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

MUNICIPALITY OF ANCHORAGE

ASSEMBLY MEMORANDUM

No. AM 352-2010

Meeting Date: June 8, 2010

From: MAYOR

Subject: 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.

Anchorage last violated the federal standard for carbon monoxide (CO) in 1996. The Federal Clean Air Act requires communities like Anchorage who have come into compliance with the standard to prepare a Maintenance Plan to ensure continued compliance. The Anchorage CO Maintenance Plan, which is incorporated as part of the State Implementation Plan (SIP) for air quality, was approved by the U.S. Environmental Protection Agency (EPA) in 2004. It includes a commitment to the continued operation of the vehicle inspection and maintenance program (I/M).

In July 2008, the Anchorage Assembly directed the Department of Health and Human Services (DHHS) to work with the Alaska Department of Environmental Conservation to remove the commitment to I/M as a primary control measure in the SIP and make it a "local option." As a local option, any changes to the program, including its termination, would not be subject to the lengthy EPA SIP approval process. This process can take two years or more.

DHHS prepared revisions to the CO Maintenance Plan that eliminate the commitment to I/M and make it a local option. Because the commitment to I/M has been withdrawn, new air quality projections in the Plan make the assumption that I/M will be discontinued. These model projections show a small increase in CO emissions as a result of the assumed discontinuation of I/M. However, even with this anticipated increase in emissions, CO concentrations in Anchorage are expected to remain well within federal air quality standards. The probability of violating the standard in any given future year is computed to be less than 1-in-100.

The revised CO Maintenance Plan was released for public comment and recommended for approval by the Anchorage Metropolitan Area Transportation Solutions (AMATS) Air Quality Advisory and Technical Advisory Committees. The AMATS Policy Committee approved the Plan during their May 27 meeting.

THE ADMINISTRATION RECOMMENDS APPROVAL OF 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.

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

CO Emissions Projections

Figure 1 shows projected CO emissions in tons per day (tpd) in the area around the Turnagain monitor in Spenard which measures the highest CO concentrations in Anchorage. Analysis shows that there is a 90% or greater probability of meeting the CO standard if emissions remain below 7.48 tpd. Emissions remain well below this threshold through 2023.

The "extra" CO emissions expected as a consequence of terminating I/M are shown in cross hatch. The termination of I/M is projected to increase CO emissions by about 12%. However, the probability of violating the standard in any given year between 2010 and 2023 is less than 1-in-100 regardless of whether the I/M Program continues.

Figure 1
Projected CO Emissions with and without I/M

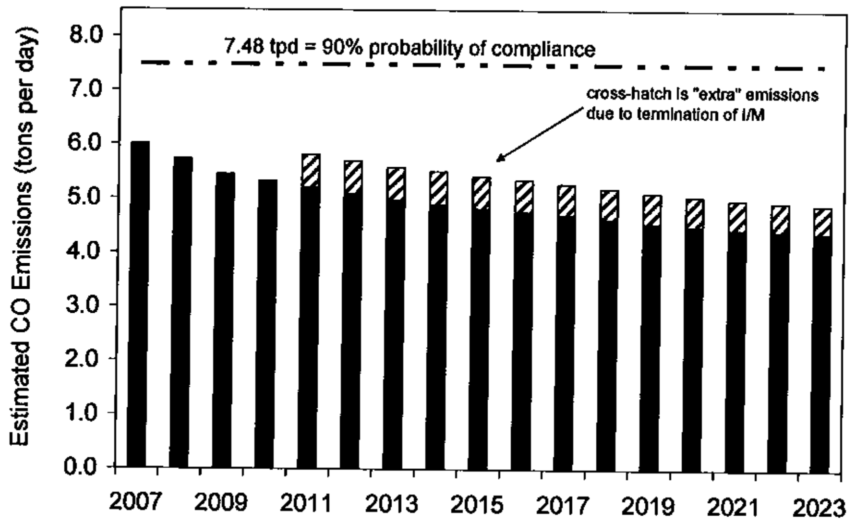
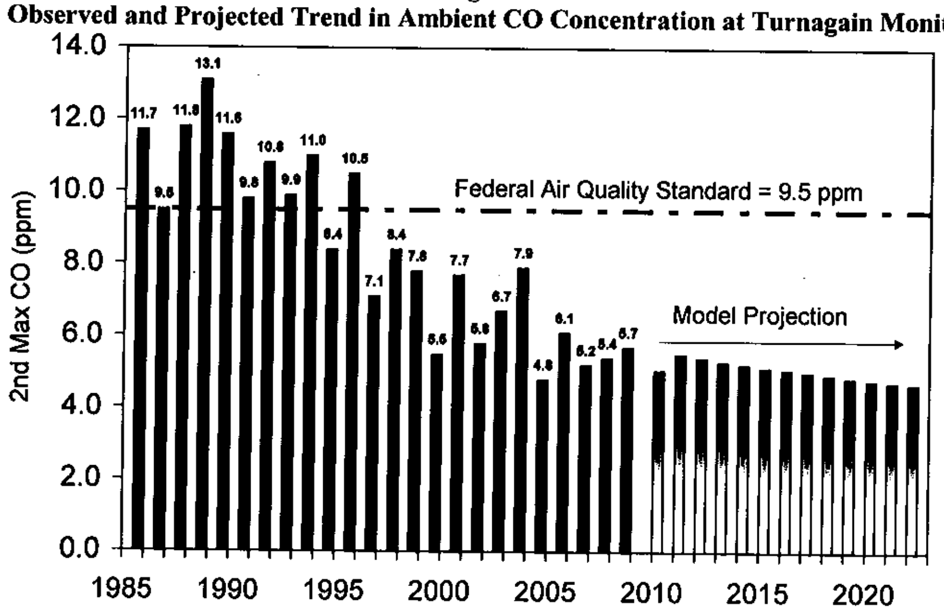


Figure 2 shows the observed and projected trend in CO air quality if the I/M program is terminated in 2011. Concentrations are expected to remain well below the 9.5 ppm standard through 2023.

Figure 2
Observed and Projected Trend in Ambient CO Concentration at Turnagain Monitor



Content ID: 009064

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Title: 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.

Author: pruittns

Initiating Dept: HHS

Review Depts: Legal

Date Prepared: 5/21/10 8:15 AM

Director Name: Diane Ingle

Assembly Meeting Date: 6/8/10

Workflow Name	Action Date	Action	User	Security Group	Content ID
Clerk_Admin_SubWorkflow	6/3/10 2:04 PM	Exit	Nina Pruitt	Public	009064
MuniManager_SubWorkflow	6/3/10 2:04 PM	Approve	Nina Pruitt	Public	009064
CFO_SubWorkflow	5/25/10 8:45 AM	Approve	Lucinda Mahoney	Public	009064
CFO_SubWorkflow	5/24/10 5:02 PM	Checkin	Nina Pruitt	Public	009064
Legal_SubWorkflow	5/21/10 9:14 AM	Approve	Dennis Wheeler	Public	009064
HHS_SubWorkflow	5/21/10 9:09 AM	Approve	Jennifer R Allen	Public	009064
AllOtherARWorkflow	5/21/10 8:30 AM	Checkin	Angela Taplin	Public	009064

addendum – CONSENT AGENDA – **RESOLUTIONS FOR ACTION-OTHER**

Ref. AR 2010-174

Anchorage CO Maintenance Plan

Proposed revision to the State of Alaska Air Quality Control Plan deleting the commitment to I/M except as a local option

Vol. II: Analysis of Problems, Control Actions
Section III.B: Anchorage Transportation Control Program

Prepared by the
Municipality of Anchorage
Department of Health and Human Services

for submission to the
Alaska Department of Environmental Conservation
for inclusion in the
State Implementation Plan for Air Quality

May 13, 2010

(This page serves as a placeholder for two-sided copying)

<u>A note on the format and organization of this document.</u>

This document is organized and formatted to be consistent with the State of Alaska Air Quality Control Plan. This document is intended to replace Volume II., Section III.B of the plan and is organized accordingly.

(This page serves as a placeholder for two-sided copying)

Introductory Note: In this document each reference to "CAAA" means the Clean Air Act Amendments of 1990, P.L. 101-549.

SECTION III.B ANCHORAGE CARBON MONOXIDE CONTROL PROGRAM

III.B.1. Planning Process

Background

Anchorage was first declared a nonattainment area for carbon monoxide (CO) on January 27, 1978. The Alaska Department of Environmental Conservation (ADEC) had recommended that the Environmental Protection Agency (EPA) designate a major portion of the Anchorage urban area as a nonattainment area for CO. The EPA accepted this recommendation, and in 1982 the Municipality of Anchorage (MOA) prepared a CO attainment plan which was incorporated as a revision to the State of Alaska Air Quality Control Plan. The State of Alaska Air Quality Control Plan serves as the State Implementation Plan (SIP) for air quality. A primary goal of the Anchorage CO plan was to attain the National Ambient Air Quality Standard (NAAQS) by December 31, 1987.

Anchorage, however, failed to achieve attainment by the December 31, 1987 deadline mandated in the 1977 Clean Air Act Amendments (CAAA). The Clean Air Act was amended again in November 1990. When these amendments were published, the EPA designated Anchorage as a "moderate" nonattainment area for CO and required the submission of a revised air quality plan to bring Anchorage into attainment with the NAAQS by December 31, 1995. The MOA prepared a revised air quality attainment plan that was approved by the Anchorage Metropolitan Area Transportation Solutions (AMATS) Policy Committee and Anchorage Assembly in December 1992. It was later approved by the EPA as a revision to the Alaska SIP in 1995. However, two violations* of the NAAQS were measured in 1996. As a consequence, on July 13, 1998, the EPA reclassified Anchorage from a "moderate" to a "serious" nonattainment area for CO.

Anchorage has not violated the NAAQS since 1996. Upon review of Anchorage CO monitoring data, EPA determined that Anchorage had attained the NAAQS. This finding was published in a July 12, 2001 Federal Register Notice (Federal Register Vol. 66, No.134, pages 36476-36477, effective August 13, 2001). However an "attainment finding" in and of itself is not sufficient to re-designate an area to attainment. The CAAA establishes additional planning requirements that must be satisfied before the EPA administrator can reclassify an area to attainment. An attainment plan and subsequently, a maintenance plan must be submitted to EPA for approval. The attainment plan, which shows that Anchorage achieved the emission reductions necessary to attain the CO NAAQS by the December 31, 2000 deadline stipulated in the CAAA for serious CO nonattainment areas, was completed and approved by the Anchorage Assembly on September 25, 2001. ADEC incorporated the plan as a revision to the Alaska SIP which was later approved by the EPA effective October 18, 2002.

* Three exceedances of the NAAQS were measured at both the Seward Highway site and Benson site. Because the NAAQS allows one exceedance of the NAAQS per year at each site, three exceedances at a site constitute two violations.

After the approval of the attainment plan, a maintenance plan was prepared. It showed that CO emissions in Anchorage would remain at a level that assures continued attainment of the NAAQS through calendar year 2023. The maintenance plan was approved by the Anchorage Assembly on October 7, 2003 and submitted to ADEC as a proposed revision to the Alaska SIP. ADEC obtained approval of this SIP revision by the EPA, effective July 23, 2004. With this approval, the EPA Regional Administrator reclassified Anchorage from serious CO nonattainment to an area that is in attainment with the NAAQS. The primary CO control measures committed for implementation in the 2004 maintenance plan were the Vehicle Inspection and Maintenance (I/M) Program, the Share-A-Ride / Vanpool Program, and the block heater promotion program.

On November 6, 2007 the Anchorage Assembly voted to discontinue the I/M Program by December 31, 2009 or earlier if EPA approval of the SIP revision necessary to delete this committed SIP measure could be obtained.* However, on July 15, 2008 they revoked this action and voted to continue I/M with some modifications. The most significant change to the I/M Program was extending the testing exemption for new cars from four to six years, beginning January 2010.†

The Assembly also directed the Municipal Department of Health and Human Services to work with the State of Alaska to remove the I/M Program as a primary control measure 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.

The MOA and ADEC decided to implement the changes mandated by the Assembly in a two-phase SIP revision. The first phase of the revisions makes the relatively straight-forward changes necessary to extend the new car I/M test exemption from four to six years. The Assembly adopted these revisions on May 26, 2009 and a revised SIP was submitted to ADEC shortly thereafter. This SIP revision also included an updated CO emission inventory and motor vehicle emission budget, and changes to the contingency measure provisions in the Plan.

The second phase of these revisions, which are reflected in this document, address the more complicated issue of deleting the commitment to I/M in the SIP while preserving the right of the MOA to continue the program as a "local option." Before these SIP revisions could proceed, however, it was necessary to determine whether Alaska statute or regulation prohibited the operation of a local I/M program not mandated in the SIP. MOA, ADEC and the Alaska Department of Administration's Division of Motor Vehicles (DMV) have worked together to examine the regulatory and operational issues associated with implementing a local option I/M program in Anchorage. They have concluded that a local option program is viable pending revisions to the Alaska Administrative Code and the execution of a memorandum of understanding between MOA, ADEC and DMV that lays out the roles and responsibilities of each entity in the operation of a local option I/M program in Anchorage.

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* Assembly Ordinance 2007-122(S)

† These actions were taken in Assembly Ordinance 2008-84(S). The ordinance also exempts vehicles with historical and classic license plates from testing.

The second phase of these SIP revisions, contained herein, deletes to the commitment to I/M as a primary CO control strategy. I/M is now included in the menu of contingency measures that could be implemented if Anchorage were to violate the NAAQS in the future. Because I/M provides reductions in CO emissions, the elimination of I/M was factored into new projections of future CO emissions and probability estimates for continued maintenance of the CO NAAQS. No other substantive changes have been made to the SIP.

To ensure that there is adequate participation by local elected officials and citizens in this planning process, the CAAA contain specific mandatory attainment planning provisions. These requirements, and MOA's response to them, are discussed below.

Local Planning Process

The Anchorage air quality maintenance plan was prepared in accordance with the provisions of sections 110(a)(2)(M) and 174 of the CAAA (42 U.S.C. 7410(a)(2)(m) and 42 U.S.C. 7504), which require the consultation and participation of local political subdivisions and local elected officials. Under section 174 (42 U.S.C. 7504), the revised plan submitted to EPA as a formal SIP amendment must be prepared by "an organization certified by the State, in consultation with elected officials of local governments." Such an organization is required to include local elected officials and representatives of the following organizations:

- the state air quality planning agency (i.e., ADEC);
- the state transportation planning agency (i.e., Alaska Department of Transportation & Public Facilities (ADOT/PF)); and
- the metropolitan planning organization (MPO) responsible for the Continuing, Cooperative, and Comprehensive (3C) transportation planning process for the affected area.

In 1976, the governor designated the MOA as the MPO for the Anchorage urbanized area. Consequently, the MOA conducts the 3C transportation planning process required under federal regulation, in cooperation with ADEC and ADOT/PF, through the AMATS planning group. In 1978, the governor designated MOA as the lead air quality planning agency in Anchorage. Based on this designation, MOA has continued its role as the lead air quality planning agency in the Anchorage area for the preparation of this plan. The air quality planning process is outlined in the AMATS Intergovernmental Operating Agreement for Transportation and Air Quality Planning. This agreement was last revised in August 2002 and became effective January 1, 2003. This operating agreement establishes the roles and relationships between governmental entities involved in the Anchorage air quality planning process.

Development of this plan required close coordination between air quality and transportation planning agencies in the community. This coordination was ensured through the oversight of the AMATS Policy Committee during plan development. AMATS is an on-going comprehensive transportation planning process for Anchorage. Cooperative efforts include 1) projecting future land use trends and transportation demands; 2) recommending long-range solutions for transportation needs; and 3) working together to implement the recommendations. The AMATS structure consists of a two-tiered committee system that reviews all transportation planning efforts within the area.

The *AMATS Policy Committee* provides guidance and control over studies and recommendations developed by support staff. Voting members of the Policy Committee are listed below.

- MOA Mayor;
- ADOT/PF Central Regional Director;
- MOA Assembly representative;
- MOA Assembly representative; and
- ADEC Commissioner or designee.

The *AMATS Technical Advisory Committee* (TAC) and member support staff analyze transportation and land use issues and develop draft recommendations for the Policy Committee. Voting members include the following:

- MOA Traffic Director;
- MOA Project Management and Engineering Director;
- MOA Planning Director;
- MOA Public Transportation Director;
- MOA Department of Health & Human Services representative;
- MOA Port of Anchorage Director;
- ADOT/PF Chief of Planning & Administration;
- ADOT/PF Regional Pre-Construction Engineer;
- ADEC representative;
- Alaska Railroad representative; and
- AMATS Air Quality Advisory Committee representative.

In addition, to help provide public input into the current air quality planning process by interested local groups and individual citizens, a third AMATS committee, the *Air Quality Advisory Committee* was appointed by the Policy Committee. The Air Quality Advisory Committee is comprised of nine members. Committee membership has generally included at least one physician or health professional, a representative of the I/M industry, a representative of the environmental community, and a representative from the Municipal Planning and Zoning Commission.

Air Quality Goals and Objectives

The goals and objectives of the Anchorage air quality maintenance plan provide the basis upon which the plan is developed and provide direction for future policy decisions that may affect air quality. The goals and objectives of the plan must reflect the intent of the CAAA as well the values, views, and desires of the citizens of Anchorage and their elected officials.

The goals and objectives need to integrate land use, air quality and transportation planning concerns. For this reason, the goals and objectives of this plan are designed to complement goals and objectives identified in the Anchorage Bowl Comprehensive Plan and Anchorage Long Range Transportation Plan.

Primary Goals and Objectives:

1. Continued maintenance of the NAAQS for CO throughout the Municipality of Anchorage through 2023 and beyond.†
2. Prevention of significant deterioration of air quality within the Municipality of Anchorage.
3. Development and implementation of control measures necessary to maintain compliance with the NAAQS through 2023.
4. Identification of contingency measures to be implemented if violations of the NAAQS occur.
5. Establishment of a mobile source emission budget to be used in future conformity determinations of transportation plans and programs.

In addition to the primary goals and objectives, there are community goals and objectives that must be considered and striven for during the development and implementation of the plan.

Community Goals and Objectives:

1. Clear healthful air that is free of noxious odors and pollutants.
2. Protection of the health of the citizens of the Municipality of Anchorage from the harmful effects of air pollution.
3. Establishment of an effective public information and participation program to ensure that the citizens of the Municipality of Anchorage have an active role in air quality planning.
4. Minimization of the negative regulatory and economic impact of air pollution control measures on Anchorage citizens and businesses.
5. Implementation and support of an efficient transportation system that offers affordable, viable choices among various modes of travel that serve all parts of the community and aids in the achievement of the goals and objectives of the State Implementation Plan for Air Quality.

Plan Development

This maintenance plan is a natural extension of a research planning effort begun in early 1997. The MOA collaborated with EPA Region 10, ADEC and the Fairbanks North Star Borough on a number of research projects aimed at quantifying the contribution of vehicle cold starts and warm up idling on ambient CO concentrations in Anchorage and Fairbanks. These studies provided insights that were important in developing this plan and in preparing the attainment and maintenance plans that preceded it.

The most significant revisions proposed in this maintenance plan are the deletion of I/M as a primary CO control measure and the inclusion of I/M in the contingency plan. The contingency plan outlines the actions that will be taken if Anchorage violates the CO NAAQS in the future. The revised contingency plan can be found in Section III.B.7.

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† Section 175A of the Clean Air Act requires maintenance plans to provide for the maintenance of the national primary ambient air quality standard for at least ten years after redesignation. The Anchorage plan exceeds this minimum requirement and demonstrates maintenance for a 15-year period, 2009-2023. The original maintenance plan covered the 20-year period 2003-2023.

Public Participation Process

Section 110(a) of the CAAA (42 U.S.C. 7410(a)) requires that a state provide reasonable notice and public hearings of SIP revisions prior to their adoption and submission to EPA. To ensure that the public had adequate opportunity to comment on revisions to the Anchorage air quality attainment and maintenance plans, a multi-phase public involvement process, utilizing AMATS and the Anchorage Assembly was used.

AMATS Air Quality Advisory Committee – The Air Quality Advisory Committee held a meeting to review the second phase of the revisions which delete I/M as a primary control measure in the SIP but retain it as a local option. A public review draft was released by the AMATS Technical Advisory Committee on March 18, 2010 for 45-day public comment. On May 6, 2010 the Air Quality Advisory Committee met to review the public review draft and to consider public comments received. During this meeting they recommended that the AMATS TAC and Policy Committees approve the public review draft of the Plan as drafted.

AMATS Technical and Policy Committees –The AMATS Technical Advisory Committee recommended approval of the second phase of the revisions during their meeting on May 13, 2010. They forwarded their own recommendation for approval to Policy Committee. The AMATS Policy Committee met on [date tbd] and [insert action taken].

Anchorage Assembly – The Anchorage Assembly adopted the first phase of the SIP revisions during a public meeting held on May 26, 2009. They met again on [date tbd] to consider the second phase of the revisions which delete the commitment to I/M and make it a local option. The Assembly [insert action taken]. Copies of Assembly Resolutions AR 2009-144 and 2010-YYY are included in the Appendix to Section III.B.10.

ADEC hearings – The final opportunity for public involvement occurs at the state administrative level. Prior to regulatory adoption of SIP revisions, ADEC holds public hearings on the revisions in the affected communities. ADEC held a public hearing on the Anchorage maintenance plan on [date tbd]. This provided another forum for the public to comment on the air quality plan prior to state adoption and submission to EPA.

III.B. 2. Maintenance Area Boundary

Portions of the MOA were first identified as experiencing high levels of ambient CO concentrations in the early 1970s. The nonattainment area within the MOA was first declared on January 27, 1978 after the completion of a monitoring study that measured CO concentrations at numerous locations. The results of that study were included in the *1979 State Air Quality Plan.* EPA reaffirmed the boundaries of the nonattainment area on November 6, 1991 (56 Fed.Reg. 56694, 56711)(40 C.F.R. 81.302. These same boundaries serve as the Anchorage CO Maintenance Area contained within the boundary described as follows:

Beginning at a point on the centerline of the New Seward Highway five hundred (500) feet south of the centerline of O'Malley Road; thence,

Westerly along a line five hundred (500) feet south of and parallel to the centerline of O'Malley Road and its westerly extension thereof to a point on the mean high tide line of the Turnagain Arm; thence,

Northwesterly along the mean high tide line to a point five hundred (500) feet west of the southerly extension of the centerline of Sand Lake Road; thence,

Northerly along a line five hundred (500) feet west of and parallel to the southerly extension of the centerline of Sand Lake Road to a point on the southerly boundary of the Ted Stevens Anchorage International Airport property; thence,

Westerly along said property line of the Ted Stevens Anchorage International Airport to an angle point in said property line; thence,

Northerly along said property of the Ted Stevens Anchorage International Airport to an angle point in said property line; thence,

Easterly, along said property line and its easterly extension thereof to a point five hundred (500) feet west of the southerly extension of the centerline of Wisconsin Street; thence,

Northerly along said line to a point on the mean high tide line of the Knik Arm; thence,

Northeasterly along the mean high tide line to a point on a line parallel and five hundred (500) feet north of the centerline of Thompson Street and the westerly extension thereof; thence,

Easterly along said line to a point five hundred (500) feet east of Boniface Parkway; thence,

Southerly along a line five hundred (500) feet east of and parallel to the centerline of Boniface Parkway to a point five hundred (500) feet north of the Glenn Highway; thence,

Easterly and northeasterly along a line five hundred (500) feet north of and parallel to the centerline of the Glenn Highway to a point five hundred (500) feet east of the northerly extension of the centerline of Muldoon Road; thence,

Southerly along a line five hundred (500) feet east of and parallel to the centerline of Muldoon Road and continuing southwesterly on a line of curvature five hundred (500) feet southeasterly of the centerline of curvature where Muldoon Road becomes Tudor Road to a point five hundred (500) feet south of the centerline of Tudor Road; thence,

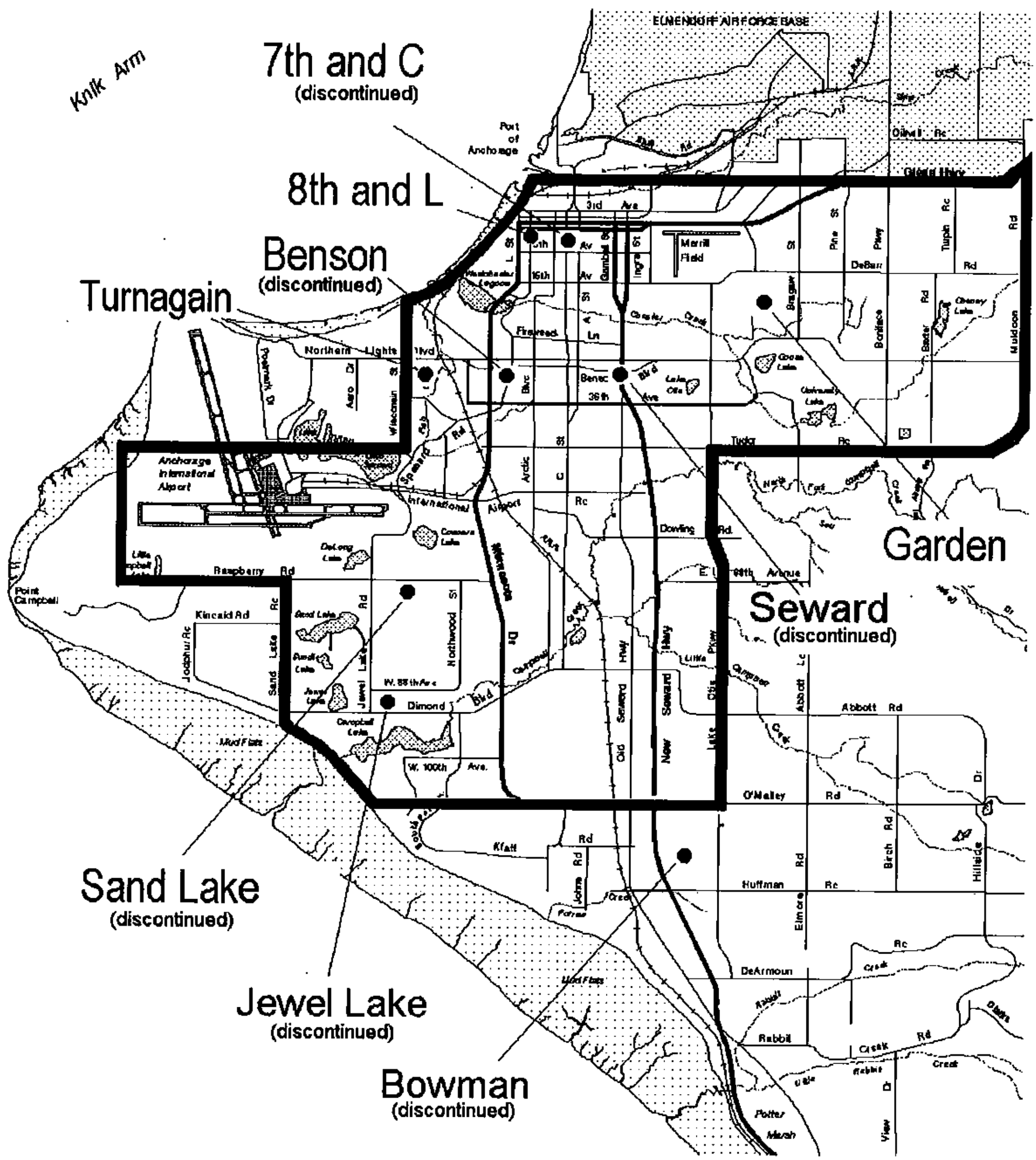
Westerly along a line five hundred (500) feet south of the centerline of Tudor Road to a point five hundred (500) feet east of the centerline of Lake Otis Parkway; thence,

Southerly, southeasterly, then southerly along a line five hundred (500) feet parallel to the centerline of Lake Otis Parkway to a point five hundred (500) feet south of the centerline of O'Malley Road; thence,

Westerly along a line five hundred (500) feet south of the centerline of O'Malley Road, ending at the centerline of the New Seward Highway, which is the point of the beginning.

The maintenance area boundary is shown in Figure III.B.2-1. This boundary is identical to the nonattainment boundary identified in previous attainment plans and it became the maintenance area boundary for the Municipality of Anchorage on July 23, 2004 when the the EPA approved the original Anchorage maintenance plan. Figure III.B.2-1 also shows the locations of CO monitoring stations in Anchorage. Monitoring at a number of these stations has been discontinued because measured values at these stations were low relative to other comparable sites in the network.

Figure III.B.2-1
MOA CO Monitoring Network and Maintenance Area Boundary



III.B.3. Nature of the CO Problem – Causes and Trends

Sources of CO – 2007 Area-wide Base Year Emission Inventory

Section 187 of the CAAA (42 U.S.C. 7512a) requires serious CO nonattainment areas to submit an inventory of actual emissions from all sources in accordance with guidance developed by EPA. This emission inventory, *Anchorage Carbon Monoxide Emission Inventory and Projections 2007 – 2023*, is contained in the Appendix to Section III.B.3.

The area inventoried includes the entire Anchorage maintenance area including areas to the west and east of the inventory boundary. These areas are included because of the growth and development that have occurred there over the past three decades. Elmendorf Air Force Base and Fort Richardson are not included in the inventory area.

According to the latest inventory compiled for the Anchorage area for base year 2007, 67% of winter season CO emissions in the maintenance area were from motor vehicles.[1] Because a large portion of these motor vehicle emissions are produced from cold engines and warm-up idling, a significant amount of resources and effort were devoted to accurately quantifying these impacts. The EPA MOBILE model is poorly suited for estimating this component of motor vehicle emissions. The MOA collaborated with the Fairbanks North Star Borough and ADEC on a local research effort aimed at quantifying the contribution of cold weather warm-up idling on the emission inventory. This research suggests that cold starts and warm-up idling are a very important component of vehicle emissions. In the winter, many Anchorage drivers engage in extended warm-ups, particularly prior to their morning commute. A study conducted in Anchorage during the winter of 1998-99 indicated that the average warm-up period for morning commuters was 12 minutes.[2]

Over the course of a 24-hour winter day, warm-up idling is estimated to account for nearly a quarter of all vehicle emissions generated in the Anchorage bowl. In some residential areas, idling accounts for almost half of all the CO emissions generated. Cold winter temperatures increase "cold start" emissions. When the EPA MOBILE6 model is run with Anchorage fleet characteristics, CO emissions at start up are almost three times greater at 20 °F than at 65 °F.

Other significant sources of CO in Anchorage include aircraft and residential wood burning. Estimated 2007 CO emissions sources in Anchorage are summarized in Table III.B.3-1. In addition to the base year 2007 inventory, emission forecasts were prepared for 2009, 2011, 2013, 2015, 2017, 2019, 2021 and 2023. These forecasts were used to develop the long term maintenance projections presented later in Section III.B.5.

Grid-based inventories were developed for each year. These grid-based inventories provide separate estimates of emissions for the 200 one square kilometer grid cells that make up the Anchorage inventory area. These grid-based estimates of emissions were further resolved by time-of-day. An estimate of the quantity of CO emitted during the AM peak traffic period (7 AM – 9 AM), the PM peak (3 PM - 6 PM) and off peak periods (6 PM- 7 AM and 9 AM – 3 PM) was provided for each grid cell. The results and methodology used to prepare these inventories is discussed in detail in the Appendix to Section III.B.3.

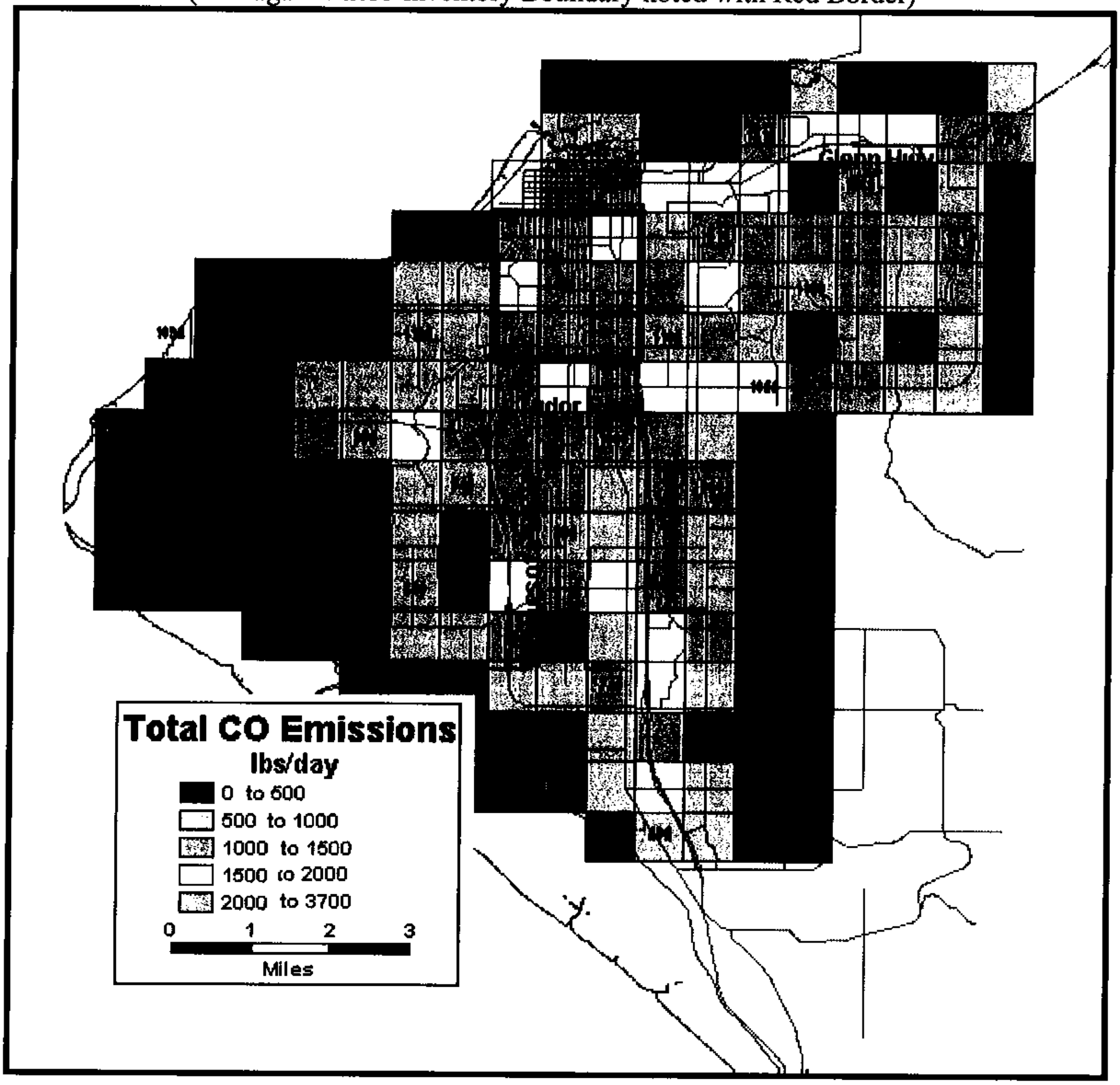
Table III.B.3-1
Sources of Anchorage CO Emissions in 2007 Base Year (Area-wide)

Source Category	CO Emitted (tons per day)	% of total
Motor vehicle – on-road travel	51.0	50.5%
Motor vehicle – warm-up idle	16.3	16.2%
Ted Stevens Anchorage International Airport Operations	12.4	12.2%
Merrill Field Airport Operations	0.7	0.7%
Wood burning – fireplaces and wood stoves	6.2	6.2%
Space heating – natural gas	3.8	3.7%
Miscellaneous (railroad, marine, snowmobiles, snow removal, portable electrical generators, welding, etc.)	9.3	9.2%
Point sources (power generation, sewage sludge incineration)	1.3	1.3%
TOTAL	**101.0**	**100%**

Analysis of CO Emissions Sources in Turnagain Area

In addition to the area-wide inventory discussed above, a micro-inventory was also prepared for the nine square kilometer area surrounding the Turnagain monitoring station in west Anchorage. The Turnagain station exhibits the highest CO concentrations of the current monitoring network; it has been shown to be approximately 20% higher than the next highest site. Analysis of historical CO data from over twenty monitoring locations in Anchorage suggests that the CO concentrations measured at this site are representative of the highest concentrations in Anchorage.[3] This micro-inventory provides added insight into the sources of CO in this particular area and is useful in developing appropriate localized control strategies. The boundaries of this nine square kilometer micro-inventory area are shown in Figure III.B.3-1 (a). This is one of the most densely populated and heavily trafficked areas of Anchorage. It also includes residential neighborhoods where vehicles are parked outside at night resulting in a prevalence of cold starts and warm-up idling. As can be seen in the figure, gridded inventory results suggest that CO emissions in this area are among the highest in the Anchorage bowl.

