ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Amendments to:

State Air Quality Control Plan

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

Anchorage CO Plan

Public Notice Draft

October 25, 2026

Mike Dunleavy, Governor

Randy Bates, Commissioner-Designee

Note: Following the completion of the 20-year maintenance period, DEC proposes to remove the contingency provisions in the Anchorage CO Plan and decommission the Garden Street CO monitor: AQS ID 02-020-0018. The revised and/or new proposed language is in bold and underlined format, while the replaced language is in strikethrough format. To aid in the public comment process, the adopted Anchorage CO Plan, the amendments, and other related documents can be found and accessed at this website: https://dec.alaska.gov/air/anpms/communities/co-anchorage/

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A note for reviewers of this document.

This document is organized and formatted to be consistent with the State of Alaska Air Quality Control Plan, also known as the State Implementation Plan (SIP). This document is revising the Anchorage Carbon Monoxide (CO) Maintenance Plan, which was most recently revised in 2013 to include the Limited Maintenance Plan for 2014-2024. The 20-year CO maintenance period ended in 2024.

This plan is being revised to remove references to monitoring requirements and contingency measures that would be triggered by violations of the CO National Ambient Air Quality Standards (NAAQS). The removed references include parts of Section III.B.1, the entirety of Section III.B.7, and the contingency plan outlined in Section III.B.12. Other sections of the Anchorage CO Maintenance Plan remain unchanged. The Alaska CO SIP complies with section 110(l) of the Clean Air Act (CAA) by demonstrating that the removal of the contingency measures and monitoring requirements will not interfere with the maintenance or any other CAA requirements for the federal 8-hour CO standard.

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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.

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

* 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 constitutes two violations.

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.

In 2007, the Anchorage Assembly began debate on whether the I/M program should be continued in Anchorage. On November 6, 2007, they voted to discontinue the I/M Program. However, less than a year later, on July 15, 2008, they revoked this action and voted to continue I/M with some modifications. Principally, they wanted to remove I/M as a commitment in the SIP but retain it as a local prerogative that would not necessitate a further SIP revision if further local action resulted in changes or a discontinuation of the program.* They directed the Municipal Department of Health and Human Services to work with the State of Alaska to amend the SIP to remove the I/M Program as a primary control measure in the SIP and retain it as a local option or prerogative. As a local option, the Municipal Assembly would be free to make changes or discontinue the program without gaining prior approval from the State or EPA.

In response to the Assembly action, a SIP revision was prepared which deletes the commitment to I/M in the SIP while preserving the right of the MOA to continue the program as a "local option." Because it was considered a local option, the maintenance projections in the Plan assumed that I/M would be discontinued in 2011. The SIP demonstrated that Anchorage could continue to comply with the CO NAAQS if I/M were terminated.

On May 11, 2010, Anchorage Assembly decided to exercise its prerogative, consistent with what is provided for in the SIP revision, to terminate the I/M program. They stipulated that the program is to be terminated 180 days after the EPA administrator approved the required SIP amendment. Shortly thereafter they approved the SIP amendment enabling the termination of I/M. It was subsequently forwarded to the State of Alaska with a request that it be submitted to EPA for approval. On September 29, 2010, after the completion of public review and their approval process, the State submitted the amendment to EPA. The Anchorage I/M program was terminated on March 3, 2012.

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:

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* Among other programmatic changes, they also extended the I/M testing exemption for new cars from four to six years.

- 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 as 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.

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

† 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.

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.

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 Revised 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 Revised Public Review Draft and to consider public comments received. During this meeting they recommended that the AMATS TAC and Policy Committees approve the Revised Public Review Draft of the Plan as drafted. The Committee met again on April 4, 2011, to review and approve technical revisions to the Plan related to reanalysis of the emission inventory, maintenance projections and emission budget using the new MOVES model.

AMATS Technical and Policy Committees **–**The AMATS Technical Advisory Committee recommended approval 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 May 27, 2010 and forwarded their recommendation for approval to the Anchorage Assembly. Upon the recommendation of the AMATS Technical Committee, the Policy Committee approved MOVES-related technical revisions to the Plan on April 28, 2011.

