a monthly basis, although more frequent checks may be conducted when meteorological conditions are favorable and access to monitoring sites is feasible. More frequent one point QC checks minimizes the extent of measurement drift by enabling earlier detection of the PM monitor's drift and allows subsequent adjustment to be made before the monitor breaches out-of-control criteria with subsequent loss of collected sample data.

One-point QC checks generally evaluate both:

- The bias of the PM monitor's calibrated flow measurement system,
- Whether specific sample design flow rate conditions are being met to ensure fractionation of particle sizes within specific ranges (e.g., $\leq 2.5\mu m$ for $PM_{2.5}$ $\leq 10\mu m$ for PM_{10}, and $\leq 35\mu m$ for TSP), and

- Whether other required method specific criteria are being met (e.g., bias of temperature, pressure and time measurement sensors).

For method specific one-point QC check acceptance criteria, please see the respective monitoring methods and data validation tables found in Appendices A and B and in the EPA QA Handbook for Air Pollution Measurement Systems, Volume II, Parts I and II.

16.7 Data Reduction Using Calibration Information

An analyzer/particulate monitor/meteorological sensor's response calibration curves relate the measurement system's response to actual concentration units of measure, and the response of most measurement system's tends to change (drift) unpredictably with passing time. Hence, for sample monitoring data to be meaningful the measurement system must:

- Be calibrated over the range of expected measurement concentrations, and
- All sample measurements must be bracketed by calibration zero/span checks and one-point QC checks (particulate and gaseous measurement systems) and/or multipoint calibrations.

These two conditions must be addressed in the mechanism that is used to process the raw sample measurement readings into final concentration measurements. Specific data reduction processes are addressed in the respective monitoring methods/SOPs and Data Validation Templates (see Appendices A and B).

16.8 Validation of Ambient Data Based Upon Calibration Information

When zero, span and/or precision drift validation limits are exceeded, ambient measurements should be invalidated back to the most recent point in time where such measurements are known to be valid. Usually this point is the previous calibration (multipoint, level 1 zero/span, One-point QC check or accuracy audit) unless some other point in time can clearly be identified and related to the probable cause of the excessive drift (power failure, etc.). Also, data following a measurement system's malfunction or period of non-operation should be regarded as invalid until the next subsequent calibration (multipoint or level 1 zero/span or one-point QC check). Specific validation criteria can be found in the **Alaska Ambient Air Quality Monitoring MQO** (**Table A7)** and the **Alaska Meteorological Monitoring MQO Table A8**. More detailed descriptions of these MQO's and how they are to be used to control and assess measurement uncertainty are described in method specific data validation tables. Method specific data validation tables may be found in **Appendix A**.

17. INSPECTION/ACCEPTANCE FOR SUPPLIES AND CONSUMABLES

Ambient air quality and meteorological parameters are measured using either chemical techniques or physical methods. Chemical analysis as well as some physical analysis involves the use of consumable supplies that must be replaced on a schedule consistent with their stability and the rate at which samples are taken. Some continuous analyzer methods require chemical scrubbers to remove contaminants from zero air sources, etc. Such scrubbers need to be replaced at a frequency determined by the manufacturer as well as by the rate it is consumed, which often are monitoring site specific. Please refer to the respective method/SOPs and/or manufacturer's operations manual for inspection/acceptance testing and consumables criteria.

18. DATA ACQUISITION REQUIREMENTS

This section addresses data not obtained by direct measurement from the Air Quality Program. This includes both outside data and historical monitoring data. Non-monitoring data and historical monitoring data are used by the Program in a variety of ways. At this time, the ADEC has not formalized the types of additional data that may be needed in support of the monitoring program. Possible data bases which might be used include:

- Chemical and Physical Properties Data
- Sampler Operation and Manufacturers' Literature
- Geographic Location
- Historical Monitoring Information
- External Monitoring Data Bases
- Lead and Speciated Particulate Data
- Air Toxics Monitoring Data
- Regional Haze Monitoring Data
- U.S. Weather Service Data

Any use of outside data will be quality controlled to the extent possible following QA procedures outlined in this document and in applicable EPA guidance documents.

19. DATA MANAGEMENT

The success of Alaska's Ambient Air Quality Monitoring Program's objectives relies on data and their interpretation. It is critical that data be available to users and that these data are:

- Of known quality,
- Reliable,
- Aggregated in a manner consistent with their prime use, and
- Accessible to a variety of users.

Quality Assurance/Quality Control (QA/QC) of data management begins with the raw data and ends with a defensible report, preferably through the computerized messaging of raw data.

Data management encompasses the overall flow of data, from field instruments, through transfer computers (laptops, data acquisition systems, etc.) to final systems, which may be local office computers, a local network, or external systems (AQS). Various air quality staff are responsible for separate or discrete parts of the data management process:

- The site operators are responsible for data download from instruments or data loggers to laptops or work computers. They assemble data files, which includes raw data, calibration information and certificates, QC checks (routine checks and audits), data flags, operator comments and meta-data where available. These files are stored on a DEC network drive or emailed to the secondary reviewer.
- Secondary reviewers are responsible for QC review, data reformatting for AQS (if necessary), and reporting to the program manager
- The program manager is responsible for final data certification
- AQS data entry staff conducts a final review (tertiary review) and submits the validated SLAMS/SPM data to AQS.

Figures B6 and B7, *AM&QA Overall Data Management Flow Charts* provide a visual summary description of the data flow/management process.

Figure B6, AM&QA Data Management Flow Chart – NCore/SLAMS/SPM

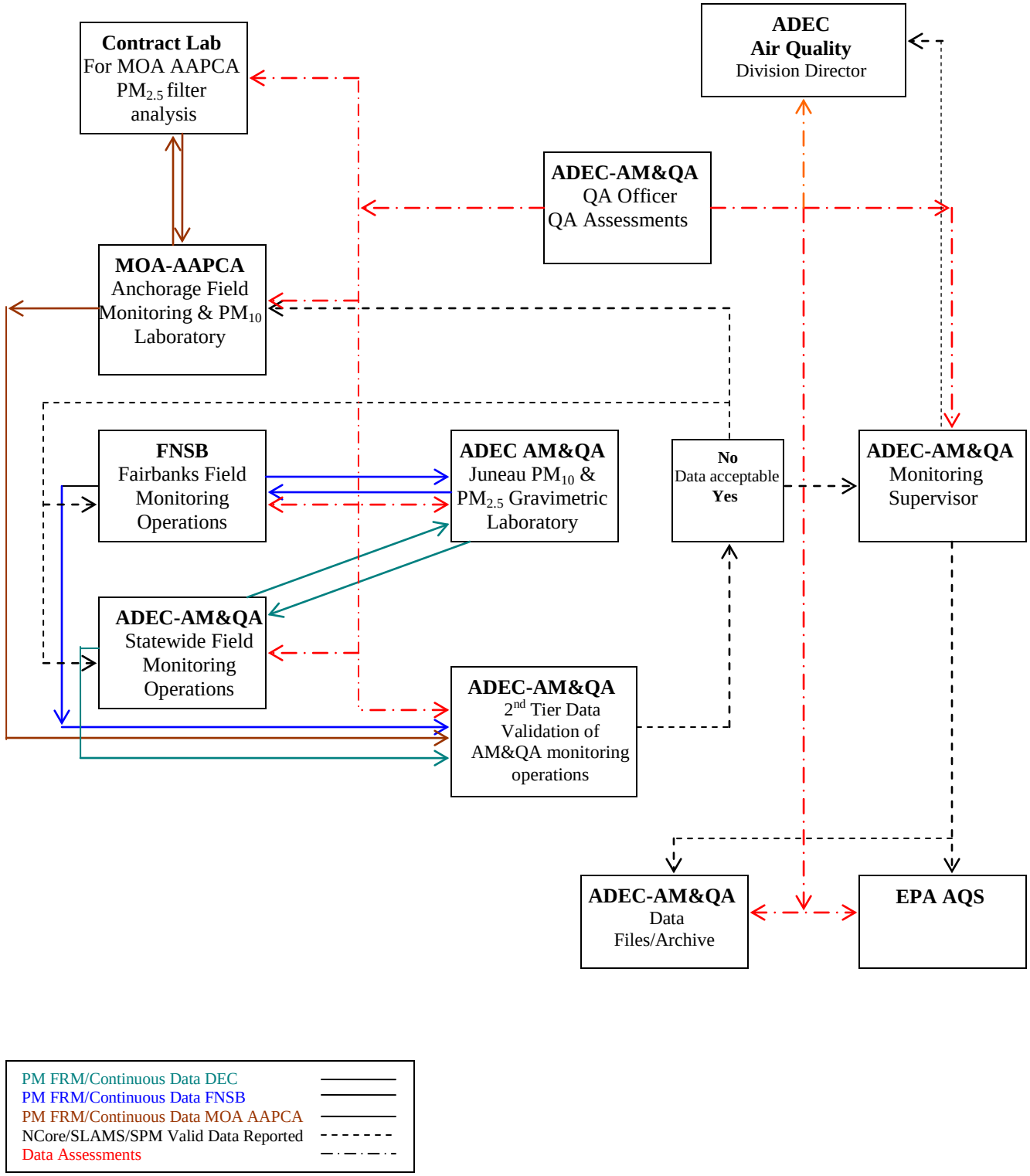
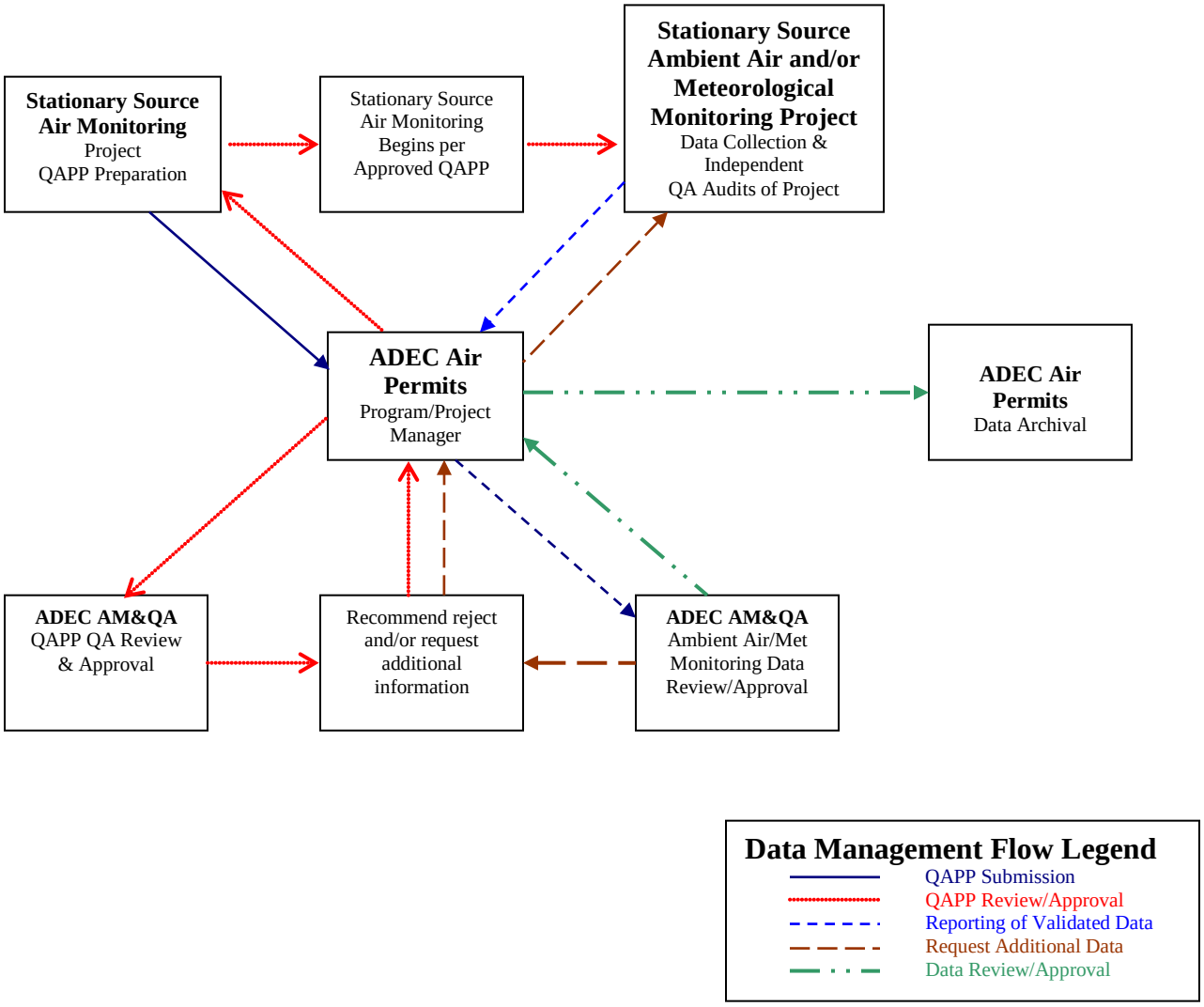