Figure III.B.3-1 (a)
CO Emissions Distribution in Anchorage
(Turnagain Micro-inventory Boundary noted with Red Border)



A breakdown of CO emissions in the Turnagain area is shown in Figure III.B.3-1 (b). Total estimated CO emissions during a 24-hour winter weekday were estimated to be 5.99 tons per day in 2007. These emissions can also be broken down by time-of-day to gain further insight into the nature of the CO sources in the Turnagain area. Figure IIII.B.3-1(c) shows CO emission rates (in lbs/hour) by source during the AM peak, PM peak and off-peak periods. Note that warm-up idle emissions are particularly significant during the AM peak. Not surprisingly, the Turnagain station typically exhibits its highest hourly CO concentrations shortly after this AM peak.

Figure III.B.3-1 (b)
24–Hour CO Emissions in the 9 km^2 Area Surrounding the Turnagain Station
Base Year 2007 Inventory

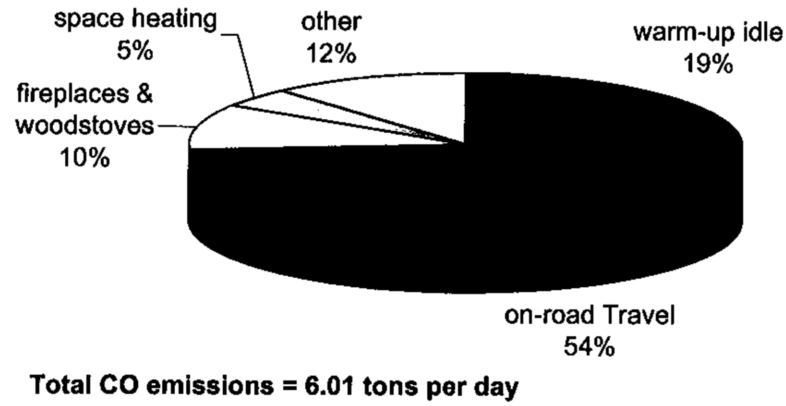
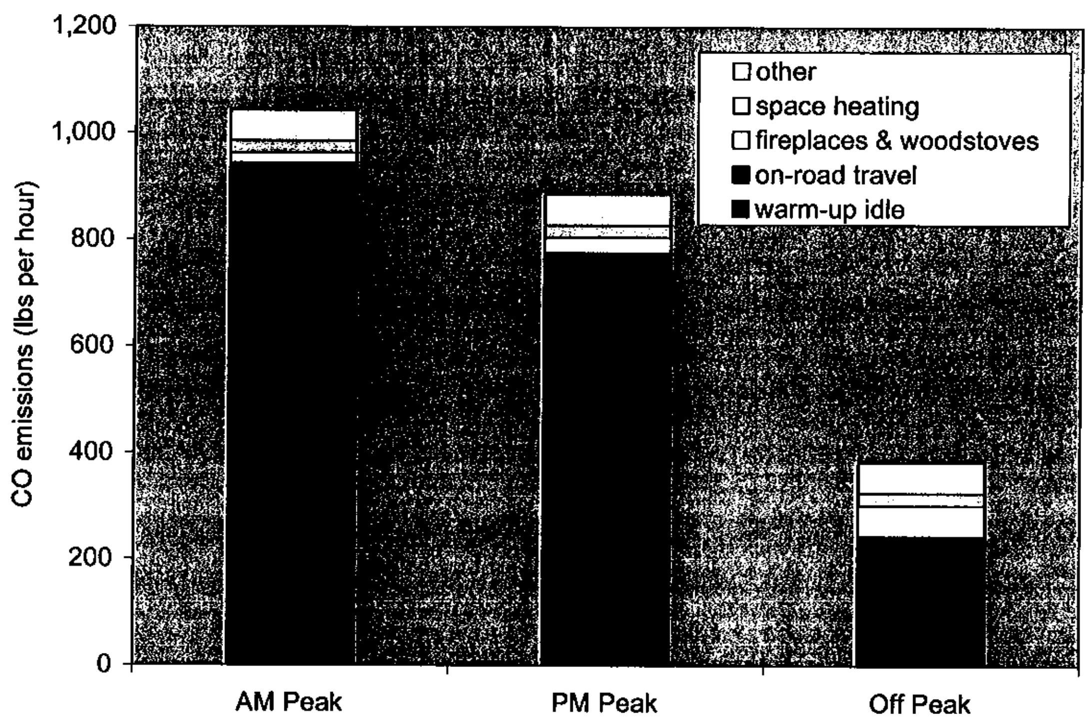


Figure III.B.3-1(c)
CO Emission Rate by Time-of-Day in Area Surrounding the Turnagain Station
Base Year 2007 Inventory



Evidence suggests that CO emissions from the Ted Stevens Anchorage International Airport, located approximately two kilometers west of the Turnagain monitoring site, have little effect on ambient CO concentrations in the Turnagain area. CO monitoring at the airport itself suggests that concentrations there are relatively low. The Winter 1997-98 CO Saturation Monitoring Study showed that maximum 8-hour CO concentrations measured at the airport (near the Fed Ex facility on Postmark Drive) were less than half those measured at the Turnagain station (see Figure III.B.3-2). CO sampling conducted in conjunction with the Ted Stevens Anchorage International Airport Air Toxics Study in January and February 2002 showed that sites along the airport perimeter had mean and maximum concentrations about four times lower than the Turnagain station.‡ Although total CO emissions from the airport are significant (12.4 tons per day in 2007), they are spread out over a large area so that the CO emissions density (in pounds emitted per square kilometer/day) is relatively low. The emission density in some one-kilometer grids immediately surrounding the Turnagain monitor is four or five times greater than the airport (see Figure III.B.3-1 (a).

Future Periodic Inventories

Periodic inventories are not required for maintenance areas. CAAA Section 175A(b) requires the submission of a SIP revision eight years after redesignation as a maintenance area. An emission inventory will be prepared to support this SIP revision. The MOA and/or ADEC may choose to prepare an additional inventory(s) in the interim.

Summary of Local Research

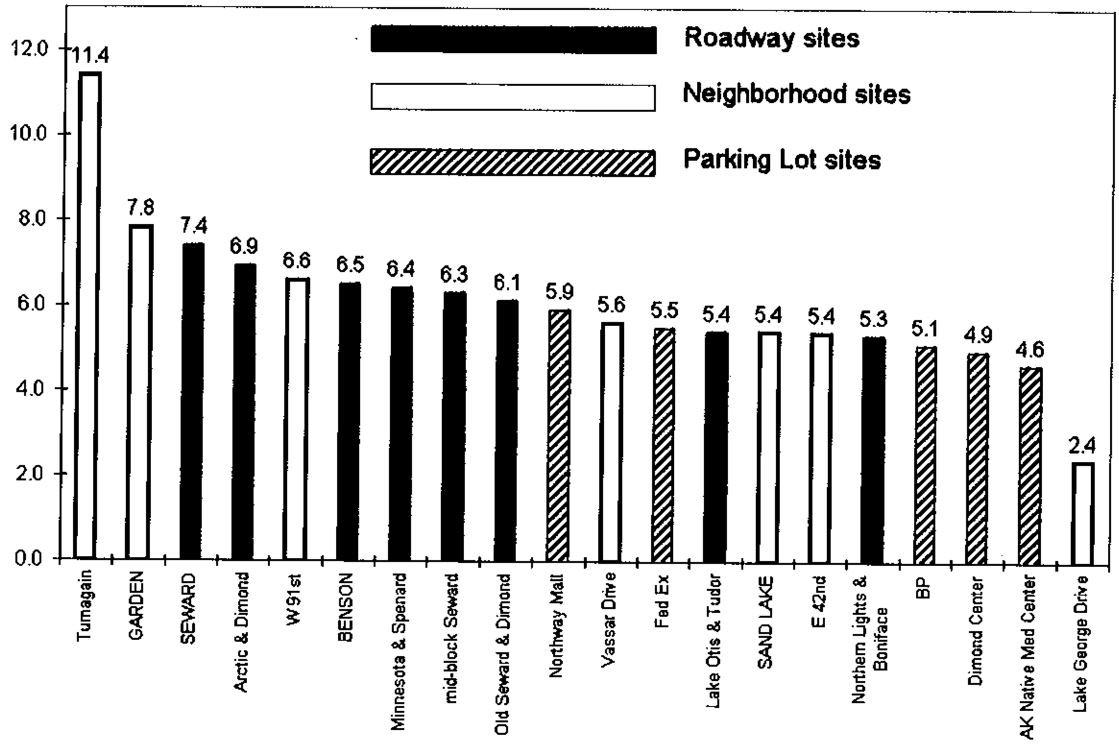
Beginning in 1997, the MOA, in cooperation with the EPA, ADEC, and the Fairbanks North Star Borough, conducted a number of studies to advance the understanding of the causes of the winter season CO problem in Anchorage and Fairbanks. In particular, these studies focused on quantifying the contribution of cold-starts and warm-up idling on the problem. These studies are summarized below.

CO Saturation Monitoring Study (1997-98)

The MOA performed additional CO monitoring during the period December 4, 1997 - February 4, 1998. Sixteen temporary monitoring sites were established to assess how well the four station permanent network was characterizing the air quality near congested roadway intersections, in neighborhoods, and in parking lots. Monitoring was conducted at a total of 20 locations during the study period. Six sites were located near major roadway intersections, five in neighborhoods, and five in large retail or employee parking lots. The maximum 8-hour concentrations measured at each of the 20 sites in the study are compared in Figure III.B.3-2.

‡ These perimeter sites included locations in Kincaid Park and Little Campbell Lake just south of the airport and near the end of North Runway north of the airport. The Concourse B site was not included in the comparison because it was heavily influenced by automobile CO emissions. It was located close to the passenger pick-up and drop-off area at the concourse. Mean and maximum 8-hour CO concentrations there were about 20% below the Turnagain station.

Figure III.B.3-2
Maximum 8-hour CO Concentrations Measured During CO Saturation Monitoring Study (1997-98)



The highest 8-hour CO concentrations were found at neighborhood locations with relatively low traffic volumes. The Turnagain neighborhood site (at Turnagain Street and 31st Avenue) recorded the highest and second highest 8-hour concentrations in the study. The next highest site was the Garden permanent station, also located in a neighborhood. Vehicle cold starts and warm-up idling by morning commuters were implicated as the cause of the elevated CO observed in these neighborhoods.

The permanent station at Seward Highway recorded the highest concentration of any of the six roadway intersection sites. The study concluded that the permanent station at Seward Highway adequately characterizes the upper range of CO concentrations experienced near Anchorage's major roadways. Lower than expected concentrations were found near a number of congested intersections. For example, the highest concentration measured near the busy intersection of Lake Otis Boulevard and Tudor Road was about 50% lower than the Turnagain neighborhood site.

CO concentrations at the five parking lot sites were generally lower than those found in neighborhoods or near the major roadway intersections monitored during the study. This was somewhat surprising given the number of vehicle start ups that originated in these parking lots. Many of these start ups, especially in retail shopping parking lots, were likely to be "hot starts," however, meaning that engines were still warm from an earlier trip. Warmer engines emit considerably lower amounts of CO and this may account for the relatively low ambient concentrations observed.

Anchorage Winter Season Driver Idling Behavior Study (1997-98)

The MOA conducted a study between November 28, 1997 and January 31, 1998 aimed at quantifying the amount of warm-up idling performed by Anchorage drivers. Field staff observed 1,321 vehicle starts at diverse locations in Anchorage. Warm-up idling duration was documented for trips that began at homes, work places, and other locations including shopping centers, restaurants, and schools.

Transportation planning models typically categorize trips into three categories as follows:

- Home-based work (HBW) trips – Commute trips that involve travel directly from home to work or from work to home.
- Home-based other (HBO) trips – Trips that originate from home to some location other than work (e.g., shopping center, school, health club, doctor office, etc.) or the return trip from the "other" location if it returns directly home.
- Non home-based (NHB) trips – Trips that originate from some location other than home (e.g., work, shopping, etc.) and are not a HBW or HBO trip.

Field observations were used to estimate idle duration for each of the trip purpose categories described above. The longest warm-up idle times were associated with morning HBW trips. The average idle duration for these trips was over 7 minutes. About 35% of morning HBW trips involved vehicles parked overnight in heated garages. Idle duration for these vehicles averaged less than one minute. The average idle duration for vehicles parked outside was over 12 minutes. The average idle duration for evening HBW trips beginning at the workplace was 3.4 minutes. The shortest idle durations were associated with morning and midday NHB trips that began at sites other than work or home. Median idle time for these trips was less than one minute.

Engine soak times, the length of time that an engine sits in the cold between trips, were also estimated as part of the driver idling behavior study. Longer soak times result in colder engines and increased CO emissions. Data from a travel survey conducted by Hellenthal and Associates for the MOA in 1992 were used to estimate soak times by trip purpose and time of day. Results of the driver idling behavior study are shown in Table III.B.3-2.

TABLE III.B.3-2
Anchorage Winter Season Driver Behavior Study
Soak Time and Idle Duration by Time of Day and Trip Purpose

		Soak Time (hours)		Idle Duration (minutes)	
Time of Day	Trip Purpose	Average	Median	Average	Median
Morning 6:00 a.m. – 9:00 a.m.	HBW	11.9	12.8	7.3	5.7
	HBO	10.7	12.0	5.9	4.8
	NHB	1.1	0.1	0.8	0.6
Midday 9:00 a.m. – 3:00 p.m.	HBW	6.3	3.7	3.5	2.0
	HBO	6.6	1.7	2.0	1.2
	NHB	1.6	0.6	1.6	0.6
Evening 3:00 p.m. – 6:00 p.m.	HBW	6.8	8.2	3.4	1.2
	HBO	2.6	0.8	2.1	0.9
	NHB	3.0	0.8	3.1	0.8
Night 6:00 p.m. – 6:00 a.m.	HBW	5.8	4.5	3.0	1.2
	HBO	2.0	1.2	2.6	2.7
	NHB	2.0	1.0	1.5	1.3

Table III.B.3-2 shows that the longest soak times and idle durations are associated with morning HBW trips and HBO trips. Because most of these trips begin with a cold engine and involve long idles, it suggests that start up and idle CO emissions are likely to be greater than other trip types. Conversely, NHB trips, because they typically involve short soak times and idle durations, likely have relatively low start-up and idle CO emissions.

Alaska Drive Cycle Study (2000)

In 1996, EPA issued a final rule that revised the certification test procedure to account for the effects of aggressive driving conditions, high acceleration rates and air conditioning on motor vehicle emissions. The rule required manufacturers to control excess emissions produced under these previously unrepresented driving conditions and was phased-in between 2000 and 2002 model year vehicles. The rulemaking significantly impacted emission inventory estimates for all pollutants by increasing estimates for pre-2000 model year vehicles and dramatically reducing emissions from post 2000 model year vehicles. A review of the high-speed, high acceleration rates represented in the new driving cycles led to concern about how well they represented winter time driving conditions when snow, ice and darkness are the prevalent conditions in Anchorage and Fairbanks.

Under contract with ADEC, Sierra Research worked with transportation agencies in Anchorage and Fairbanks to select representative routes in those communities. Data were collected using a "chase car" equipped with a GPS system to collect second-by-second position measurements over each of the routes driven. The "chase car" followed and mimicked the behavior of randomly selected vehicles while driving over the route so that the collected data represented the operation of in-use vehicles. A total of 80 separate routes were driven in Anchorage and 79 routes in Fairbanks.

The position measurements in the collected data set were differentiated to produce speed estimates. Summary statistics were computed for each community and blended in proportion to each community's share of their combined travel to produce an overall estimate of activity. The results showed that winter driving in Alaska had almost none of the high speed, high acceleration rate driving represented in EPA's revised certification test procedure. As a result, a decision was made to not include the effects of these driving conditions on the emission inventories developed for both Anchorage and Fairbanks.

The collected driving data was used to develop a driving cycle representative of Alaska driving conditions. The approach used to develop the Alaska Driving Cycle was to select a mixture of driving patterns that best represented the overall speed acceleration frequency distribution of the collected dataset. Over 5,000 candidate cycles were created. Adjustments were made to minimize brake wear during decelerations and improve representation of constant speed activity. The resulting cycle was designed to mimic the federal test procedure (FTP) by establishing a cold start, hot start and stabilized mode of operation. Bag 1, the cold start, includes 2 minutes of idle activity and is 500 seconds long. Bag 3 is a repeat of Bag 1 with a hot start instead of a cold start. Bag 2 is 316 seconds long and represents operation between seconds 501 and 816.

Alaska Cold Temperature Vehicle Emission Studies (1998 – 2001)

In the time since the attainment and maintenance planning process began in 1997, two significant studies have been undertaken to better understand the nature of vehicle emissions in Alaska's cold winter climate. The MOA collaborated with ADEC and the Fairbanks

North Star Borough on the design of these studies, both of which were conducted by Sierra Research working under contract with ADEC.

During the winter of 1998-99, Sierra Research conducted a study to quantify emissions from Alaskan vehicles during cold start and idling. They equipped a large van with a modified Horiba IMVETS emissions test system that provided measurements of CO and hydrocarbon (HC) mass emissions on a second-by-second basis. The van could be driven from location to location to test a variety of vehicles representative of the fleet mix in both Anchorage and Fairbanks.

After an initial cold soak of four hours or more at ambient temperature, test vehicles were cold-started and mass emissions were measured for a period of twenty minutes subsequent to start-up. Testing was conducted at ambient temperatures that ranged from -6 °F to +23 °F in Anchorage and -36 °F to +14 °F in Fairbanks.

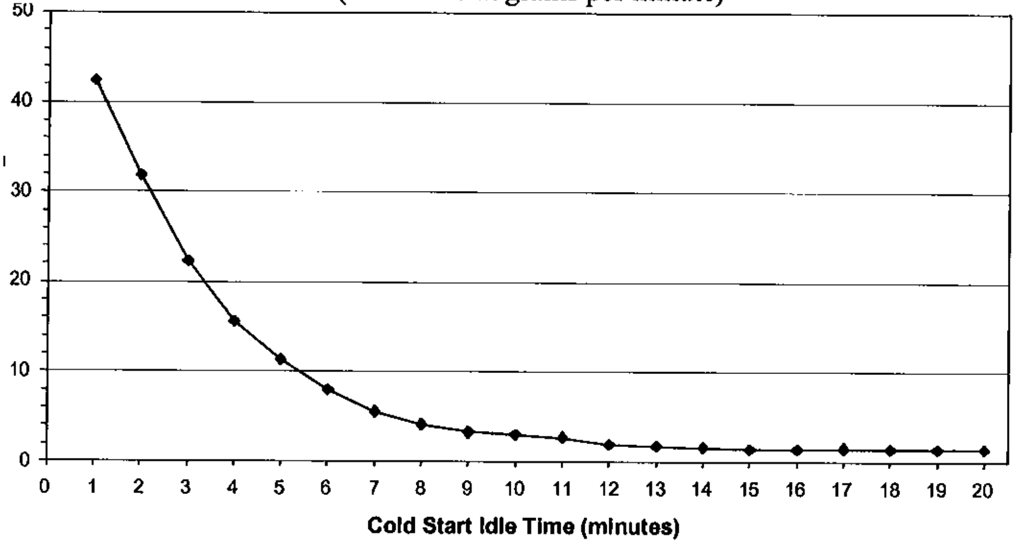
A second, follow-up vehicle emission study was conducted in Fairbanks during the winter of 2000-2001. For this study, Sierra Research procured a vehicle dynamometer that allowed vehicle emissions to be measured in simulated transient or travel mode. Sierra Research performed a gamut of tests on a sample of 35 vehicles selected to represent the Anchorage and Fairbanks fleet mix. These tests included a variety of soak and warm-up times designed to examine the influence of soak and idle times on CO emissions generated during the course of a vehicle trip. Transient mode emissions were evaluated with the dynamometer using the Alaska Drive Cycle to best reflect actual winter-season driving behavior in Anchorage. The emission reduction benefits of engine block heater use were also evaluated.

Key findings from these two studies are summarized below:

- *A large portion of CO emissions occur during warm-up idle.*
  In order to simulate a typical morning commute in Anchorage, CO emissions from cold-started vehicles were measured during the course of a 10-minute warm-up and a subsequent 7.3 mile drive. The warm-up idle accounted for 68% of the total CO emitted.

- *Emissions decrease dramatically during the course of a warm-up idle.*
  Testing showed that idle emissions drop significantly during the first five minutes, especially for newer model vehicles. Figure III.B.3-3 shows the decrease in emissions over time.

Figure III.B.3-3
Cold Start Idle Emission Rate vs. Time
(emissions in grams per minute)



- *Engine block heaters provide very significant reductions in cold start and warm-up idle emissions.*
  Test data showed that, during the first ten minutes of a warm-up idle, the use of an engine block heater reduced CO emissions by an average of 57%. Fuel consumption was reduced by 22% during this same ten-minute period.
- *Anti-idling programs appear to offer little promise of significant CO emission reductions.*
  Test data showed that on an overall trip basis, CO emissions actually increase when warm-up idle times are cut shorter than 10 minutes. When the idle time is cut to 5 minutes, Sierra Research found that overall trip emissions increased by an average of 8%, and by about 20% when the warm-up time was cut to 2 minutes. They also found that there was little or no air quality benefit from turning off a warmed-up vehicle if it was going to be started soon thereafter. For example, they found that turning-off a warmed vehicle during a short (60 minute or less) shopping errand provides no CO air quality benefit. The emissions from a vehicle left running were roughly comparable to a vehicle that was turned off and re-started at the end of the errand.

Anchorage I/M Evaluation Study (2006)

During the winter of 2005-2006, under contract with the MOA, Sierra Research conducted dynamometer emissions testing on over 200 vehicles in order to quantify the CO emission reductions provided by I/M under "real world" conditions in Anchorage.[4] This testing simulated the driving behaviors and temperatures experienced in the winter when CO concentrations are the highest. Vehicles were recruited from owners whose vehicles had recently failed an I/M test in one of Anchorage's 80 privately-operated I/M testing facilities. Vehicles were tested both before and after repair to determine the CO reduction provided by the repair.

Some key findings:

- *The I/M Program is projected to reduce CO emissions from the Anchorage vehicle fleet by approximately 12% in 2010.§*
  This reduction is reasonably consistent with emissions reductions predicted by the EPA model MOBILE6.
- *The I/M Program is less effective in reducing cold start / warm-up idle emissions than reducing emissions from warm vehicles.*
  CO reductions resulting from I/M repairs were more than three times greater during the warm or "running" phase of the Alaska Drive Cycle (ADC) than during the 10 minute idle period following a cold start.
- *The I/M Program is less effective at reducing emissions from newer vehicles.*
  Because newer vehicles emit less CO, I/M repairs on these vehicles yield less benefit. On average, repairing a model year 1996 or newer vehicle that has failed I/M reduces CO by about 5 grams per mile. The repair of model year vehicles between 1990 and 1995 produces an average emission reduction nearly five times greater, about 24 grams per mile.

§ This is the estimated aggregate benefit of I/M. Based on emission testing of over 200 vehicles, Sierra Research estimated that I/M reduction from a *single* cycle of I/M testing and repair to be 5.1% among the fleet subject to I/M. When the effects of multiple I/M testing and repair cycles, seasonal waivers, and pre-inspection repairs were considered, the overall CO reduction benefit for the Anchorage fleet as a whole was estimated to be 12.1%.

Influence of Meteorology on Ambient CO Concentrations

In Anchorage, CO concentrations are highest during the months of November through February. As a high-latitude community, with long winter nights and weak daytime solar insolation, Anchorage frequently experiences strong and persistent temperature inversions that trap CO close to the ground. In mid-winter, due to the short daytime period available for warming and the low sun angle, inversions often persist throughout the day. Inversion strengths as high as +5°F per 100 foot rise in elevation have been measured. When winds are light, there is little vertical or horizontal dispersion of pollutants. Poor dispersion conditions, combined with high emission rates from motor vehicles started in cold temperatures create an environment particularly conducive to developing elevated CO concentrations.

The highest CO concentrations tend to occur on days with low wind speeds, clear or partly cloudy skies, and cold temperatures. Weather conditions during periods when the 8-hour average CO concentrations at the Turnagain site were at or above the 98th percentile are summarized in Table III.B.3-3.** .The average temperature during these periods was 4°F, with a range from -16°F to +18°F. The average wind speed was 2 miles per hour.

It should be noted that Local Climatological Data from the National Weather Service observatory at Point Campbell on the Ted Stevens Anchorage International Airport were used to prepare Table III.B.3-3. Point Campbell is in the extreme western part of Anchorage, adjacent to Cook Inlet. Temperatures there are often moderated by the surrounding water body. Temperatures in east Anchorage, away from the inlet, can sometimes be 10 to 20°F lower than temperatures in west Anchorage. Wind speeds at Point Campbell can also be higher than areas to the east, particularly under a northerly wind regime. Thus, the wind speed and temperatures recorded at Point Campbell may not always accurately reflect conditions elsewhere in Anchorage.

** CO data from Turnagain for the period October 1998 – December 2008 were analyzed to determine the 98th percentile 8-hour average concentration. This was computed to be 5.8 ppm. Table III.B.3-3 provides a summary of weather conditions during 8-hour periods when CO concentrations were equal to or higher than 5.8 ppm.

Table III.B.3-3
Meteorological Conditions during Periods of High CO Concentrations at Turnagain Monitoring Station (8-hour Average >= 98th Percentile)
October 1998 – December 2008

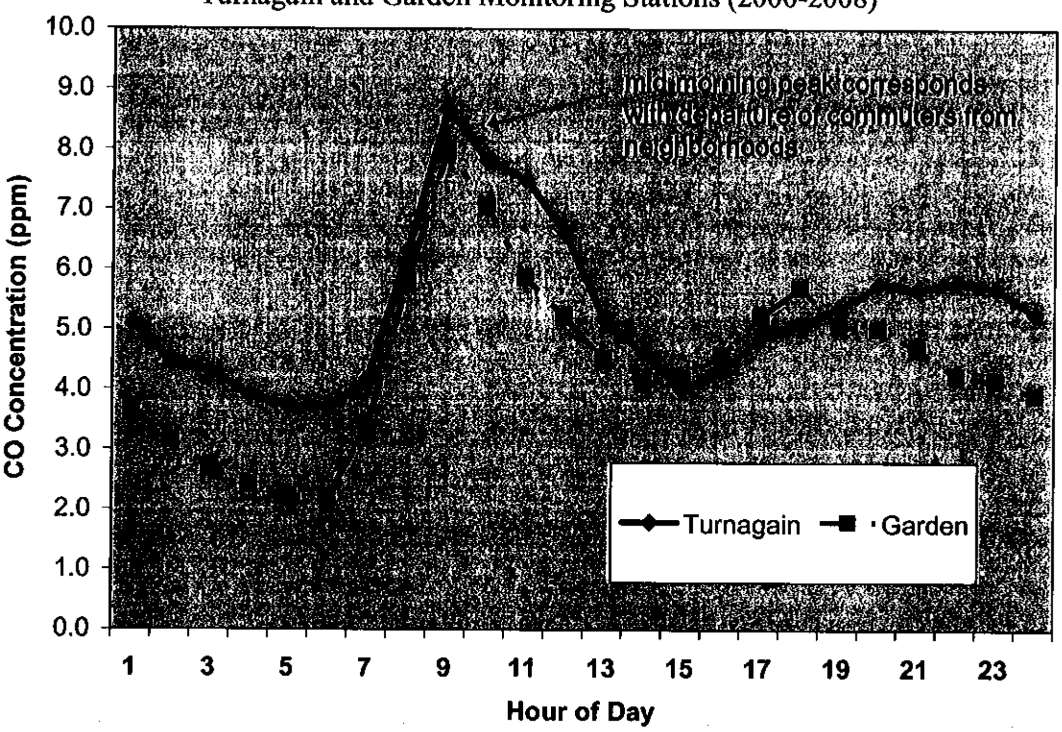
Date	8-hour Average (ppm)	Day of Week	Time of Day	Temp (°F)	Wind Speed (mph)	Sky Cover*
12/16/1998	7.69	Wed	4 PM - 12 AM	2	2	CLR
12/24/1998	8.06	Thu	4 PM - 12 AM	6	0	FEW
1/4/1999	5.90	Mon	4 PM - 12 AM	-1	4	CLR
1/6/1999	10.14	Wed	11 AM - 7 PM	2	2	FEW
2/7/1999	5.80	Sun	10 PM - 6 AM	-9	2	FEW
2/8/1999	7.31	Mon	3 AM - 11 AM	-9	7	SCT
2/11/1999	6.09	Thu	1 AM -9 AM	-16	4	CLR
2/22/1999	6.50	Mon	7 PM - 3 AM	9	3	BKN
2/23/1999	7.61	Tues	4 AM - 12 PM	11	0	OVC
11/10/1999	5.93	Wed	4 AM - 12 PM	10	4	CLR
11/27/1999	7.16	Sat	5 PM - 1 AM	10	1	CLR
12/6/1999	7.24	Mon	6 AM - 2 PM	9	5	CLR
1/15/2000	7.21	Sat	7 PM - 3 AM	2	3	CLR
2/17/2001	6.13	Sat	10 PM - 6 AM	15	2	CLR
11/13/2001	6.13	Tues	7 PM - 3 AM	14	0	SCT
11/14/2001	7.74	Wed	4 AM - 12 PM	12	0	SCT
11/30/2001	5.90	Fri	9 PM - 5 AM	1	2	FEW
12/3/2001	6.30	Mon	8 AM - 4 PM	-3	1	CLR
12/4/2001	5.95	Tues	8 AM - 4 PM	2	3	FEW
12/5/2001	7.23	Wed	7 AM - 3 PM	3	3	BKN
12/7/2001	6.28	Fri	5 PM - 1 AM	-7	3	BKN
12/16/2001	9.78	Sun	12 PM -8 PM	-8	5	SCT
12/18/2001	7.40	Tues	9 AM - 5 PM	-6	3	SCT
1/25/2002	5.86	Fri	4 AM - 12 PM	2	5	CLR
2/6/2002	6.49	Wed	4 AM - 12 PM	18	0	SCT
12/5/2003	8.27	Fri	5 PM - 1 AM	8	2	CLR
1/1/2004	7.48	Thu	2 PM - 10 PM	4	0	SCT
1/3/2004	7.61	Sat	1 PM - 9 PM	11	2	CLR
1/4/2004	7.88	Sun	12 PM -8 PM	6	3	BKN
1/5/2004	8.11	Mon	10 AM - 6 PM	5	0	FOG
1/12/2004	5.87	Mon	5 PM - 1 AM	6	1	FEW
1/17/2006	6.09	Tues	6 AM - 2 PM	8	2	BKN
1/24/2006	6.11	Tues	4 AM - 12 PM	-5	1	SCT
11/29/2006	6.53	Wed	8 AM - 4 PM	14	0	SCT
12/29/08	6.35	Mon	7 AM – 3 PM	-2	0	FEW

* Sky Cover is the fraction amount of sky obscured. CLR = 0, FEW = 1/8 - 2/8, SCT = 3/8 – 4/8, BKN = 5/8 – 7/8, OVC = 8/8

Diurnal Pattern in CO Concentrations

There is a distinct diurnal pattern in ambient CO concentration that corresponds to driving patterns in the vicinity of a monitoring site. Residential neighborhood sites like Turnagain and Garden typically experience their highest concentrations in the mid-morning following the morning commute and accompanying vehicle warm-up idle. Figure III.B.3-4(a) shows the 99th percentile hourly concentration measured at the Turnagain and Garden sites during the winter CO seasons (October-March) in the period 2000-2008. The diurnal patterns observed at these two sites are very similar and implicate cold start and warm-up idling as a significant source of emissions at both sites. CO concentrations rise quickly in the early morning hours as commuters start their cars and leave for work from these two residential neighborhoods. They peak between 9 and 10 a.m. and drop off substantially during the late morning and early afternoon. Concentrations build again somewhat in the evening hours but the evening peak is substantially lower than the morning peak.

Figure III.B.3-4(a)
Diurnal Variation in 99th Percentile Hourly CO Concentrations at
Turnagain and Garden Monitoring Stations (2000-2008)

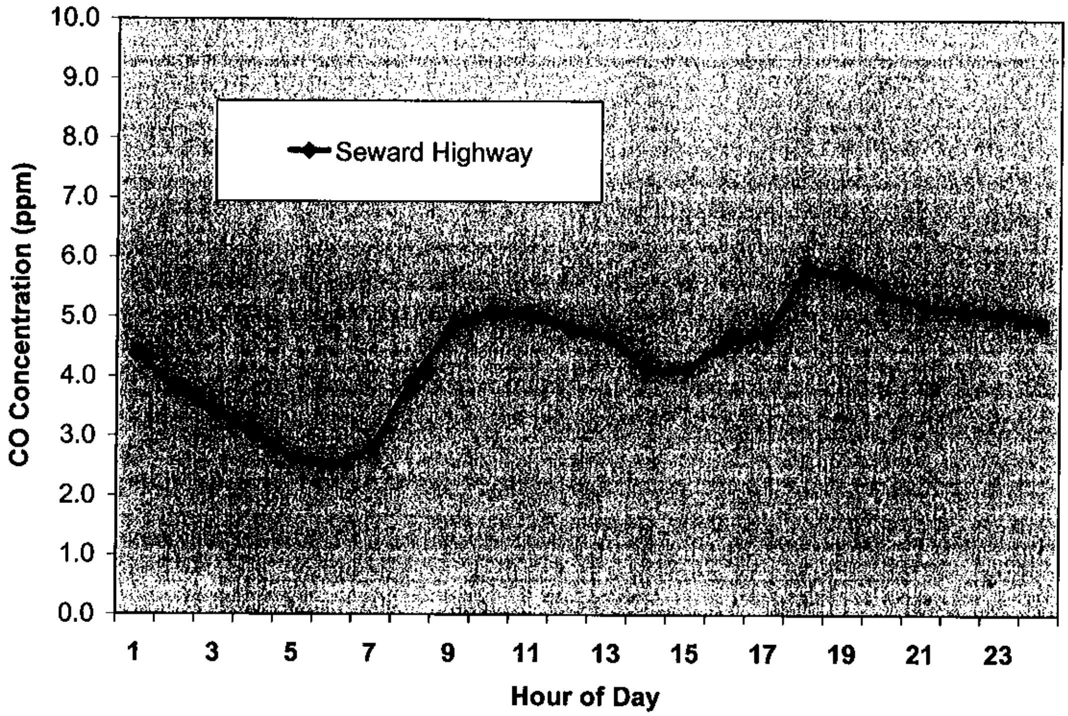


The diurnal pattern in CO concentrations near major traffic arterials is different than residential areas. Figure III.B.3-4(b) shows the diurnal pattern at the Seward Highway station, located at the busy intersection of the Seward Highway and Benson Boulevard†† Although a morning peak is present, the highest concentrations in the day correspond with the evening commute. Concentrations peak between 5 and 6 p.m. and decline slowly

†† The Seward Highway Station was decommissioned on December 30, 2004. This discussion and Figure III.B.3-4(b) therefore are limited to data collected from 2000-2004.

thereafter. Cold start emissions from evening commuters leaving from downtown and mid-town employment centers likely contribute to this evening peak.