Anchorage Assembly –On June 8, 2010, the Assembly adopted Plan revisions which deleted the commitment to I/M and make it a local option and directed that it be forwarded to ADEC for inclusion in the SIP. A copy of Anchorage Assembly Resolution (AR) 2010-174, adopting this CO Maintenance Plan, is included in the Volume III, Appendix to Section III.B.1. The Assembly approved MOVES-related technical revisions to the Plan on May 10, 2011. A copy of Anchorage Assembly Resolution (AR) 2011-133, adopting the MOVES-related technical revisions to the CO Maintenance Plan, is included in Volume III, Appendix to Section III.B.1.

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 CO Maintenance Plan on August 2, 2010. This provided another forum for the public to comment on the air quality plan prior to state adoption and submission to EPA. No public comments were received. ADEC held a public hearing on the MOVES-related technical revisions to the plan on June 29, 2011. No public comments were received.

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,

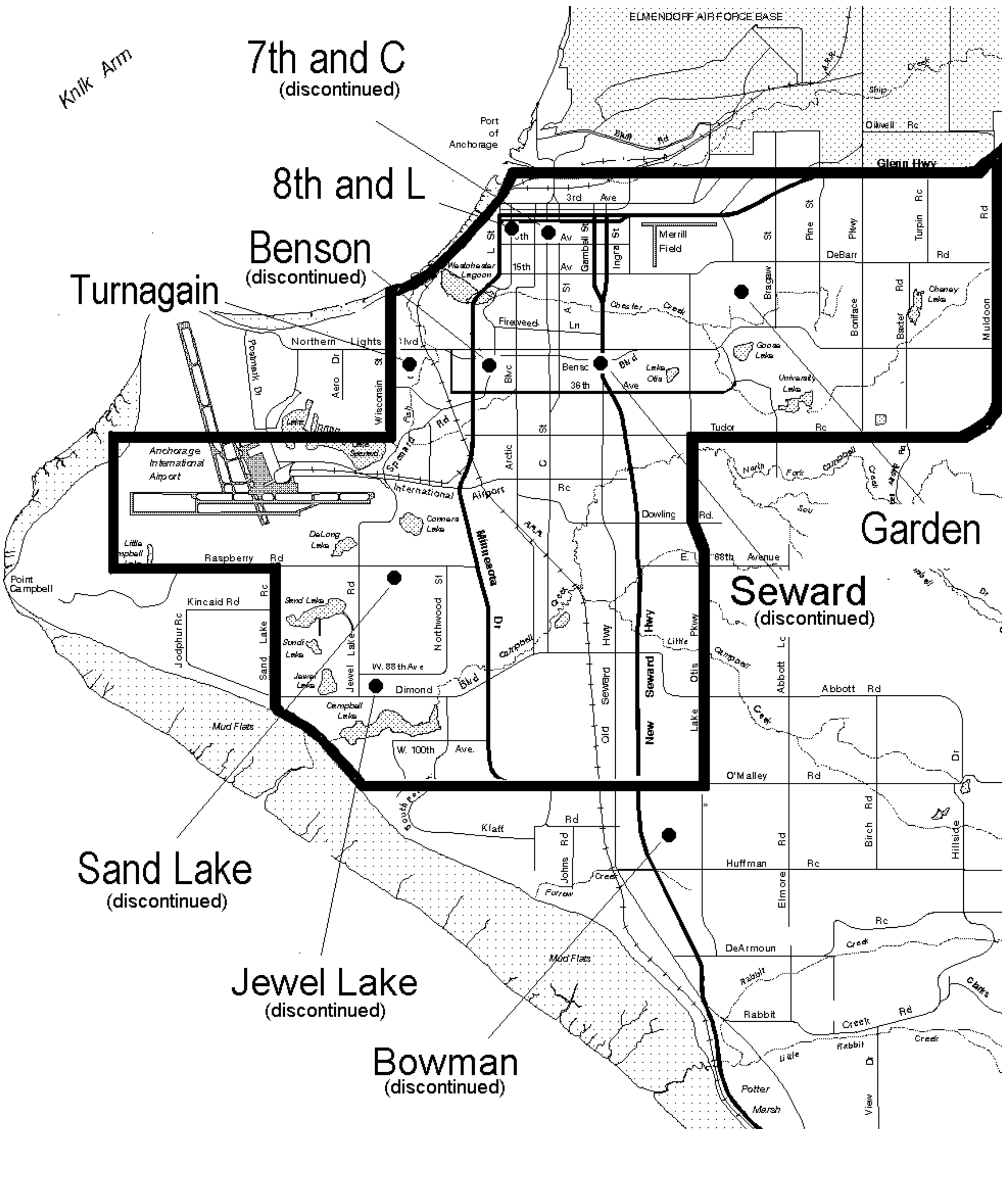
Westerly along a line five hundred (500) feet south of the centerline of Tudor Road to a point five hundred (500) feet east of the centerline of Lake Otis Parkway; thence,