Figure B7, AM&QA Data Management Flow Chart – Ambient Air & Meteorological Monitoring Conducted by Stationary Source for Regulatory Permitting Needs



There are two basic sources of data collected in support of ADEC's NCore/SLAMS/SPM/PSD ambient air monitoring network. These are:

1. Data collected via manual ambient air monitoring sampling methods. Manual methods are those methods that require manual/physical intervention by an operator/analyst to collect and measure and calculate subsequent sample results. Each sample is collected/measured as an aggregate of a preset sample collection time, usually 24-hours. These methods include
   - PM_{10} HiVol FRM and PM_{10} LoVol FRM ;
   - $PM_{2.5}$ FRM;
   - Lead on TSP; and
   - A variety of parameter-specific sampling systems utilizing various methodologies and sample collection media (i.e., drum samplers, dragger tube samplers, canister samplers for VOCs, sorbent trap cartridges for carbonyl compounds, etc)

2. Data collected via continuous sampling ambient air and meteorological monitoring methods. Continuous methods are those methods that sample and analyze the pollutant of interest without required physical intervention by an operator to collect and measure the result. These methods utilize instrumentation that continuously measures and records the measured result, usually as an hourly average. These methods include:
   - Gaseous monitors (e.g., CO, NO_2, O_3, SO_2, NH_3);
   - Continuous particulate monitors for PM_{10} and $PM_{2.5}$ (e.g., TEOMs, BAMs, Black carbon—Aethalometers, Nephelometers); and
   - Meteorological parameters (e.g., wind speed, wind direction, temperature, barometric pressure, relative humidity, solar radiation,).

Measurement methods utilized in support of NCore/SLAMS/SPM/PSD monitoring projects will utilize specific standard operating procedures (SOPs) and method-specific data validation tables that detail the necessary steps to be taken to ensure collected/reported data is reliable and of known quality.

The specific process of data management (sample collection, measurement, verification, validation, review and reporting) may vary depending upon overall method specific process. However, the overall goal for data management is to develop and implement the necessary steps to ensure that the data that resides in the final storage area reliably represents the data that were collected. This process begins with providing proper training to the field operators and/or lab analysts.

All data are first reviewed by the field/lab operators. The operator checks the collected data to ensure that the data file is complete and accurately represents the collected samples. The operator ensures all field/lab logbooks and/or data sheets are reviewed and any questionable data is appropriately flagged with additional comments added to the file describing the reason for the flag. Data files should include raw data, instrument calibration and all subsequent quality control checks and independent audit results, plus a copy of the certification documentation.

The data then go through a secondary review process where the field operator's comments are reviewed and appropriate actions taken regarding the data in question. This action may include flagging data, voiding data, re-evaluating SOPs and making changes in cases where there are recurrent problems, or as corrective action response to problem areas identified in an audit. The secondary review will be conducted by a section member not immediately involved with data collection, to add an independent perspective to the data.

All NCore/SLAMS/SPM data collected and/or reported to ADEC are then stored on a secured state operated network server. If the data are to be submitted to AQS, they are properly formatted and uploaded to the AQS data storage system following AQS data management protocols.

Figures B8 and B9 depicts ADEC's Manual and Continuous Method Data Management Schemes.

Figure B8, Data Management of Manual Methods

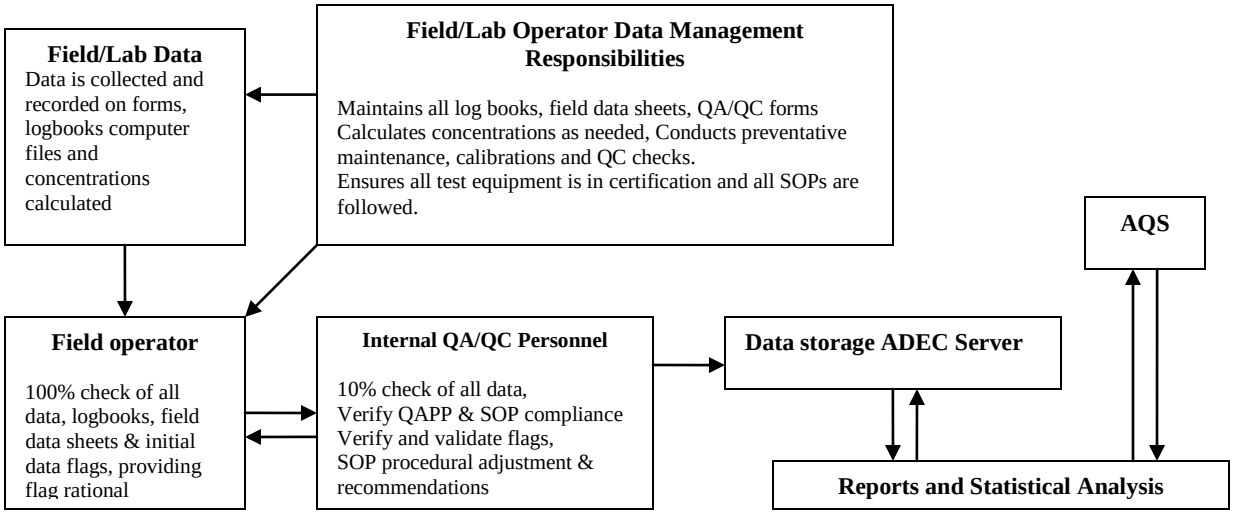
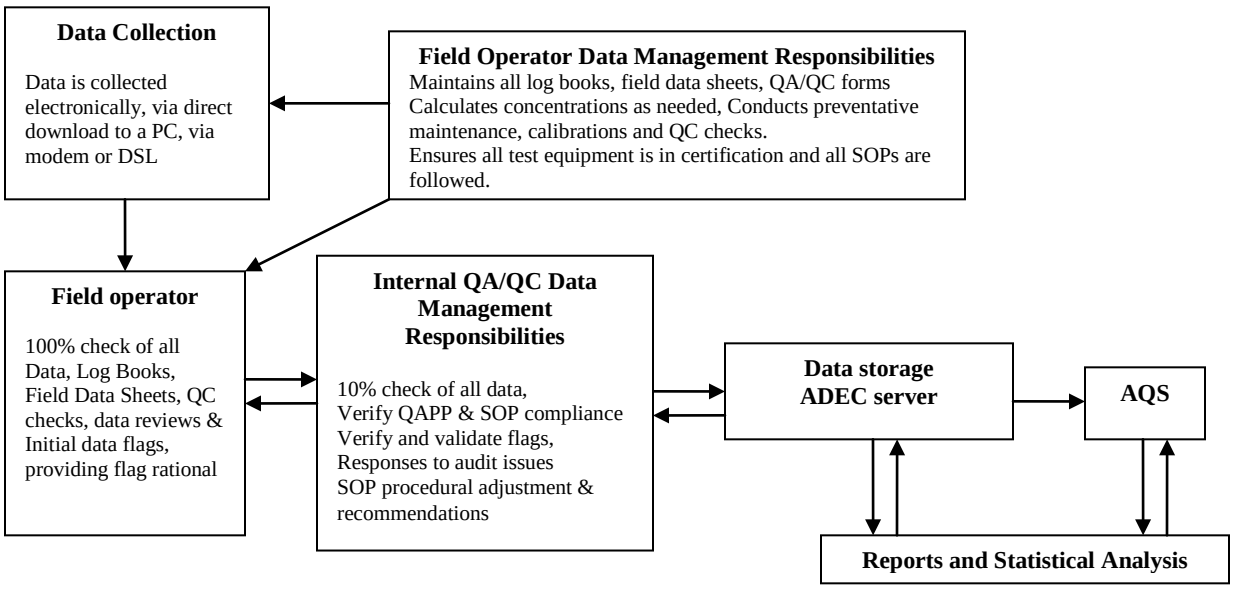