Figure III.B.3-4(b)
Diurnal Variation in 99th Percentile Hourly CO Concentrations at Seward Highway Monitoring Stations (2000-2004)



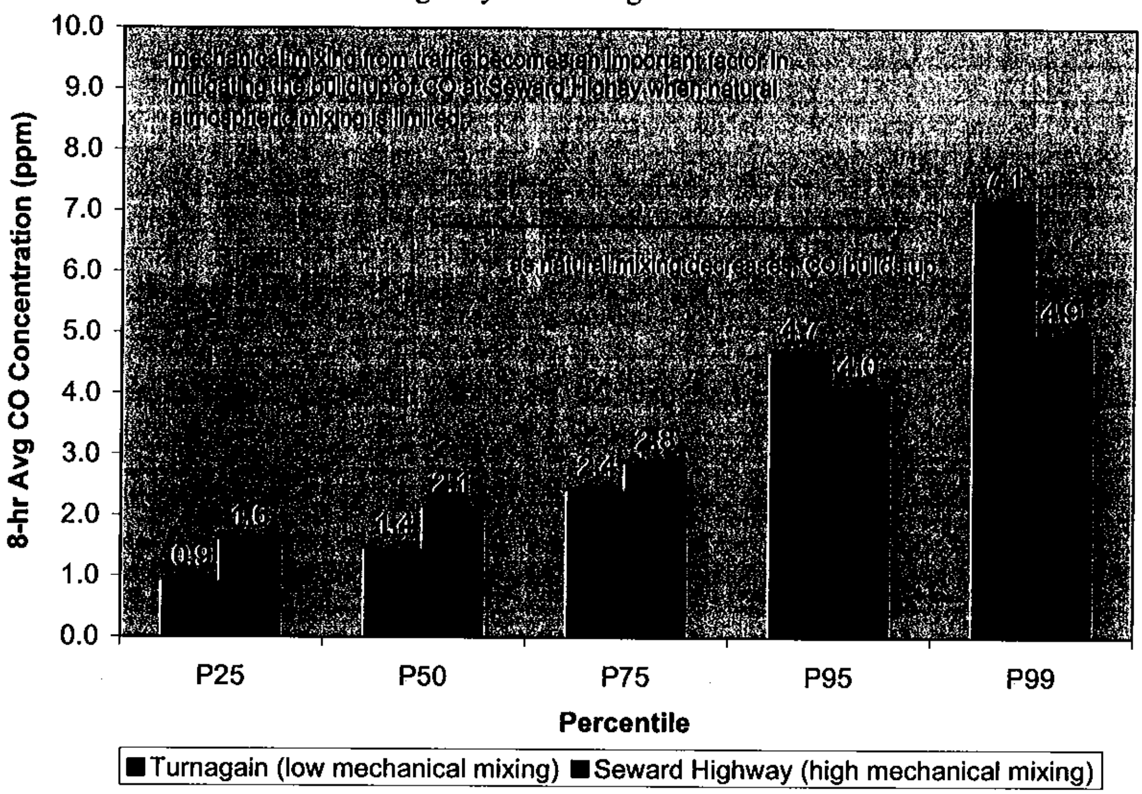
Role of Mechanical Turbulence from Vehicle Traffic in Reducing Ambient CO Concentrations during Stagnation Conditions

As noted to earlier, the highest CO concentrations in Anchorage tend to occur in residential neighborhoods rather than near major roadways where vehicle traffic volumes may be an order of magnitude greater. Although vehicle cold starts result in higher *per vehicle* emission rates in residential areas, total CO emissions in commercial areas in midtown Anchorage are greater due to the shear volume of vehicles traveling along its major roadways. If the ambient CO concentration in a particular area were solely a function of the quantity of emission produced there, CO concentrations near major roadways in midtown Anchorage should be higher than residential areas. Ambient monitoring data indicate that this is not the case.

In testimony given before a National Research Council committee assembled in 2001 to review the CO problem in Fairbanks, Anchorage and other cold climate areas, the MOA posed the hypothesis that mechanical mixing from high-speed vehicle traffic may reduce ambient CO concentrations near major traffic thoroughfares on severe stagnation days.[5] Monitoring data support this hypothesis.

Figure III.B.3-5 compares CO concentrations by percentile at the Seward Highway and Turnagain stations. Traffic volumes are an order of magnitude greater near the Seward Highway station than the Turnagain station. On days when natural atmospheric mixing from wind and thermal convection is good, the additional mixing provided by mechanical turbulence of vehicle traffic at Seward Highway is relatively unimportant. Under these conditions one would expect CO concentrations at Seward Highway to be higher than those at Turnagain because traffic and CO emissions are so much greater. Indeed, the lower quartile (P25) and median (P50) concentration are considerably higher at Seward than Turnagain. However, when a strong ground-based temperature inversion and lack of wind create very poor natural atmospheric mixing, mechanical mixing from vehicle traffic appears to be a very important factor in mitigating the build up of high CO concentrations. Under these extreme meteorological conditions concentrations at Turnagain are much higher than those at Seward Highway. The 99th percentile (P99) CO concentration at the Turnagain station is more than 40% higher than the Seward Highway station.

Figure III.B.3-5
Effect of Mechanical Mixing on CO Concentrations at
Seward Highway and Turnagain Stations



Carbon Monoxide Trends

In 1983, CO levels in Anchorage exceeded the NAAQS at one or more monitoring sites on 53 days. During midwinter months in the early 1980's, a violation of the NAAQS was measured roughly one-in-four days. However CO concentrations have fallen dramatically over the past twenty years. No violations have been measured since 1996. Single exceedances of the NAAQS were measured in 1998, 1999 and 2001 but these are not considered violations because the NAAQS allows up to one exceedance per calendar year. No exceedances were measured in 1995, 1997, 2000, or between 2002 and 2008.

The highest and second highest 8-hour averages for five Anchorage monitoring stations are tabulated by year, 1980 – 2008, in Table III.B.3-5. The number of days exceeding the NAAQS at each station is also tabulated. Dramatic declines in CO have occurred in Anchorage over the past three decades.

Data from the 7th & C Street, Jewel Lake and Bowman, and 8th and L stations are not tabulated. Monitoring at 7th & C was discontinued in 1995 because concentrations there were the lowest in the network. The Jewel Lake station went into operation in October 2002 and was discontinued in March 2004 because concentrations measured there were lower than the other monitors operating in the network. The Bowman station in South Anchorage was operated from January 2006 through March 2007. It was discontinued because it too had low CO concentrations. The 8th and L station has only been in operations since October 2007.

The trend in the second highest 8-hour average concentration or second maximum measured in each calendar year is often used to measure improvements in CO air quality and progress toward attainment of the NAAQS. The second maximum is statistically more robust (i.e., less prone to year-to-year fluctuation) than the first maximum, making it easier to discern long-term air quality trends. The second maximum is also a direct measure of compliance with the NAAQS. A community is considered to be in compliance if the second maximum at all monitoring stations is below 9.5 ppm.

Table III.B.3-5

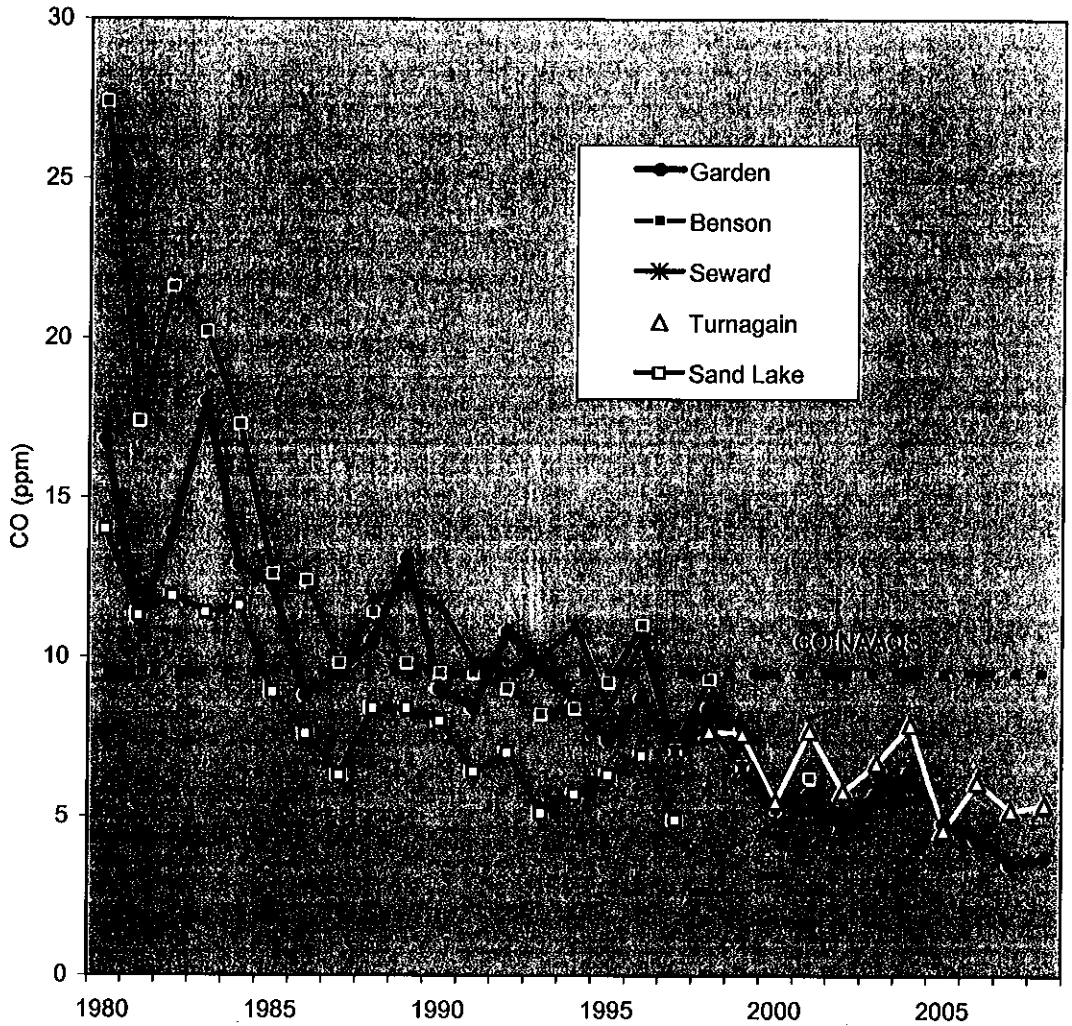
Summary of CO Data from Anchorage Monitoring Stations (1980 –2008)

	Benson (microscale) 2902 Spenard Road			Garden (neighborhood) 3000 E 16th Street			Sand Lake (neighborhood) 3426 Raspberry Road			Seward (microscale) 3002 New Seward Highway			Turnagain (neighborhood) 3201 Turnagain Street		
Year	**max**	**2nd max**	**# days ≥9.5**	**max**	**2nd max**	**# days ≥9.5**	**max**	**2nd max**	**# days ≥9.5**	**Max**	**2nd max**	**# days ≥9.5**	**max**	**2nd max**	**# days ≥9.5**
1980	27.4	26.3	39	17.1	16.8	21	14.0	14.0	6	--	--	--	--	--	--
1981	17.4	16.2	33	12.6	11.2	7	12.6	11.3	5	--	--	--	--	--	--
1982	21.6	18.1	30	15.6	13.9	14	16.6	11.9	3	--	--	--	--	--	--
1983	20.2	16.0	48	19.6	18.0	24	11.5	11.4	7	--	--	--	--	--	--
1984	17.3	17.1	27	13.0	12.9	6	12.6	11.6	5	--	--	--	--	--	--
1985	12.6	12.4	9	12.7	12.2	4	9.2	8.9	0	--	--	--	--	--	--
1986	12.4	11.7	5	10.5	8.8	1	8.1	7.6	0	--	--	--	--	--	--
1987	9.8	8.6	1	10.7	9.5	1	8.1	6.3	0	--	--	--	--	--	--
1988	11.4	10.4	3	11.8	10.5	2	8.5	8.4	0	12.3	11.8	9	--	--	--
1989	9.8	9.6	2	14.0	13.1	2	10.0	8.4	1	14.0	12.2	5	--	--	--
1990	9.5	9.4	1	9.8	9.0	1	8.8	8.0	0	13.0	11.6	11	--	--	--
1991	9.5	8.1	0	8.9	8.4	0	6.7	6.4	0	11.5	9.8	3	--	--	--
1992	9.0	8.8	0	10.9	10.8	2	7.1	7.0	0	10.4	9.5	2	--	--	--
1993	8.2	7.6	0	10.0	9.7	2	8.8	5.1	0	10.4	9.9	2	--	--	--
1994	8.4	8.3	0	9.4	8.6	0	5.8	5.7	0	11.3	11.0	2	--	--	--
1995	9.2	7.6	0	8.4	7.4	0	6.7	6.3	0	9.0	8.4	0	--	--	--
1996	11.0	9.6	3	8.9	8.7	0	7.7	6.9	0	10.8	10.5	3	--	--	--
1997	7.1	6.8	0	7.3	7.1	0	5.9	4.9	0	7.3	7.0	0	--	--	--
1998	9.3	8.2	0	9.5	8.4	1	--	--	--	9.4	7.9	0	8.1*	7.7*	0*
1999	6.6	5.9	0	8.2	7.8	0	--	--	--	7.5	6.5	0	10.1	7.6	1
2000	5.2	4.7	0	5.8	5.4	0	--	--	--	5.2	4.8	0	7.2	5.5	0
2001	6.2	5.7		6.1	5.7	0	--	--	--	5.4	5.2	0	9.8	7.7	1
2002	--	--	--	4.7	4.6	0	--	--	--	5.4	4.7	0	6.4	5.8	0
2003	--	--	--	6.1	5.7	0	--	--	--	6.2	5.4	0	8.3	6.7	0
2004	--	--	--	6.8	6.4	0	--	--	--	5.8	5.5	0	8.1	7.9	0
2005	--	--	--	4.8	4.8	0	--	--	--	--	--	--	5.7	4.6	0
2006	--	--	--	5.1	4.3	0	--	--	--	--	--	--	6.5	6.1	0
2007	--	--	--	4.0	3.5	0	--	--	--	--	--	--	5.5	5.3	0
2008	--	--	--	4.0	3.7	0	--	--	--	--	--	--	6.3	5.4	0

* Incomplete year of data. In 1998 Turnagain station began operations in mid-October.

Annual second maximum concentrations recorded from these five sites are plotted in Figures III.B.3-6. Available data from 1980-2008 are plotted. The Garden station, located in an east Anchorage residential area provides the longest data record in the network. CO concentrations at Garden declined by 76% during this 29 year period. Benson, Sand Lake and Seward Highway experienced similar declines.

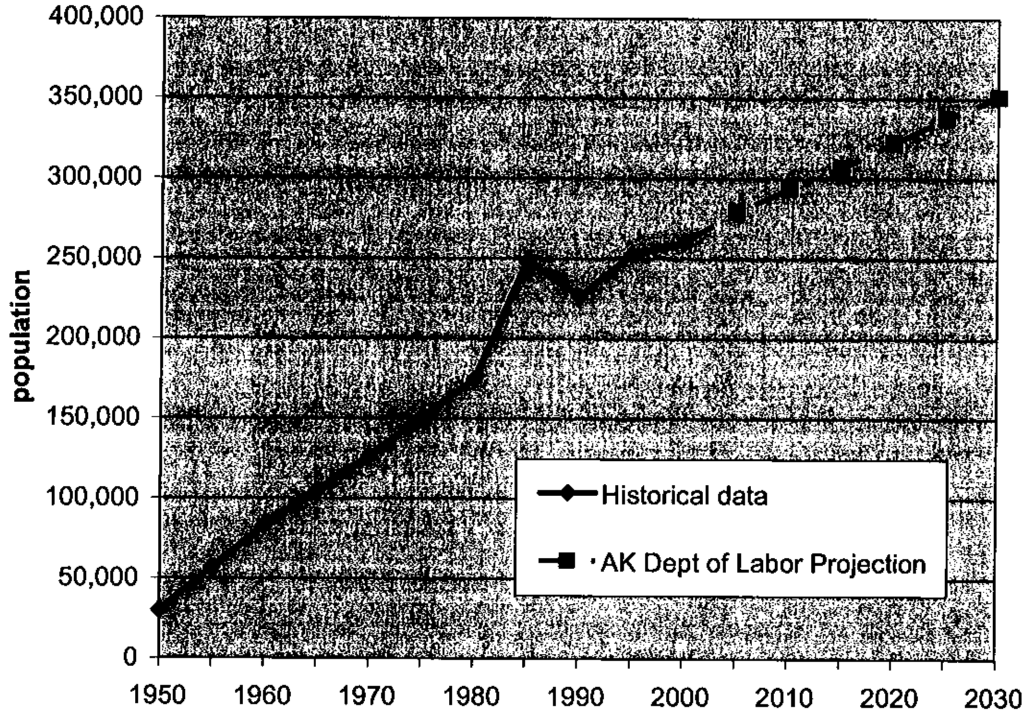
Figure III.B.3-6
Trend in 2nd Maximum 8-hour CO Concentration at Anchorage CO Monitoring Stations 1980 - 2008



Population Growth

Located in a state that has been historically subject to short-term cycles of economic booms and recessions, the Anchorage area has experienced a slowing, but stable pattern of long-term population growth in recent years. Between 1950 and 1990 the average rate of growth was nearly 5,000 persons per year. Growth between 1990 and 2008 slowed to about 3,500 per year. Growth over the next twenty years is expected to further slow to about 2,900 per year, slightly under 1% per annum. Figure III.B.3-7 depicts historic and projected population growth in the Municipality of Anchorage.‡‡

Figure III.B.3-7
Population Growth and Projected Growth and in Anchorage, Alaska



Sources: U.S. Census (1950 -2000), Alaska Department of Labor (projections 2010 – 2030)

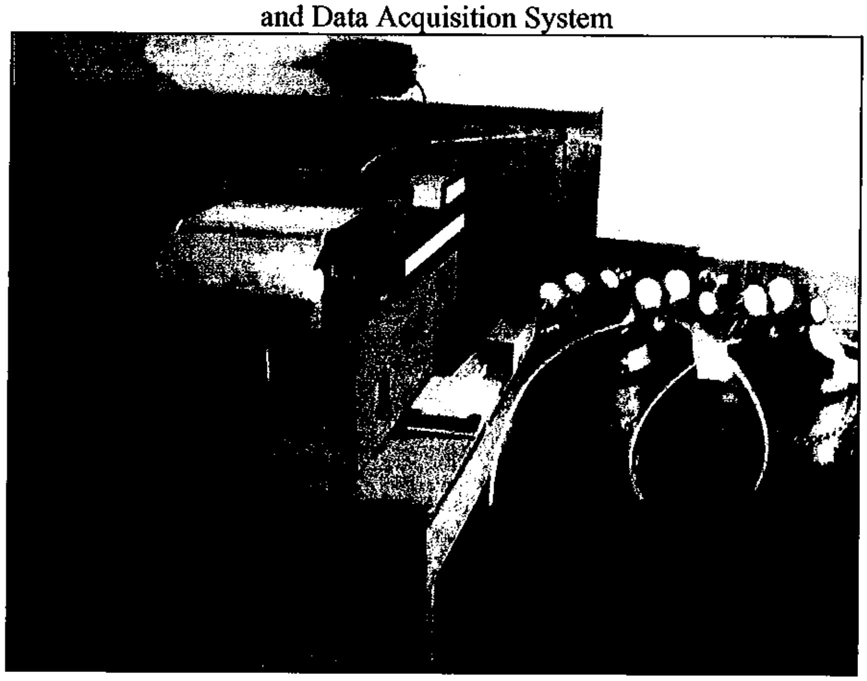
‡‡ Figure III.B.3-7 includes population outside the Anchorage bowl but within the Municipality of Anchorage. Thus, the Eagle River-Chugiak and Girdwood areas are included.

III.B.4. Carbon Monoxide Monitoring Program

Although emission projections are used to track reasonable further progress (RFP), it is actual ambient air quality monitoring data that determine whether or not an area meets the NAAQS. The difficulty with using ambient monitoring data to assess trends is the fluctuation in pollution concentrations caused by daily, weekly, and yearly variations in meteorological conditions, traffic levels, and other factors. However, it is important to monitor and compare ambient air quality concentrations to modeled emission projections to determine if the projections are reasonable and credible. Section 110(a)(2)(B)of the CAAA (42 U.S.C. 7410(a) (2) (b)) requires that each implementation plan submitted to EPA provide for the establishment and operation of "appropriate devices, methods, systems, and procedures necessary to monitor, compile, and analyze data on ambient air quality."

The Anchorage CO monitoring network is currently comprised of four sampling stations. The MOA uses TECO48 CO analyzers at each station (Figure III.B.4-1). These instruments meet all specifications required by the EPA for ambient CO monitoring and are designated by the EPA as a "reference method" for CO.

Figure III.B.4-1
TECO 48 CO Analyzer with Strip Chart Recorder
and Data Acquisition System



The monitoring network is operated 24 hours a day from October 1 through March 31. Hourly averages of CO levels are provided from each station in the network. These data are uploaded to a central computer every weekday. Data are submitted to EPA on a quarterly basis for inclusion in the nationwide air quality database known as AQS. CO monitoring is conducted in conformance with guidelines established in federal regulations, EPA guidance and instrument manufacturer recommendations. Third party instrument performance audits are conducted by EPA and/or ADEC quarterly.

The locations of the stations in the CO monitoring network are described in Table III.B.4-1. The purpose of this network is to characterize the range of CO exposures experienced by Anchorage residents. By analyzing pollution concentration trends over time, CO monitoring stations can also serve to assess the effectiveness of strategies designed to reduce air pollution emissions and improve air quality. Each monitoring station was selected in accordance with guidelines established by the EPA. As more has been learned about the nature of the CO problem in Anchorage, more emphasis has been placed on monitoring CO levels in neighborhoods.

Table III.B.4-1

Description of Anchorage CO Monitoring Sites

Location	Site Description
Turnagain (active)	Monitoring began at this neighborhood-scale site in October 1998 CO concentrations measured here were the highest of the twenty sites monitored during a saturation monitoring study conducted in the winter of 1997-98. It now exhibits the highest concentrations of the current network. It exceeded the NAAQS once in 1999 and 2001..
Garden (active)	Monitoring began at this residential neighborhood location at 16th and Garden Street in 1979. In the early 2000's, Garden typically recorded higher peak concentrations than the micro-scale sites at Seward Highway and at Benson.
Parkgate (active)	Monitoring began at this middle-scale site in Eagle River (approx 10 miles north of Anchorage) in December 2005. Thus far, concentrations appear to be low relative to other active sites (i.e., Turnagain, Garden) in the network.
8th and L Street (active)	Monitoring began at this middle-scale site in downtown Anchorage in October 2007. Thus far, concentrations appear to be low relative to other active sites in the network.
7th & C Street (discontinued)	This station was located mid-block between 6th and 7th Avenue on C Street. Monitoring began here in 1973 and was discontinued in 1995. The last exceedance at this site was recorded in 1990.
Benson (discontinued)	Monitoring began at this micro-scale site on the southwest corner of Spenard Road and Benson Blvd in 1978. This site frequently recorded exceedances of the NAAQS in the late 1970's, 1980's and early 1990's. The last exceedance was measured here in 1996. Benson was decommissioned in December 2001 when it became evident that the Seward Highway site exhibited higher concentrations.
Sand Lake (discontinued)	Monitoring began at this neighborhood-scale site in 1980 and was discontinued in March 1998. This station was located on Raspberry Road approximately 0.3 miles east of Jewel Lake Road in west Anchorage. The last exceedance was recorded here in 1989.
Seward Highway (discontinued)	Monitoring began at this micro-scale site, located on the southwest corner of the intersection of Benson Blvd. and Seward Highway, in October of 1987. In the late 80's and early 90's this site frequently measured exceedances of the NAAQS. However, no exceedances were measured after calendar year 1996. This station was decommissioned in December 2004 when it became clear that future exceedances at this site were unlikely and the highest CO concentrations were occurring in residential areas.
Jewel Lake (discontinued)	Monitoring began here at this neighborhood-scale site in west Anchorage in October 2002 and was discontinued in March 2004 because CO concentrations were lower than the other three sites in the network.
Bowman (discontinued)	Monitoring at this neighborhood-scale site in south Anchorage was conducted between January 2006 and March 2007. Monitoring was terminated when it became apparent that CO concentrations were very low at this site.

The locations of the monitoring sites are shown on the maintenance area boundary map (Figure III.B.2-1) in Section III.B.2.

Continued Monitoring

The Clean Air Act Section 110(a)(2)(B) (42 U.S.C. 7410(a)(2)(B)) requires implementation plans to provide for the "establishment and operation of appropriate devices, methods, systems, and procedures necessary to monitor, compile, and analyze data on ambient air quality…." The MOA is committed to the continued operation of this network. Three saturation monitoring studies have been conducted by the MOA to assess the adequacy of the monitoring network. The 1997-98 saturation study resulted in the establishment of the Turnagain Station in west Anchorage. Any changes to the monitoring network are discussed in advance with the ADEC and EPA Region 10. The EPA Administrator has final authority on the placement of monitoring sites.

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III.B.5 Transportation Control Strategies

Control Measures Implemented as a Consequence of the 2004 Maintenance Plan

This section discusses the control measures implemented in fulfillment of commitments of the maintenance plan approved by the EPA in 2004 and previous attainment and maintenance plans. The Anchorage 2004 maintenance plan included I/M, the Share-A-Ride and Vanpool programs, and public awareness and incentive programs that encourage the use of engine block heaters to reduce cold start CO emissions.

The current status of these programs is described in the sections below. Note that this section includes a description of the I/M Program as it existed in 2007 when "new" vehicles were exempted for the first four years after initial purchase. In January 2010 this exemption was extended to six years. MOA's commitment to continued operation of I/M will cease upon approval of this document as a revision to the SIP.

The CO reductions from all the programs listed below were estimated for calendar year 2007 using a MOBILE6-based modeling approach.

Vehicle Emissions I/M Program

Program Description - The MOA I/M program was implemented in July 1985 as a primary control measure in the 1982 air quality attainment plan. It has been included in all subsequent attainment and maintenance plans approved by the EPA including the maintenance plan approved in 2004. The MOA administers the program in cooperation with the ADEC. The basic design includes a decentralized test and repair program with both idle and 2500 rpm tests for model year vehicles 1968-1995 and OBDII§§ testing for 1996 and newer vehicles. The current program requires biennial testing but exempts new vehicles for the first four years after purchase.*** According to an independent evaluation by Sierra Research in 2001, the Anchorage I/M program was rated among the best decentralized programs in the country.[6]

Cut points - CO emission cut points, the maximum tailpipe CO emission concentration allowed in a passing I/M test in Anchorage, are generally more stringent than the federal warranty limit of 1.2%. Cut points by vehicle category, as defined in Table 1 of AAC52.037(b),are:

Light Duty Gasoline Vehicles (LDGV)

	Idle	2500 RPM
1968-1971	5.0%	4.0%
1972-1974	4.0%	3.0%
1975-1980	2.0%	2.0%
1981-1993	1.0%	1.0%
1994 and newer	0.5%	0.5%

§§ OBDII refers to the second generation of On-board Diagnostic Systems on vehicles. OBDII was required on all MY 1996 and newer vehicles and allows I/M technicians to determine whether a vehicle's emission testing system is working properly by interrogating the OBDII computer on the vehicle.

*** The I/M Program was modified slightly in January 2006 to expand the new car I/M testing exemption from two years to four years. The Municipality and the State submitted SIP revisions supporting the four-year test exemption to the EPA in 2006.

Light Duty Gasoline Trucks (LDGT1 and LDGT2)

	Idle	2500 RPM
1968-1972	5.0%	4.0%
1973-1978	4.0%	3.0%
1979-1983	2.0%	2.0%
1984-1993	1.0%	1.0%
1994 and newer	0.5%	0.5%

Anchorage has also implemented a hydrocarbon cut point of 220 ppm for 1994 and newer vehicles.

Test Equipment and Procedures - Beginning in January 2000, BAR90 test analyzer systems in the MOA were replaced with emission inspection systems with BAR97-grade hardware. Although these systems do not perform functional gas cap or loaded mode testing, the BAR97 upgrade provides significant improvements in measurement accuracy particularly at lower concentrations of CO. The new systems include dilution correction capability that reduces the possibility of a vehicle being falsely passed due to accidental or intentional dilution of the exhaust gas being analyzed. The new emission inspection system also includes an enhanced Internet-based communications system and Vehicle Information Database (VID) that facilitates the proper identification of the vehicle being tested. This system also provides for on-line oversight and scrutiny of the mechanics conducting emission tests. Presumably, these upgrades have resulted in an overall improvement in the identification of vehicles requiring repair, improved the quality of the emission tests, and consequently reduced CO emissions. In addition, mandatory OBDII testing was implemented on July 1, 2001, ahead of the EPA mandated implementation date.

Enforcement - Working with ADEC, the MOA has implemented a number of changes to improve the effectiveness of enforcement against program evaders. ADEC has conducted parking lot surveys in Anchorage[7] that suggest that up to 10% of the vehicles operating in Anchorage could be evading I/M requirements. In January 2000, in cooperation with ADEC, the MOA implemented a windshield sticker program that allows for easier and more obvious identification of vehicles that may be evading I/M requirements. The windshield sticker program supplements the registration denial program already in place. The windshield sticker program is discussed in 18 AAC 52.020 and 18 AAC 52.025.

Enhancements in Mechanic Training and Certification - Mechanic training and certification has been a part of the MOA I/M program since its inception. I/M mechanics are required to complete classroom and hands-on training and pass a test prior to being certified to perform tests in the MOA program. More recently, the MOA worked in consultation with ADEC to implement an additional technician training and certification program (TTC). TTC was included as a contingency measure in the MOA element of the SIP. Violations in 1996 triggered this measure. The MOA worked with ADEC to develop a comprehensive 40-hour training course.

Estimated CO Reduction – A MOBILE6-based method was used to model the estimated CO reductions from I/M in 2007. Modeled benefits of the MOA program exceed the basic I/M performance standard stipulated in the CAAA. In 2007, the I/M program reduced area-wide CO emissions in Anchorage by an estimated 11.6 tons per day, about 15% of total vehicle emissions. Attributes of the MOA program are summarized in Table III.B.5-1.

Table III.B.5-1 Attributes of Anchorage I/M Program in 2007	
Program Element	**Year 2007 Anchorage Program**
Network type	Decentralized
Start date	July 1, 1985
Inspection frequency	Biennial, exemption for newest 4 model years
Model year coverage	1968 and newer
Vehicle type coverage*	LDGV, LDGT1, LDGT2, HDGV
Test type	Two-speed idle (1995 and older) OBDII (1996 and newer)
Emission cut points	More stringent than federal limits
Under hood inspection**	Comprehensive visual and functional checks
Pre-1981 stringency	23%
Waiver rate	0%
Compliance rate	90%
Assumed program effectiveness (relative to centralized)	85%
% Reduction in vehicle emissions (2007)	14.8%
Estimated CO Reduction in Year 2007	11.6 tons per day

* LDGV = light-duty gasoline vehicles, LDGT = light-duty gasoline trucks, HDGV = heavy-duty gasoline trucks.

** Visual and functional tests are not required for 1968-74 model year vehicles. For 1996 and newer vehicles, visual and functional tests are limited to catalyst and oxygen sensor inspection. 1975-1995 vehicles receive a comprehensive visual and functional test.

Share-A-Ride Program

Program Description – The Anchorage Share-A-Ride Program provides carpool and vanpool services to individuals travelling within or commuting to Anchorage. Carpooling was first identified as a CO control strategy in the 1982 MOA air quality plan. The vanpool program began in 1995. The Share-A-Ride Program was included in the 2004 CO Maintenance Plan as primary control measure. Carpooling and vanpooling programs are supported with Congestion Mitigation / Air Quality funding from the Federal Highway Administration.

In 2007, there were 365 individuals and 181 carpools actively participating in the program. The vanpool program has experienced substantial growth since its inception and there is an on-going demand for more vanpools especially among long distance commuters living outside of Anchorage in the Matanuska Susitna Valley, Eagle River-Chugiak and Girdwood. Table III.B.5-2 shows the growth that has occurred in the vanpool program over the last decade. In 2007 there were 42 vanpools and 589 vanpool riders; by 2008 this number had increased by another 20%.[8]

Table III.B.5-2 Vanpool Program Participation (1996-2008)		
Year	**Number of Vanpools**	**Number of Vanpoolers**
1996	9	126
1997	10	137
1998	11	151
1999	14	184
2000	18	231
2001	18	260
2002	21	270
2003	23	323
2004	24	363
2005	24	375
2006	41	569
2007	42	589
2008	52	810

Estimated CO Reduction – In 2007, based on program statistics, the carpooling and vanpooling components of the Share-A-Ride program eliminated approximately 800 cold starts and 10,000 miles of travel per day from the Anchorage roadway network. This resulted in an estimated CO reduction in the Anchorage maintenance area of approximately 0.25tons per day or about 0.3% of motor vehicle emissions.

Promotion of Engine Block Heater Use Prior to Vehicle Cold Starts

Program Description - Testing performed as part of the Alaska Cold Start and Idle Emission Study during the winters of 1998-99 and 2000-2001 showed that the use of an engine block heater reduced CO emissions by an average of 57% over the course of a 10-minute cold start and idle.[9] Survey data show that over three-quarters of the vehicles in the MOA are equipped with block heaters.[10] Because cold starts and warm-up idling make up such a large portion of Anchorage's CO emissions, particularly in residential neighborhoods, significant reductions could be realized if motorists were convinced to use their engine block heaters prior to their morning commute.

Beginning with the winter of 1999-2000, television commercials, radio advertising, and newspaper inserts have been used to promote the advantages of using a block heater. In addition to reducing air pollution, using a block heater results in easier start-ups, reduced engine wear-and-tear, and a shorter time for the heater and defroster to work. All of these advantages have been emphasized in campaigns over the past several winters. Beginning in the winter of 2004, the MOA initiated the Plug@20 public awareness campaign, encouraging vehicle owners to plug-in their block heaters whenever temperatures drop below 20 °F. Television, radio, and print media along with targeted advertising have been employed. Plug@20 is now highly recognizable among Anchorage residents.