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 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. Motor vehicle emission estimates in the inventory and projections have been updated with the MOVES model.

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, almost 80% of winter season CO emissions in the maintenance area were from motor vehicles.[1] The MOVES model suggests that start emissions account for about two-thirds of all motor vehicle emissions.† This result is consistent with local research conducted by Sierra Research on behalf of the ADEC, MOA, and Fairbanks North Star Borough which aimed at quantifying the contribution of cold weather warm-up idling on the emission inventory. This research indicated that cold starts and warm-up idling were very important components of overall 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] As a consequence, in Anchorage, a large portion of CO emissions occur in residential areas where these morning commute trips start.

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 are discussed in detail in the Appendix to Section III.B.3.

† In MOVES start emissions are defined as "the addition to running emissions caused by the engine start." If a vehicle spends a substantial time warming up, most of these emissions occur while the vehicle is stationary, before the trip begins.

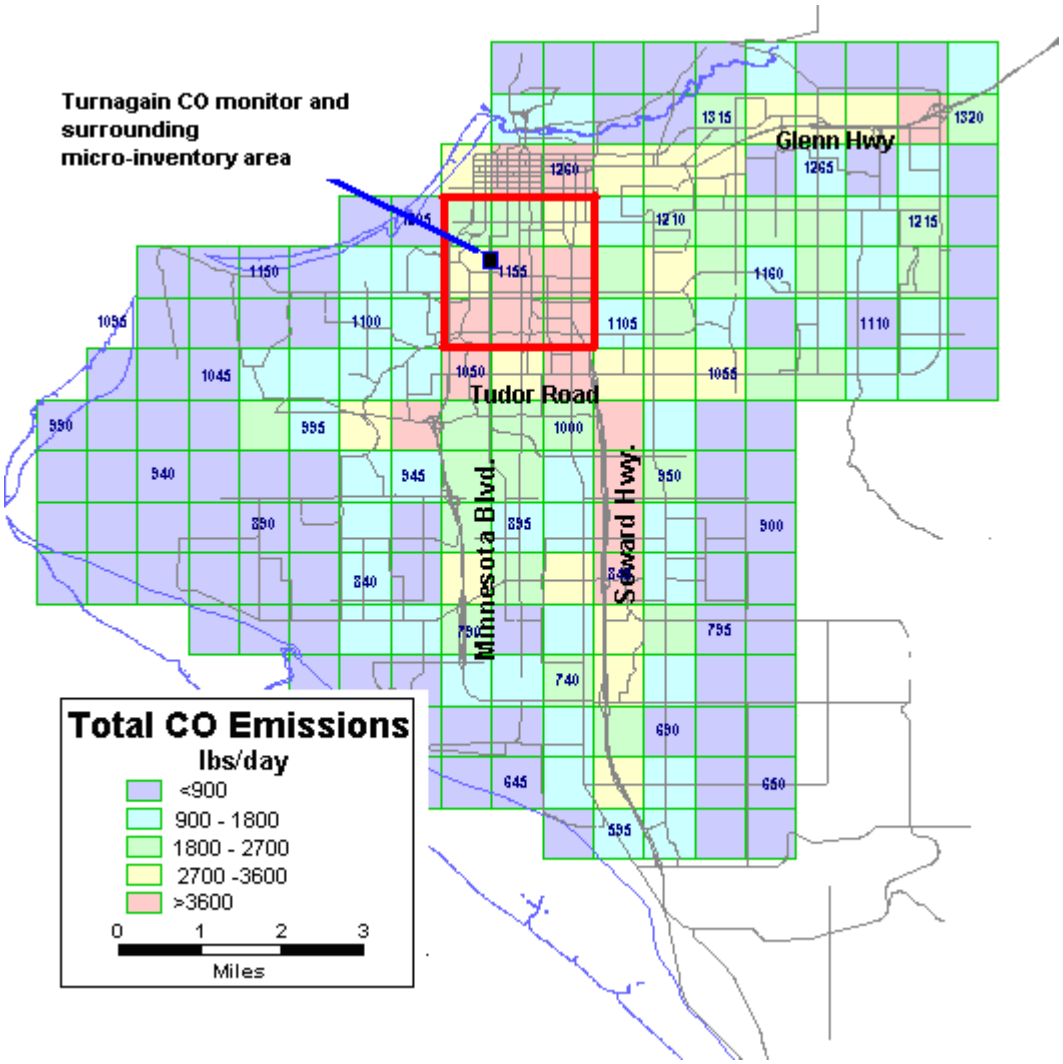
Table III.B.3-1
Sources of Anchorage CO Emissions in 2007 Base Year (Area-wide)