Figure B9, Data Management of Continuous Methods



19.1 Data Recording

Data entry, validation, and verification functions are integrated into each monitoring method's data management scheme. Procedures for data entry are provided in method specific procedures/SOPs included in Appendix B.

Data for gaseous analyzers are continuously collected via on-site data acquisition systems and accessed either remotely from office computers or downloaded onto computers on-site.

Air monitoring station reports are prepared by ADEC station operators and revised when changes in the instrumentation or surrounding area occur. These reports identify the station name, station identification, date and time of the change, operator, instrument identification, parameter, scale and units. Additionally, reports document the station location, address, GPS coordinates, elevation, and probe location. These reports will be sent to the air monitoring supervisor for review processing and archiving. Annually an updated Network Plan including a description of SPM and SLAMS sites should be provided for public comment on the DEC web page for at least 30 days. After addressing the public comments the document will be submitted to EPA.

Air monitoring equipment calibration reports will be prepared and sent to the air monitoring supervisor for review, processing and archiving.

The Station Operators maintain station logbooks/log sheets documenting operational and maintenance activities at the monitoring site. Station logbook/log sheets are identified with the station name, station identification, date and time of site visit, operator, instrument identification, parameter, scale and units. Log book/log sheets are used to document quality control checks (time, zero, span, precision, calibration, temperature, pressure, flow, etc.), maintenance, audits, equipment changes (span gas, permeation tubes, analyzer, recorder, pen, paper, probe, etc), and missing or invalid data. Station records are reviewed periodically by the air monitoring supervisor, and when full, archived by the respective monitoring unit (AM&QA, FNSB, MOA-AAPCA, etc.) accordingly. Station records will be reviewed as part of oversight QA audits.

Charts documenting air monitoring data are processed by the station operator, reviewed and archived by the respective monitoring unit. The charts will identify the station name, station number, date and time of the review, operator initials, instrument identification, parameter, scale and units. The charts will be used to document quality control checks (time, zero, span, precision, calibration, temperature, pressure, flow, etc.), maintenance, audits, equipment changes (e.g., span gas, permeation tube, analyzer, data acquisition system, chart recorder, pen, paper, probe, etc), and missing or invalid data.

SLAMS/SPM summary data reports should be produced annually or as directed by the project and should be published on the DEC Web page. The summary data reports will identify the project, date of issue and author. The report will include: station identification, pollutant parameters measured, monitoring period, max and second max value, averages, precision and bias, and units of measure. The monitoring results will be compared to the National Ambient Air Quality Standards, where applicable.

19.2 Data Transformation & Reduction

Data reduction processes involve aggregating and summarizing results so that they can be understood and interpreted in different ways. The ambient air monitoring regulations require certain summary data to be computed and reported regularly to U.S. EPA. Other data are reduced and reported for other purposes such as station maintenance. Data

transformation and reduction for criteria pollutants will follow EPA guidance. Currently the State uses scientific calculators and Windows Excel™® software to manipulate the data. In the future some of the data reduction and transformation will be accomplished in the DR DAS data acquisition system.

Data transformation

The data collected by ADEC can fall into two main categories:

- Data collected using a manual method requiring subsequent laboratory analysis of samples and concentration calculations
- Data collected using a continuous method that requires no subsequent laboratory sample analysis and concentration calculations.

Manual Method
Data that are manually collected requiring subsequent calculations to report a concentration are listed at the beginning of Section 19 and include such method parameters as PM_{10} and $PM_{2.5}$. For all of these methods, only those calculations identified in the SOP for that specific method and/or listed in the CFR for that specific method are used. Currently all of these calculations are done within an established Excel spreadsheet designed for that specific purpose. All of the Excel spreadsheets used in this process are established forms that have been review by ADECs Air QA officer and AM&QA's lead technical personnel. As regulations and methodologies change these forms may be edited to reflect the respective changes. When a spreadsheet is edited, the edits are reviewed by lead technical staff (and as needed by the Air QA Officer) to ensure they conform to all CFR requirements with regard to calculations and content. Where possible, it is the policy of the air monitoring group to develop and maintain concentration calculation procedures that minimize the possibility of transcription and calculation errors.

On occasion the ADEC operates monitoring sites that collect data using a manual method that is not a federal or equivalent PM_{10} or $PM_{2.5}$ method. In these cases, it is the ADEC's policy to follow established methodology using a two level review process for all data concentration determinations. In some cases these methods require laboratory analysis that can not be performed within ADEC. In these cases ADEC makes the best effort to ensure that the sample collection and lab analysis methods are in accordance with established procedures and are followed. Specifics detailing these methods will be developed as needed. Project plans and SOPs will be developed, reviewed and approved by knowledgeable professionals.

Continuous Methods
Continuous sampling methods are listed at the beginning of Section 19 and include such methods as gaseous monitors, meteorological sensors, and continuous PM monitors. The method used for each of type of monitoring system is specific to the monitor type, monitor manufacturer, and the data end use requirements. In all cases the ADEC follows either established EPA CFR requirements or manufacturer recommended operating procedures or ADEC developed methods and SOPs. The ADEC is currently in the process of developing and/or updating some of these SOPs. In some cases the ADEC is attempting to reduce the level of work needed to develop these SOPs. In these cases the ADEC is using approved SOPs from other monitoring groups to develop the new SOPs that will be used in the future. During this developmental stage the SOP that is being used as a template will be followed.

Data Reduction
Data reduction is performed according to the needs of the project. Continuous data which are used in comparisons with the FRM data will be reduced to yield concentrations covering the same time periods and interval as the FRM data.

Data Formatting
Data formatting is performed according to the needs of the project. SLAMS and SPM data will be reformatted as required for AQS submittal. PSD quality data will be formatted as required by DEC Air Permits.

19.3 Data Transmittal

Data transmittal occurs whenever information is transferred from one person or location to another or copied, by hand or electronically, from one form to another. An example of data transmittal is copying raw data from a notebook onto a data entry form for keying into a computer file. Data copied from data forms and/or logbooks and entered into computer files will be checked at 10%. Instructions for data verification will be included in method specific SOPs.

19.4 Data Storage and Retention

Hard copy files (paper files) of Ambient Air Quality Monitoring projects and Stationary Source (e.g., PSD) Ambient Air Quality and Meteorological Monitoring projects are kept in the project manager's office. Electronic files of validated data maintained on ADEC network drives managed by the AM&QA Program manager and his/her staff. Validated data is also available from the EPA Air Quality System (AQS) Database (http://www.epa.gov/ttn/airs/airsaqs/index.htm).

The Division of Air Quality maintains a hard copy of the Division's Air Records Retention Schedule #183200 in the Anchorage, Juneau and Fairbanks offices. The Division of Air Quality follows this retention schedule. AS: Alaska Statute, Management & Preservation of Public Records, may be found at: http://www.archives.state.ak.us/pdfs/records_management/schedules/dec/air/183200.pdf.

Raw data sheets are retained on file at the respective air monitoring office for a minimum of three years, and are readily available for audits and data verification activities. After three years, hardcopy records, and computer backup media are cataloged and boxed for storage. Data archival policies for the data are listed in following table. Security of data in the database is ensured by password protection.