In addition, the MOA and ADEC have provided additional incentives to encourage residents to plug-in. Since the winter of 1999-2000, nearly 10,000 programmable electrical timers, designed to turn block heaters on two-to-three hours prior to the morning commute, have been distributed free-of-charge to Anchorage residents. In addition, beginning in the winter of 2002-2003, and continuing on for the four following winters, residents who owned vehicles without block heaters could have them installed for a nominal charge of $25. By the time this program ended in December 2006, over 8,000 block heaters had been installed in Anchorage vehicles.

Annual telephone surveys have been conducted at the conclusion of each winter since 2000 to assess the effectiveness of the block heater promotion and incentive programs. These surveys suggest that the public awareness and incentive programs have had a positive effect on block heater usage. Residents who have taken advantage of the programmable timers and/or block heater installations have a greater inclination to plug-in. Survey data suggest that, even for those who have not received incentives, plug-in rates have increased as a result of TV, radio and print media advertising.

Estimated CO Reduction – Annual telephone survey data indicate that over 70% of respondents saw or heard the television or radio ads. Survey results suggest that plug-in rates have doubled from about 10% from October 1999 to about 20% in 2007. Survey data indicate that plug-in rates among those who have received either a free timer or subsidized block heater installations approach 50% when temperatures fall to 10°F or colder.

In 2007, on an area-wide basis, the increase in plug-in rates resulting from incentives and promotions provided an estimated CO reduction of about 0.5 tons per day. This amounts to a 0.6% reduction in area-wide vehicle emissions. The impact of block heater promotion and incentives in residential areas is likely greater because cold start emissions are a more significant part of total emissions. In neighborhoods with large numbers of vehicles parked outside, increases in block heater plug-in rates may play a significant role in reducing CO emissions from the morning commute. Some of the highest CO concentrations in Anchorage are experienced in these neighborhoods on cold winter mornings.

Combined Impact of Control Programs on Base Year 2007 CO Emissions

In the year 2007, the combined reduction of the three CO control programs described above was 12.3 tons per day. These programs reduced daily motor vehicle CO emissions from an estimated 79.4 tons per day to 67.1 tons per day. Reductions are summarized in Table III.B.5-3

Table III.B.5-3
Combined Reduction from Locally Implemented CO Control Programs in Anchorage (2007)

Control Program	**Estimated CO Reduction (tons per day)**
I/M Program	11.61
Share-A-Ride Program (carpool and vanpool)	0.25
Engine Block Heater Promotion	0.49*
Cumulative Benefit of Control Measures	**12.3**
% Reduction in Motor Vehicle Emissions	**15.5%**

* This is the estimated *incremental* benefit of an increased plug-in rate resulting from block heater promotion campaign and incentives. The total benefit of all block heater use is estimated to be about one ton per day.

Stationary Source Program

The CAAA section 172 (c) requirements for nonattainment areas do not apply to maintenance areas. The requirements for reasonable further progress, identification of certain emissions increases and other measures needed for attainment do not apply, because these measures only have meaning for areas not attaining the standard. Under this maintenance plan, the requirements of CAAA Part D, New Source Review (NSR) no longer apply as they did under nonattainment. Upon redesignation to maintenance, the prevention of significant deterioration (PSD) program replaces the NSR program requirements for major stationary sources. Section 302 of the CAAA (42 U.S. C. 7602) defines a major stationary source as any stationary facility or source of air pollutants that directly emits, or has the potential to emit, 100 tons per year of any pollutant.

Given the fifteen year timeframe evaluated in this maintenance plan, a growth allowance has been applied to stationary source emissions. Stationary source emissions increase in proportion to projected population growth. This is a conservative assumption; no future improvements in CO emission control technology for these sources have been assumed.

Permits for construction and operation of new or modified major stationary sources within the maintenance area must be approved through the PSD program. Within the MOA, ADEC is responsible for issuing construction and Title V operating permits. ADEC has incorporated the requirements for PSD in 18 AAC 50, Article 3.

Primary Control Measure Commitments for the 2008 – 2023 Maintenance Plan Period

Section III B.6 contains an analysis of Anchorage maintenance prospects during the 2008-2023 maintenance plan period. The most significant revision in this plan from previous maintenance plans submitted to EPA is the deletion of the commitment to I/M as a primary CO control measure. Even if I/M continues to operate as a "local option," because the commitment to IM in the SIP has been removed, the CO reduction provided by I/M is assumed to be zero after 2010. The impact of eliminating the I/M Program on overall CO emissions in Anchorage and on the probability of continued maintenance of the CO NAAQS will be discussed in Section III.B.6.

Under this Maintenance Plan, the probability of complying with the NAAQS is estimated to be 99% or higher each year during the period 2008-2023. In other words, even with deletion of I/M as a primary control measure., there is less than a 1-in-100 chance of violating the standard in any year.

Primary CO Control Measures

Three primary control measures will be implemented during the 2008-2023 maintenance plan period. These include air quality public awareness, transit marketing, and the ridesharing and vanpooling program. Because all of these programs rely on voluntary participation by the public in order to realize emission reductions, the CO reduction benefits of these programs were ignored in the analysis of maintenance prospects discussed later in Section III.B.6.†††

The status of these four programs in the 2008-2023 maintenance planning period is discussed in more detail below.

Air Quality Public Awareness

Air quality public awareness was a key air quality improvement strategy and primary measure of the 2004 maintenance plan and this effort will continue. Survey data suggest that public awareness campaign efforts over the past eight years have resulted in measureable changes in engine block heater plug-in rates among Anchorage motorists. Air quality public awareness is supported by congestion mitigation / air quality funds from the Federal Highway Administration. Future funding is programmed in the 2010-2013 Anchorage Transportation Improvement Program (TIP). The public awareness effort is expected to broaden into other areas where changes in public behavior can result in improvements in CO air quality. Some of these areas include:

- Promotion of alternatives to the single occupancy vehicle such as bicycling, walking, public transit, car and vanpooling, telecommuting, and electronic meetings and conferencing.‡‡‡

††† Generally speaking, the benefits of voluntary strategies are less certain. EPA guidance recommends excluding anticipated pollutant reductions from voluntary measures when analyzing prospects for compliance with the NAAQS. The EPA guidance regarding voluntary measures can be found in *Incorporating Emerging and Voluntary Measures in a SIP,* U.S. EPA, September 2004.

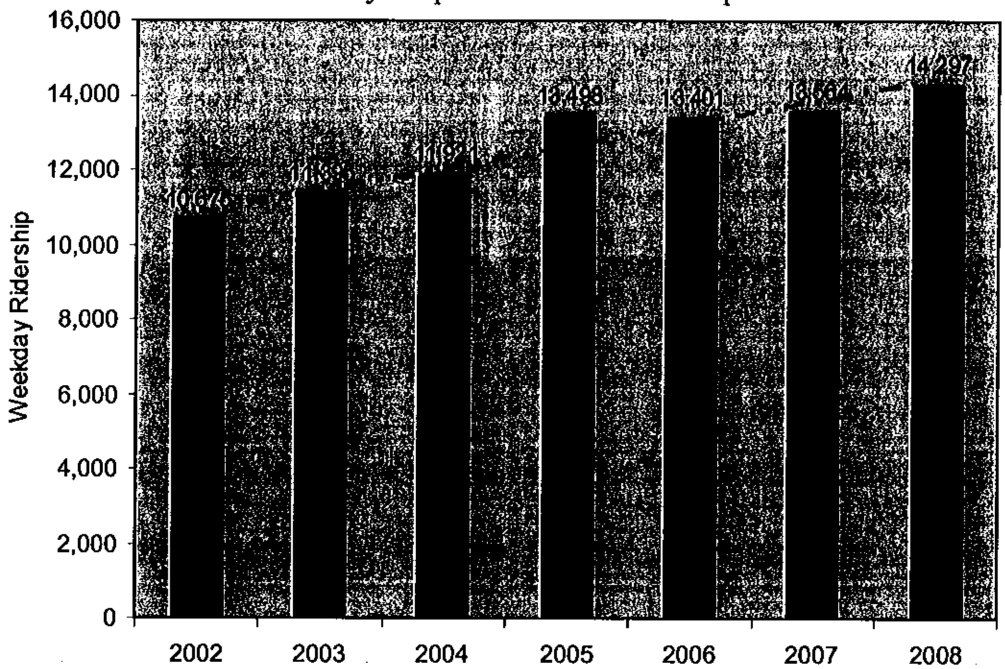
‡‡‡ One important factor in the successful promotion of bicycling, walking and transit is providing safe and accessible routes for pedestrians and cyclists. This means making routes available that minimize conflicts with motor vehicle traffic and clearing snow promptly in the winter. Safe routes to school are particularly important for "school age" pedestrians and bicyclists. A significant number of vehicle trips could be eliminated if more

- Encouraging motorists to combine trips to reduce travel and the number of cold starts (i.e., promote trip chaining).
- Increasing public awareness with regard to the importance of regular vehicle maintenance in reducing air pollution and improving fuel economy. Simple maintenance checks such as air filter replacement, oil changes, and proper tire inflation can make a big difference.

Transit Marketing

Anchorage's public transit system, People Mover, receives congestion mitigation / air quality (CMAQ) funding from the Federal Highway Administration to advertise and promote its service in Anchorage. The Anchorage TIP includes funding through 2013 for transit promotion. Figure III.B.5-2 shows transit ridership has increased significantly over the past several years. [11] Although many factors have probably contributed to increased ridership, on-going marketing is an essential part of the continued growth of People Mover ridership. A transit marketing effort will continue, now as a committed primary measure in this Maintenance Plan.

Figure III.B.5-2
Weekday People Mover Bus Ridership



In 1998, as a direct result of its transit promotion efforts, People Mover reached an agreement with the University of Alaska that provides free bus service (called U-Pass) for their students and staff. Since that time Alaska Pacific University, Charter College have joined in with a faculty and staff pass program and most recently Conoco Phillips has joined the U-Pass program for all their Anchorage-based employees. Efforts to reach similar agreements with other employers and institutions are on-going.[12]

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students walked, biked or took the bus to school instead of being dropped off by parents.

Carpooling and Vanpooling

The 2004 maintenance plan committed to implementing a carpooling and vanpooling program in Anchorage. Support for Anchorage's Share-A-Ride Program will continue through the 2008-2023 maintenance plan period. As noted earlier in this section, the vanpooling program has experienced considerable growth in the past decade and demand for new service is on-going. CMAQ funds for support of the Share-A-Ride Program are programmed through 2013 in the Anchorage TIP.

Estimated CO Reduction Benefit from Implementation of Primary Measures 2008-2023

The I/M Program is projected to reduce motor vehicle CO emissions by roughly 15% during the 2008-2023. However, because the motor vehicle fleet is expected to grow progressively cleaner over time, the absolute magnitude of emission reduction provided by I/M drops from about 10.2 tons per day in 2011 to 8.8 tons per day in 2023.

As noted earlier, because of the voluntary nature of the air quality public awareness, transit marketing and the Share-A-Ride programs, the CO reductions anticipated from these three measures are ignored in the assessment of future probability of compliance with the NAAQS. Nevertheless, survey data suggest that these measures are currently providing tangible CO reductions in Anchorage and they have the potential to provide additional reductions in the future. The current overall combined benefit of these three measures is estimated to be in the range of one ton per day CO reduced.

Ancillary Benefits of Primary Measures

Although reducing CO emissions has been a prime focus in Anchorage for three decades, there is growing realization of the need to reduce other air pollutants. Monitoring data in Anchorage suggest that ambient concentrations of benzene, a known human carcinogen associated with leukemia, are among the highest in the U.S. Alaska gasoline contains more benzene than most of the U.S. and motor vehicles are a significant source of this toxic air pollutant in Anchorage. Studies conducted in Fairbanks by Sierra Research suggest that strategies aimed at reducing CO also reduce benzene. Like CO, emissions of hydrocarbons such as benzene tend to be highest during cold start and warm-up idle when engines are cold. Thus, using an engine block heater prior to a cold start not only reduces CO emissions but also benzene and other air toxics.[13]

Greenhouse gas emissions are of growing concern globally and locally. Besides being a source of CO, motor vehicles are a significant source of carbon dioxide (CO_2) and other greenhouse gas emissions. This plan supports the use of transit, carpooling and vanpooling, telecommuting, walking, bicycling and other alternatives to the single occupancy vehicle. Besides reducing CO emissions, these strategies provide CO_2 emission reduction benefits. As these strategies become more successful, CO_2 reductions increase.

This plan recognizes the importance of addressing other air pollutants even if they are unrelated to CO emissions. The Municipality of Anchorage is committed to examining new technlogies that lead to reduction of air pollutant emissions including CO_2 and diesel particulate. The Muncipality is examining the purchase of of high fuel economy vehicles, including hybrid electrics, for its own fleet.

Consistency with Other Municipal Plans and Programs

The air quality improvement strategies outlined in the CO Maintenance Plan rely in large part on reducing the dependence on the single occupancy vehicle by enhancing alternative transportation modes such as transit, carpooling, vanpooling, bicycling and walking. This strategy is consistent with many other plans and programs adopted by the Municipality.

One of the goals of the *Anchorage Long Range Transportation Plan* (LRTP) is to "provide a transportation system that provides viable transporation choices among various modes." Objectives include the "development of a safe network of trails and sidewalks that provide year-round, reasonable access to work, schools, parks, services, and the natural environment." Meeting these objectives will make walking, cycling and transit more attractive, reduce single occupancy vehicle use and help decrease air pollution, including CO. The LRTP also recognizes the need for transit service improvements and endorses recommendations included in *The People Mover Blueprint: A Plan to Restructure the Anchorage Transit System.* Additional buses and stable funding will be necessary to attain the goals and objectives identified in the route restructuring plan.

The Municipality is in the process of developing a plan that will address specific needs as related to pedestrian and bicycle travel. This Non-Motorized Plan was identified in the LRTP as a task to be completed. The first chapter of the Non-Motorized Plan, the Pedestrian Plan was adopted by the Municipality in October 2007. The Pedestrian Plan establishes a 20 year framework for improvements to enhance the pedestrian environment and increase opportunities to choose walking as a mode of transportation. The Pedestrian Plan features a list of over 300 capital projects in the Municipality that will create safer and more pleasant places to walk. The Municipality recently adopted the next chapter of the Non-Motorized Plan, the Bicycle Plan. This Bicycle Plan identifies a network of facilities to be used by commuter cyclists to navigate Anchorage more safely. Both of these plans identify ways for Anchorage to develop the infrastructure necessary to make walking and bicycling more attractive as a means to get to work, school and shopping.

III.B.6 Modeling and Projections

EPA, based on its regulatory guidance, prefers that dispersion modeling techniques be used to demonstrate attainment and maintenance of air quality standards in State Implementation Plans. In May of 2002, representatives from the MOA, FNSB and the ADEC met with EPA Region 10 staff to discuss the modeling techniques and approaches to be used in maintenance demonstrations in Anchorage and Fairbanks. Meeting participants reviewed the results of an area wide modeling feasibility analysis performed by a consultant on behalf of ADEC and MOA[14], and concluded that currently available area wide dispersion models lack the capability to adequately address the meteorological extremes encountered in Anchorage and Fairbanks. Also, the existing meteorological database in Anchorage and Fairbanks may not have the micro-scale meteorological parameters needed for adequate model performance for regulatory purposes. Therefore, after evaluating several options, the participants settled on the use of a probabilistic roll-forward approach in the maintenance demonstration.

As general guidance, EPA staff has stated that this maintenance demonstration should show a 90% or greater probability of complying with the NAAQS each year during the maintenance planning period. The modeling analysis discussed in this section assumes that the CO reductions provided by the I/M Program will be zero in 2011 and beyond.§§§

Probabilistic Roll-Forward Modeling / Maintenance Demonstration

Because the Turnagain site exhibits the highest CO concentrations in the monitoring network, a regression analysis of observed second 8-hour maximum CO concentrations at this site was performed.[§] Using commonly accepted statistical techniques, the CO regression line and upper-bound 90th percentile prediction interval were computed. In theory, 90% of observed second maximum concentrations should fall below this interval. The upper-bound 90th percentile prediction interval values for 2007 serves as the design value (DV).

A nine square kilometer area surrounding the Turnagain site was identified and the emissions within this area were inventoried for base year 2007 and projected through 2023. (See Figure III.B.3-1 (a)) Conventional statistical methods were used 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, was 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. A more detailed description of the methodology used in this analysis can be found in the Appendix to Section III.B.6.

§§§ The actual termination date for I/M is unknown. The commitment to I/M will continue until EPA approves this SIP revision; this could take up to 18 months from submission. I/M could also continue well beyond 2011 as a local option. Thus, for the purpose of this maintenance demonstration, a 2011 termination date for the reductions provided by I/M is a conservative assumption.

§ Although not shown here, a similar analysis was also performed on data from the Garden station. Because Garden has lower CO concentrations than Turnagain, the computed probability of complying with the NAAQS is substantially higher at Garden than Turnagain. Thus, Turnagain provides a more rigorous analysis with regards to the likelihood of a future violation.

The probabilistic roll-forward procedure consists of 5 basic steps:

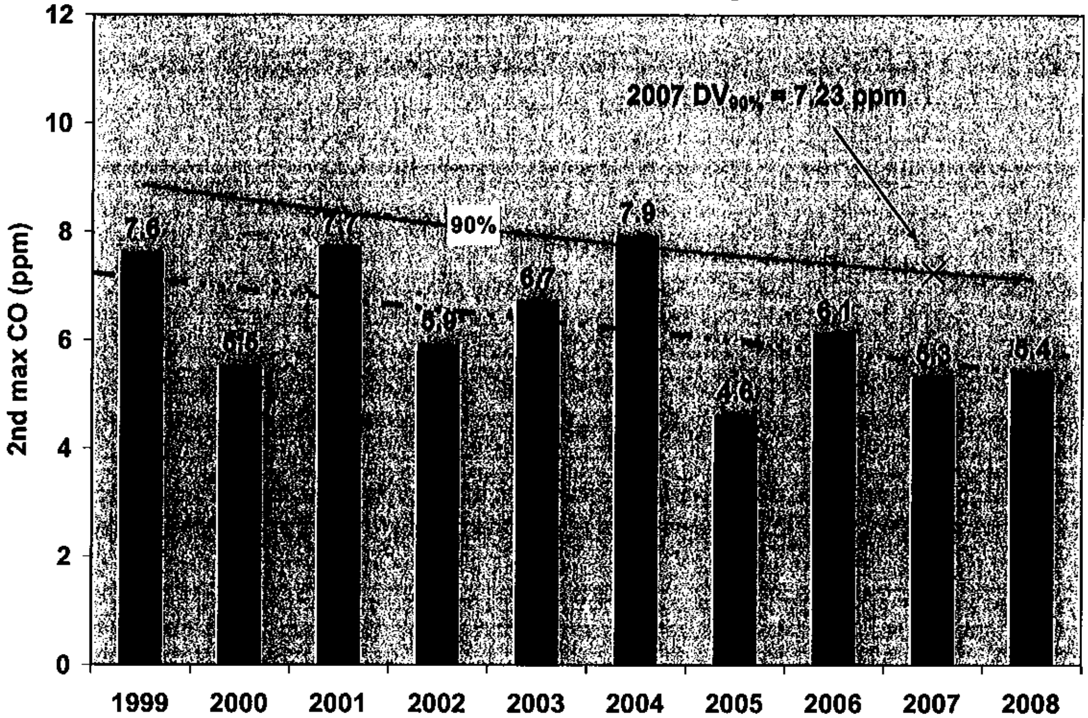
1. Compute the base year 2007 DV using the 90th percentile prediction interval from Turnagain station CO data.
2. Compile the 2007 base year CO inventory and determine the quantity of emissions generated in the nine square kilometer area surrounding the Turnagain monitoring station during a 24-hour "design day." A design day is defined as a winter weekday when a CO violation is most likely to occur. Emission modeling assumptions (i.e. ambient temperature, traffic activity, etc.) reflect conditions on the design day.
3. Using the roll-forward technique, the computed 2007 DV and assumed background CO concentration, determine the emission reduction required to achieve attainment or, conversely, the increase in emissions that can occur and still maintain attainment of the NAAQS at Turnagain.
4. Using the roll-forward equation, compute the quantity of emissions that can be generated within the Turnagain site area on a design day and still remain in compliance with the NAAQS.
5. Using the best available data and assumptions regarding growth in population, vehicle miles traveled and trip starts within the nine kilometer square area surrounding the Turnagain site, project the quantity of CO emissions generated on a design day in 2009, 2011, 2013, 2015, 2017, 2019, 2021, and 2023 to assess whether compliance of the NAAQS will be maintained throughout the 2008-2023 maintenance plan period with a 90% probability or greater.

A description of how this procedure was applied in the nine square kilometer area surrounding the Turnagain monitoring station follows.

Step 1: Computation of 2007 DV for Turnagain Monitoring Station

The probabilistic approach referred to above was used to compute the DV for the Turnagain Highway monitor. Results of the statistical procedure employed to compute the DV are illustrated in Figure III B.6-1. The computed 2007 DV is 7.23 ppm.

Figure III.B.6-1
Computation of Probabilistic DV for 2007 from
90th Percentile Prediction Interval at Turnagain Station



Step 2: Computation of Micro-area Emission Inventory for Turnagain Station

A gridded emission inventory comprised of the 200 one-kilometer square grids that make-up the Anchorage bowl was prepared for base year 2007. The mobile source portion of these inventories was based on transportation activity outputs (e.g., volumes, speeds, number of trip starts) from the Anchorage Transportation Model· These estimated transportation activity levels were used in conjunction with a "hybrid" MOBILE6 emission factor model to estimate mobile source CO emissions. MOBILE6 was used to estimate on-road travel emissions and locally-developed cold start emissions data from two studies conducted by Sierra Research were used to estimate warm-up idle emissions. MOBILE6 was run with supplemental FTP speed correction factors disabled to better simulate winter season driving behavior in Alaska. The Sierra Research studies used as the basis for mobile source modeling are discussed in more detail in Section III.B.3.

The Anchorage Transportation Model was also useful in providing key information for the area source inventory. The transportation model provided estimates of demographic parameters (population, employment, and housing stock) for each of the grids that were utilized to estimate area source activity (e.g. non-road sources, space heating, industrial activity, and electricity generation, fireplace and woodstove emissions). For example, the quantity of CO emitted from fireplace and woodstoves in a specific grid was proportional to the number of households in that grid. Other area source types, like commercial space heating emissions, were assumed to be a function of the amount of employment in each grid.

A micro-area inventory for the nine square kilometer area surrounding the Turnagain monitor was compiled by summing the CO emission estimates from each of the nine grid cells that comprise the area. CO emissions are summarized in Table III.B.6-2.

Table III.B.6-2

Estimated Year 2007 CO Emissions in Nine Square Kilometer Area Surrounding the Turnagain Monitoring Station (emissions in tons per day)

Motor Vehicles	Fireplace or Woodstove	Space Heating	Other	**TOTAL CO EMISSIONS**
4.42	0.62	0.28	0.70	**6.01**

Step 3: Use Roll-Forward Equation to Calculate Allowable Emission Increase at Turngain Station

The roll-forward equation can be used to compute the amount that CO emissions can be increased and still maintain compliance with the NAAQS. The equation is written as follows:****

$$\%\ allowable\ emission\ increase = \frac{NAAQS - DV}{DV - bkg} x100 = \frac{9.0 - DV}{DV - bkg} x100$$

In the equation above the DV was computed in Step 1 to be 7.23 ppm but the background concentration *(bkg)* has not yet been defined. Note, that the background value yielding the least allowable percentage increase in emissions is zero. Thus the most conservative assumption for computing allowable emissions is a background value of zero. This was utilized in this maintenance demonstration. The allowable increase in emission in the Turnagain area from base year 2007 is calculated as follows:

$$\%\ allowable\ emission\ increase = \frac{9.0 - 7.23}{7.23 - 0.0} x100 = 24.5\%$$

Thus, in the Turnagain area, emissions can increase from 2007 levels by 24.5% and still maintain a 90% probability of compliance with the NAAQS.

Step 4: Calculate Quantity of CO Emissions that can be Generated in the Nine Square Kilometer Area Surrounding the Turnagain Station and Still Attain the NAAQS

If the allowable emission increase at each monitoring station is known from Step 3, the quantity of CO that can be emitted in the nine square kilometer area surrounding the Turnagain station and still meet compliance with 90% probability can be determined from the 2007 micro-inventory. The result of this computation is shown in Table III.B.6-3.

**** Note that the value assumed for the NAAQS in this equation is 9.0 ppm when in fact 8-hour CO concentrations below 9.5 ppm meet the NAAQS. This lends an added margin of safety to the computation.

Table III.B.6-3 Allowable Emissions in the Nine Square Kilometer Area Surrounding the Turnagain Monitoring Station (Maintain >= 90% Probability of Compliance)		
2007 Emissions (tons per day)	**Allowable Emission Increase**	**Allowable Emissions in 9 km^2 Area surrounding Turnagain Monitoring Station (tons per day)**
6.01	24.5%	7.48

Step 5: Prepare CO Emission Projections for 2008-2023 and Assess Prospects for Continued Compliance with the NAAQS

Prospects for continued compliance with the NAAQS during the 2008-2023 maintenance plan period were assessed by preparing emission projections for a design day in 2009, 2011, 2013, 2015, 2017, 2019, 2021 and 2023. The Anchorage Transportation Model was run for analysis years 2007, 2017, and 2027. Although mobile and area source activity levels in intervening years were interpolated, mobile source emission factors were estimated by running MOBILE6 for each and all years evaluated. Depending on the type of source, area source activity levels were projected to grow in proportion with housing stock and/or employment.

As was the case with the 2007 base year runs, MOBILE6 was run with supplemental FTP speed correction factors disabled to better reflect winter driving behavior in Anchorage. MOBILE6 was run with the assumption that the I/M Program will change from a four year new car exemption to a six year exemption in January 2010.

Cold start / warm-up idle emissions were estimated using data collected by Sierra Research in testing programs conducted in 1998-1999 and 2000-2001. These data provide a "snapshot" of warm-up idle emission rates in the year 2000. The effect of new emission control technology and fleet turnover on future emissions was estimated by running MOBILE6 at 2.5 miles per hour and computing the emission rate in grams per hour.[‡‡] The relative change in this MOBILE6 idle emission rate relative to the year 2000 was applied to the Sierra Research data to project idle emission factors through 2023.

Data collected by Sierra Research indicate block heater usage reduced emissions by 86 grams per cold start in the year 2000. In order to estimate block heater benefits in the future, the benefit in the year 2000 was discounted in proportion with the overall decline in idle emissions predicted by MOBILE6 (i.e., as idle emissions decline, the absolute benefit of plugging-in a block heater also declines). For example, the plug-in benefit falls from 86 grams in 2000 to 52 grams per cold start in 2013.

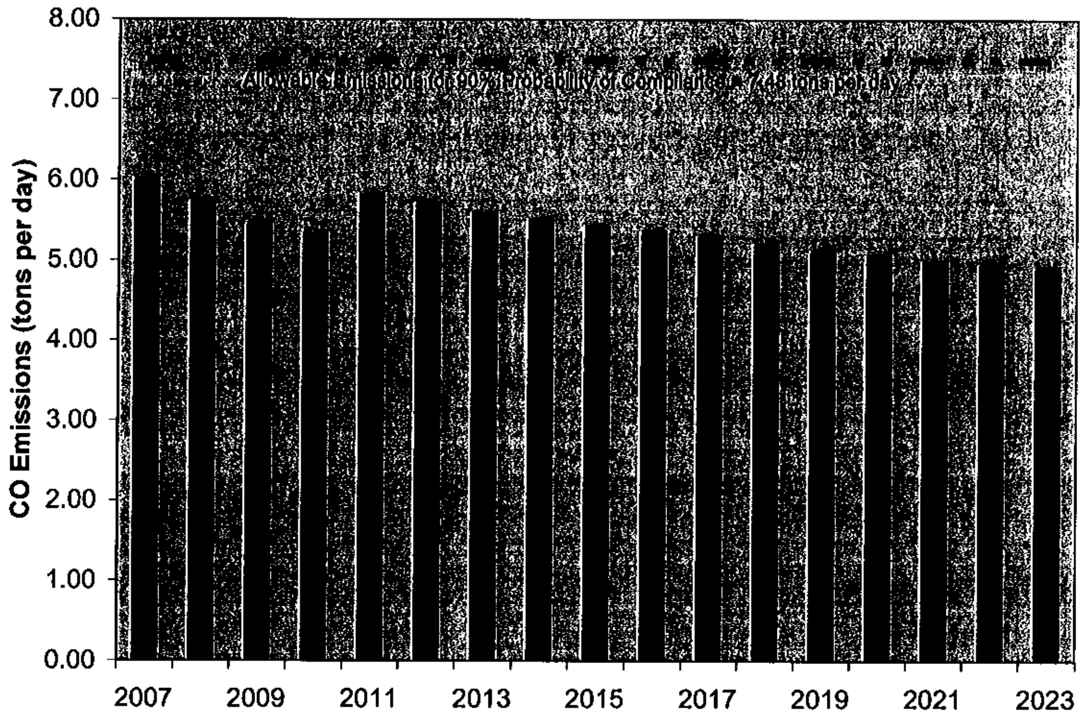
As noted earlier, CO reductions from the I/M program were assumed to be zero after 2010 and any CO reductions that might result from enhancements to the other primary control measures discussed in Section III.B-5 (i.e., air quality public awareness, rideshare/vanpooling, transit marketing) have been ignored in these emission and

‡‡ This method of estimating idle emissions is recommended in the *Users Guide to MOBILE6*.

compliance projections. Although the MOA and ADEC intend to continue and enhance current efforts to increase plug-in rates among motorists, plug-in rates were conservatively assumed to remain at year 2007 levels throughout the maintenance plan period. Anticipated growth in vanpooling and transit ridership has also been disregarded. This provides an added measure of conservatism to the computations.

Figure III.B.6-3 shows projected emissions and prospects for continued compliance with the NAAQS at the Turnagain station. (Projected CO emissions increase in 2011 because CO reductions provided by I/M are assumed to cease in that year.) In theory, the probability of maintaining compliance with the NAAQS in any given year is 90% or greater if emissions remain below the allowable emission levels identified in the figure.

Figure III.B.6-3 Compliance Prospects at the Turnagain Station through 2023



Conclusions Regarding Long-Term Prospects for Compliance with the CO NAAQS in Anchorage

The preceding analysis suggests there is a very high probability of continued compliance with the CO NAAQS. Anchorage has not violated the NAAQS since 1996 and no exceedances have been measured since 2001. During the period 2008-2023, the estimated probability of complying with the NAAQS is 99% or higher each year.

An additional analysis was performed (see Appendix to Section III.B.6) to see how sensitive the compliance projections were to assumptions about the growth in emissions over time and the effect of eliminating the I/M Program. This sensitivity analysis examined a "worst case" scenario in which:

(1) the growth in vehicle travel in the Turnagain area will be three times greater than projected (vehicle travel would increase by 12% between 2007 and 2023 instead of the 4% assumed);

(2) there will be a 2% per annum growth in wood heating among households in the Turnagain area resulting from high natural gas prices.

Using these substitute assumptions, CO emissions were re-estimated for the 2008-2023 period and the resultant probabilities of complying with the NAAQS were re-computed. *Even with the assumed higher rates of growth in vehicle travel and wood burning, the probability of compliance remains at 99% or greater each year through 2023.*

The sensitivity analysis provides additional confidence that there is a high likelihood that Anchorage will remain in compliance with the NAAQS even if future growth in vehicle travel and wood burning is more rapid than anticipated in the projections presented earlier.

Impact of Deleting I/M as a Primary Control Measure in the SIP on Other Criteria Pollutants

Section 110(l) of the Clean Air Act states:

> *Each revision to an implementation plan submitted by a State under this Act shall be adopted by such State after reasonable notice and public hearing. The Administrator shall not approve a revision to a plan if the revision would interfere with any applicable requirement concerning attainment and reasonable further progress (as defined in section 171), or any other applicable requirement of this Act.*

A review of EPA's Green Book†††† shows that, with the exception of CO, Anchorage has not been classified as nonattainment for any of the criteria pollutants, including: ozone, PM-2.5, PM-10, sulfur dioxide, nitrogen dioxide and lead. It should be noted, that unlike Fairbanks, PM-2.5 concentrations in Anchorage are well below the current 24-hour and annual NAAQS.

†††† *http://www.epa.gov/oar/oaqps/greenbk/index.html*

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III.B.7 Contingency Plan

Section 172(c)(9) of the CAAA requires individual nonattainment plans to "provide for the implementation of specific measures to be undertaken if the area fails to make reasonable further progress, or to attain the national primary ambient air quality standard by the (applicable) attainment date . . . ." It further states that such contingency measures shall be structured to take effect, if triggered, without any further action by the State or EPA.

Because I/M and the ethanol-blended gasoline program were control measures in the previous Anchorage attainment plan, they must be included as contingency measures to be implemented if needed to address future violations of the CO NAAQS.

In addition, a number of other control measures are included in the contingency plan for possible implementation. The menu of control measures available for implementation and the projected amount of time needed for implementation after being triggered by a violation of the NAAQS is listed in Table III.B.7-1.

In the event monitoring data indicate that a violation of the ambient CO standard has occurred, Anchorage would examine the data to assess the spatial extent (i.e., hot spot versus region), severity and time period of the episode as well as trends over time.‡‡‡‡ Based on this information, Anchorage, in consultation with ADEC, would determine which measure or measures in Table III.B.7-1 to implement.

Table III.B.7-1

Menu of Anchorage Contingency Measures

Contingency Measure	Projected Time Necessary for Implementation
Increase public awareness and education, transit, carpool and vanpool promotion efforts	6 to 12 months
Curtail or limit use of fireplaces, wood stoves and other wood burning appliances when high CO is predicted	6 to 12 months
Promote increase in transit ridership among commuters by offering reduced fares, or free transit fares for employees of companies that contribute to subsidy.	12 to 24 months
Reinstate block heater installation subsidy	12 to 24 months
Reinstate ethanol-blended gasoline	12 to 24 months
Reinstate I/M	12 to 24 months

The schedule for completing the above process would allow one month for data analysis and control measure selection once the data are validated. The time required for control measure implementation would depend on the measure(s) selected, but in no case would extend beyond 24 months of the violation. If inventory revisions in future years indicate the

‡‡‡‡ For example, if the CO violation(s) occurred in a residential area during evening hours and was associated with elevated PM-2.5, it might implicate residential wood heating as important factor in the violation. Thus, it might be appropriate to implement a curtailment or restriction of fireplace and wood stove use when high CO episodes are predicted.

probability of attainment will drop below a 90% confidence interval, Anchorage would conduct a similar analysis and consultation process with ADEC to select and implement the appropriate control measure or measures. Once implemented, Anchorage will track monitoring data and determine in consultation with ADEC whether additional controls are needed.

III.B.8 Anchorage Emergency Episode Plan

The CAAA section 127 (42 U.S.C. 7427) requires that all state implementation plans include measures to provide public notification when the NAAQS has been exceeded, advise the public of the health hazards associated with the pollution, and enhance public awareness of the measures that can be taken to reduce air pollution. The MOA air pollution episode plan is outlined in municipal code and meets the requirements of Section 127 (42 U.S.C. 7427). Local ordinance AMC 15.30.060 requires the director of the MOA Department of Health and Human Services to publish and distribute copies of an Air Pollution Episode Plan that prescribes the specific actions to be taken at each stage of notification. The plan was developed and published by the MOA in October 1993 and adopted by reference under AMC 15.30.06. Copies of the plan are available from the MOA, Department of Health and Human Services. A copy of AMC 15.30 is included in the Appendix to Section III.B.8.