Official data storage for NCore/SLAMS data is AQS. In addition DEC will store all monitoring data on the DR DAS server (Washington Department of Ecology (DOE) server). The intent is to import as much of the historical data as possible. Data and log sheets will be stored in electronic format on the state owned server in station specific folders. Data retention on the DEC and DOE server, as well as AQS, are indefinite.

Annual and special summary data reports are developed for upper management and the public and are stored on the DEC web page. Raw and validated data will be stored on the AQS, DR DAS, and State network servers. Automated data backup is performed according to DOE and State procedures. AQS, DR DAS, and the State network servers are all password protected systems, which only allow state authorized personnel to access and manipulate data (following state and federal procedures).

C. ASSESSMENTS AND OVERSIGHT

20. ASSESSMENTS AND CORRECTIVE ACTION

Assessments are evaluation processes used to measure the performance or effectiveness of a system and its elements. It is an all-inclusive term used to denote any of the following: audit, performance evaluation, management system review, peer review, inspection and surveillance. For the Ambient Air and Meteorological Quality Monitoring Program, assessments are:

- Network Reviews,
- Bias — Performance Evaluations (ADEC),
- Bias — Performance Evaluations (Independent Audits by EPA),
- Technical Systems Audits, and
- Data Quality Assessments.

Section 14 of this QAPP provides definitions for Quality Assessment, Quality Control and Quality Assurance. **Figure B3** (in Section 14) depicts Quality Assessment's relationship to Quality Control and the overarching umbrella of Quality Assurance.

20.1 Network Reviews

ADEC's Ambient Air Quality Monitoring program conducts annual network reviews of its own and other monitoring networks/agencies under its umbrella as time and resources permit. Detailed Network Assessments are conducted every five years. Network reviews and assessments are conducted to determine how well the ambient air quality monitoring system is achieving the required monitoring objectives and how it may need to be modified to continue and/or to meet its objectives (monitoring objectives are set forth in 40 CFR Part 58 Appendices D and E).

20.1.1 Network Selection

Prior to the implementation of the network review, significant data and information pertaining to the review is compiled and evaluated. Such information might include the following:

- Date of last review,
- Areas where attainment/non-attainment, redesignations are taking place or are likely to take place,
- Results of special studies, saturation sampling, point source oriented ambient monitoring, etc.,
- Agencies which have proposed network modifications since the last network review, and
- Pollutant-specific priorities such as PM_{10} problem areas, etc.
- Network files (including updated site information and site photographs),
- AQS reports,
- Air quality summaries for the past five years for the monitors in the network,
- Emissions trends reports for metropolitan area,
- Emission information, such as emission density maps for the region in which the monitor is located and emission maps showing the major sources of emissions, and
- National Weather Service summaries for monitoring network area.

Upon receiving the information it is checked to ensure it is the most current. Discrepancies are noted on the checklist and resolved during the review. Files and/or photographs that need to be updated will also be identified. Adequacy of the location of monitors can only be determined based on stated objectives. During the network review, the stated

objective for each monitoring location or site (see section 10) are reconfirmed and the spatial scale re-verified and then compared to each location to determine whether these objectives can still be attained at the present location.

An on-site visit will consist of the physical measurements and observations to determine compliance with the requirements, such as height above ground level, distance from trees, paved or vegetative ground cover, etc. Since many of these conditions will not change within one year, this evaluation at each site is performed every 3 years.

In addition to the items included in the checklists, other subjects for discussion as part of the network review and overall adequacy of the monitoring program will include:

- Installation of new monitors,
- Relocation of existing monitors,
- Siting criteria problems and suggested solutions,
- Problems with data submittals and data completeness,
- Maintenance and replacement of existing monitors and related equipment,
- Quality assurance problems,
- Air quality studies and special monitoring programs,
- Other issues, such as community concerns,
- Proposed regulations, **and most importantly**
- Funding.

A report of the network review should be written within two months of the review, distributed and appropriately filed.

20.1.2 Conformance to Network Siting Design (40 CFR Part 58 Appendix D)

Using requirements of ***40 CFR Part 58 Appendix D*** and ***Section 10, Sampling Process & Design***, the network is evaluated to ensure:

- Monitoring network meets number of monitors required by design criteria requirements, and
- Monitors are properly located based upon the monitoring objectives and spatial scale of representativeness.

Alaska only has SLAMS, SPM and PSD quality category monitoring sites. ADEC and EPA Region 10 meet periodically to decide how to best achieve the monitoring objectives specified in 40 CFR Part 58 Appendix D.

PSD monitoring networks/stations are regulated by the ADEC Air Permits Program. ADEC AM&QA provides technical support to the Air Permits Program on all aspects of Ambient Air Quality and Meteorological Monitoring.

20.1.3 Conformance to Probe Siting Requirements (40 CFR Part 58 Appendix E)

Siting criteria are specified in ***40 CFR Part 58 Appendix E*** and ***Section 11, Sampling Methods.*** Using these criteria, on-site physical measurements and observations are made to determine compliance with sample probe/monitor criteria such as: probe height and distance from potential obstructions, paved or vegetative ground cover, potential sources of point-source pollution, etc.

EPA QA Manual Volume II Part I Appendix 15 contains an on-site checklist for use in evaluating monitoring networks. In addition to items on this checklist, the reviewer should also:

- Ensure manifold and inlet probes/lines are clean and free of obstructions,
- Estimate sample manifold and probe/lines inside diameters and lengths,
- Inspect monitoring shelters for weather leaks, safety and security,
- Check to ensure all sample lines are connected and free of kinks,
- Check to ensure that monitor exhausts are not likely to be reintroduced back to the sample inlet,
- Check to ensure that monitor exhausts are vented properly so as not to be a safety concern,
- Check equipment for missing parts, frayed cords, etc.,
- Record findings/observations in a field notebook and/or checklist,
- Take photographs in each cardinal direction, (both looking at and looking away from sample probe as well as the shelter's interior layout,
- Record monitoring site's GPS location (latitude/longitude/elevation), and
- Document site conditions (include any additional photographs/videotape).

20.2 Bias – Performance Evaluations (ADEC)

Performance evaluations are a type of audit in which the quantitative data generated in a measurement system are obtained independently and compared with routinely obtained data to evaluate the proficiency of an analyst, air monitoring station, and/or laboratory. In order to estimate bias, an external instrument/standard must be compared against the field instruments collecting monitoring data. This external (independent) standard can not be the same standard/s as used to calibrate and/or perform the routine QC checks of the monitoring instruments. In addition, the individual conducting the "independent evaluation" must also be independent from routine operations and calibration(s) of the monitoring instruments. Bias is expressed as a positive or negative percentage of the "true" value.

Bias (Performance Evaluations) implemented in this air monitoring program include periodic:

- Flow rate performance audits of PM monitors,
- Laboratory audits of PM gravimetric operations,
- Lead filter (laboratory analysis) audits,
- Performance audits of gaseous ambient air monitors, and
- Meteorological performance audits

The equations to be used to calculate results of performance audits are found in the respective monitoring methods, EPA QA Handbook for Air Pollution Measurement Systems Volume II Part I Section 15, and references listed in Table C1, Bias (Accuracy) Assessments. The required frequency of performance audits and the equations used to assess gathered bias/accuracy data are listed and/or referenced in Table C1. In general, the corresponding equations in the referenced software (EPA Data Assessment Statistical Calculator, DASC) are suggested rather than the hand-calculated versions.

20.3 Bias –Performance Evaluations (Independent Audits by EPA)

EPA Performance Evaluations are conducted through the EPA regional office in the form of participation in the National Performance Evaluation Program (NPEP). The NPEP audit is a quantitative comparison of results between the equipment being tested and the equipment calibrated by another primary standard (audit standard). Successful participation requires an agreement of less than 10% between the NPEP equipment and the auditee's equipment. ADEC AM&QA will participate in NPEP as arranged and agreed to with EPA Region 10.

NPEP audits will be conducted by US EPA Region 10 personnel in accordance with all applicable EPA SOPs once per year (http://www.epa.gov//ttn/amtic/npepqa.html). These audits will be conducted when necessary and if resources are available. The audit results will be summarized and reported to DEC Division of Air Quality director and the Air QA Officer when they are finalized by U.S. EPA Region 10.

PSD quality monitoring projects are required to participate in the NPEP audit program, however participation is dependent upon funding and audit equipment availability through EPA.

20.4 Bias – Performance Evaluations (PSD Quality Monitoring Projects)

Bias for PSD quality monitoring operations is determined the same as for NCore/SLAMS monitoring except for the required frequency of performance evaluations (see Table C1) and independence of agencies/contractual firms allowed to conduct the performance evaluations.

Performance Evaluations for PSD quality monitoring operations will only be conducted by air monitoring contractors/agencies that are completely independent from the air monitoring contractor/agency responsible for the specific PSD ambient air and/or meteorological monitoring operations. Specifically, this requires that agencies/industry selecting contractors to conduct performance evaluations and/or technical systems audits must use independent contractual firms/air monitoring agencies with the requisite expertise to conduct the performance evaluations and that the agency/contractual firm must have complete managerial, fiscal and technical independence from the agency/contractual firm conducting/managing the monitoring and laboratory operations.

20.5 Technical Systems Audits

A technical system audit (TSA) is a thorough, systematic, on-site (field & laboratory) qualitative audit of facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a system. Once every 3 years the U.S.EPA Region 10 may conduct a technical systems audit of the ADEC air-monitoring program. These audits and/or reviews may also be conducted when necessary and if resources are available. The audit results will be summarized and reported to the DEC Division of Air Quality director and the Air QA Officer when they are finalized.

In addition to the EPA TSAs, the ADEC QA Officer may also conduct internal technical system audits of ADEC's AM&QA program as time and resources allow.

EPA QA Handbook for Air Pollution Measurement Systems Volume II Part I Section 15 contains an example TSA form.

PSD quality monitoring networks are required to have an independent TSA performed at the beginning of a monitoring project (recommended within 30 days of start-up) and annually thereafter.

20.6 Data Quality Assessments

Data quality assessments are statistical and scientific evaluations of the data set to determine the validity and performance of the data collection design and statistical test, and to determine the adequacy of the data set for its intended use. Data Quality Assessments for ADEC's Ambient Air Quality Monitoring Network are reported quarterly, annually and every 3 years to the AM&QA program manager and to EPA Region 10. Each parameter reported will assess the reported data:

- Completeness,
- Bias, and
- Precision

20.6.1 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct, normal conditions. Data completeness requirements are included in the reference methods (40 CFR 50). Data Completeness objectives are listed in the Measurement Quality Objectives Tables B7 and B8. The data completeness goal for NCore, SLAMS and SPM pollutants is ≥ 75% valid data/monitoring quarter and for meteorological measurements is ≥ 80% valid data/monitoring quarter. The completeness of the data will be determined for each monitoring instrument and expressed as a percentage (equations below).

Gaseous & Meteorological % DC = valid hourly data/all hours within monitoring quarter

PM_{10}/$PM_{2.5}$/Pb on TSP % DC = valid 24-hour data/all scheduled sample run days within monitoring quarter (1/1, 1/2, 1/3, and/or1/6 sample day frequency)

20.6.2 Bias

Accuracy has been a term frequently used to represent closeness to truth and includes a combination of precision and bias uncertainty components. This term has been used throughout the CFR. In general, ADEC follows the conventions of the NIST and, more recently, of EPA (ref. NIST Report 1297 and EPA G-9) and will not use the term accuracy, but will describe measurement uncertainties as precision, bias, and total uncertainty (total uncertainty is the combination of both precision and bias). For the Ambient Air Quality & Meteorological Monitoring program, bias is estimated using the results of the manual checks with a known concentration performed every two weeks for gaseous pollutants, or monthly for particulate pollutants, and will be the major estimate of bias on an ongoing basis. The performance evaluations (performance audits) will provide another estimate of bias (see **Table C1, Bias Assessments** and web link to *EPA Data Assessment Statistical Calculator, DASC*). In general, the corresponding equations in the referenced DASC software are suggested rather than the hand-calculated version shown.

TABLE C1 BIAS ASSESSMENTS

Method Parameters	Bias Assessment Frequency		References
	Single/Multi-Point Analyzer Audits	Quarterly, Annual and 3-Year Network Assessment	
Manual (gravimetric) and continuous PM_{10} , $PM_{2.5}$, and TSP monitors	Audit flow rate percent difference, d_i, is calculated by: $$d_i = \frac{Y_i - X_i}{X_i} \times 100$$ where X_i is the flow rate of the audit standard and Y_i is the sampler's measured flow rate **Note 1**: for SLAMS, SPM and NCore sites 50 % of network audited frequency every 6 months, and each network sampler audited 1/ year. **Note 2**: for PSD quality monitoring each sampler audited 1/quarter	For specific calculations (and calculators) for determining and reporting quarterly and annual bias please refer to the federal references/web links listed in this table	• *40CFR Part 58 Appendix A section 4, Calculations for Data Quality Assessment,* http://www.epa.gov/ttn/amtic/files/ambient/pm25/092706sign.pdf • *Guideline on the Meaning and The Use of Precision and Bias Data Required by 40 CFR Part 58 App A* http://www.epa.gov/ttn/amtic/parslist.html • *Data Assessment Statistical Calculator (DASC) – The software to assist those in calculating the new precision and bias statistics – MS Excel File Type* http://www.epa.gov/ttn/amtic/parslist.html • See EPA QA Handbook Volume II Part 1 Appendix 15 Section 3 for audit procedures • See respective ADEC Gaseous monitoring Methods for audit procedures
Lead on TSP	Lead Filter Strip Performance Audit $$d_i = \frac{Y_i - X_i}{X_i} \times 100$$ where X_i is the known concentration audit filter strip and Y_i is the lead filter strip's measured value **Note 1**: for SLAMS, SPM, NCore quality monitoring networks, each lab reporting lead on TSP is audited 2/year **Note 2**: for PSD quality monitoring network, each lab is audited 1/quarter		
Gaseous (NH_3, CO, NO_2, O_3, SO_2)	Where: Y_i =analyzer response value X_i =audit gas known value $$d_i = \frac{Y_i - X_i}{X_i} \times 100$$ **Note 1:** Each multipoint audit requires at a minimum the following audit concentration ranges: • Zero • Within 6% to 16% of analyzer full scale (FS) • Within 30% to 40% of analyzer FS • Within 70% to 90% of analyzer FS • Report individual % Δ and avg. % Δ • Report Linear Regression factors: slope, y-intercept, correlation coefficient (r^2) • Report % NO_2 converter efficiency (NO_2 method) • Report % NO_2 converter efficiency and % NH_3 converter efficiency (NH_3 method) **Note 2:** For SLAMS, SPM and NCore monitors, each pollutant instrument within a network audited 1/year with 25% of a network audited each quarter **Note 3:** For PSD quality monitoring networks each monitor audited every monitoring quarter.		
WS, WD, VWS, VWD, σθ, σΦ, T, TΔ, SR,BP, Dew Point , RH	$$\Delta = Y - X$$ Where: Δ = audit differences, Y = sensor response, X = audit known value **Note:** For PSD Quality Data, Performance Audits of each sensor required semiannually		EPA-454/R-99-005 Section 5. http://www.epa.gov/scram001/guidance/met/mmgrma.pdf

TABLE C1 BIAS ASSESSMENTS			
Method Parameters	**Bias Assessment Frequency**		**References**
	Single/Multi-Point Analyzer Audits	**Quarterly, Annual and 3-Year Network Assessment**	
SR, Precipitation	$\%\Delta = (Y - X)X \cdot 100$ Where: %Δ = audit % difference, Y = sensor response, X = audit known value **Note:** For PSD Quality Data, Audits of each sensor required semiannually		EPA QA Handbook Volume IV (revised draft) http://www.epa.gov/ttn/amtic/files/ambient/met/draft-volume-4.pdf

20.6.3 Precision

Precision is a measure of mutual agreement among individual measurements of the same property usually under prescribed similar conditions, or how well side-by-side measurements of the same thing agree with each other. Sometimes, as in the case of environmental measurements such as flow rate of an instrument, precision can be estimated by repeated measurements of the same thing over some time period, such as three months. It is important that the measurements be as similar as possible, using the same equipment or equipment as similar as possible. Precision represents the random component of uncertainty. This random component is what changes randomly high or low, and which, try as you might, you cannot control with the equipment and procedures you are using. Precision is estimated by various statistical techniques using the standard deviation or, if you only have two measurements, the percent difference

The equations and references in **Table C2**, **Precision Assessments** lists references, frequency of required precision checks and the equations that are to be used to evaluate gathered precision data for NCore, SLAMS, SPM and PSD quality monitoring networks. Some of these equations are used on an ongoing basis to evaluate frequent precision checks, some are used every quarter and annually or as-needed. In general, the corresponding equations in the referenced software (EPA Data Assessment Statistical Calculator, DASC) are suggested rather than the hand-calculated version shown.