Three levels of notification are outlined in AMC 15.30.060 related to the level of air pollution predicted or measured in the air. For CO these levels are as follows:

- *Level 1 – Alert* – Declared when the 8-hour average CO concentration has reached or is predicted to reach 9 ppm.
- *Level 2 – Warning* – Declared when the 8-hour average CO concentration has reached or is predicted to reach 15 ppm.
- *Level 3 – Emergency* – Declared when the 8-hour average CO concentration has reached or is predicted to reach 30 ppm.

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III.B.9 Assurance of Adequacy

Under the CAAA Section 110(a)(2)(E) (42 U.S.C. 7410(a)(2)(E)) each SIP must provide the necessary assurances that the State or the local government designated by the State for such purposes (e.g., MOA), will have "adequate personnel, funding, and authority" under State or (as appropriate) local law to carry out the SIP. The CAAA also states that the SIP must provide necessary assurances that, where the State has relied on a local government for the implementation of any plan provision, the State retains responsibility for ensuring adequate implementation of such plan provisions.

Local Legal Authority

The State of Alaska has delegated authority for air pollution control within the Municipality to MOA under AS 46.14.400 (formerly AS 46.03.210). AS 46.03.210 allowed local municipalities to establish air pollution control programs within their jurisdictions by August 5, 1974. In the MOA, air pollution control powers are exercised under the South Central Clean Air Ordinance, codified in Anchorage Municipal Code (AMC), Chapters 15.30 and 15.35. A copy of AS 46.14.400 is included in Volume III, Appendix to Section II, and copies of AMC 15.30 and 15.35 are included in Volume III, Appendix to Section III.B.8.

AS 46.14.400, AS 28.10.041(a)(10), and AS 29.04 authorize the MOA to implement a motor vehicle emissions inspection program. The MOA Assembly initially enacted the authority for the MOA I/M program in March 1984 in local ordinance AMC 15.80. As noted in Section III.B.5, the commitment to continued operation of I/M will cease upon approval of this document as a revision to the SIP. However, if the Assembly so chooses, I/M may continue as a local option as stipulated in local ordinance. AMC 15.80 is included in the Appendix to Section III.B.9.

The State of Alaska retains the regulatory authority to reestablish the I/M and oxygenated fuels programs under 18 AAC 52.007, 18 AAC 52.005(i) and 18 AAC 52.030 in the event that the I/M area violates the NAAQS for carbon monoxide in the future.

Adequate Local Personnel and Funding

Air quality monitoring and planning in Anchorage is performed by the Municipal Department of Health and Human Services (DHHS). These functions are currently supported by revenues from I/M Program Certificate of Inspection fees and an annual Section 105 grant from EPA.[§§§§] The overall budget and staffing level of the air quality program is reviewed annually by the MOA Administration and by the Anchorage Assembly. This process provides a means to address needs on a timely basis, consistent with requirements outlined in the Municipal charter and ordinance.

§§§§ In 2007, air quality program activities in DHHS were supported with $323,000 in I/M Program revenues and with a $135,195 EPA Section 105 grant.

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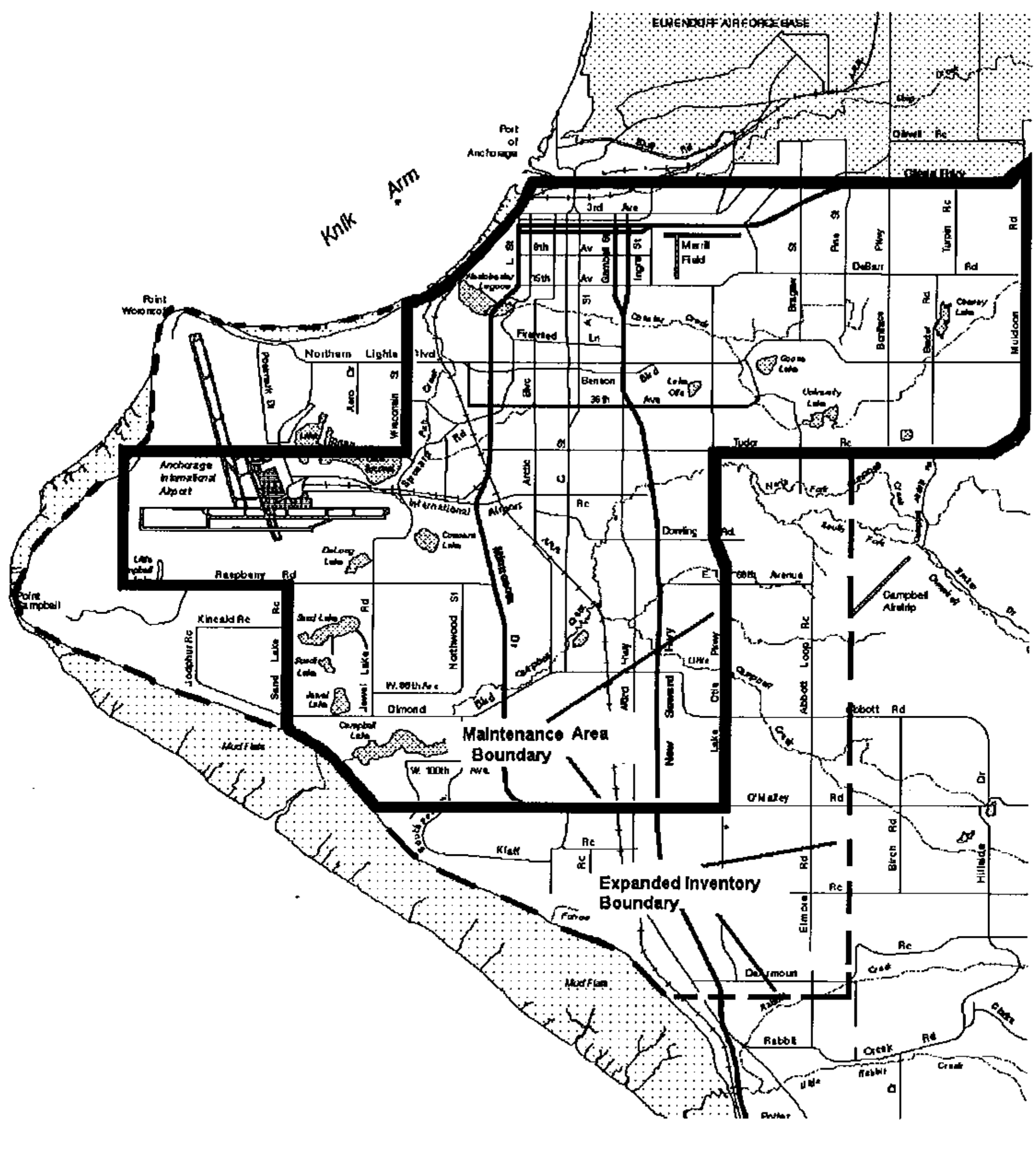
III.B.10 Motor Vehicle Emissions Budget

Before any regional transportation plan can be adopted or amended, the emissions from the transportation network proposed in the plan must be shown to be less than the motor vehicle emission budget established in the SIP. The motor vehicle emissions budget presented here applies during the period 2008 and beyond, unless changed in an EPA-approved SIP.

Motor Vehicle Emission Budget Inventory Area

The motor vehicle budget is compiled on an area-wide basis. The area encompassed by "expanded inventory boundary" noted in Figure III.B.10-1 will be used to establish the emission budget. Future conformity determinations will evaluate emissions in this same area.

Figure III.B.10-1 Expanded Emission Inventory Area Used to Compute Emission Budget



Methodology Used to Establish Motor Vehicle Emission Budget

In a manner similar to that used in the compliance demonstration discussed in III.B.6, the roll-forward approach was used to compute the regional motor vehicle emissions budget for the expanded emission inventory area described in Figure III.B.10-1. The emission budget is based on estimated emissions within the boundary of this area during the 2007 base year. As was the case in the maintenance demonstration presented in Section III.B.6, it can be shown that total emissions within the inventory area can increase from 2007 levels because there was a greater than 90% probability of meeting the NAAQS at 2007 levels. In other words, CO emissions can increase somewhat from 2007 levels and the probability of compliance would still be greater than 90%. The roll-forward computation is used to determine how much the CO emission sources can increase within the inventory area and still maintain compliance with the NAAQS. This amount is the "total CO emission budget." Because some of these emission are from sources other than motor vehicles (aircraft, wood heating, etc.), the budget "available" for motor vehicle emissions will be less than the total budget.

The process for determining the motor vehicle emission budget for base year 2007 is described below.

1. Use roll-forward method to compute *total* CO emission budget from 2007 area-wide emission inventory and computed 2007 design value (DV).

   Area-wide CO emissions (2007) = 101.0 tons per day
   2007 DV = 7.23 ppm
   Allowable increase in area-wide emissions = $\frac{9.0-7.23}{7.23-0.0} x100 = 24.5\%$

   Total CO emissions budget = (1+0.245) x 101.0 = 125.8 tons per day

2. Estimate 2007 motor vehicle budget by subtracting other "non-motor vehicle emissions" from total allowable area wide emissions.

Ted Stevens Anchorage International Airport Operations	12.4
Merrill Field Airport Operations	0.7
Wood burning – fireplaces and wood stoves	6.2
Space heating – natural gas	3.8
Miscellaneous (railroad, marine, snowmobiles, snow removal, portable electrical generators, welding, etc.)	9.3
Point sources (power generation, sewage sludge incineration)	1.3
TOTAL NON MOTOR VEHICLE EMISSIONS	**33.7 tons per day**

2007 Motor Vehicle Emissions Budget = Total allowable emissions less non motor vehicle emissions = 125.8 – 33.7 = **92.1 tons per day**

The motor vehicle emission budget for the years covered by the maintenance plan, 2008-2023, will shrink over time because emissions from other non motor vehicle sources are expected to grow during this period. Because emissions from all sources in the inventory area cannot exceed the 125.8 ton per day limit, the amount of the budget available for motor vehicle emissions will decrease. This is shown in Table III.B.10.1.

Table III.B.10.1

Motor Vehicle Emission Budget

	Stevens Int'l Airport	Merrill Field	Wood Burning	Space Heating	Point Sources	Other	**Non Motor Vehicle Sources TOTAL**	TOTAL CO EMISSION BUDGET	**MOTOR VEHICLE EMISSION BUDGET**
2007	12.4	0.7	6.2	3.8	1.3	9.3	33.7	125.8	**92.1**
2008	12.7	0.7	6.3	3.8	1.3	9.3	34.1	125.8	**91.7**
2009	13.0	0.7	6.4	3.8	1.3	9.4	34.6	125.8	**91.2**
2010	13.3	0.7	6.4	3.8	1.3	9.5	35.0	125.8	**90.8**
2011	13.6	0.7	6.5	3.9	1.3	9.5	35.5	125.8	**90.3**
2012	13.8	0.7	6.5	3.9	1.3	9.6	35.9	125.8	**89.9**
2013	14.1	0.8	6.6	3.9	1.3	9.6	36.4	125.8	**89.4**
2014	14.4	0.8	6.7	3.9	1.3	9.7	36.8	125.8	**89.0**
2015	14.7	0.8	6.7	4.0	1.3	9.8	37.3	125.8	**88.5**
2016	15.0	0.8	6.8	4.0	1.3	9.8	37.7	125.8	**88.0**
2017	15.3	0.8	6.8	4.0	1.3	9.9	38.2	125.8	**87.6**
2018	15.8	0.8	6.9	4.0	1.3	10.0	38.8	125.8	**87.0**
2019	16.2	0.8	6.9	4.0	1.4	10.0	39.4	125.8	**86.4**
2020	16.7	0.8	6.9	4.1	1.4	10.1	40.0	125.8	**85.8**
2021	17.2	0.8	7.0	4.1	1.4	10.1	40.6	125.8	**85.2**
2022	17.6	0.9	7.0	4.1	1.4	10.2	41.2	125.8	**84.6**
2023	18.1	0.9	7.0	4.1	1.4	10.3	41.8	125.8	**84.0**

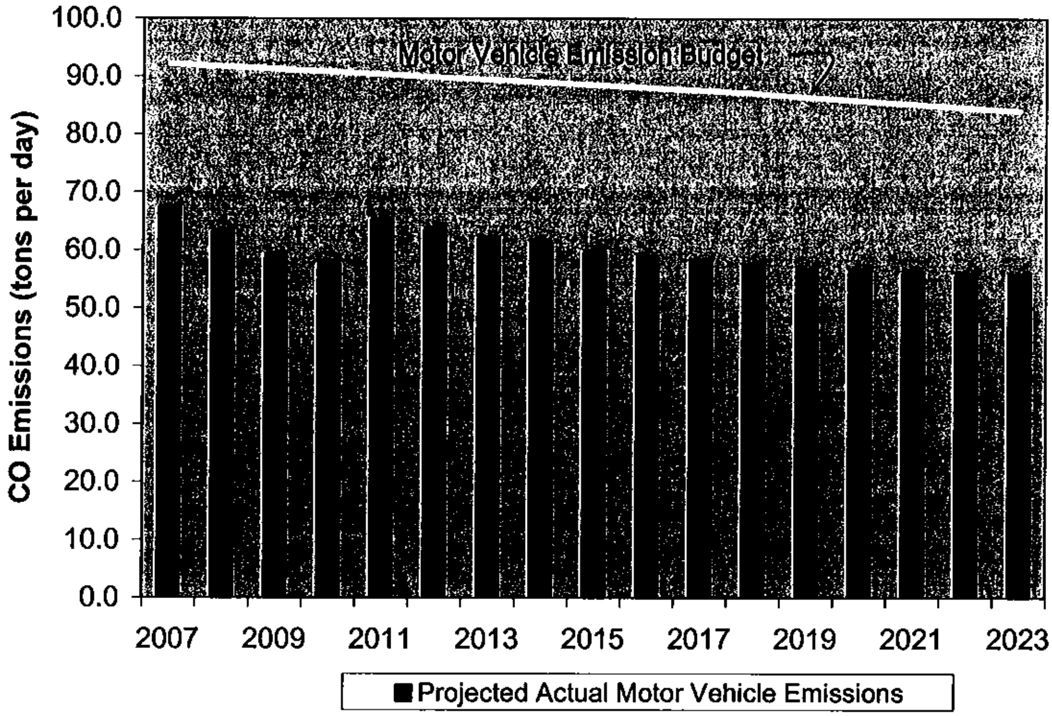
Note: Some rows may not total exactly because of rounding. Totals are rounded to one significant digit beyond the decimal.

Emission budgets for years beyond 2023, the end of the maintenance plan, shall be assumed to be 84.0 tons per day.

Long Term Prospects for Meeting Conformity Budget

A preliminary analysis of long term prospects for meeting the conformity budget were evaluated using the travel activity projections and transportation network assumptions contained in the current Long Range Transportation Plan. The analysis suggests that, barring unanticipated major changes in population or employment growth, motor vehicle emissions from Anchorage transportation network will remain below the motor vehicle emission budget during the period 2008–2023. Projected motor vehicle emissions are compared to the budget in Figure III.B.10.2.

Figure III.B.10-2. Projected Motor Vehicle Emissions vs. Budget 2007 - 2023



Finding of Adequacy of Mobile Source Emissions Budget

For an emissions budget to be found adequate by EPA, the revisions to the air quality control plan that establishes the budget must:

- be endorsed by the Governor (or a designee);
  - Prior to submittal to EPA, this plan will be filed by the Lieutenant Governor as per state regulation.
- be subject to a public hearing;
  - Prior to submittal to EPA, these plan revisions were the subject of a public hearing held in Anchorage on [date tbd]*****. The affidavit of oral hearing will be included in Appendix to Section III.B.10.
- be developed through consultation among federal, State and local agencies;
  - Federal, state, and local agencies were consulted on the motor vehicle emissions budget. (Note ADEC will update based on comments received).

***** This date is to be determined. This plan is being written in anticipation of its eventual incorporation in the Alaska SIP. The actual date this event occurs will be inserted before the State adopts this Plan as a SIP amendment.

- be supported by documentation that has been provided to EPA ;

  - This plan contains documentation supporting the motor vehicle emission budget. See Section III.B.3. The CO emission inventory is included in the Appendix to Section III.B.3.

- address any EPA concerns received during the comment period;

The methodology presented in this section is consistent with the methodology employed in the previous Maintenance Plan, which was designed to address guidance received from EPA Region 10 staff, including:

- clearly identify and precisely quantify the revised budget;

  - This section clearly identifies the motor vehicle emissions budget for Anchorage.

- show that the motor vehicle emissions budget, when considered together with all other emissions sources, is consistent with the requirements for continued maintenance of the ambient CO standard;

  - The motor vehicle emissions budget is established based on the Anchorage CO emission inventory. The budget when considered with all other emission sources is consistent with the requirements for continued maintenance of the CO standard.

- demonstrate that the budget is consistent with and clearly related to the emissions inventory and the control measures in the plan revision;

  - The motor vehicle emissions budget is established based on the Anchorage CO emission inventory and control measures included in the plan.

- explain and document revisions to the previous budget and control measures, and include any impacts on point or area sources; and

  - The budget presented in this plan is an update of the budget established in the previous version of this plan. A discussion of revisions to the control measures and impacts on point and area sources is included in section III.B.5

- address all public comment on the plan's revisions and include a compilation of these comments.

  - The response to comments received is included in the Appendix to Section III.B.10. In addition, the Anchorage Assembly passed a resolution (2009-144) approving the plan revisions on May 26, 2009. A copy of this resolution is also included in the same appendix. (Note ADEC will update based on comments received and Assembly action taken)

Once a motor vehicle emissions budget is found to be adequate by EPA, emissions modeled from the transporation network reflected in the Anchorage Long Range Transportation Plan (LRTP) and Transportation Improvement Program (TIP) must be less than or equal to the motor vehicle emissions budget. For projects not from a conforming TIP, the additional emissions from the project together with the TIP emission must be less than or equal to the budget.

Use of the Hybrid Model in Conformity Analysis

Because a hybrid method, that relies on the use of MOBILE6 for modeling on road travel emissions and local emissions data to estimate idle emissions, it is necessary to clearly set out a means for agencies to compute emissions for use in TIP and project conformity determinations.

On-road mobile source emission inventories typically are computed using emission factors generated by EPA's latest vehicle factor model, MOBILE6 (version 6.2). Unfortunately, MOBILE6 is limited in its ability to represent wintertime CO emission factors in cold-weather communities. That model fails to adequately treat two very common wintertime practices in Anchorage that significantly affect vehicle CO emissions:

1. Extended initial idling of vehicles to warm them up prior to travel; and

2. Use of block heaters to keep the engine warm while parked for long periods to aid in cold start driveability.

To address these limitations, on-road mobile source emissions were computed using a hybrid methodology that combines actual measurements of warm-up idling and plug-in benefits with emission factors from MOBILE6. This methodology is described in detail in Appendix to Section III.B.3.

To address the subsequent use of this hybrid approach within the conformity process, the following steps are being incorporated into the conformity procedures for Anchorage transportation plans and projects. The additional steps set out in this section are to be used in conjunction with the applicable requirements for conformity found in 18 AAC 50.700-18 AAC 50.735 and Volume II - Sections III.I and III.J of this SIP.

Regional Conformity Determination Methodology

Analysis Years Required for Demonstration of Consistency with Emission Budget

Transportation plans and programs must be shown consistent with the motor vehicle emission budget shown above. Criteria and procedures for determining the consistency with the emissions budget are established in 40 CFR Part 93.118. These regulations state that consistency with the motor vehicle emission budget must be demonstrated for

- each year that the applicable emission plan specifically establishes a motor vehicle emission budget;
- for the last year of the transportation plan's forecast period; and
- for any intermediate years as necessary so that the years for which consistency is demonstrated are no more than ten years apart.

The conformity regulations state that "the regional emissions analysis may be performed for any years in the timeframe of the transportation plan provided they are not more than ten years apart and provided the analysis is performed for the attainment year (if it is in the timeframe of the transportation plan) and the last year of the plan's forecast period."††††† The regulations also state that consistency with the motor vehicle budget for other years "may be determined by interpolating between the years for which the regional analysis is performed." Because Anchorage is a maintenance area that has already attained the CO standard, it will not be necessary to include the attainment year as an analysis year in future transportation plans. Thus, for future transportation plans and programs in Anchorage, explicit conformity analysis, involving a separate run of the transportation model and computation of the CO emissions for that particular year, must be performed for the last year of the transportation plan, and any additional years necessary to ensure that explicit conformity demonstrations are performed no more than ten years apart. Intervening years may be computed by interpolation to establish conformity with each year of the emission budget shown in Table III.B.10-2.

Assumptions used in modeling analysis for conformity determinations must be consistent with those in the CO Maintenance Plan. Because this SIP revision assumes that the CO reductions provided by the I/M program cease after 2010, any modeling performed for conformity analyses must also assume this, even if the I/M program is still in operation as a "local option." The other primary measures included in the Plan (air quality public awareness, transit marketing, and the ridesharing and vanpooling program) are voluntary programs; their CO reduction benefits were disregarded in the analysis of Anchorage's prospects for continued compliance with the NAAQS. Therefore the CO reductions from those programs must also be disregarded in regional conformity analyses.

Methodology Employed to Compute Emissions in Analysis Years

The motor vehicle emission budget shown in Table III.B.10-1 was prepared using a "hybrid" method that combined locally collected idle test data with the MOBILE6 model run with supplemental FTP speed correction factors disabled. This same hybrid approach was used to prepare the maintenance demonstration for the Turnagain area. It will also be employed in future regional conformity analyses.

This MOBILE6-based hybrid method provides a means to model the impact of extended initial idling of vehicles prior to travel and the use of "plug-in" heaters to keep the engine warm while parked for long periods to aid in cold start driveability. Because the hybrid method used to estimate motor vehicle emissions in the MOA is unique and somewhat unconventional, it is necessary to delineate a method to compute emissions for use in future TIP and project-level conformity determinations.

To address subsequent use of this hybrid approach within the conformity process, the following steps are being incorporated into the conformity procedures for the MOA transportation plans and projects. The additional steps set out in this section are to be used in conjunction with the applicable requirements for conformity found in Volume II, Sections III.I and III.J of this plan and 18 AAC 50.700 – 18 AAC 50.720.

The emission calculations of a project, program, or plan must be consistent with the methodology used to establish the motor vehicle emissions budget. For regional emissions analyses (e.g., the LRTP or TIP) computations of mobile source emissions will use the same hybrid method used in developing the emission budget. In a regional conformity determination, mobile source emissions resulting from the plan or program must be

††††† See 40 CFR 93.118 d(2)

compared to the applicable emissions budget established in the SIP. All regionally significant projects must be specifically modeled in the conformity analysis.

The computation of motor vehicle emissions relies on VMT, speed, and operating mode outputs provided by the Anchorage Transportation Model and post processing software. Currently, these post-processor outputs are utilized in a separate Excel spreadsheet model that contains MOBILE6 emission factors used to estimate travel emissions and idle emission factors that are based on local test data. The user must provide estimates of average soak times, idle duration and plug-in rates by trip purpose. Base year 2007 assumptions are shown in Tables III.B.10-2 (a-c). These same assumptions should be used for other analysis years. Any deviation from these assumptions should be discussed and approved through the interagency consultation process outlined in 40 CFR 93.105.

Changes to the Anchorage Transportation Model may necessitate modifications in the manner in which regional mobile source emissions are calculated. Significant changes should be documented and then discussed and approved through the interagency consultation process.

Tables II.B. 10-2(a-c) Assumptions Regarding Soak Times, Idle Duration and Plug-In Rates for Modeling Regional Conformity

Table III.B.10.2(a) Assumptions for AM Peak Period (7 AM – 9 AM)					
Trip Type‡‡‡‡‡	Trip Origin	Average Soak Time (hours)	Average Idle Duration (minutes)	% plugged in	Proportion of Trips originating from home vs. other§§§§§
HB Work	Home	12	7	20%	0.955
	Other	5	3	0%	0.045
HB Shop	Home	12	7	10%	0.794
	Other	1	1	0%	0.206
HB School	Home	12	7	20%	0.972
	Other	0.5	1	0%	0.028
HB Other	Home	12	7	20%	0.798
	Other	1	1	0%	0.202
NHB Work	Home	NA	NA	0%	0.000
	Other	4	3	0%	1.000
NHB Non-work	Home	NA	NA	0%	0.000
	Other	1	1	0%	1.000
Truck	Home	NA	NA	0%	0.000
	Other	2	3	0%	1.000

‡‡‡‡‡ Trip types include: *HB Work* = trips between home and work or vice versa, *HB shop* = trips between home and a shopping destination or vice versa; *HB School* = trips between home and school or vice versa, *HB Other* = trips between home and some destination other than work, shopping or school or vice versa; *NHB Work* = trips between work and a destination other than home or vice versa; *NHB non-work* = trips between two locations that are neither work or home; and *Truck* = freight trips made by commercial trucking.

§§§§§ The travel model provides information regarding the types a trip taken in a particular grid but does not specify whether they began and work, home, or other location. For example, the travel model might estimate that 1,000 HB work trips began in a particular grid between 7 AM and 9 AM. We do not know, however, whether these trips began at home or work. For modeling purposes, we assume that 95.5% of these trips began at home and would therefore have an average soak time of 12 hours, an idle duration of 7 minutes and 20% would be plugged in. The remaining 4.5% of these trips we assume began at work with shorter soak (5 hours) and idle times (3 minutes) than home. The plug-in rate at work is assumed to be zero. These assumptions are based on an analysis of Anchorage Home Interview Survey data.

Table III.B.10.2(b) Assumptions for Off Peak Periods (9 AM – 3 PM, 6 PM – 7 AM)					
Trip Type	Trip Origin	Average Soak Time (hours)	Average Idle Duration (minutes)	% plugged in	Proportion of Trips originating from home vs. other
HB Work	Home	3	3	10%	0.500
	Other	5	3	0%	0.500
HB Shop	Home	1	1	0%	0.500
	Other	0.5	1	0%	0.500
HB School	Home	2	2	0%	0.500
	Other	0.5	1	0%	0.500
HB Other	Home	2	2	5%	0.500
	Other	1	1	0%	0.500
NHB Work	Home	NA	NA	0%	0.000
	Other	3	2	0%	1.000
NHB Non-work	Home	NA	NA	0%	0.000
	Other	1	1	0%	1.000
Truck	Home	NA	NA	0%	0.000
	Other	2	1	0%	1.000

Table III.B.10.2(c) Assumptions for PM Peak Periods (3 PM - 6 PM)					
Trip Type	Trip Origin	Average Soak Time (hours)	Average Idle Duration (minutes)	% plugged in	Proportion of Trips originating from home vs. other
HB Work	Home	3	3	10%	0.500
	Other	5	3	0%	0.500
HB Shop	Home	1	1	0%	0.500
	Other	0.5	1	0%	0.500
HB School	Home	2	2	0%	0.500
	Other	0.5	1	0%	0.500
HB Other	Home	2	2	5%	0.500
	Other	1	1	0%	0.500
NHB Work	Home	NA	NA	0%	0.000
	Other	3	2	0%	1.000
NHB Non-work	Home	NA	NA	0%	0.000
	Other	1	1	0%	1.000
Truck	Home	NA	NA	0%	0.000
	Other	2	1	0%	1.000

Project-Level Conformity Methodology

In project-level analysis, conformity determinations cannot be made by comparing localized project emissions to a regional emissions budget. Instead, a project-level conformity analysis consists of performing hot-spot dispersion modeling to determine whether a project will cause or contribute to any new violations of ambient standards or increase the frequency or severity of existing violations. This hot-spot modeling requirement applies to non-attainment and maintenance areas for each pollutant. Thus, in Anchorage, hot-spot CO modeling must be performed in project-level conformity determinations. Inputs to the hot-spot modeling include link-specific vehicle emission factors for roadway segments in the project vicinity. For project-level analyses, these emission factors will be developed in one of two ways, depending on the type of project. Through the interagency consultation process, a project will be put into one of two tracks as follows:

1. Projects that do **not** significantly impact off-network emissions (e.g., projects that are not likely to affect the amount of initial idling and/or engine block heater use in the project area) will follow a more routine approach to computing emission impacts using MOBILE6 with supplemental FTP speed correction factors disabled. Off-network emissions will not be directly modeled in the analyses of these projects, as they do not change as a result of the project. For these types of projects, off-network emissions are accounted for in the background concentration input in CAL3QHC.

2. Those projects that do significantly impact off-network emissions (e.g., projects that are likely to affect the amount of initial idling and/or engine block heater use in the project area) will follow a process that incorporates both the off-network emissions and the on-road "traveling" emissions. This will require a hybrid approach similar to that used in developing the emission budget and adapted to represent roadway link-specific emission factors in the vicinity of the project.

The interagency consultation process will be the key means of ensuring that projects are placed in the correct track for calculation of emission impacts. The interagency consultation process will also be important in ensuring that appropriate analyses of project emission impacts are conducted under the two scenarios listed above. Moreover, it is important that the interagency process be used to develop guidance so that consistent methodologies are utilized in project-level analyses. Hot spot modeling is often required in project-level conformity determinations. When possible, the interagency consultation process should be used to develop written guidance regarding modeling inputs and assumptions and these assumptions should be consistent with those employed in the maintenance demonstration in this Plan.****** As always, conformity determinations will be subject to the applicable public review requirements. This provides the public an opportunity to comment on the approach that is taken for the conformity determination for each plan, program, and project.

Unless otherwise approved through interagency consultation, the CO background value to be employed in hot spot modeling is 5.1 ppm for a one-hour average or 3.6 ppm for an 8-hour average. These values should be used to model CO emissions in 2008. Background concentrations are expected to decline over time in relation to anticipated future reductions in CO emissions. To estimate background concentrations for future years, the 2008 background concentration should be adjusted downward in accordance with CAL3QHC

****** As noted earlier, this means disregarding the CO reduction benefits of air quality public awareness, transit marketing, and the ridesharing and vanpooling programs..

modeling guidance. A detailed discussion on how the 2008 background concentration was derived can be found in the Appendix to Section III.B.10.

General Conformity

For projects requiring general conformity determinations, it is also important to consider the impacts of off-network motor vehicle emissions (e.g., idle emissions). Interagency consultation shall be used to determine whether off-network mobile source emissions are significant and what analysis of these emissions is appropriate for determining general conformity. An example of a project of this type is an airport expansion.

III.B.11 Redesignation Request

On February 18, 2004 the State of Alaska submitted a request to the EPA that Anchorage be redesignated from a serious nonattainment area to an attainment area. Section 107(d)(3)(E) of the CAAA requires the U.S. EPA administrator to make five findings prior to granting a request for redesignation:

1. The U.S. EPA has determined that the NAAQS has been attained;
2. The applicable implementation plan has been fully approved by U.S. EPA under section 110(K);
3. The U.S. EPA has determined that the improvement in air quality is due to permanent and enforceable reductions in emissions;
4. The U.S. EPA has fully approved a maintenance plan, including a contingency plan, for the area under Section 175A, which includes as contingency measures all contingency measures that were contained in the most recently approved State Implementation Plan;
5. The U.S. EPA has fully approved a maintenance plan, including a contingency plan, for the area under Section 175A, which includes as contingency measures all contingency measures that were contained in the most recently approved State Implementation Plan.

The information necessary for EPA to make these five findings was as follows:

Attainment of the Standard

According to EPA guidance, the demonstration of attainment with the CO standard must rely on three complete, consecutive years of quality-assured air quality monitoring data collected in accordance with 40 CFR 50, Appendix K. The Anchorage CO nonattainment area did not experience any violations of the NAAQS during the three-year period, 2000-2002, prior to submission of the redesignation request. (††††††

Approved Implementation Plan

As discussed in Section III.B.1, the department revised its State Implementation Plan in response to the moderate nonattainment designation in 1994. When Anchorage was unable to achieve attainment by the 1995 deadline, the department submitted revisions to meet the requirements of its serious nonattainment redesignation. The attainment plan revisions were approved through the AMATS process, incorporated into state regulations and submitted to EPA for findings of adequacy and budget approvals. The attainment plan became effective on October 18, 2002.

Permanent and Enforceable Emission Reductions

CO reductions leading to attainment of the federal standards are the result of local control actions that were implemented beginning in 1978. Section III.B.5 contains an expanded discussion of existing control action implementation. Section III.B.6 contains a discussion of long-term prospects for attainment aided by the reductions resulting from the continued implementation of the vehicle inspection and maintenance program, the Rideshare and Vanpooling program, and engine block heater program.

†††††† The period without a violation now extends through 2008. An expanded discussion of Anchorage CO air quality data is included in Section III.B.3.

Section 110 and Part D Requirements

Section 110 and Part D of the CAAA address implementation of SIPs and SIP requirements for nonattainment areas. EPA's finding of adequacy and budget approval of the MOA Serious Area SIP on October 18, 2002, demonstrates compliance with the Section 110 and Part D requirements.

Approved Maintenance Plan

The department in conjunction with the MOA submitted the Maintenance Plan concurrently with the redesignation request. The department requested that EPA expeditiously review the Plan and, if determined to meet the provisions of the CAAA, approve the Maintenance Plan as a part of the redesignation process. This request was approved by EPA effective July 23, 2004 (64FR 34935).

References

[1] "Anchorage 2007 Carbon Monoxide Emission Inventory and 2007 – 2023 Emission Projections," Air Quality Program, Municipality of Anchorage, April 2009.

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

[3] "Analysis of the Probability of Complying with the National Ambient Air Quality Standard for CO in Anchorage between 2007 and 2023," Anchorage Air Quality Program, April 2009.

[4] "Municipality of Anchorage I/M Program Evaluation Study," prepared for the Municipality of Anchorage by Sierra Research, Inc., Report No. SR2007-01-01, January 19, 2007.

[5] "The Ongoing Challenge of Managing Carbon Monoxide Pollution in Fairbanks, Alaska," National Research Council, May 2002.

[6] "United States Motor Vehicle Inspection and Maintenance Programs," prepared by Sierra Research for the U.S. EPA, July 2001.

[7] "Anchorage I/M Compliance Rate Study," ADEC Air and Water Quality Program, March 1999.

[8] "Public Transportation Department Ridership Report," Anchorage People Mover, prepared January 2009.

[9] "Fairbanks Cold Temperature Vehicle Testing: Warm-up Idle, Between Trip Idle, and Plug-in," prepared for the Alaska Department of Environmental Conservation by Sierra Research, Inc., Report No. SR01-07-01, July 2001.

[10] "Anchorage Public Opinion Survey, February 2000," Ivan Moore Research, February 2000.

[11] Public Transportation Department Ridership Report, Anchorage People Mover, prepared January 2009.

[12] E-mail communication from Alton Staff, Anchorage People Mover, March 2009.

[13] "Fairbanks Cold Temperature Vehicle Testing: Warm-up Idle, Between Trip Idle, and Plug-in," Sierra Research, July 2001.

[14] "CO Dispersion Model Feasibility Study: Fairbanks and Anchorage, Alaska," prepared for the Alaska Department of Environmental Conservation by Systems Applications International, Inc. / ICF Consulting, June 14, 2002.

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.