TABLE C2 PRECISION ASSESSMENTS

Method Parameters	Precision Assessment Frequency		Reference
	Single Point	**Quarterly Annually**	
PM_{10} – Collocated, gravimetric **$PM_{2.5}$ – Collocated, gravimetric** **Lead on TSP - Collocated**	relative percent difference, di, is calculated by: $d_i = \frac{Y_i - X_i}{(Y_i + X_i)/2} \times 100$ Where X_i is the concentration of the primary sampler and Y_i is the concentration value from the collocated sampler. Notes: • PM_{10} precision calculated for all PM_{10} measurements, however, reported only for paired values ≥ 15 µg/m^3 • $PM_{2.5}$ precision calculated and reported only for paired values ≥ 3.0 µg/m^3 • Pb on TSP precision calculated for all paired measurements, however, reported only for paired values with mass ≥ 0.15 µg/m^3 • **Note 1**: Collocated sampling required on 1/12 day g frequency for SLAMS/SPM/NCore Monitoring Networks • **Note 2**: Collocated sampling required on 1/6 day frequency for all PSD Quality monitoring projects	$CV_ub = \sqrt{\frac{n \cdot \sum_{i=1}^{n} d_i^2 - \left(\sum_{i=1}^{n} d_i\right)^2}{2n(n-1)}} \cdot \sqrt{\frac{n-1}{\chi^2_{0.1,n-1}}}$ The precision upper bound statistic, CVub, is a standard deviation on di with a 90 percent upper confidence limit (Equation 11). CVub, is a standard deviation on di with a 90 percent upper confidence limit. Where, n is the number of valid data pairs being aggregated, and χ^2 0.1, n-1 is the 10th percentile of a chi-squared distribution with n-1 degrees of freedom. The factor of 2 in the denominator adjusts for the fact that each di is calculated from two values with error.	• 40CFRPart 58 App A section 4.2.1 Precision Estimate from Collocated Samplers and section 4.3.1 Precision Estimate(PM2.5 & PM10-2.5) http://www.epa.gov/ttn/amtic/parslist.html • *Guideline on the Meaning and The Use of Precision and Bias Data Required by 40 CFR Part 58 App A* • *Data Assessment Statistical Calculator (DASC) – The software to assist those in calculating the new precision and bias statistics – MS Excel File Type).*
Gaseous (NH_3, CO, NO_2, O_3, SO_2)	$d_i = \frac{Y_i - X_i}{(Y_i + X_i)/2} \times 100$ Where: Y_i =analyzer response value X_i =precision gas known value Precision check gas standard (X) recommended in range of 16 to 20% of instrument full scale response. **Note 1:** Gaseous precision sample at 15 – 20% of analyzer FS response required on every 2 week frequency for all SLAMS, SPM, NCore and PSD quality monitoring	$CV = \sqrt{\frac{n \cdot \sum_{i=1}^{n} d_i^2 - \left(\sum_{i=1}^{n} d_i\right)^2}{n(n-1)}} \cdot \sqrt{\frac{n-1}{\chi^2_{0.1,n-1}}}$ The precision estimator is the coefficient of variation upper bound and is calculated using the above equation. Where χ^2 0.1, n-1 is the 10th percentile of a chi-squared distribution with n-1 degrees of freedom.	• 40CFRPart 58 App A section 3.2.1 http://www.epa.gov/ttn/amtic/parslist.html • *Guideline on the Meaning and The Use of Precision and Bias Data Required by 40 CFR Part 58 App A* • *Data Assessment Statistical Calculator (DASC) – The software to assist those in calculating the new precision and bias statistics – MS Excel File Type).*
Meteorological	**Precision not assessed for Meteorological Parameters**		

20.7 Corrective Actions, Corrective Actions Response & Corrective Action Reports

The ADEC and the audited organization may work together to solve required corrective actions for findings issued. As part of corrective action and follow-up, an audit finding response will be generated by the audited organization for each finding submitted by the ADEC. The audit finding response is signed by the local monitoring network manager or (where appropriate) the Laboratory Manager and sent to the ADEC Air Quality Assurance Officer and AM&QA Program Manager which reviews and accepts the corrective action. The audit response will be completed within 30 days of acceptance of the audit report. The next audit of the monitoring network will ensure that the stated corrective action(s) were implemented and corrective action(s) taken were appropriate to return routine monitoring operations to acceptable levels of precision, bias, completeness, representativeness, comparability and detectability.

For PSD quality monitoring, each audit finding the audit agency/audit contractor issues, a corresponding audit finding response and corrective action report will be generated and signed by the audited organization's project manager and project QA officer. This response will be included in the PSD *Quality Ambient Air Quality & Meteorological Monitoring Annual Data Report (http://www.dec.state.ak.us/air/am/PSD_Met_annual_1-1.pdf).*

All corrective action reports at a minimum shall include the following information*:*

- Audit finding(s)
- Cause of the problem(s)
- Actions taken or planned to be taken to rectify the problem(s)
- Responsibilities and timetable for the above actions taken
- Project manager's printed name, title, signature and date
- Organization's QA Officer approval (printed name, signature and date of approval)
- Statement identifying if finding is closed or further following action is required.

All corrective action reports are to be filed with the official audit records with copies sent to the auditee and all other affected parties.

20.8 Revisions to ADEC AM&QA QAPP

Annually the ADEC AM&QA QAPP will be reviewed and revised as needed. Minor revisions may be made without formal comment. Such minor revisions may include changes to identified program staff, QAPP distribution list and/or minor editorial changes.

Revisions to the QAPP that affect stated monitoring Data Quality Objectives, Method Quality Objectives, method specific data validation *"critical"* criteria and/or inclusion of new monitoring methods will solicit public input/comment prior to adoption of major revisions.

Notice of proposed major revisions to the QAPP will be posted on the ADEC AM&QA web site with a specified formal comment period/window.

Only the most current QAPP revision will be posted on the ADEC AM&QA web site.

21. REPORTS TO MANAGEMENT

Table C3, Reports to Management identifies the type and content of quality-related reports and communications to management necessary to support NCore/SLAMS/SPM network operations associated with data acquisition, validation, assessment, and data reporting.

Required reports to management for the NCore/SLAMS/SPM ambient air quality monitoring program, and in general are discussed in various sections of 40 CFR Parts 50, 53, and 58. Guidance for management report format and content are provided in guidance developed by EPA's Quality Assurance Division (QAD) and the Office of Air Quality Planning and Standards (OAQPS). These reports are described in EPA QA Handbook Volume II Part 1, Section 16.

Required reports to management/ADEC Air Permits Group for PSD ambient air quality and meteorological monitoring are further prescribed in the following two data report formats and are available online at http://www.dec.state.ak.us/air/am/index.htm:

- *PSD Quality Ambient Air Quality & Meteorological Monitoring Annual Data Report Format*
- *PSD Quality Ambient Air Quality & Meteorological Monitoring Summary Data Report Format*

Table C3 Reports to Management

QA Report Type	Contents	Presentation Method	Report Issued by	Reporting Frequency		
				As Required	Quarter	Year
Performance Audit Reports (NCore, SLAMS, SPM)	Description of audit results, audit methods and standards/equipment used and any recommendations	Written text and charts, graphs displaying results	QA Officer/auditor	✔		✔
Performance Audit Report (PSD)	Description of audit results, audit methods and standards/equipment used and any recommendations	Written text and charts, graphs displaying results	QA Officer/auditor	✔		✔
Corrective Action Recommendation	Description of problem(s); recommended action(s) required; time frame for feedback on resolution of problem(s)	Written text/table	QA Officer/auditor	✔		
Response to Corrective Action Report	Description of problem(s), description/date corrective action(s) implemented and/or scheduled to be implemented	Written text/table	Air Monitoring Program Manager	✔		
EPA NPAP Audit Results	Description of audit results, audit methods and standards/equipment used and any recommendations	Written text and charts, graphs displaying results	EPA NPAP Program and/or Region X	✔		✔
EPA PM2.5 PEP Audit Results	Description of audit results, audit methods and standards/equipment used and any recommendations	Written text and charts, graphs displaying results	EPA PEP Program and/or Region X	✔		✔
Technical Systems Audits (NCore, SLAMS, SPM)	Summary of results; description of TSA areas reviewed; findings; and any recommendations	Written text and charts, graphs displaying results	EPA Region X QA Manager	✔		✔
Technical Systems Audits (PSD)	Summary of results; description of TSA areas reviewed; findings; and any recommendations	Written text and charts, graphs displaying results	Responsible QA Officer	✔		✔
AQS Report to EPA	Alaska NCore/SLAMS/SPM data report	Quarterly valid data & QA/QC results	ADEC-AM&QA data base manager		✔	
Annual summary data report for local monitoring networks (NCore, SLAMS, SPM)	Summary of monitoring data and associated QA/QC used to validate reported data. See PSD Quality Annual Data Report Format (above) as example.	Written text, charts, graphs, etc summarizing monitoring data for collection period	Air Monitoring Section Manager or designee			✔
Quality Assurance Report to Management	Executive summary, precision, bias and system and performance audit results	Written text and charts, graphs displaying results	ADEC Air QA Officer			✔
Network Reviews	Review results and suggestions for actions, as needed	Written text and tables, charts, graphs displaying results	ADEC AM&QA Division Director	✔		✔

D. DATA VALIDATION AND USABILITY

22. DATA REVIEW VALIDATION AND VERIFICATION REQUIREMENTS

Data review, verification and validation, are assessment techniques used to accept, reject or qualify data in an objective and consistent manner.

Data review – data review is the process that evaluates the overall data package to ensure procedures were followed and that reported data is reasonable and consistent with associated QA/QC results.

Data verification – data verification is the process of evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual requirements.

Data validation – data validation is an analyte- and sample-specific process that extends the evaluation of data beyond method, procedural, or contractual compliance (i.e., data verification) to determine the analytical quality of a specific data set to ensure that the reported data values meet the quality goals of the environmental data operations (method specific data validation criteria).

These assessment techniques are performed by persons implementing the environmental data operations as well as by personnel "independent" of the operation, such as the respective organizations QA personnel and at some specified frequency. These activities occur prior to submitting data to AQS, or as in the PSD program, reporting data to DEC Air Permits.

Each of the following areas of discussion is to be considered during the data review/verification/validation process.

1. **Sampling Design** – How closely the measurement(s) represent the actual environment at a given time and location is a complex issue that is considered during development of the sampling design. Each sample should be checked for conformance to the specifications, including type and location (spatial and temporal). By noting deviations in sufficient detail, subsequent data users should be able to determine the data's usability under scenarios different from those included in project planning.

2. **Sample Collection Procedures** – Details of how a sample is separated from its native time/space location are important for properly interpreting the measured results. Sampling methods, method specific data validation templates and field SOPs provide these details, which include sampling and ancillary equipment and procedures (including equipment contamination). Acceptable departures (for example, alternate equipment) from the QAPP, and the action to be taken if requirements cannot be satisfied, should be specified for each critical aspect. Validation activities should note potentially unacceptable departures from the QAPP. Comments from field surveillance on deviations from written sampling plans should also be noted.

3. **Sample Handling** – Details of how a sample is physically treated and handled during relocation from its original site to the actual measurement site are extremely important. Correct interpretation of subsequent measurements requires that deviations from "accepted/standardized" sample handling procedures and the actions taken to minimize or control the changes be detailed and justified. Data collection activities should indicate events that occur during sample handling that may affect sample integrity. At a minimum, sample containers, sample preservation and sample shipping methods should be evaluated to ensure they are appropriate to the nature of the sample and the type of data generated from the sample. Sample identity, transport and proper sample storage conditions should also be confirmed to ensure that samples are representative of its native environment as it moves through the analytical process.

4. **Analytical procedures** – Each sample should be verified to ensure that the analytical procedures used to generate the data were implemented as specified (e.g., method specific data validation templates). Sample analyses deviating from specified criteria should be flagged with suitable codes so that the potential effects of the deviation can be evaluated during data quality assessment (DQA).

5. **Quality Control (QC)** – The quality control section of the QAPP specifies the QC checks that are to be performed during sample collection, handling and analysis. These include analyses of check standards, blanks and replicates, which provide indications of the quality of the data being produced by specific components of the measurement process. For each specific QC check, the procedure, QC check standard certified value, certification/expiration date, acceptance criteria, and corrective action (and changes) need to be specified. All measurement data need to be bracketed by acceptable QA, calibration and/or audit (accuracy) data to be considered valid. Data validity needs to document the corrective actions that were taken, which samples were affected, and the potential effect on affected data validity. Method specific QC criteria are summarized in the respective method data validation templates (Appendix A).

6. **Calibration** – Calibration of instruments and equipment and the information that should be presented to ensure that the calibrations:

   - were performed within an acceptable time prior to generation of measurement data;
   - were performed in the proper sequence;
   - included the proper number of calibration points;
   - were performed using **in-certification standards** that **bracketed** the range of reported measurement results otherwise, results falling outside the calibration range should be appropriately flagged; and
   - had acceptable linearity checks and other checks to ensure that the measurement system was stable when the calibration was performed.

   Method specific calibration criteria can be found in the respective monitoring method/SOP and are summarized in the respective method data validation templates (Appendix A).

7. **Data Reduction and Processing** – Checks on data integrity evaluate the accuracy of "raw" data and include the comparison of important events and the duplicate keying of data to identify data entry errors.

   Data reduction involves aggregating and summarizing results so that they can be understood and interpreted in different ways. The ambient air monitoring regulations require certain summary data (e.g., precision, bias, data completeness, etc.) to be computed and reported regularly to U.S. EPA. Other data are reduced and reported for other purposes such as station maintenance, PSD data reporting, etc. DEC requires PSD quality monitoring data to be reduced and reported on a quarterly (summary results only) and annual basis to the ADEC Air Permits Program. The required reporting formats are available online at: http://www.dec.state.ak.us/air/am/index.htm.

23. DATA VERIFICATION AND VALIDATION METHODS

The following data verification and validation processes will provide for data that meets the Project's quality assurance criteria.

23.1 Data Verification Methods

Data verification is a two-step process:

1. Identify project needs for records, documentation, and technical specifications for data generation, and determining the location and source for these records.
2. Verify records that are produced or reported against the method, procedural, or contractual requirements, as per the field and analytical operations (i.e., sample collection, sample receipt, sample preparation, sample analysis and data verification records review).

***Step 1 -- Identify project needs for records, etc*:** For ambient air and/or meteorological monitoring project needs can be broken down into whether the monitoring project supports NCore, SLAMS, SPM or PSD quality monitoring. The project needs is stated in the required monitoring project's QAPP (chapter 5). The data verifier uses this and other support documents to determine the purpose of data collection and specified needs for sample collection, data generation and documentation of the analysis.

Even though requirements for NCore, SLAMS, SPM and PSD quality monitoring are standardized, planning document requirements will vary according to the specific purpose of sample collection and anticipated end-use of the collected monitoring data. These differences should be reflected in the planning documents.

Project specifications may also include specifications for monitoring data (sample collection and field and/or lab analyses) and for the resulting data reports. These specifications are important in verifying that the actual methods employed (field/lab equipment as well as measurement procedures, etc. used) match what was requested. This ensures, *"verifies,"* that the specified method was used and that it met technical criteria established in the approved QAPP.

Know/determine where the records are maintained. Records may be produced by a number of personnel and maintained in a number of rooms or locations. All personnel need to comply with the record-keeping procedures of the monitoring project (field, laboratory, etc). At any point in the data generation chain, the information needed for data verification needs to be available to the people responsible and the respective project requirements need to be clearly identified in the planning documents.

Step 2 – Verify records that are produced or reported, etc*:** Step 2 compares the records produced against the project needs/requirements. The project planning document (respective QAPP) that specifies the records to be reported should be used to determine what records to verify. Note: In the ***rare absence of such an organizational specification, the determination of data to be verified may be left to the discretion of the project manager/principal investigator and the respective agency's quality assurance person. Such a determination must be justified/documented and appended to the data package for subsequent data validation.

Outputs of Data Verification

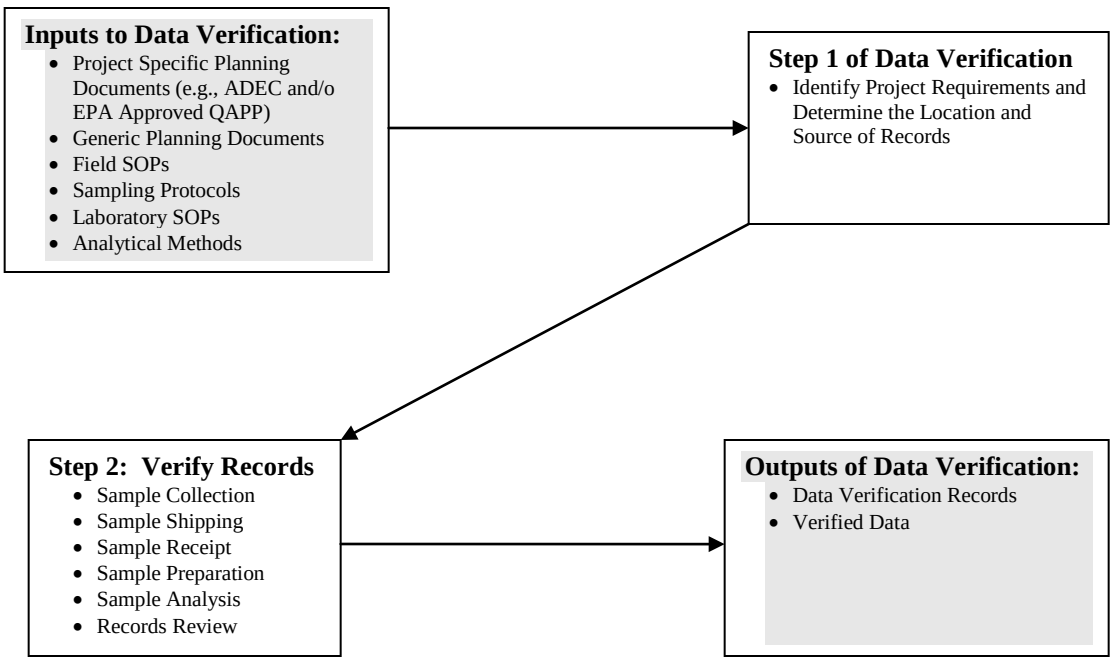
1. The first output is "***verified data***." Examples of verified data that have been checked for a variety of factors during the data verification process include:
   - Transcription errors,
   - Correct application of dilution factors,
   - Correct application of conversion factors,
   - Correct reporting units of measure, and
   - Appropriate field and/or laboratory data qualifiers.

Any changes to the results as originally reported by the field/lab monitoring group must be accompanied by a note of explanation from the data verifier or reflected in a revised sample data report.

2. The second output of data verification is the ***"data verification record."*** This record includes a *"certification statement"* certifying the data have been verified. The statement is signed by responsible personnel either within the organization or as part of external data verification. Data verification records must also include technical non-compliance issues or shortcomings of the data produced during the field and/or laboratory activities. If the data verification identified any non-compliance issues, then the narrative must identify the records involved and indicate the appropriate corrective actions taken in response. The records routinely produced during field activities and at the analytical laboratory (commonly referred to as a data package) and other documentation such as checklists, handwritten notes, or tables should also be included as part of the data verification records. Definitions and supporting documentation for any field/laboratory qualifiers assigned also should be included.

The following **Figure D1, Data Verification Process**, summarizes the steps.

Figure D1: Data Verification Process



Note 1: For NCore, SLAMS, SPM monitoring projects performed by ADEC AM&QA staff, steps 1 and 2 of data verification is the responsibility for the ADEC AM&QA field and laboratory technicians.

Note 2: For NCore, SLAMS, SPM monitoring projects performed by Local Agencies, steps 1 and 2 of data verification is the responsibility for the local agency's air monitoring staff.

Note 3: For PSD quality monitoring projects performed by agencies/facilities/industry, steps 1 and 2 of data verification is the responsibility of the respective agency/facility/industry reporting data to ADEC.

23.2 Data Validation Methods

Data validation is an analyte- and sample-specific process that extends the evaluation of data beyond *"data verification"* to determine the analytical quality of a specific data set. Data validation criteria are based upon the measurement quality objectives (MQOs, see chapter 5) developed in a quality assurance project plan (QAPP). Data validation includes a determination, where possible, of the reasons for any failure to meet method, procedural, or contractual requirements,

and an evaluation of the impact of such failure on the overall data set. Data validation applies to activities in the field as well as in the analytical laboratory.