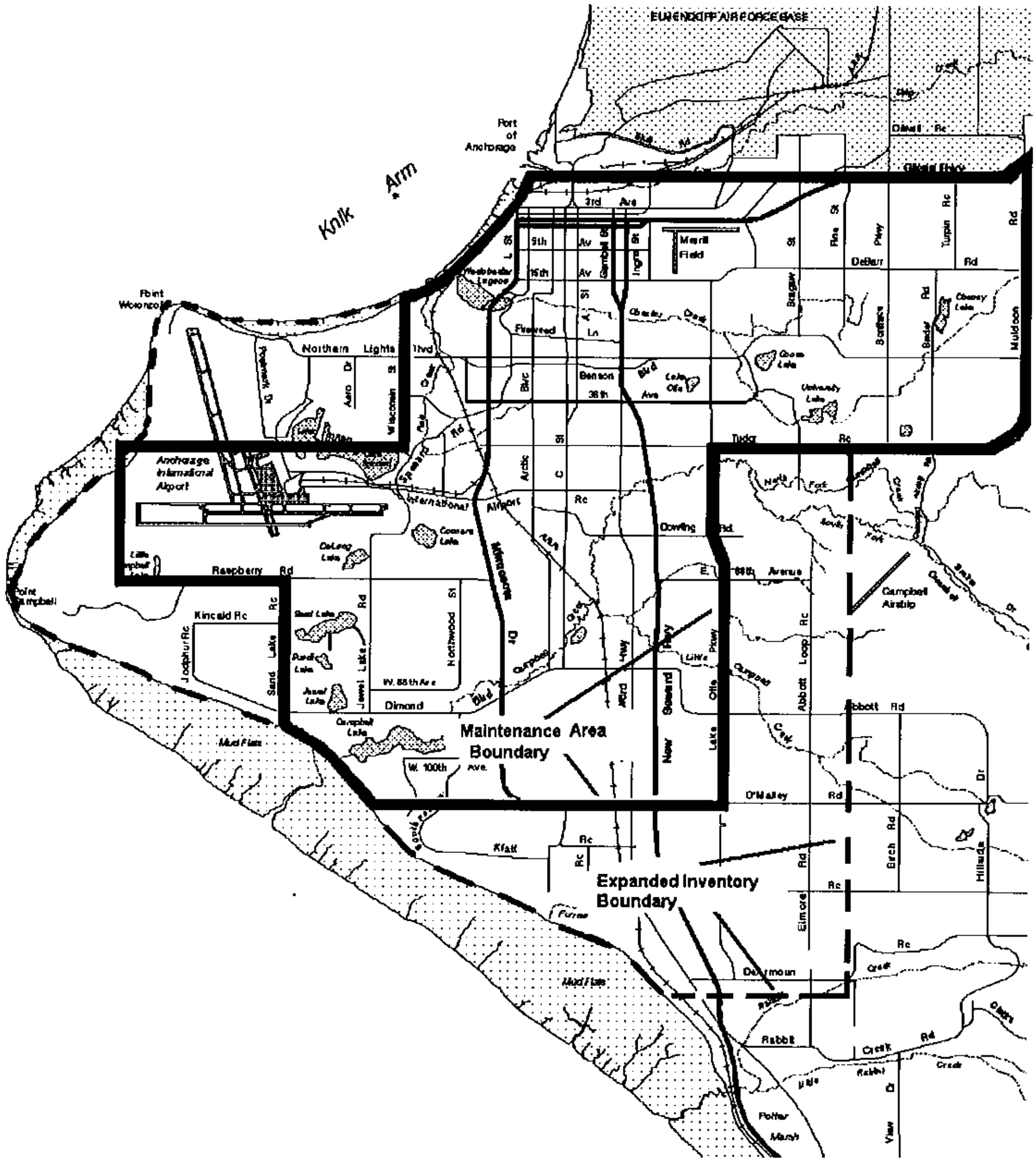
The methodology employed to develop the 2007 base year emission inventory and projections through 2023 was very similar to that employed to develop previous emission inventories for the CO attainment plan in 2000 and the maintenance plan in 2004.

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.

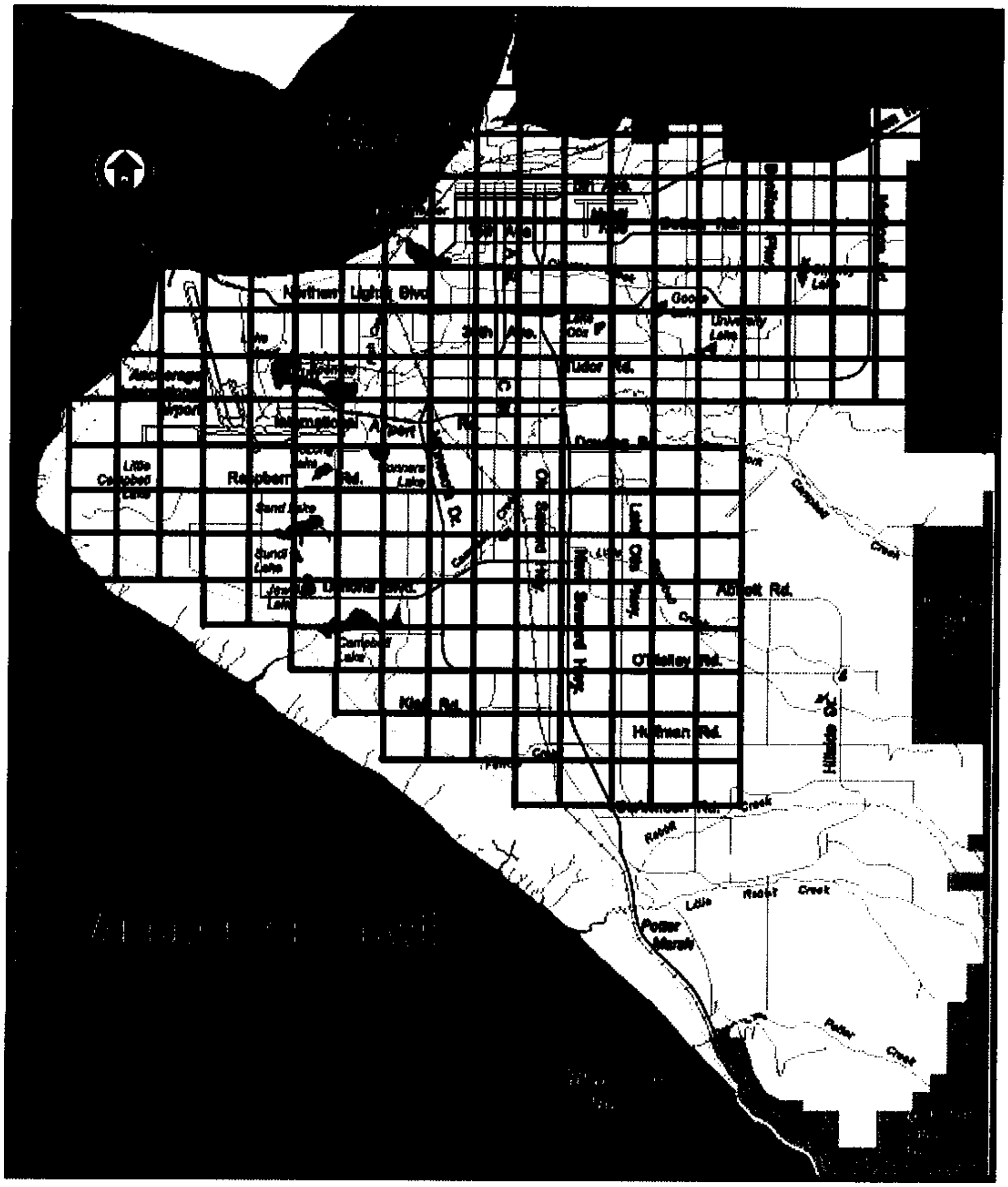
Emissions from other area sources such as Ted Stevens Anchorage International Airport, Merrill Field, marine vessel operations at the Port of Anchorage and railroad activity in the rail yard and haul routes were assigned to the grids where the activity takes place. Similarly, emissions from point sources 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	Revised Year 2000 Idle Emissions (assumes 2.7% EtOH and Year 2000 Anchorage I/M)														
	Initial Idle Time (min)														
(hrs)	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

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* 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:

Operating mode = f (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.

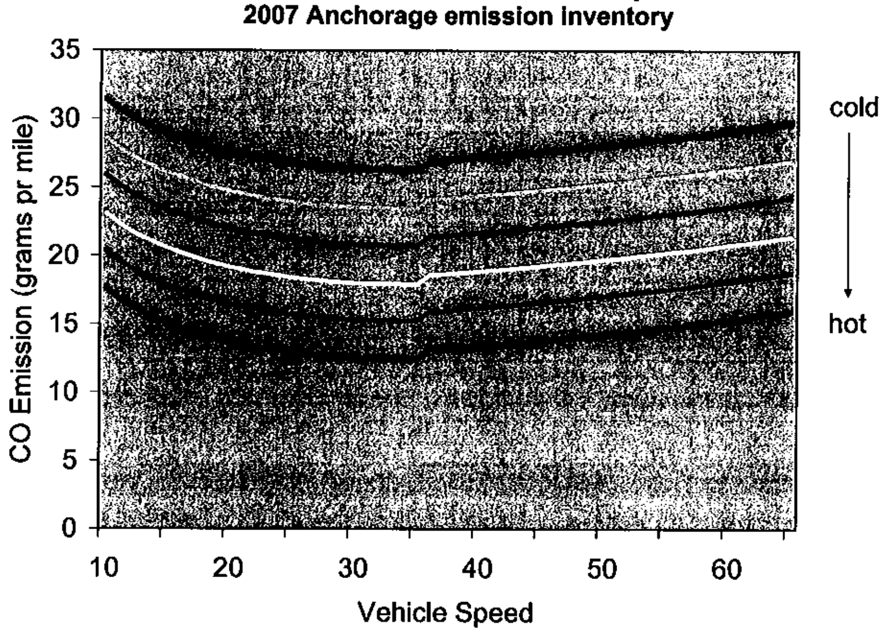
Table 10 compares the bag fraction approach used in the attainment plan to the soak distribution approach used in the maintenance plan. To develop the maintenance inventory, the VMT accrued by a particular trip type (e.g. home-based work trips beginning at home) was assumed to be characterized by one 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:

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

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)

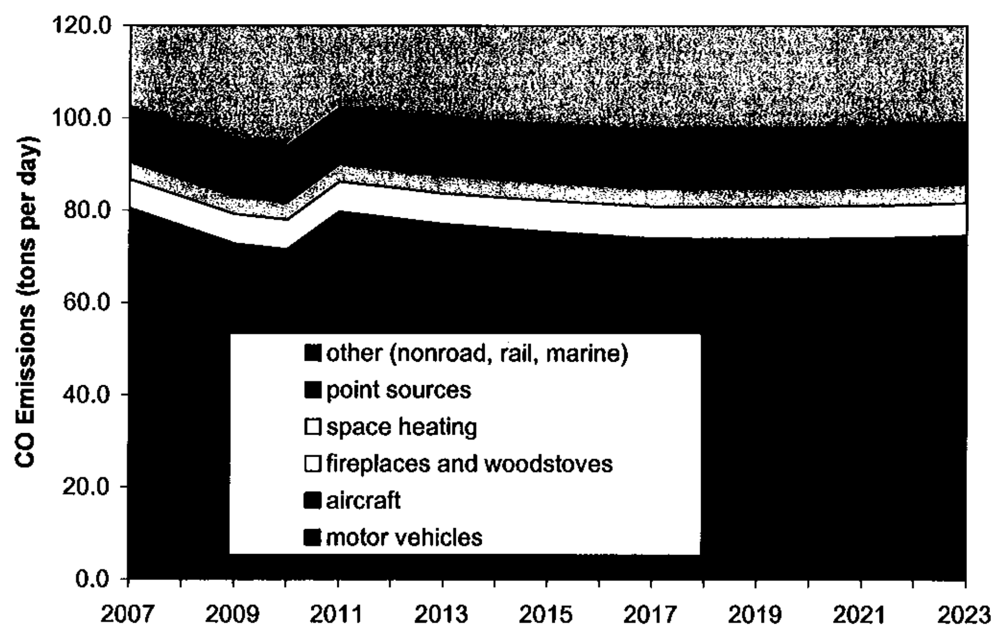
As described in the previous sections, CO emissions for the Anchorage inventory area were projected for each of the source categories for a 24-hour day in 2007, 2009, 2011, 2013, 2015, 2017, 2019, 2021 and 2023. Results are tabulated in Table 26. Area-wide CO emissions for the period 2007-2023 are plotted 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	98.6
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	96.6
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)

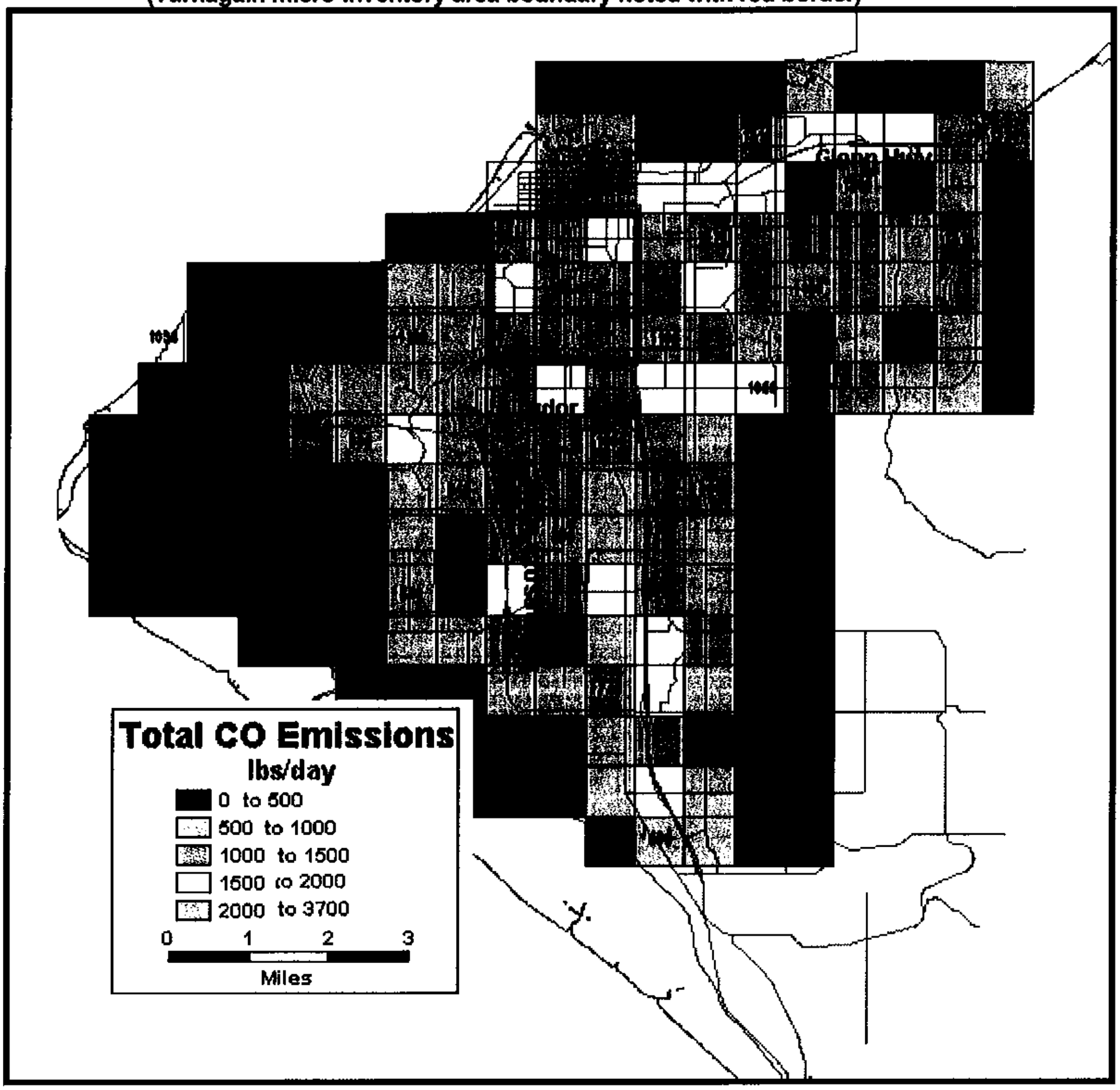
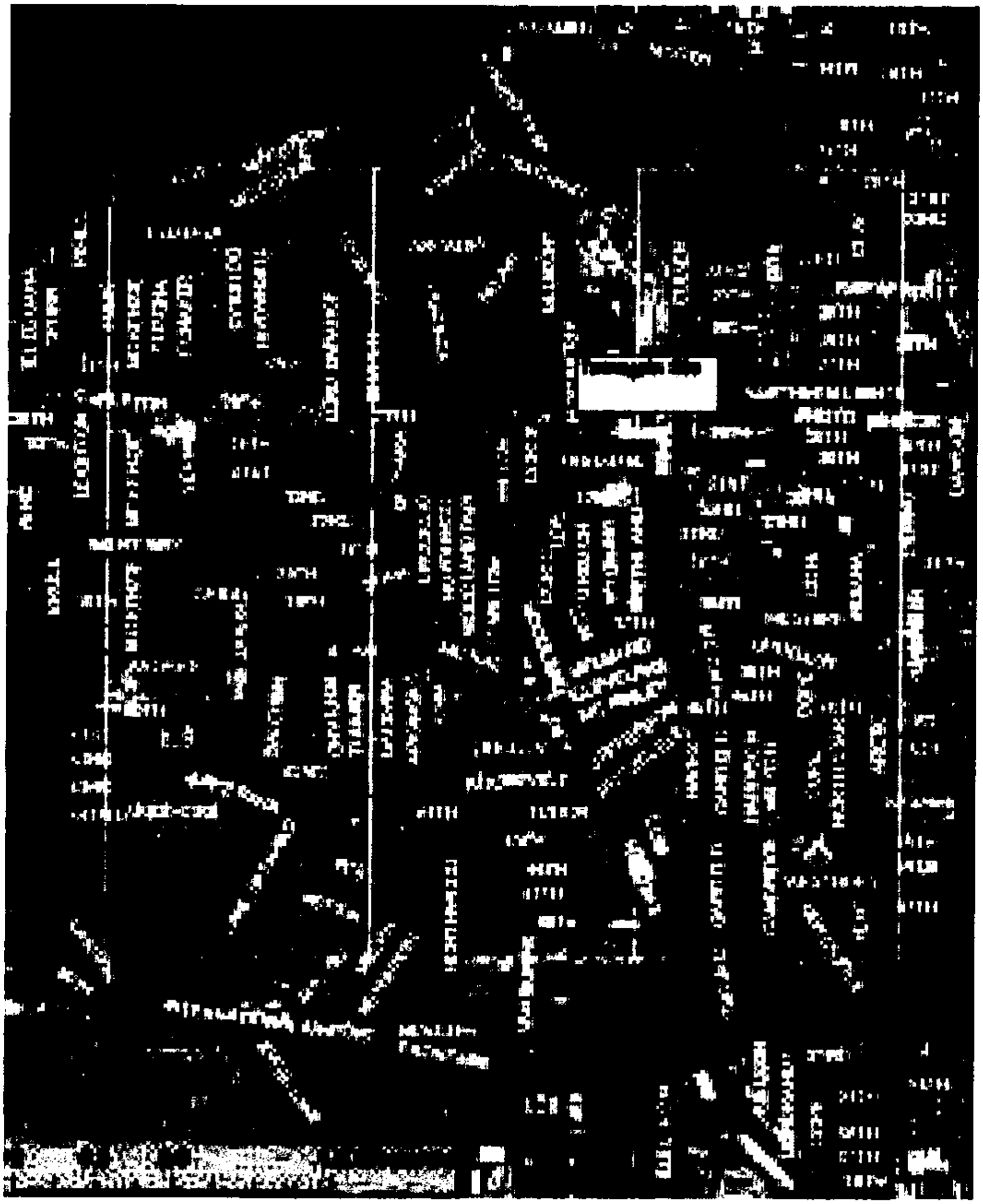


Figure 6
Aerial photo of Turnagain micro-inventory area boundary



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)

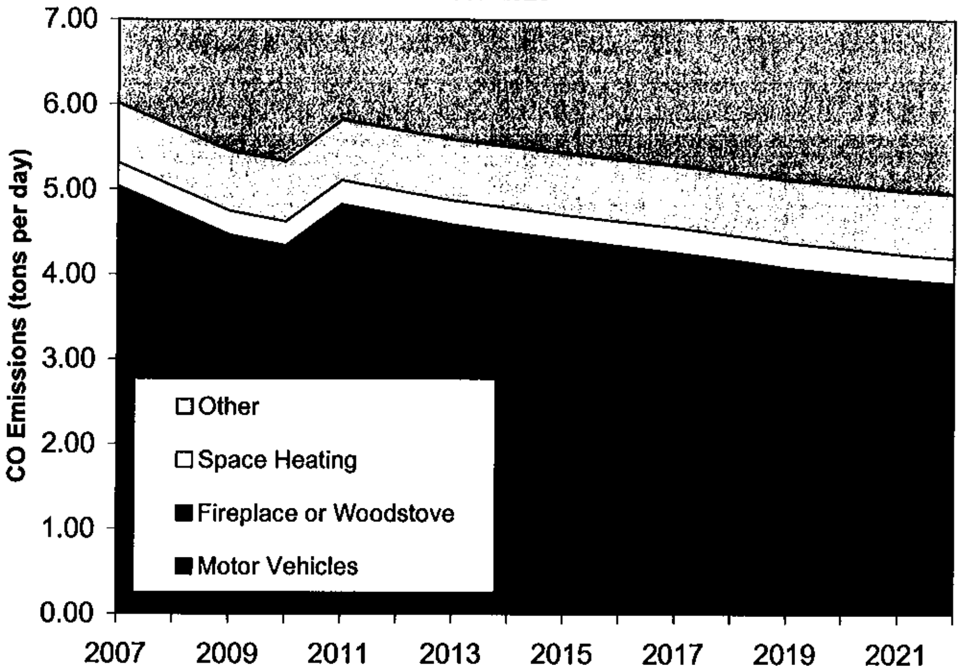
Projected emissions in the Turnagain micro-inventory area are tabulated for the period 2007-2023 in Table 27. CO emissions increase slightly in 2011 due to the assumed termination of the I/M Program and decline steadily thereafter. By 2023 CO emissions in the Turnagain area are projected to decline by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



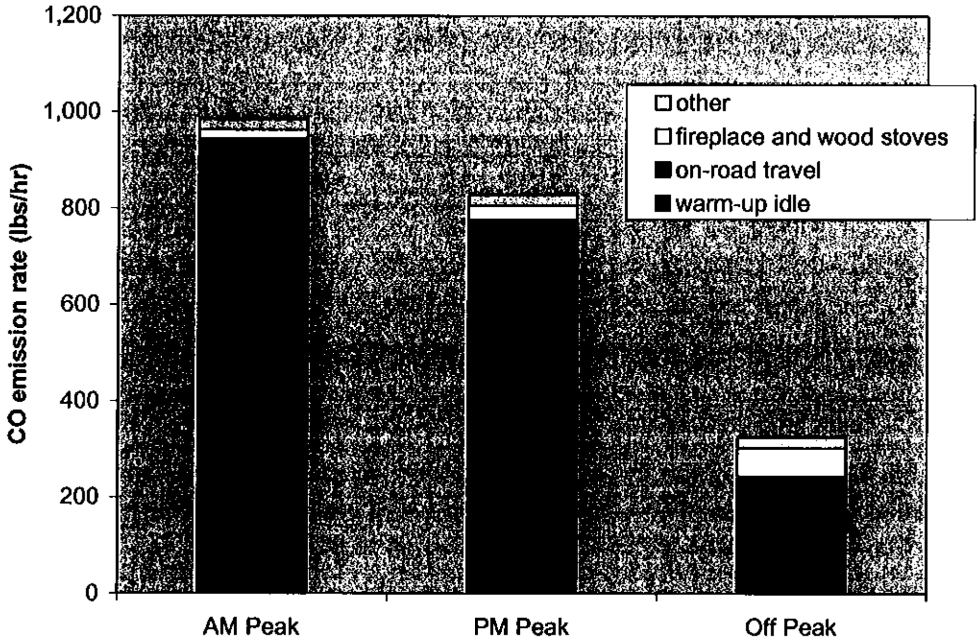
Time-of-Day Inventory at Turnagain

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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[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.

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

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 90[th] 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

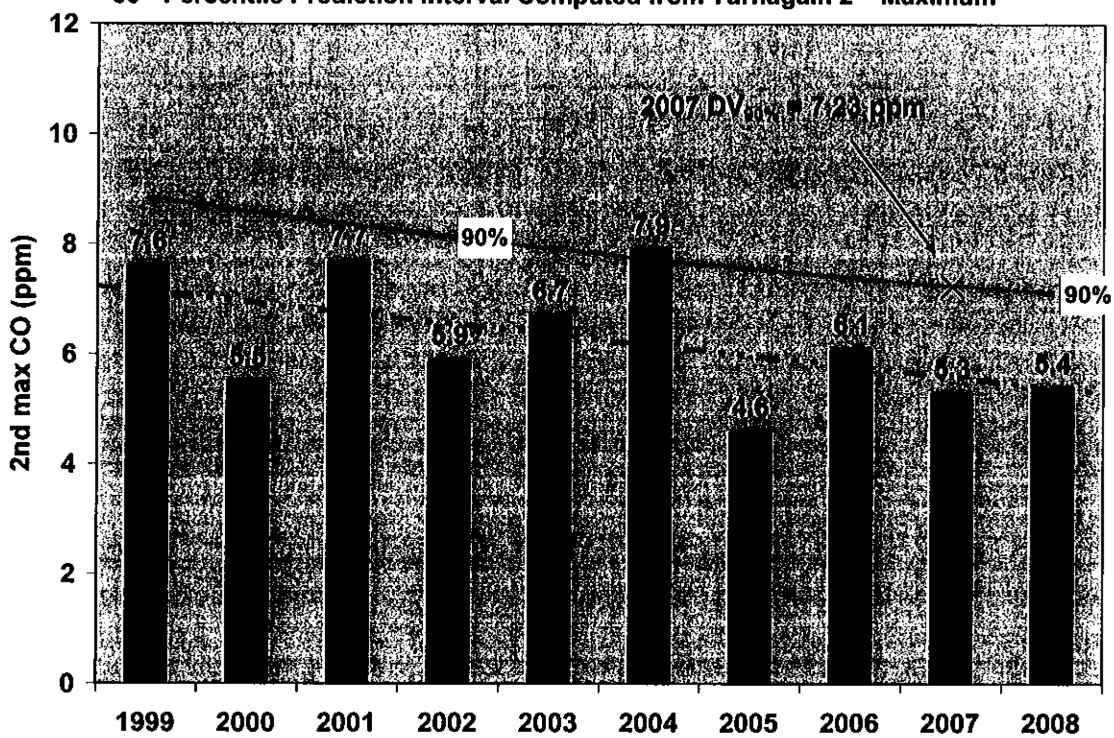
[†] This is known as a one-sided prediction interval. In this case we use the one-sided t-statistic when using Equation 1.

[‡] 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 ppm / 2007 DV_{2007}) x CO emissions in 2007*

= *(9.0 ppm/7.23 ppm) x 6.01 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 km² 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	
	Estimated Total CO Emissions (tpd)	**Probability of Compliance**
2007	6.01	99.0%
2008	5.73	99.3%
2009	5.45	99.5%
2010	5.33	99.6%
2011	5.82	99.2%
2012	5.70	99.3%
2013	5.59	99.4%
2014	5.51	99.4%
2015	5.43	99.5%
2016	5.36	99.6%
2017	5.29	99.6%
2018	5.20	99.7%
2019	5.12	99.8%
2020	5.05	99.9%
2021	4.99	99.9%
2022	4.95	>99.9%
2023	4.90	>99.9%

Revised Assumptions in Sensitivity Analysis	
Estimated Total CO Emissions (tpd)	**Probability of Compliance**
6.01	99.1%
5.77	99.2%
5.51	99.4%
5.43	99.5%
5.94	99.1%
5.86	99.2%
5.77	99.2%
5.72	99.3%
5.67	99.3%
5.63	99.3%
5.59	99.4%
5.53	99.4%
5.47	99.5%
5.44	99.5%
5.41	99.5%
5.39	99.5%
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

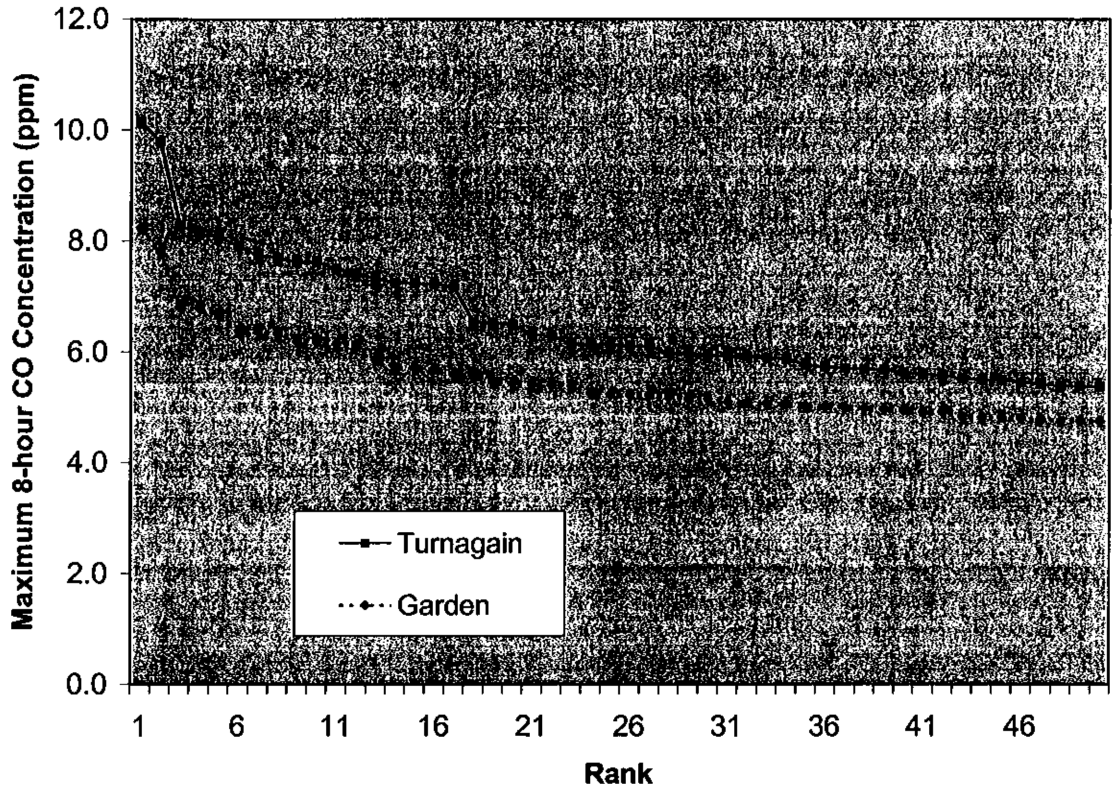


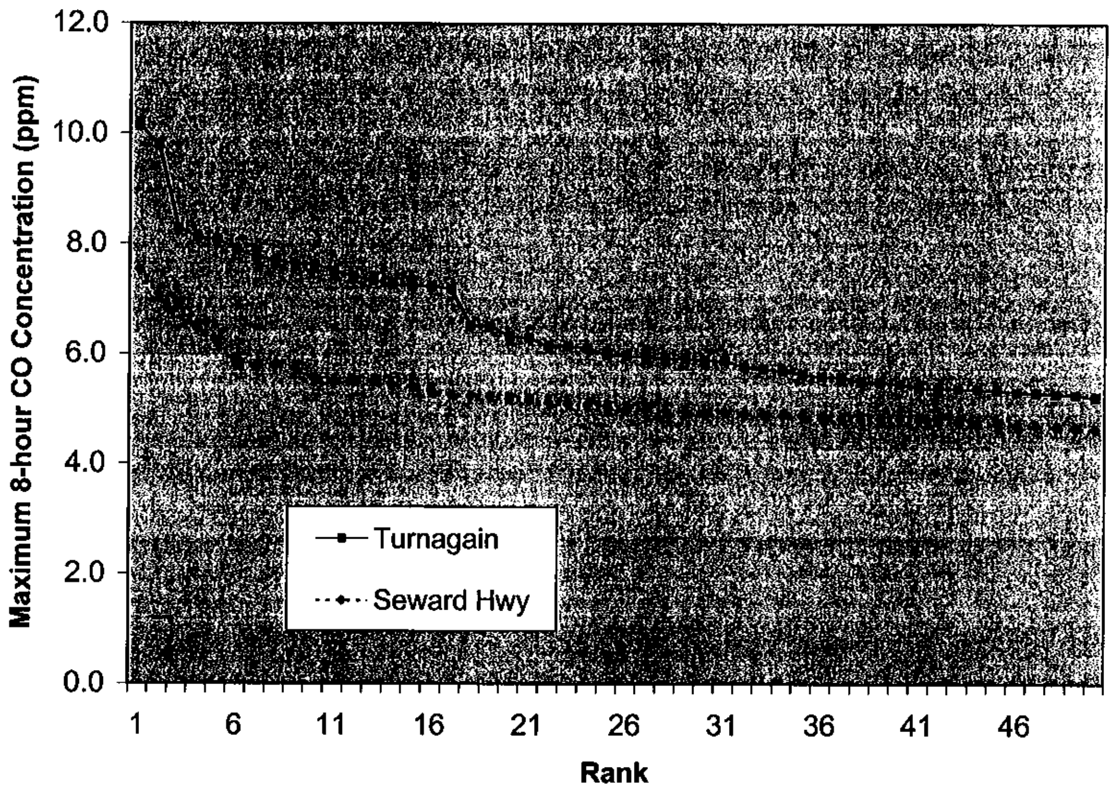
Figure 1 shows that the 50 highest 8-hour average concentrations at the Turnagain station are about 12% to 25% higher than the corresponding rank-pair value at Garden. The greatest differences occur among the highest ranks. For example the highest 8-hour concentration at Turnagain is 23% higher than the highest value at Garden while the 50^{th} highest value at Turnagain is 13% higher than the corresponding 50^{th} 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%

Appendix to Section III.B.8, Anchorage CO Maintenance Plan

Anchorage Municipal Code AMC 15.30 and 15.35

Chapter 15.30 SOUTH CENTRAL CLEAN AIR PROGRAM*

***Cross references:** South Central clean air authority commission,§ 4.40.115; environmental protection, AMCRTitle 15.

State law references: Local program authorized, AS 46.14.400.

15.30.010 Short title of chapter.

This chapter may be known and cited as the South Central Clean Air Ordinance.

(AO No. 78-140; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70)

15.30.020 South Central Clean Air Authority.

A. A regional air pollution control authority called the South Central Clean Air Authority is hereby established within the boundaries of the municipality and the Matanuska-Susitna Borough.

B. Subject to the powers granted by law to member governments, the South Central Clean Air Authority shall have primary responsibility for control of air pollution from all sources within the boundaries of the member governments except where jurisdiction is reserved by law exclusively for the United States or the state, shall adopt and enforce rules and regulations that endeavor to achieve and maintain national and state ambient air quality standards and emission standards, and shall enforce this chapter and any rules and regulations promulgated pursuant thereto.