Method specific data validation tables for ADEC criteria pollutants and meteorological parameters can be found in Appendix A. These validation tables list criteria for determining whether data under evaluation is acceptable for reporting as NCore, SLAMS, SPM and/or PSD quality data.

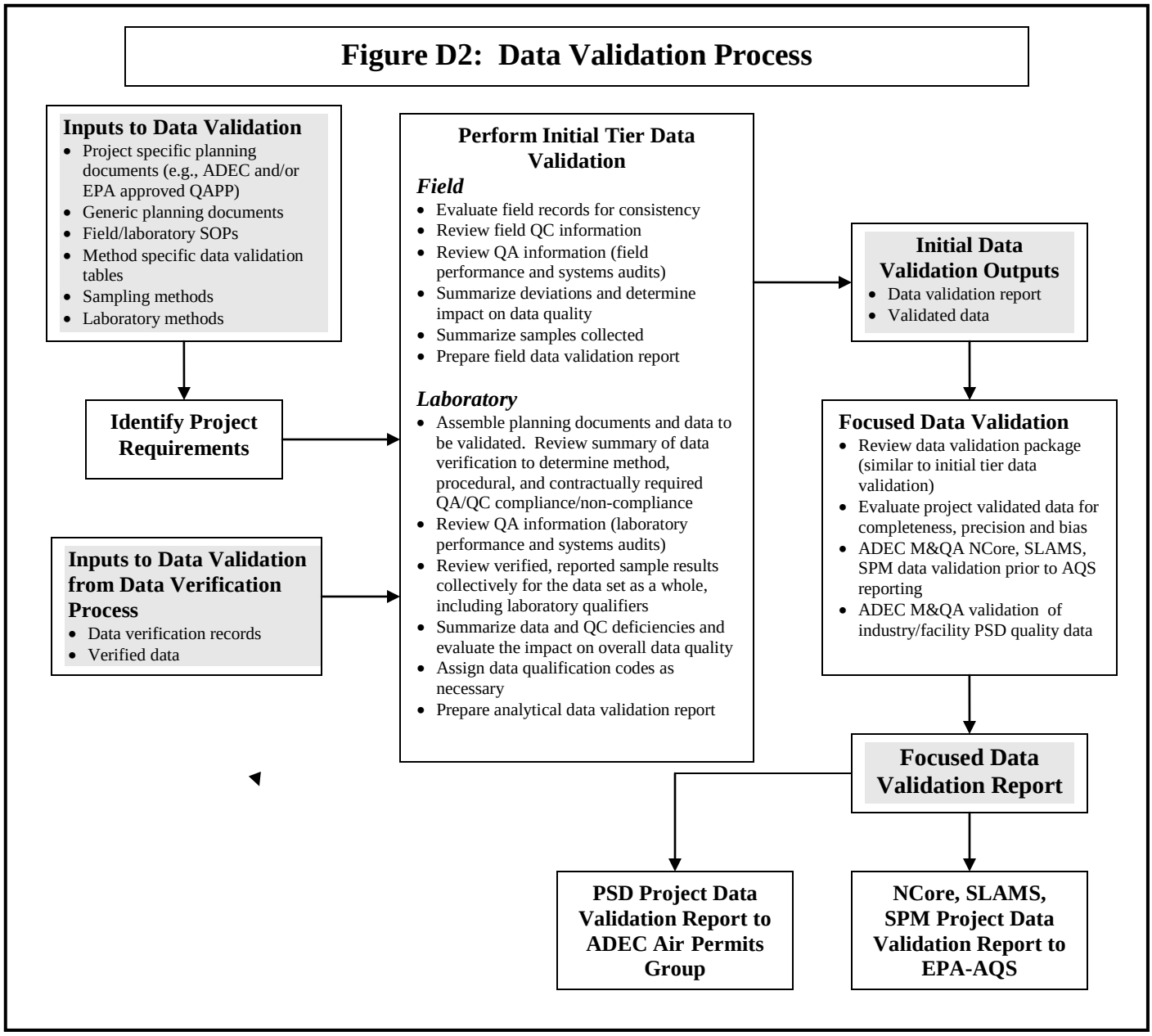
Prior to the ADEC officially reporting or using the data to make decisions concerning air quality, air pollution abatement, or control, the data will be verified and certified by the M&QA program manager in consultation with the Air Quality Assurance Officer.

In order for the data to be considered valid the following conditions must be satisfied:

- The air monitoring instrumentation must be calibrated and operated according to standard methods that have been approved for use in the ambient air and meteorological monitoring program.
- The data must be accompanied by back up documentation which meet the specifications outlined in Section 14 of this Plan, and be identified with respect to station name, station number, date, time, operator, instrument identification, parameter, scale and units.
- The data must be bracketed by documented quality control which substantiate that they meet the criteria in Section 14 of this plan.

Data which are reviewed and found to satisfy these criteria will be considered valid. Data that do not, will be invalidated back to the last valid quality control check and future data will be invalidated until it can be shown to meet the project's tolerances.

Figure D2, Data Validation Process, depicts the overall process.



Note 1: For NCore, SLAMS and SPM monitoring projects performed by ADEC AM&QA staff, initial tier of data validation is the responsibility for the ADEC AM&QA field and laboratory technicians. For NCore, SLAMS and SPM projects, the focused data validation step is the responsibility of the ADEC AM&QA Monitoring supervisor or his/her designee.
Note 2: For NCore, SLAMS and SPM monitoring projects performed by Local Monitoring Agencies, the initial tier of data validation is the responsibility of that local monitoring agency. The focused data validation step is the responsibility of the ADEC AM&QA Monitoring supervisor or his/her designee.

Note 3: For PSD quality monitoring projects performed by agencies/facilities, both tiers of data validation are the responsibility of the responsible agency/facility conducting the monitoring project. ADEC-AM&QA conducts an additional independent data validation/data review to ensure monitoring project conformed to ADEC-AM&QA PSD data quality criteria.

The primary focus of data validation is determining data quality in terms of accomplishment of the monitoring project's stated measurement quality objectives (MQOs).

Data validation is typically performed by person(s) independent of the activity which is being validated. In large organizations this is standard practice. However, in smaller organizations/agencies it is acceptable for the air monitoring technicians (who conduct the monitoring) to conduct the first tier of data validation, with the focused data validation performed by the air monitoring project's supervisor/project manager. The appropriate degree of independence is determined on a program specific basis and identified and approved in the respective QAPP.

As in the data verification process, planning documents, methods, procedures, data validation tables, verified data, etc. need to be readily available to the data validators. The data validator must be knowledgeable of the specific types of information to be validated. For this reason, it may require different individuals with specific knowledge to validate discreet components of a data set (e.g., field monitoring/measurement activities, laboratory gravimetric analyses, metals analyses, volatile organic compound analyses, etc.).

The data validator needs to be aware of signs that indicate improper field and laboratory practices that can/will affect data integrity. EPA QA/G-8, *"Guidance on Environmental Data Verification and Validation," EPA/240/R-02/004*, devotes chapter 5 to Data Integrity. This document can be found at: http://www.epa.gov/quality1/qs-docs/g8-final.pdf . Each data validator is encouraged to familiarize themselves with this and other chapters in this guidance document.

24. RECONCILIATION WITH USER REQUIREMENTS

The Air Quality Assurance Officer will prepare a quarterly Air Monitoring Data Quality Assessment Report for Alaska's NCore/SLAMS/SPM monitoring network that describes data quality in terms of precision, accuracy and data completeness. This report will be posted on the ADEC website at http://www.dec.state.ak.us/air/am/index.htm.

APPENDIX A

METHOD SPECIFIC DATA VALIDATION TABLES

Met-One BAM 1020 PM_{10} & $PM_{2.5}$
$PM_{2.5}$ FRM
PM_{10} FRM & FEM HiVol
PM_{10} FRM & FEM LowVol
Met-One SSASS $PM_{2.5}$
Meteorological Measurements
Pb on TSP FRM/FEM by AA Spectroscopy
Gaseous (SO_2, NO_x, CO, O_3) Methods
NH_3 by chemiluminescence

APPENDIX B

MONITORING METHODS AND STANDARD OPERATING PROCEDURES

PM_{10} GMW Accu-Vol FRM Hi Volume Sampler
PM_{10} & $PM_{2.5}$ Met-One Beta Attenuation Mass (BAM) Monitor Model 1020
$PM_{2.5}$ FRM R&P Partisol 2000
$PM_{2.5}$ R&P 1400a Tapered Element Oscillating Microbalance (TEOM)
$PM_{2.5}$ R&P 1400a Tapered Element Oscillating Microbalance w/ 8500 FDMS (TEOM/FDMS)
$PM_{2.5}$ Met-One Super SASS Speciation Monitor
$PM_{2.5}$ Magee Scientific Aethalometer
Thermo Electron 48(c) Carbon Monoxide Monitor
O_3 by UV absorption
SO_2 by UV fluorescence
NO_x by chemiluminescence
NH_3 by chemiluminescence
Laboratory Gravimetric Analysis of $PM_{2.5}$ Air Quality Filter Samples
Network Data Collection
Meteorological Monitoring

These documents can be viewed at:
http://www.dec.state.ak.us/air/am/index.htm