(AO No. 78-140; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70)

15.30.030 Definitions.

Unless separately defined in a rule or regulation promulgated pursuant to this chapter or unless the context clearly indicates otherwise, the following terms used in this chapter or any rule or regulation promulgated pursuant thereto shall be defined as follows:

Air contaminant means dust, fumes, mist, smoke, fly ash, other particulate matter, vapor, gas or an odorous substance, or a combination of these, but not including water vapor or steam condensate.

Air contaminant source means any source whatsoever at, from or by reason of which there is emitted or discharged into the atmosphere any air contaminant.

Air pollutant means a material in the atmosphere, either from natural or manmade sources, in a concentration that reaches or exceeds a level that tends to have some adverse effect on human health or welfare, have some deleterious effect on animal or plant life, or damage materials of economic value to society.

Air pollution means the presence in the outdoor atmosphere of one or more air pollutants.

Air quality control plan means the Alaska Air Quality Control Plan as approved by the administrator of the Environmental Protection Agency pursuant to those provisions of the federal Clean Air Act relative to state implementation plans.

Alteration means any addition to, any enlargement of, any replacement of, any major modification of, or any change in the design, capacity, process or arrangement of, or any increase in, the connected loading of equipment or control apparatus that will affect the kind or amount of air contaminant emitted.

Ambient air and *atmosphere* mean any unconfined portion of the atmosphere or the outside air.

Authority means the South Central Clean Air Authority.

Best practical technology means the best system of technology available to correct the emission problem when considering cost of system, efficiency of the process, and commercial availability on the market.

Borough means the Matanuska-Susitna Borough.

Commission means the South Central Clean Air Authority commission.

Director means the director of the South Central Clean Air Authority or his authorized representative.

Emission means a release of air contaminants into the environment.

Equipment means any stationary or portable device or any part thereof capable of causing the emission of any air contaminant.

Facility means a pollutant-emitting source or activity located on one or more contiguous or adjacent properties and which is operated by the same person under common control.

Indirect source means a facility, building, structure or installation that attracts or may attract activity that results in emissions of a pollutant for which there is a national ambient air quality standard, including but not limited to highways and roads; parking facilities; retail, commercial and industrial facilities; recreation, amusement, sports and entertainment facilities; airports; office and governmental buildings; apartment and condominium buildings; and education facilities.

Installation means the placement, assemblage or construction of equipment or control apparatus at the premises where equipment, as defined in this section, or control apparatus will be used.

Marine installation means a movable or fixed petroleum exploration, production or extraction platform, or other offshore facility, in or on the waters located within the municipality, from which the emission of air contaminants occurs.

Member government means the municipalities of Anchorage and the Matanuska-Susitna Borough.

Motor vehicle means any self-propelled vehicle designed and used for transporting persons or property, but excludes aircraft, vessels operated on water and vehicles operated exclusively on rails.

National air quality standard means a national primary or secondary ambient air quality standard promulgated pursuant to the federal Clean Air Act.

Opacity means the degree to which emissions reduce the transmission of light and obscure the view of an object in the background.

Owner means the person who owns, leases or supervises equipment, control apparatus or a stationary or mobile source of air contaminants.

Particulate matter and *particulates* mean finely divided solid or liquid particles in the air or in an emission, including but not limited to dust, smoke, fumes, spray and fog.

ppm means parts per million by volume.

Person means any individual, trust, estate, firm, corporation, association, partnership or any officer, employee, department, agency, board, bureau or commission of the United States, a state or any political subdivision thereof.

Regulation means any regulation, ambient air quality standard, emission standard, limitation or control or subsequently adopted additions or amendments thereto promulgated pursuant to this chapter.

Standard cubic foot of gas means that amount of gas that would occupy a cube having dimensions of one foot on each side, if the gas were free of vapor and at a pressure of 14.7 PSIA and a temperature of 70 degrees Fahrenheit.

Visible emissions means those gases or particulates, excluding uncombined water, that separately or in combination are visible upon release to the outdoor atmosphere.

(GAAB 16.68.020, 16.70.010; AO No. 78-140; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70; AO No. 93-131, § 1, 10-26-93)

Cross references: Definitions and rules of construction generally,§ 1.05.020.

15.30.035 South Central Clean Air Authority commission.

A. A South Central Clean Air Authority commission of six members shall be the governing body of the South Central Clean Air Authority, shall exercise all powers vested in that authority by law, and shall administer the provisions of this chapter within the member governments.

B. The commission shall consist of two assembly members and the mayor or his designee from each member government appointed in the manner provided by the law of that member government. The Anchorage commission members shall consist of the mayor or his designee and two assembly members appointed by the mayor.

C. The term of each commission member shall be equal to the duration of his elected term or until a vacancy occurs. When a vacancy occurs, a new member shall be appointed in the manner provided by the law of that member government for the appointment of commission members.

D. The commission shall meet at least annually and shall elect annually from its membership a presiding officer and such other officers as it deems appropriate. All officers shall serve terms of one year and may be reelected to their positions.

E. A quorum shall consist of four voting members of the commission. No action of the commission shall be taken or shall be effective except upon concurrence of at least four voting members.

F. The commission shall determine its own rules of procedure, order of business, and meeting places and times.

G. Each commission member shall be compensated for his attendance at official commission meetings in the manner provided by the law of his member government. The Anchorage commission members shall be compensated in the same manner as members of adjudicatory commissions pursuant toSection 4.05.050. Each commission member may also be paid such per diem and travel expenses for meetings outside his member government as may be provided by the law of that member government.

H. In order to effect the powers and duties of the authority, the commission shall:

1. Hear appeals from decisions of the director concerning applications for variances, permits or other entitlements, appeals from compliance orders and other decisions of the director for which appeals are authorized underSection 15.30.220;

2. Advise the mayors and assemblies of member governments regarding enactment or revision of legislation affecting air quality within the authority;

3. Hold such public hearings as it deems necessary for administration and enforcement of rules and regulations of the authority, member government ordinances and state law, compel the attendance of witnesses and the production of evidence, and adopt such rules of procedure as it finds reasonable and necessary for holding public hearings; and

4. Issue such orders in the exercise of its appellate jurisdiction as may be necessary to effect the provisions of this chapter.

(AO No. 80-70)

15.30.040 Director.

A. The administrative powers and duties of the authority shall be exercised by the director.

B. The director shall be the director of the Anchorage member government's department of health and human services.

C. The director shall:

1. Grant or deny applications for variances pursuant toSection 15.30.140.

2. Grant or deny applications for permits for which application is made to the authority pursuant to this chapter.

3. Determine the existence of and order curtailment actions for air episodes consistent withSection 15.30.060.

4. Enforce the provisions of this chapter and all regulations, rules, permits, variances or orders pursuant thereto.

5. Serve as a nonvoting, ex officio member and secretary of the commission.

D. The director shall have the power to:

1. Issue such enforcement orders as are necessary to control or reduce fugitive emissions pursuant to the law of a member government.

2. Require the owner or operator of air contaminant sources to install, maintain and operate emission or ambient air monitoring devices or both and to furnish data collected to the director.

3. Gather data concerning air pollution within the authority, conduct research and investigation into the causes and prevention of air pollution and conduct other related and scientific and technical investigations.

4. Render general administrative services to the commission and its member governments and provide such other duties as may be assigned by the commission or required to administer this chapter.

5. Contract for technical, professional, advisory, legal and other services that may be reasonable and proper for the performance of the authority's powers and duties, subject to the provisions of subsection 6 of this subsection.

6. Apply for, receive, administer and expend federal aid, state aid and other funds for the control of air pollution or the development and administration of programs related to that control in accordance with the approved budgets of each member government.

(GAAB 16.70.020, 16.70.050, 16.70.060, 16.70.090; AO No. 78-140; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70)

15.30.050 Air pollution inspections.

The director or a duly authorized officer, employee or representative may at a reasonable time and upon presentation of a proper search warrant, where required by the constitution of the United States or the state, enter and inspect the property and premises where an air contaminant source is located or is being constructed for the purpose of ascertaining the state of compliance with this chapter and the rules and regulations promulgated pursuant thereto. No person may interfere with such inspection.

(GAAB 16.70.080; AO No. 78-140; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70)

15.30.060 Air pollution episodes.

A. *Concentration levels.* An air pollution episode shall be declared when in the opinion of the director the concentration of air contaminants in the ambient air has reached or is predicted to reach any of the following levels:

1. *Air alert.*

a. Sulfur dioxide: 365 micrograms per cubic meter of air or 0.14 parts per million (24-hour average).

b. PM-10: 150 micrograms per cubic meter (24-hour average).

c. Carbon monoxide: Ten milligrams per cubic meter or nine parts per million (eight-hour average).

2. *Air warning.*

a. Sulfur dioxide: 800 micrograms per cubic meter of air or 0.3 parts per million (24-hour average).

b. PM-10: 350 micrograms per cubic meter (24-hour average).

c. Carbon monoxide: 17 milligrams per cubic meter or 15 parts per million (eight-hour average).

3. *Air emergency.*

a. Sulfur dioxide: 1,600 micrograms per cubic meter of air or 0.6 parts per million (24-hour average).

b. PM-10: 420 micrograms per cubic meter (24-hour average).

c. Carbon monoxide: 34 milligrams per cubic meter or 30 parts per million (eight-hour average).

B. *Air pollution episode plan.* The director shall, in order to effect the purposes of this section, prescribe and publish an air pollution episode plan that describes the curtailment actions, communication and public notification procedures to be employed when the concentration of air contaminants has reached or is predicted to reach the concentrations set forth in subsection A of this section. The Anchorage Air Pollution Episode Plan is adopted by reference as part of this chapter. Copies of this plan shall be maintained at the mayor's office, department of health and human services, and office of emergency management.

C. *Air quality advisory.* The director or his designee shall issue an air quality advisory when, in his judgment, air quality or atmospheric dispersion conditions exist that may cause injury to public health.

(GAAB 16.70.100; AO No. 78-140; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70; AO No. 86-111; AO No. 93-131, §§ 2--4, 10-26-93)

15.30.070 Confidentiality of records.

Records and information other than emission data in the possession of the municipality which relate to production or sales figures or to processes or production techniques of the owner or operator of an air contaminant source are considered confidential records of the municipality after application by the party that their public disclosure would tend to adversely affect his competitive position.

(GAAB 16.70.120; AO No. 78-140; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70)

15.30.080 Limitations.

This chapter does not:

A. Grant to the director jurisdiction or authority with respect to air contamination existing solely within commercial and industrial plants, works or shops.

B. Affect the relations between employers and employees with respect to or arising out of a condition of air contamination or air pollution.

C. Supersede or limit the applicability of a law or ordinance relating to sanitation, industrial health or safety.

(GAAB 16.70.130; AO No. 78-140; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70)

15.30.090 Compliance with federal and state law.

Unless otherwise allowed by law and by this chapter or a regulation promulgated pursuant thereto, no person shall commit any act prohibited by, omit any act required by, or exceed any standard or limitation established by the federal Clean Air Act, as amended, or by ASTitle 46, article 4, as amended, or by any valid rule, regulation, emission standard or limitation, ambient air quality standard or performance standard promulgated pursuant to either the federal or state legislation.

(AO No. 78-140; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70; AO No. 93-131, § 5, 10-26-93)

15.30.100 Registration of air contaminant sources; notification of completion.

A. *Registration required.* Except as otherwise provided in subsection F of this section, no person shall construct, install or establish any of the following air contaminant sources within the territorial limits of the municipality without first registering that source with the director:

1. Any facility requiring a permit to operate pursuant to state or municipal law or regulation for the control of air contaminants.
2. Any facility that can emit into the ambient air, without regard to whether air quality control equipment is operating, carbon monoxide, sulfur oxides or particulate matter in an amount that equals or exceeds five tons per year or hydrocarbons or nitrogen oxides in an amount that equals or exceeds ten tons per year.
3. Rock crushing or screening operations.
4. Coal- or oil-fired equipment having a rating that equals or exceeds 3,000 kilowatts or 10,000,000 Btu's per hour.
5. Incinerators having a rated capacity that equals or exceeds 250 pounds per hour.
6. Storage tanks, reservoirs or containers having a capacity that equals or exceeds 40,000 gallons and are used for the storage of petroleum liquids.
7. Marine installations within the municipality for more than 30 consecutive days in a year.

B. *Registration form; responsibility for registration.* The owner or lessee of an air contaminant source or his agent shall register all facilities subject to registration on forms furnished by the director. The owner of the source shall be responsible for registration and shall verify the correctness of the information submitted.

C. *Inventory of contaminant sources.* The registration of each air contaminant source subject to registration and notification pursuant to subsection A of this section shall include a detailed inventory of contaminant sources and emissions related to such process; provided, however, that separate registration shall not be required for identical units of equipment or control apparatus installed, altered or operated in an identical manner on the same premises.

D. *Notification of completion required.* No person shall operate or cause the operation of an air contaminant source for which registration is required pursuant to this section without first notifying the director of the date upon which such source shall begin to operate.

E. *Inspection.* The director shall, within 30 days of receipt of notice of completion, inspect the facility, and shall issue a notice of violation if he finds that the construction, installation or establishment of the facility is not in accord with the plans, specifications or other information submitted to the director or that the facility is otherwise in violation of this chapter or regulation promulgated pursuant thereto.

F. *Exception.* Neither air contaminant source registration nor notification of completion shall be required for a point source of an air contaminant that has previously registered with the Cook Inlet Air Resources Management District, has previously issued a notice of completion to that district, and has not undergone significant alteration since such registration and issuance of the notice of completion.

(GAAB 16.68.030; AO No. 78-140; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70)

15.30.110 Permit to operate air contaminant source.

A. *Required for certain facilities.* No person shall operate or cause the operation of a facility capable of emitting into the ambient air, regardless of whether air quality control equipment is operating, an air contaminant from any of the following sources without first applying at least 30 days prior to either purchasing equipment or commencing construction of the facility and without first receiving a permit to operate from the director:

1. Industrial process units having a total design rate, capacity or throughput that equals or exceeds five tons per hour.

2. Fuel-burning equipment having a combined rating that equals or exceeds 35 million Btu's per hour.

3. A facility containing one or more incinerators, with a total combined rated capacity that equals or exceeds 500 pounds per hour.

B. *Approval of plans.* No person may construct, modify, replace or undertake a major alteration of a facility requiring a permit to operate until detailed plans and specifications are submitted to the director and approved. The director shall approve or reject such plans and specifications within 30 days of receipt of a complete set of such plans and specifications unless the director holds a public hearing pursuant to subsection C of this section. These plans and specifications shall include the following information:

1. One set of plans and specifications, clearly indicating the layout of the facility, location of individual pieces of equipment and points of discharge.

2. One set of maps or aerial photographs of a scale of at least one inch to one mile indicating the location and zoning of the proposed facility and, within a one-mile radius of the facility, the land use and zoning of the surrounding area, all homes, buildings, watercourses, roads and other adjacent facilities, and the general topography.

3. An engineering report outlining the proposed methods of operation, the quantity and quality of material to be processed, the proposed use and distribution of the processed material, and a process flow diagram indicating the points of emission, including estimated quantities and types of air contaminants to be emitted.

4. A description and the specifications of all air quality control devices, including design criteria and other information indicating that such equipment is capable of complying with applicable federal, state and municipal emission requirements.

5. An evaluation of the effect on the surrounding ambient air of the emissions from the facility, if requested by the director.

6. Plans for emission reduction procedures during an air pollution episode if requested by the director.

C. *Public hearing.* The director may hold a public hearing concerning any application for a permit to operate if the director determines that public testimony is necessary before approval or rejection of an application for a permit to operate and if the director provides public notice of such hearing not less than 30 days prior to the hearing in a newspaper of general circulation. In such cases the director shall approve or reject the application within five days after conclusion of the public hearing.

D. *Criteria for approval.* Approval to construct a new air contaminant source or modify an existing facility requiring a permit to operate may not be granted unless the applicant shows to the satisfaction of the director that:

1. The new or modified source will not prevent or interfere with the attainment or maintenance of any federal, state or municipal ambient air quality standard.

2. The new or modified source will operate without causing a violation of this chapter or

any regulation, rule, permit or final order issued pursuant thereto.

3. The equipment incorporates the control technology required by federal, state and municipal law or regulation for the kind and amount of air contaminant emitted by the equipment.

E. *Transfer; conditions.* A permit to operate may:

1. Not be transferred without the written consent of the director.

2. Not be issued for a period greater than five years, after which the permit must be renewed for continued operation of the facility.

3. Include a compliance schedule approved by the director approving for the minimum time necessary to install the required control equipment if the facility would or is emitting air contaminants in excess of federal, state or municipal emission standards or limitations; provided, however, that a compliance schedule for any facility emitting air contaminants subject to federal or state regulation may not allow compliance later than the date provided by federal or state regulation. A permit including a compliance schedule must be reviewed and renewed every year of its duration.

4. Require that specific emission reduction procedures be taken during an air pollution episode.

F. *Authority to impose additional requirements.* The director may require an applicant for a permit to operate: to install, use and maintain monitoring equipment; to sample emissions in accordance with methods prescribed by the director at locations, intervals and by procedures as may be specified; to provide source test ports of the size, number and location as may be required and safe access to each port; to provide emission data and information from analysis of any test samples; and to provide periodic reports on process emissions.

G. *Notification of denial.* If an application for a permit to operate is denied, the director shall notify the applicant in writing of the reasons.

H. *Equipment requirements.* Nothing in this section may be construed to authorize the director to require the use of machinery, devices or equipment from a particular supplier or produced by a particular manufacturer if the required emission standards may be met by machinery, devices or equipment available from other sources.

I. *Fee.* A reasonable fee in the amount set by the director will be charged for the issuance of a permit.

J. *Compliance with applicable regulations.* The issuance of a permit to operate shall neither relieve the owner of a facility requiring a permit of the obligation to comply with all applicable federal, state or municipal emission standards and limitations nor prevent the director from issuing other orders pursuant to this chapter and the rules and regulations of the director promulgated pursuant thereto.

K. *Revocation or suspension.* A permit to operate may be revoked or suspended by the director if the conditions of the permit or applicable laws, rules or regulations are violated.

(GAAB 16.68.090, 16.70.070; AO No. 78-140; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70; AO No. 93-131, § 6, 10-26-93)

15.30.120 Source reports.

The air contaminant emission data required bySection 15.30.100or 15.30.110 shall be compiled and submitted to the director at reasonable intervals upon the request of the director.

(GAAB 16.68.050; AO No. 78-140; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70)

15.30.130 Source tests.

A. The director may conduct or have conducted source testing in order to determine compliance with this chapter or any rule or regulation promulgated pursuant thereto.

B. Testing to determine compliance with provisions of this chapter or any rule or regulation promulgated pursuant thereto shall be by methods of measurement approved by the director and undertaken in such a manner as to characterize the actual discharge into the ambient air.

C. The cost, if any, to the municipality of any such source testing authorized by subsection A of this section shall be a debt due the municipality from the owner or operator of such source and recoverable in any court of competent jurisdiction when such testing shall have proved the emission of air contaminants in violation of this chapter or any rule or regulation promulgated pursuant thereto.

(GAAB 16.68.250; AO No. 78-140; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70)

15.30.140 Variance criteria.

A. A person who owns or is in control of a plant, building, structure, establishment, process or equipment may apply to the director for a variance from any emission standard or limitation promulgated pursuant to this chapter. The director may grant the variance, but only after public hearing following 30 days' notice, if the director finds that:

1. The emissions occurring or proposed to occur do not endanger human health or safety; and

2. Compliance with the rules or regulations from which the variance is sought would produce serious hardship without equal or greater benefits to the public.

B. No variance may be granted under this section until the director has considered the relative interest of the applicant, other owners of property likely to be affected by the emissions, and the general public.

C. A variance granted under subsection A of this section shall be for periods and under conditions consistent with the reasons for it and within the following limitations:

1. If a variance is granted on the grounds that there is no practicable means known or available for the adequate prevention, abatement or control of the air pollution involved, it shall be effective only until the necessary means for prevention, abatement or control become known and available, subject to the taking of substitute or alternate measures that the director may prescribe.

2. If a variance is granted on the grounds that compliance with the particular requirement from which a variance is sought will necessitate the taking of measures which because of their complexity or cost will involve considerable hardship, it shall be effective for a period of time which in the opinion of the director is necessary and reasonable. A variance granted on this ground shall contain a timetable for compliance with the particular requirement from which a variance is sought in an expeditious manner and shall be for not more than five years.

3. If a variance is granted on the grounds that it is justified to relieve or prevent hardship of a kind other than that provided in subsections C.1 and C.2 of this section, it shall be for not more than one year.

D. A variance granted under this section may be renewed on terms and conditions and for periods which would be appropriate for the initial granting of a variance. If complaint is made to the director on account of the variance, no renewal of it shall be granted unless, after public hearing on the complaint following the notice, the director finds that renewal is justified. No renewal may be granted except upon application for renewal made at least 60 days before the expiration of the variance. Immediately upon receipt of an application for renewal, the director shall give public notice of it.

E. The grant of a variance or renewal is not a right of the applicant but is within the discretion of the director.

F. No variance or renewal granted under this section may be construed to prevent or limit the air pollution episode provisions of this chapter.

(GAAB 16.70.110; AO No. 78-140; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70)

15.30.150 Judicial review of action on variance.

A person adversely affected by the grant, denial or renewal of a variance by the director may obtain judicial review of the director's order by filing appeal within 30 days after the date of such order. Judicial review of the grant, denial or renewal of a variance may be had only on the grounds that the grant, denial or renewal was arbitrary or capricious.

(GAAB 16.70.110; AO No. 78-140; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70)

15.30.160 Other limitations.(Repealed).

(AO No. 80-70)

15.30.170 Rule-making procedures.(Repealed).

(AO No. 80-70)

15.30.180 Notice of violation.

When the director has evidence that a violation of this chapter or rule or regulation issued under this chapter has occurred, the director shall serve a written notice of violation upon the suspected violator. The notice shall specify the provision believed to be violated and the facts believed to constitute the violation and may include a compliance order that necessary corrective action be taken within a reasonable time.

(GAAB 16.70.140; AO No. 78-140; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70)

15.30.190 Effect of compliance order.

A compliance order issued pursuant toSection 15.30.180shall become a final order unless within ten days after receipt of service of the notice of violation and compliance order the person named requests in writing a hearing before the director in the manner provided inSection 15.30.210.

(GAAB 16.70.140; AO No. 78-140; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70)

15.30.200 Voluntary compliance.

The director may make efforts to obtain voluntary compliance through warning, informal conference or other appropriate means.

(GAAB 16.70.140; AO No. 78-140; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70)

15.30.210 Administrative hearings.

A. Upon the written request by any person aggrieved by any decision of the director made pursuant to this chapter or any rule or regulation in force pursuant thereto, including a decision to deny a permit to operate or the issuance of a compliance order, served on the director no later than ten days after that decision, the commission shall conduct a hearing to review the legality, appropriateness or wisdom of that decision. The hearing shall occur not later than 30 days after receipt of service of the request upon the director, and, after considering the evidence presented at the hearing, the commission shall affirm, modify or reverse the decision of the director except as otherwise provided by this chapter or a rule or regulation issued pursuant thereto. The director's decision shall not be stayed pending review by the commission unless the director so orders.

B. If after a hearing held under subsection A of this section the commission finds that a violation of an ordinance, rule, regulation, permit or variance has occurred, it shall affirm or modify the compliance order previously issued or issue an appropriate compliance order for taking corrective action. If the commission finds that no violation has occurred, it shall rescind the previous order, if any. A compliance order issued as a part of a notice of violation or after a hearing may prescribe the date by which the violation shall cease and may prescribe timetables for necessary action in preventing, abating or controlling emissions.

C. In connection with a hearing held under this section, the commission shall have power to, and upon application by a party to the hearing it shall have the duty to, compel the attendance of witnesses and the production of evidence on behalf of all parties.

D. Upon unanimous consent of the commission, the commission may delegate, in writing, the authority to conduct administrative hearings under the provisions of this section to the director of the department for the member government wherein the subject of the administrative hearing arose.

(AO No. 80-70; AO No. 93-131, § 7, 10-26-93)

15.30.220 Appeals.

All appeals of any final decision of the commission shall be made to the Superior Court, Third Judicial District, no later than 30 days allowing that decision, pursuant to rule 601 et seq., of the Rules of Appellate Procedure for the state. Review of the court shall be limited to whether the decision of the commission or director is supported by substantial evidence. A final appealable decision by the commission pursuant to this chapter must indicate that it is a final order and that a party disputing the decision has 30 days to appeal.

(AO No. 80-70; AO No. 95-180, § 13, 9-26-95)

15.30.230 Enforcement.

A. Notwithstanding any other provision of this chapter or other remedy provided by law, any person who violates any provision of this chapter or any regulation, rule, permit, variance or final order issued pursuant thereto shall be subject to injunctive relief to restrain the person from continuing the violation or threat of violation. Upon application for injunctive relief and a finding that a person is violating or threatening to violate any provision of this chapter or any rule, regulation, permit, variance or order issued pursuant to this chapter, the court shall grant injunctive relief to restrain the violation.

B. In addition to any other remedy or penalty provided by law, a person who violates any provision of this chapter or any regulation, rule, permit, variance or final order issued pursuant thereto shall be subject to the civil, criminal and administrative remedies or penalties provided by the law of that member government wherein such violation occurred.

(AO No. 80-70)

Chapter 15.35 SOUTH CENTRAL CLEAN AIR ORDINANCE REGULATIONS

15.35.010 Adoption of regulations.

The municipality hereby adopts as ordinance the following regulations of the South Central Clean Air Ordinance as set forth in full in Sections15.35.030--15.35.170of this chapter.

A. Regulation 1: Stationary Source Emissions.

B. Regulation 2: Mobile Source Emissions.

(AO No. 78-141; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70)

15.35.020 Availability of copies.

At least five copies of each regulation adopted inSection 15.35.010shall be available for public inspection at the offices of the Anchorage Department of Health and Human Services.

(AO No. 78-141; AO No. 80-2; AO No. 80-70; AO No. 85-8)

15.35.030 Stationary source emissions--Short title.

This regulation may be known and cited as South Central Clean Air Ordinance Regulation 1: Stationary Source Emissions.

(AO No. 78-141; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70)

15.35.040 Stationary source emissions--General definitions.

Unless the context clearly indicates otherwise, the following terms used in this regulation shall be defined as follows:

Anchorage bowl area means that area within the boundaries of the Municipality of Anchorage enclosed by a border beginning at the intersection of 61 degrees 18 minutes north latitude and 149 degrees 42 minutes west longitude, thence due south to 61 degrees 4 minutes north latitude, thence due west to 150 degrees 5 minutes west longitude, thence due north to 61 degrees 18 minutes north latitude, and thence due east to the point of beginning, 149 degrees 42 minutes west longitude.

Clean wood means wood with no paint, stains, or other types of coatings, and wood with no preservative treatment(s) including, but not limited to, copper chromium arsenate, creosote, or pentachlorophenol.

Fire chief means the Anchorage Fire Chief or his authorized representative.

Habitable structure means a structure suitable for human habitation including, but not limited to, single or multi-family residences, schools, churches and buildings for commercial purpose. A habitable structure includes porches, gazebos, and other attached improvements.

Incinerator means any furnace used in the process of burning solid waste for the purpose of reducing the volume of the waste by removing combustible matter.

Industrial waste means any material resulting from a production or manufacturing operation having no net economic value to the source producing it.

Open burning means the burning of any matter in such manner that the products of combustion resulting from the burning are emitted directly into the atmosphere without passing through an approved stack, duct, vent or chimney but does not refer to the operation of safety flares for the purpose of protecting human life.

Open, untreated areas means land upon which all of the natural vegetation has been removed and no successful measures have been taken to either revegetate or resurface the ground to prevent the emission of dust, vapors or other particulate matter into the atmosphere.

Outdoor wood-fired boiler or *outdoor wood-fired hydronic heater* means a fuel burning device:

1. Designed to burn primarily wood, wood pellets or other solid fuels and

2. Designed to heat spaces or water by the distribution through pipes of a fluid heated in the device, typically water or a mixture of water and anti-freeze; and

3. Specified by the manufacturer for outdoor installation or in structures not normally inhabited by humans including sheds and garages.

4. Wood-fired boilers that are specifically designed to burn wood pellet fuel with metered air and fuel feed and controlled combustion engineering and burns only pellets from untreated natural wood are exempt from this chapter.

Smolder means to burn and smoke without flame.

Stationary source means any building, structure, facility, installation or equipment that emits or may emit any air contaminant and that contains apparatus to which this regulation applies.

(AO No. 78-141; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70; AO No. 2009-41(S), § 1, 7-1-09)

15.35.050 Stationary source emissions--Visible emission standards.

A. No person shall cause, permit or allow the emission of any air contaminant, excluding portions of emissions containing condensed uncombined water vapor from any stationary source including air curtain incinerators to reduce visibility through the exhaust effluent by:

1. Greater than 20 percent for a period or periods aggregating more than three minutes in any one hour, except as provided in subsection 2 of this subsection; or

2. Twenty percent or greater for municipal wastewater treatment plant sludge incinerators; or

3. Greater than 20 percent for a period or periods aggregating more than six minutes in any hour for wood-fired boilers, except during the first 20 minutes after the initial firing of

the unit.

B. The opacity of an air contaminant shall be determined at the point of emission, except when the point of emission cannot be readily observed, in which case it may be determined at an observable point of the plume nearest the point of emission.

C. This section shall not apply to smoke-generating equipment used by the director for the training, instruction or certification of persons to observe and determine the opacity of air contaminants, nor shall this section apply to smoke-generating equipment used by the fire chief for instruction in firefighting, when such equipment is otherwise operated in compliance with applicable federal and state laws.

(AO No. 78-141; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70; AO No. 93-131, § 8, 10-26-93; AO No. 2009-41(S), § 2, 7-1-09)

15.35.060 Stationary source emissions--Emission standards.

A. Except as otherwise provided in subsection B, no person shall cause, permit or allow emissions of particulate matter into the atmosphere from any stationary source in excess of 0.05 grains per standard cubic foot of exhaust gas.

B. No person may cause, permit or allow emissions into the atmosphere from any single source or emission whatsoever any one or more of the following air contaminants, in any state or combination thereof exceeding the following concentrations at the point of discharge:

1. Sulphur compounds calculated as sulphur dioxide (SO_2) above 500 parts SO_2 per million parts of exhaust gas;

2. Particulate matter as combustion contaminants calculated to 12 percent of carbon dioxide (CO_2):

a. 0.05 grains per standard cubic foot of exhaust gas except as noted in subsections b through g below;

b. 0.04 grains per standard cubic foot of exhaust gas for asphalt batch plants constructed or modified after June 11, 1973;

c. 0.08 grains per standard cubic foot of exhaust gas for incinerators equal to or larger than 2,000 pounds per hour rated capacity;

d. 0.10 grains per standard cubic foot of exhaust gas for those sources in operation prior to July 1, 1972, and for fuel-burning equipment using coal for fuel or for incinerators equal to or larger than 1,000 pounds per hour capacity;

e. 0.15 grains per standard cubic foot of exhaust gas for fuel-burning equipment using more than 20 percent wood waste as fuel;

f. 0.20 grains per standard cubic foot of exhaust gas for incinerators equal to or larger than 200 pounds per hour rated capacity but equal to or less than 1,000 pounds per hour rated capacity;

g. 0.30 grains per standard cubic foot of exhaust gas for incinerators less than 200 pounds per hour rated capacity.

C. No person shall cause, permit or allow the emission of particulate matter from any stationary source that exceeds in any one hour the amount shown in the following table for the process weight rate allocated to such source:

TABLE 1

TABLE INSET:

Process Weight (lb./hr.)	Emission Standards (lb./hr.)
100--299	0.6
300--499	1.2
500--699	1.8
700--999	2.2
1,000--1,999	2.8
2,000--2,999	4.1
3,000--3,999	5.4
4,000--4,999	6.5
5,000--5,999	7.6
6,000--6,999	8.6
7,000--7,999	9.5
8,000--8,999	10.4
9,000--9,999	11.2
10,000--14,999	12.0
15,000--19,999	15.0
20,000--29,999	19.2
30,000--39,999	25.2
40,000--49,999	30.5
50,000--59,999	36.0
60,000--79,999	40.0
80,000--99,999	48.0
100,000--139,999	55.0
140,000 or more	65.0

D. No person shall cause, permit or allow the emission of particulate matter onto the property of others except when such emissions comply with the requirements of Sections15.35.050and15.35.060.A--C.

(GAAB 16.68.130, 16.68.150; AO No. 78-141; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70; AO No. 93-131, § 9, 10-26-93)

15.35.070 Stationary source emissions--Other emission limitations.

A. No person shall cause, allow or permit the emission of any air contaminant or water vapor, including but not limited to odorous matter, that tends to be injurious to or adversely affects human health, safety or welfare, animal or plant life, or property or interferes with the normal use and enjoyment of life, property or business.

B. Nothing in this regulation shall be construed to impair any cause of action or legal remedy therefor of any person or the public for injunctive relief, injury or damages arising from the emission of any air contaminant in such place, manner or concentration as to constitute air pollution or a common law nuisance.

C. The director may establish reasonable requirements that a building or stationary source be enclosed and ventilated in such a way that all the air, gases and particulate matter are effectively dispersed or treated for removal or destruction of odorous matter or other air contaminants before emission to the atmosphere.

(GAAB 16.68.160, 16.68.170; AO No. 78-141; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70)

15.35.080 Stationary source emissions--Circumvention.

A. No person shall willfully cause, allow or permit the installation or use of any device or use any means which, without resulting in a reduction in the total amount of air contaminant emitted, conceals an emission of air contaminant which would otherwise violate these regulations.

B. No person shall cause, allow or permit the installation or use of any device or use of any means designed to mask the emission of an air contaminant which causes detriment to health, safety or welfare of any person.

C. No person shall cause, permit or allow the use of air for dilution of emission contaminants without affecting any total decrease in such contaminants as a method to effect compliance with the requirements of this regulation.

D. No person shall cause, permit or allow the use of stack heights that exceed good engineering practice or dispersion techniques to affect the degree of emission limitation required for control of air contaminants.

(GAAB 16.68.180; AO No. 78-141; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70; AO No. 93-131, § 10, 10-26-93)

15.35.090 Stationary source emissions--Fugitive emissions.

A. No person shall cause, allow or permit particulate matter to be handled, transported or stored without taking reasonable measures to prevent the particulate matter from becoming airborne.

B. Within the boundaries of the municipality no person shall cause, allow or permit a building or its appurtenances or a road to be constructed, altered, repaired or demolished without taking reasonable measures to prevent particulate matter from becoming airborne.

C. Within the boundaries of the municipality no person shall cause, allow or permit untreated open areas, including but not limited to roads, parking lots or construction sites located within a private or public lot or roadway, to be improved, graded, excavated, repaired, demolished, altered or constructed without taking reasonable measures to prevent particulate matter from becoming airborne.

D. The director shall publish guidelines he determines to be reasonable measures for controlling fugitive emissions, and compliance with such guidelines to the satisfaction of the director shall be deemed to fulfill the requirements of subsections A through C.

(AO No. 78-141; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70)

15.35.100 Stationary source emissions--Open burning.

A. Within the boundaries of the municipality no person shall cause, suffer, permit or allow any open burning except the following unless otherwise prohibited by law:

1. Open burning for pleasure, religious, ceremonial, cooking or like social purposes and

open burning from flares, torches, waste gas burners, incense burners and insect pots is allowed.

2. Open burning authorized by the fire chief for the disposal of dangerous materials is allowed, provided no alternate means of disposal is reasonably available.

3. Open burning authorized by the fire chief for instruction in the method of fighting fires or testing fire resistive materials and fire protection equipment is allowed provided that these outdoor fires have prior written approval from the director, and, unless waived by the department, the public shall be notified through the news media of the time, place and purpose of the exercise at least three days in advance of the activity. Prior written approval from the director and public notice shall not be required when such outdoor fires do not exceed 30 inches in diameter.

4. Open burning for the disposal of trees and brush on property being developed for commercial or residential purposes or on property where the trees and brush were grown is allowed provided that:

   a. Open burning shall be allowed only outside the Anchorage bowl area and only during the periods from April 1 through May 31 and August 15 through October 31;

   b. The person responsible for such open burning shall obtain a written permit for such fire from the fire chief and upon terms and conditions specifically approved by the director and shall comply with all the laws and regulations of the director, the fire chief and all other governmental agencies regarding such fires;

   c. Tires or heavy petroleum products may not be used to start or maintain open burning.

5. Open burning for the disposal of household refuse is allowed in the areas of the municipality where municipal or Alaska Public Utilities Commission sanctioned refuse collection service is not available.

6. The burning of combustible construction debris, trees, brush and other vegetative matter is allowed in a commercial air curtain combustion system properly operated and maintained according to the manufacturer's specifications, provided that the device has been registered with the director, that the operator obtains written approval from the director prior to operation, and that the operation of the device complies with all rules and regulations of the director, the fire chief and all other governmental agencies regarding such equipment.

7. Open burning for the disposal of small quantities of grass, leaves, weeds and other organic debris accumulated during winter months may be allowed without an open burning permit throughout the municipality during a ten-day period in the spring authorized by the mayor upon appropriate terms and conditions that take into consideration those factors described in subsection A.10. of this section.

8. Open burning for the disposal of small quantities of grass, leaves, brush, weeds and other organic debris may be allowed without an open burning permit in the area east of the Bragaw Road/Elmore/Abbot Loop alignment and south of Tudor Road up to 24 days between May 1 and June 14 and up to 14 days between August 15 and October 15, when authorized by the mayor and upon appropriate terms and conditions that take into consideration those factors described in subsection A.10. of this section.

9. The fire chief, with the approval of the air pollution control officer or department, may issue open burning permits for the disposal of small quantities of grass, leaves, brush, weeds and other organic debris at such times and places and upon such terms and conditions as the fire chief and director deem appropriate in consideration of and consistent with those factors described in subsection A.10. of this section.

10. The fire chief, with the approval of the air pollution control officer or the department may issue open burning permits allowed by this section upon appropriate terms and conditions that take into consideration the ambient air quality, the achievement and maintenance of federal, state or municipal ambient air quality standards, meteorological conditions, the suitability of air pollution control devices for large quantities of waste, means of reducing fire hazards, the suitability of disposal by other available means, the amount and nature of waste to be burned, the proximity of the burn site to developed areas and the population density of the surrounding area.

B. The director shall publish the dates during which open burning will be allowed along with appropriate terms and conditions to be followed while burning.

C. The director may suspend or prohibit open burning at any time based on air quality considerations, or, upon consultation with the fire chief, for fire safety reasons.

D. The fire chief, in consultation with the air pollution control officer, and upon appropriate terms and conditions that take into consideration those factors described in subsection A.10 of this section, may issue written permits for the destruction of timber infested with spruce bark beetle during periods outside of the open burn periods designated in this section.

E. The fire chief shall establish guidelines and may establish an appropriate fee schedule for the issuance of written permits authorized under this section.

F. It shall be a rebuttable presumption that the person who owns or controls the property on which open burning occurs has caused or allowed said open burning.

(GAAB 16.68.210; AO No. 78-141; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70; AO No. 93-131, § 11, 10-26-93; AO No. 93-210(S), § 1, 1-18-94; AO No. 95-196(S), §§ 1, 2, 10-17-95; AO No. 96-135(S), § 1, 10-22-96)

15.35.105 Stationary source emissions--Wood-fired boilers.

A. Unless otherwise prohibited by law, within the boundaries of the municipality no person shall cause, suffer, permit or allow the operation of a wood-fired boiler except when fired by:

1. Clean wood, or

2. Wood pellets made from clean wood; or

3. Corn; or

4. Home heating oil and natural gas as a starter fuel or substitute fuel in dual-fired wood boilers.

B. Within the boundaries of the municipality the burning of wood that has been treated, painted, or treated with preservatives or other coatings is prohibited.

C. Within the boundaries of the municipality the burning of used oil, waste petroleum products and home heating oil not meeting applicable limits for sulfur content is prohibited.

D. Within the boundaries of the municipality, no person shall install or allow the installation of a wood-fired boiler subject to the requirements of this section unless:

1. The wood-fired boiler is located more than 50 feet from an adjacent property line and 100 feet from any habitable structure that it is not serving at the time of installation, unless that property or habitable structure is under common ownership; and

2. The wood-fired boiler has an attached permanent stack extending higher than the peak of the roof of the structure(s) being served by the wood-fired boiler, and higher than the peak of the roof of any other habitable structure located within 150 feet of the wood-

fired boiler; and

3. The wood-fired boiler is certified to meet the U.S. Environmental Protection Agency voluntary phase 2 emissions level for wood-fired boilers through testing by an accredited independent laboratory showing it emits no more than 0.32 pounds of particulate matter per million BTUs of heat output; and

4. The wood-fired boiler complies with all applicable laws, including but not limited to local ordinances, and its operation does not create a public nuisance; and

5. Scaled drawings, prepared by a registered professional engineer or registered professional land surveyor, are submitted and approved by the air pollution control officer showing the wood-fired boiler will meet the separation requirements to adjacent property lines and habitable structures established in this subsection and that the stack of the boiler will be higher than the roof peak of any habitable structure within 150 feet.

6. Installation, modification and repair of a wood-fired boiler shall comply with the provisions of the Anchorage Building Code, Title 23of the Anchorage Municipal Code.

(AO No. 2009-41(S), § 3, 7-1-09)

15.35.110 Mobile source emissions--Short title.

This regulation may be known and cited as the South Central Clean Air Ordinance Regulation 2: Mobile Source Emissions.

(AO No. 78-141; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70)

15.35.120 Mobile source emissions--Application.

The provisions of this regulation apply only to mobile sources within the boundaries of the municipality.

(AO No. 78-141; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70)

15.35.130 Mobile source emissions--Definitions.

Unless the context clearly indicates otherwise the following terms used in this regulation shall be defined as follows:

Mobile source means a source capable of simultaneous motion and emission of air contaminants.

Motor vehicle means any self-propelled vehicle designed and used for transporting persons or property but excludes aircraft, vessels operated on water and vehicles operated exclusively on a rail or rails.

(AO No. 78-141; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70)

15.35.140 Motor vehicle emissions.

A. No person shall operate, drive, cause or permit to be driven or operated any motor vehicle upon a public street or highway that emits any visible emission for a period in excess of five consecutive seconds except for those motor vehicles powered by compression ignition or diesel-powered engines and except when the presence of uncombined water is the only reason an emission fails to meet this requirement.

B. No person shall operate, drive, cause or permit to be driven or operated any diesel-powered motor vehicle that emits for a period in excess of ten consecutive seconds any air contaminant that obscures an observer's vision to a degree greater than 30 percent opacity.

C. No person shall operate, drive, cause or permit to be driven or operated any motor vehicle that violates or exceeds any federal or state law, regulation, emission standard or limitation applicable to such motor vehicle for the control of emissions of carbon monoxide, hydrocarbons or oxides of nitrogen.

(AO No. 78-141; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70)

15.35.150 Motor vehicle fleet operation.

The director by written notice may require the owner of any motor vehicle fleet operation of more than five vehicles to certify annually that its motor vehicles are maintained in good working order and, if applicable, in accordance with the motor vehicle manufacturer's specifications and maintenance schedules that may or tend to affect visible emissions. The director by written notice may require records pertaining to observations, tests, maintenance and repairs performed to control or reduce visible emissions from individual motor vehicles to be made available for review and inspection by the director.

(AO No. 78-141; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70)

15.35.160 Motor vehicle inspection.

The director by written notice may require the owner of any motor vehicle of a motor vehicle fleet operation or the owner of any motor vehicle that the director has reason to believe may be in violation of this regulation to make such motor vehicle available for testing for compliance withSection 15.35.140of this regulation at a reasonable time and place.

(AO No. 78-141; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70)

15.35.170 Motor vehicle owner liability.

It shall be a rebuttable presumption that the owner of a motor vehicle that violates or exceeds any provision of this regulation has caused or permitted the operation or driving of that motor vehicle.

(AO No. 78-141; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70)

Chapter 15.35 SOUTH CENTRAL CLEAN AIR ORDINANCE REGULATIONS

15.35.010 Adoption of regulations.

The municipality hereby adopts as ordinance the following regulations of the South Central Clean Air Ordinance as set forth in full in Sections15.35.030--15.35.170of this chapter.

A. Regulation 1: Stationary Source Emissions.

B. Regulation 2: Mobile Source Emissions.

(AO No. 78-141; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70)

15.35.020 Availability of copies.

At least five copies of each regulation adopted inSection 15.35.010shall be available for public inspection at the offices of the Anchorage Department of Health and Human Services.

(AO No. 78-141; AO No. 80-2; AO No. 80-70; AO No. 85-8)

15.35.030 Stationary source emissions--Short title.

This regulation may be known and cited as South Central Clean Air Ordinance Regulation 1: Stationary Source Emissions.

(AO No. 78-141; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70)

15.35.040 Stationary source emissions--General definitions.

Unless the context clearly indicates otherwise, the following terms used in this regulation shall be defined as follows:

Anchorage bowl area means that area within the boundaries of the Municipality of Anchorage enclosed by a border beginning at the intersection of 61 degrees 18 minutes north latitude and 149 degrees 42 minutes west longitude, thence due south to 61 degrees 4 minutes north latitude, thence due west to 150 degrees 5 minutes west longitude, thence due north to 61 degrees 18 minutes north latitude, and thence due east to the point of beginning, 149 degrees 42 minutes west longitude.

Clean wood means wood with no paint, stains, or other types of coatings, and wood with no preservative treatment(s) including, but not limited to, copper chromium arsenate, creosote, or pentachlorophenol.

Fire chief means the Anchorage Fire Chief or his authorized representative.

Habitable structure means a structure suitable for human habitation including, but not limited to, single or multi-family residences, schools, churches and buildings for commercial purpose. A habitable structure includes porches, gazebos, and other attached improvements.

Incinerator means any furnace used in the process of burning solid waste for the purpose of reducing the volume of the waste by removing combustible matter.

Industrial waste means any material resulting from a production or manufacturing operation having no net economic value to the source producing it.

Open burning means the burning of any matter in such manner that the products of combustion resulting from the burning are emitted directly into the atmosphere without passing through an approved stack, duct, vent or chimney but does not refer to the operation of safety flares for the purpose of protecting human life.

Open, untreated areas means land upon which all of the natural vegetation has been removed and no successful measures have been taken to either revegetate or resurface the ground to prevent the emission of dust, vapors or other particulate matter into the atmosphere.

Outdoor wood-fired boiler or *outdoor wood-fired hydronic heater* means a fuel burning device:

1. Designed to burn primarily wood, wood pellets or other solid fuels and

2. Designed to heat spaces or water by the distribution through pipes of a fluid heated in the device, typically water or a mixture of water and anti-freeze; and

3. Specified by the manufacturer for outdoor installation or in structures not normally inhabited by humans including sheds and garages.

4. Wood-fired boilers that are specifically designed to burn wood pellet fuel with metered air and fuel feed and controlled combustion engineering and burns only pellets from untreated natural wood are exempt from this chapter.

Smolder means to burn and smoke without flame.

Stationary source means any building, structure, facility, installation or equipment that emits or may emit any air contaminant and that contains apparatus to which this regulation applies.

(AO No. 78-141; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70; AO No. 2009-41(S), § 1, 7-1-09)

15.35.050 Stationary source emissions--Visible emission standards.

A. No person shall cause, permit or allow the emission of any air contaminant, excluding portions of emissions containing condensed uncombined water vapor from any stationary source including air curtain incinerators to reduce visibility through the exhaust effluent by:

1. Greater than 20 percent for a period or periods aggregating more than three minutes in any one hour, except as provided in subsection 2 of this subsection; or

2. Twenty percent or greater for municipal wastewater treatment plant sludge incinerators; or

3. Greater than 20 percent for a period or periods aggregating more than six minutes in any hour for wood-fired boilers, except during the first 20 minutes after the initial firing of

the unit.

B. The opacity of an air contaminant shall be determined at the point of emission, except when the point of emission cannot be readily observed, in which case it may be determined at an observable point of the plume nearest the point of emission.

C. This section shall not apply to smoke-generating equipment used by the director for the training, instruction or certification of persons to observe and determine the opacity of air contaminants, nor shall this section apply to smoke-generating equipment used by the fire chief for instruction in firefighting, when such equipment is otherwise operated in compliance with applicable federal and state laws.

(AO No. 78-141; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70; AO No. 93-131, § 8, 10-26-93; AO No. 2009-41(S), § 2, 7-1-09)

15.35.060 Stationary source emissions--Emission standards.

A. Except as otherwise provided in subsection B, no person shall cause, permit or allow emissions of particulate matter into the atmosphere from any stationary source in excess of 0.05 grains per standard cubic foot of exhaust gas.

B. No person may cause, permit or allow emissions into the atmosphere from any single source or emission whatsoever any one or more of the following air contaminants, in any state or combination thereof exceeding the following concentrations at the point of discharge:

1. Sulphur compounds calculated as sulphur dioxide (SO_2) above 500 parts SO_2 per million parts of exhaust gas;

2. Particulate matter as combustion contaminants calculated to 12 percent of carbon dioxide (CO_2):

a. 0.05 grains per standard cubic foot of exhaust gas except as noted in subsections b through g below;

b. 0.04 grains per standard cubic foot of exhaust gas for asphalt batch plants constructed or modified after June 11, 1973;

c. 0.08 grains per standard cubic foot of exhaust gas for incinerators equal to or larger than 2,000 pounds per hour rated capacity;

d. 0.10 grains per standard cubic foot of exhaust gas for those sources in operation prior to July 1, 1972, and for fuel-burning equipment using coal for fuel or for incinerators equal to or larger than 1,000 pounds per hour capacity;

e. 0.15 grains per standard cubic foot of exhaust gas for fuel-burning equipment using more than 20 percent wood waste as fuel;

f. 0.20 grains per standard cubic foot of exhaust gas for incinerators equal to or larger than 200 pounds per hour rated capacity but equal to or less than 1,000 pounds per hour rated capacity;

g. 0.30 grains per standard cubic foot of exhaust gas for incinerators less than 200 pounds per hour rated capacity.

C. No person shall cause, permit or allow the emission of particulate matter from any stationary source that exceeds in any one hour the amount shown in the following table for the process weight rate allocated to such source:

TABLE 1

TABLE INSET:

Process Weight (lb./hr.)	Emission Standards (lb./hr.)
100--299	0.6
300--499	1.2
500--699	1.8
700--999	2.2
1,000--1,999	2.8
2,000--2,999	4.1
3,000--3,999	5.4
4,000--4,999	6.5
5,000--5,999	7.6
6,000--6,999	8.6
7,000--7,999	9.5
8,000--8,999	10.4
9,000--9,999	11.2
10,000--14,999	12.0
15,000--19,999	15.0
20,000--29,999	19.2
30,000--39,999	25.2
40,000--49,999	30.5
50,000--59,999	36.0
60,000--79,999	40.0
80,000--99,999	48.0
100,000--139,999	55.0
140,000 or more	65.0

D. No person shall cause, permit or allow the emission of particulate matter onto the property of others except when such emissions comply with the requirements of Sections15.35.050and15.35.060.A--C.

(GAAB 16.68.130, 16.68.150; AO No. 78-141; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70; AO No. 93-131, § 9, 10-26-93)

15.35.070 Stationary source emissions--Other emission limitations.

A. No person shall cause, allow or permit the emission of any air contaminant or water vapor, including but not limited to odorous matter, that tends to be injurious to or adversely affects human health, safety or welfare, animal or plant life, or property or interferes with the normal use and enjoyment of life, property or business.

B. Nothing in this regulation shall be construed to impair any cause of action or legal remedy therefor of any person or the public for injunctive relief, injury or damages arising from the emission of any air contaminant in such place, manner or concentration as to constitute air pollution or a common law nuisance.

C. The director may establish reasonable requirements that a building or stationary source be enclosed and ventilated in such a way that all the air, gases and particulate matter are effectively dispersed or treated for removal or destruction of odorous matter or other air contaminants before emission to the atmosphere.

(GAAB 16.68.160, 16.68.170; AO No. 78-141; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70)

15.35.080 Stationary source emissions--Circumvention.

A. No person shall willfully cause, allow or permit the installation or use of any device or use any means which, without resulting in a reduction in the total amount of air contaminant emitted, conceals an emission of air contaminant which would otherwise violate these regulations.

B. No person shall cause, allow or permit the installation or use of any device or use of any means designed to mask the emission of an air contaminant which causes detriment to health, safety or welfare of any person.

C. No person shall cause, permit or allow the use of air for dilution of emission contaminants without affecting any total decrease in such contaminants as a method to effect compliance with the requirements of this regulation.

D. No person shall cause, permit or allow the use of stack heights that exceed good engineering practice or dispersion techniques to affect the degree of emission limitation required for control of air contaminants.

(GAAB 16.68.180; AO No. 78-141; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70; AO No. 93-131, § 10, 10-26-93)

15.35.090 Stationary source emissions--Fugitive emissions.

A. No person shall cause, allow or permit particulate matter to be handled, transported or stored without taking reasonable measures to prevent the particulate matter from becoming airborne.

B. Within the boundaries of the municipality no person shall cause, allow or permit a building or its appurtenances or a road to be constructed, altered, repaired or demolished without taking reasonable measures to prevent particulate matter from becoming airborne.

C. Within the boundaries of the municipality no person shall cause, allow or permit untreated open areas, including but not limited to roads, parking lots or construction sites located within a private or public lot or roadway, to be improved, graded, excavated, repaired, demolished, altered or constructed without taking reasonable measures to prevent particulate matter from becoming airborne.

D. The director shall publish guidelines he determines to be reasonable measures for controlling fugitive emissions, and compliance with such guidelines to the satisfaction of the director shall be deemed to fulfill the requirements of subsections A through C.

(AO No. 78-141; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70)

15.35.100 Stationary source emissions--Open burning.

A. Within the boundaries of the municipality no person shall cause, suffer, permit or allow any open burning except the following unless otherwise prohibited by law:

1. Open burning for pleasure, religious, ceremonial, cooking or like social purposes and

open burning from flares, torches, waste gas burners, incense burners and insect pots is allowed.

2. Open burning authorized by the fire chief for the disposal of dangerous materials is allowed, provided no alternate means of disposal is reasonably available.

3. Open burning authorized by the fire chief for instruction in the method of fighting fires or testing fire resistive materials and fire protection equipment is allowed provided that these outdoor fires have prior written approval from the director, and, unless waived by the department, the public shall be notified through the news media of the time, place and purpose of the exercise at least three days in advance of the activity. Prior written approval from the director and public notice shall not be required when such outdoor fires do not exceed 30 inches in diameter.

4. Open burning for the disposal of trees and brush on property being developed for commercial or residential purposes or on property where the trees and brush were grown is allowed provided that:

a. Open burning shall be allowed only outside the Anchorage bowl area and only during the periods from April 1 through May 31 and August 15 through October 31;

b. The person responsible for such open burning shall obtain a written permit for such fire from the fire chief and upon terms and conditions specifically approved by the director and shall comply with all the laws and regulations of the director, the fire chief and all other governmental agencies regarding such fires;

c. Tires or heavy petroleum products may not be used to start or maintain open burning.

5. Open burning for the disposal of household refuse is allowed in the areas of the municipality where municipal or Alaska Public Utilities Commission sanctioned refuse collection service is not available.

6. The burning of combustible construction debris, trees, brush and other vegetative matter is allowed in a commercial air curtain combustion system properly operated and maintained according to the manufacturer's specifications, provided that the device has been registered with the director, that the operator obtains written approval from the director prior to operation, and that the operation of the device complies with all rules and regulations of the director, the fire chief and all other governmental agencies regarding such equipment.

7. Open burning for the disposal of small quantities of grass, leaves, weeds and other organic debris accumulated during winter months may be allowed without an open burning permit throughout the municipality during a ten-day period in the spring authorized by the mayor upon appropriate terms and conditions that take into consideration those factors described in subsection A.10. of this section.

8. Open burning for the disposal of small quantities of grass, leaves, brush, weeds and other organic debris may be allowed without an open burning permit in the area east of the Bragaw Road/Elmore/Abbot Loop alignment and south of Tudor Road up to 24 days between May 1 and June 14 and up to 14 days between August 15 and October 15, when authorized by the mayor and upon appropriate terms and conditions that take into consideration those factors described in subsection A.10. of this section.

9. The fire chief, with the approval of the air pollution control officer or department, may issue open burning permits for the disposal of small quantities of grass, leaves, brush, weeds and other organic debris at such times and places and upon such terms and conditions as the fire chief and director deem appropriate in consideration of and consistent with those factors described in subsection A.10. of this section.

10. The fire chief, with the approval of the air pollution control officer or the department may issue open burning permits allowed by this section upon appropriate terms and conditions that take into consideration the ambient air quality, the achievement and maintenance of federal, state or municipal ambient air quality standards, meteorological conditions, the suitability of air pollution control devices for large quantities of waste, means of reducing fire hazards, the suitability of disposal by other available means, the amount and nature of waste to be burned, the proximity of the burn site to developed areas and the population density of the surrounding area.

B. The director shall publish the dates during which open burning will be allowed along with appropriate terms and conditions to be followed while burning.

C. The director may suspend or prohibit open burning at any time based on air quality considerations, or, upon consultation with the fire chief, for fire safety reasons.

D. The fire chief, in consultation with the air pollution control officer, and upon appropriate terms and conditions that take into consideration those factors described in subsection A.10 of this section, may issue written permits for the destruction of timber infested with spruce bark beetle during periods outside of the open burn periods designated in this section.

E. The fire chief shall establish guidelines and may establish an appropriate fee schedule for the issuance of written permits authorized under this section.

F. It shall be a rebuttable presumption that the person who owns or controls the property on which open burning occurs has caused or allowed said open burning.

(GAAB 16.68.210; AO No. 78-141; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70; AO No. 93-131, § 11, 10-26-93; AO No. 93-210(S), § 1, 1-18-94; AO No. 95-196(S), §§ 1, 2, 10-17-95; AO No. 96-135(S), § 1, 10-22-96)

15.35.105 Stationary source emissions--Wood-fired boilers.

A. Unless otherwise prohibited by law, within the boundaries of the municipality no person shall cause, suffer, permit or allow the operation of a wood-fired boiler except when fired by:

1. Clean wood, or
2. Wood pellets made from clean wood; or
3. Corn; or
4. Home heating oil and natural gas as a starter fuel or substitute fuel in dual-fired wood boilers.

B. Within the boundaries of the municipality the burning of wood that has been treated, painted, or treated with preservatives or other coatings is prohibited.

C. Within the boundaries of the municipality the burning of used oil, waste petroleum products and home heating oil not meeting applicable limits for sulfur content is prohibited.

D. Within the boundaries of the municipality, no person shall install or allow the installation of a wood-fired boiler subject to the requirements of this section unless:

1. The wood-fired boiler is located more than 50 feet from an adjacent property line and 100 feet from any habitable structure that it is not serving at the time of installation, unless that property or habitable structure is under common ownership; and

2. The wood-fired boiler has an attached permanent stack extending higher than the peak of the roof of the structure(s) being served by the wood-fired boiler, and higher than the peak of the roof of any other habitable structure located within 150 feet of the wood-

fired boiler; and

3. The wood-fired boiler is certified to meet the U.S. Environmental Protection Agency voluntary phase 2 emissions level for wood-fired boilers through testing by an accredited independent laboratory showing it emits no more than 0.32 pounds of particulate matter per million BTUs of heat output; and

4. The wood-fired boiler complies with all applicable laws, including but not limited to local ordinances, and its operation does not create a public nuisance; and

5. Scaled drawings, prepared by a registered professional engineer or registered professional land surveyor, are submitted and approved by the air pollution control officer showing the wood-fired boiler will meet the separation requirements to adjacent property lines and habitable structures established in this subsection and that the stack of the boiler will be higher than the roof peak of any habitable structure within 150 feet.

6. Installation, modification and repair of a wood-fired boiler shall comply with the provisions of the Anchorage Building Code, Title 23of the Anchorage Municipal Code.

(AO No. 2009-41(S), § 3, 7-1-09)

15.35.110 Mobile source emissions--Short title.

This regulation may be known and cited as the South Central Clean Air Ordinance Regulation 2: Mobile Source Emissions.

(AO No. 78-141; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70)

15.35.120 Mobile source emissions--Application.

The provisions of this regulation apply only to mobile sources within the boundaries of the municipality.

(AO No. 78-141; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70)

15.35.130 Mobile source emissions--Definitions.

Unless the context clearly indicates otherwise the following terms used in this regulation shall be defined as follows:

Mobile source means a source capable of simultaneous motion and emission of air contaminants.

Motor vehicle means any self-propelled vehicle designed and used for transporting persons or property but excludes aircraft, vessels operated on water and vehicles operated exclusively on a rail or rails.

(AO No. 78-141; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70)

15.35.140 Motor vehicle emissions.

A. No person shall operate, drive, cause or permit to be driven or operated any motor vehicle upon a public street or highway that emits any visible emission for a period in excess of five consecutive seconds except for those motor vehicles powered by compression ignition or diesel-powered engines and except when the presence of uncombined water is the only reason an emission fails to meet this requirement.

B. No person shall operate, drive, cause or permit to be driven or operated any diesel-powered motor vehicle that emits for a period in excess of ten consecutive seconds any air contaminant that obscures an observer's vision to a degree greater than 30 percent opacity.

C. No person shall operate, drive, cause or permit to be driven or operated any motor vehicle that violates or exceeds any federal or state law, regulation, emission standard or limitation applicable to such motor vehicle for the control of emissions of carbon monoxide, hydrocarbons or oxides of nitrogen.

(AO No. 78-141; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70)

15.35.150 Motor vehicle fleet operation.

The director by written notice may require the owner of any motor vehicle fleet operation of more than five vehicles to certify annually that its motor vehicles are maintained in good working order and, if applicable, in accordance with the motor vehicle manufacturer's specifications and maintenance schedules that may or tend to affect visible emissions. The director by written notice may require records pertaining to observations, tests, maintenance and repairs performed to control or reduce visible emissions from individual motor vehicles to be made available for review and inspection by the director.

(AO No. 78-141; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70)

15.35.160 Motor vehicle inspection.

The director by written notice may require the owner of any motor vehicle of a motor vehicle fleet operation or the owner of any motor vehicle that the director has reason to believe may be in violation of this regulation to make such motor vehicle available for testing for compliance withSection 15.35.140of this regulation at a reasonable time and place.

(AO No. 78-141; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70)

15.35.170 Motor vehicle owner liability.

It shall be a rebuttable presumption that the owner of a motor vehicle that violates or exceeds any provision of this regulation has caused or permitted the operation or driving of that motor vehicle.

(AO No. 78-141; AO No. 79-80(AM); AO No. 80-2; AO No. 80-70)

Appendix to III.B.10

The Appendix to III.B.10 includes:

1. Technical justification for the Background CO Concentration to be Used in Anchorage Project-Level Conformity Analyses
2. Anchorage Assembly Resolution (AR 2010-xxx) adopting the revised CO Maintenance Plan (to be included later).
3. Affidavit of a future oral hearing to be held by the State of Alaska. (to be included later)

Municipality of Anchorage
Department of Health and Human Services
April 2008

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.

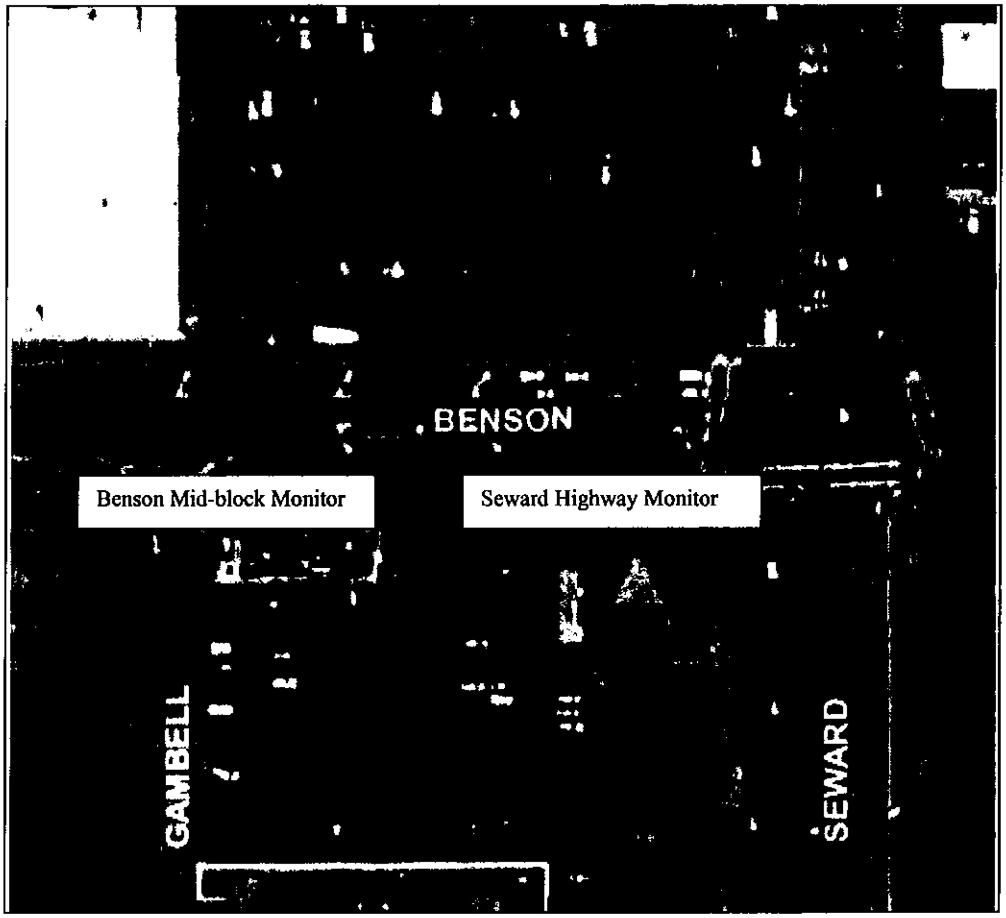
In order to better determine an appropriate background value for CAL3QHC modeling, CO data from two monitors near the intersection of Seward Highway and Benson Boulevard were examined. The first site, known as the *Seward Highway* site, was located on the southwest corner of the intersection of Seward 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 Seward Highway, it was less affected by the emissions from idling traffic queued up on Benson waiting for the red light at Seward Highway.

[•] 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.

Figure 1

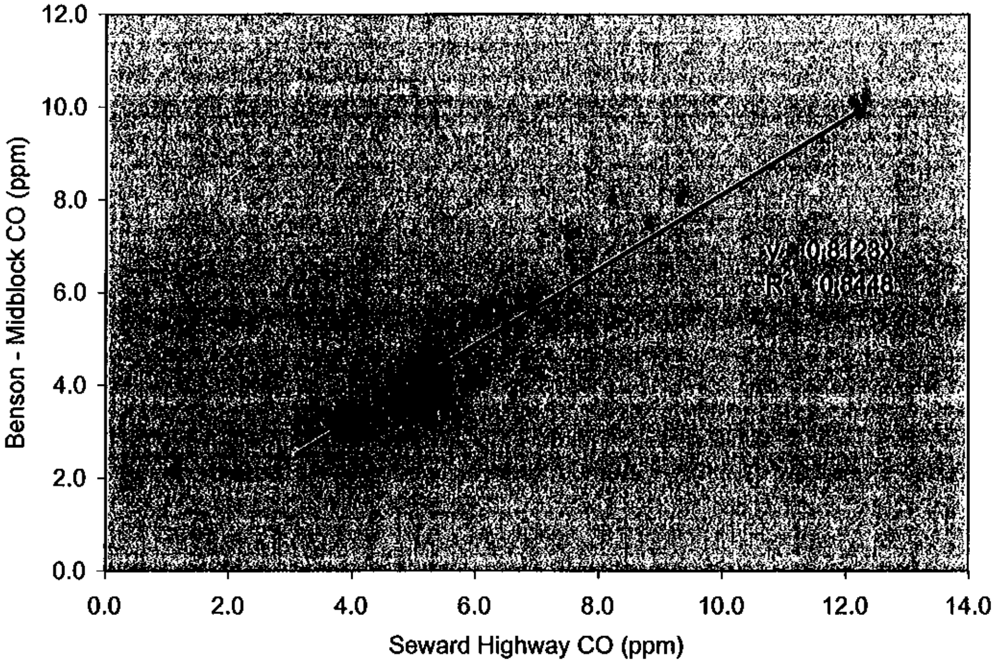
Aerial Photo of Intersection of Seward Highway and Blvd
Seward Highway Monitor was located approximately 80 meters east of the Benson Mid-block Monitor



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)



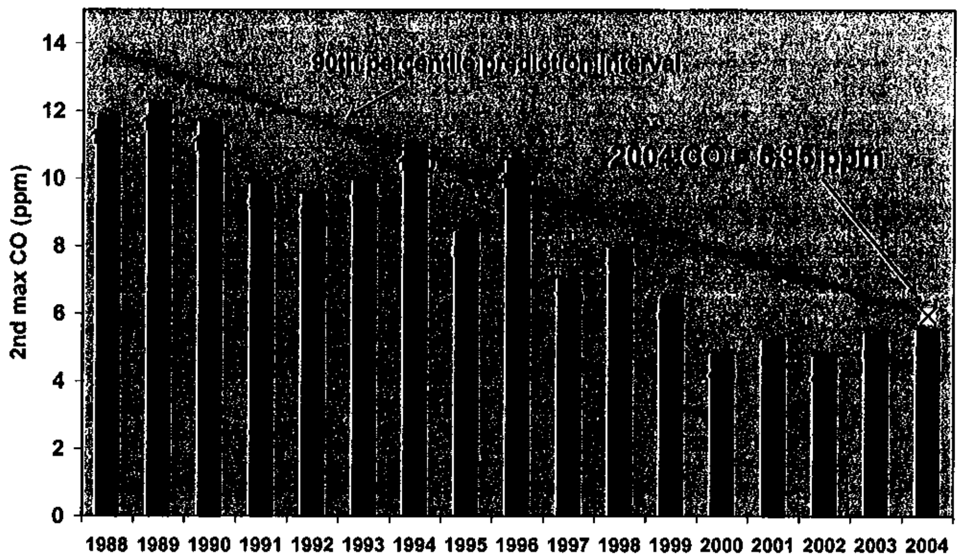
Although concentrations at the *Benson Mid-block* site were lower than those at the *Seward Highway* site, concentrations there were still probably unduly influenced by the heavy traffic on Benson Boulevard to be considered a good background site. The probe for *Benson Mid-block* was located just 10 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.)

90th Percentile Prediction Interval
2nd Maximum 8-hour Average at Seward Highway



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.