Source Category	CO Emitted (tons per day)	% of total
Motor vehicle – running emissions	40.5	25.4%
Motor vehicle – start emissions	84.8	53.4%
Motor vehicle – extended idling by combination long-haul trucks	0.3	0.1%
Ted Stevens Anchorage International Airport Operations	12.4	7.8%
Merrill Field Airport Operations	0.7	0.4%
Wood burning – fireplaces and wood stoves	6.2	3.9%
Space heating – natural gas	3.8	2.4%
Miscellaneous (railroad, marine, snowmobiles, snow removal, portable electrical generators, welding, etc.)	9.3	5.8%
Point sources (power generation, sewage sludge incineration)	1.3	0.8%
TOTAL	**159.3**	**100%**

Analysis of CO Emissions Sources in Turnagain Area

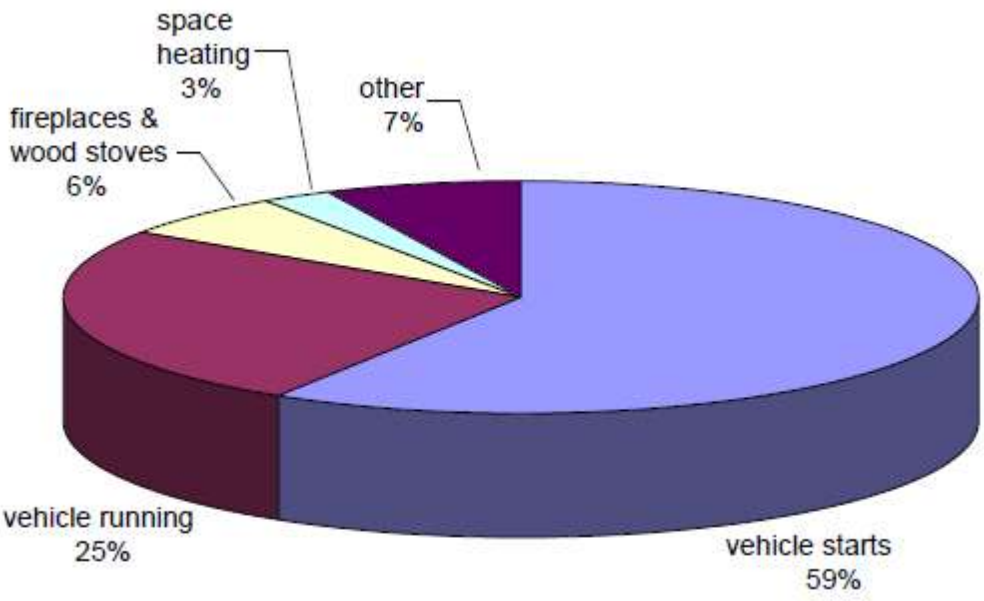
In addition to the area-wide inventory discussed above, a micro-inventory was also prepared for the nine square kilometer area surrounding the Turnagain monitoring station in west Anchorage. The Turnagain station exhibits the highest CO concentrations of the current monitoring network; it has been shown 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 10.20 tons per day in 2007.

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



Total CO emissions = 10.20 tons per day

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 (amount emitted per square kilometer/day) is relatively low. The emission density in some one-kilometer grids immediately surrounding the Turnagain monitor is four or more 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.

‡ 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.

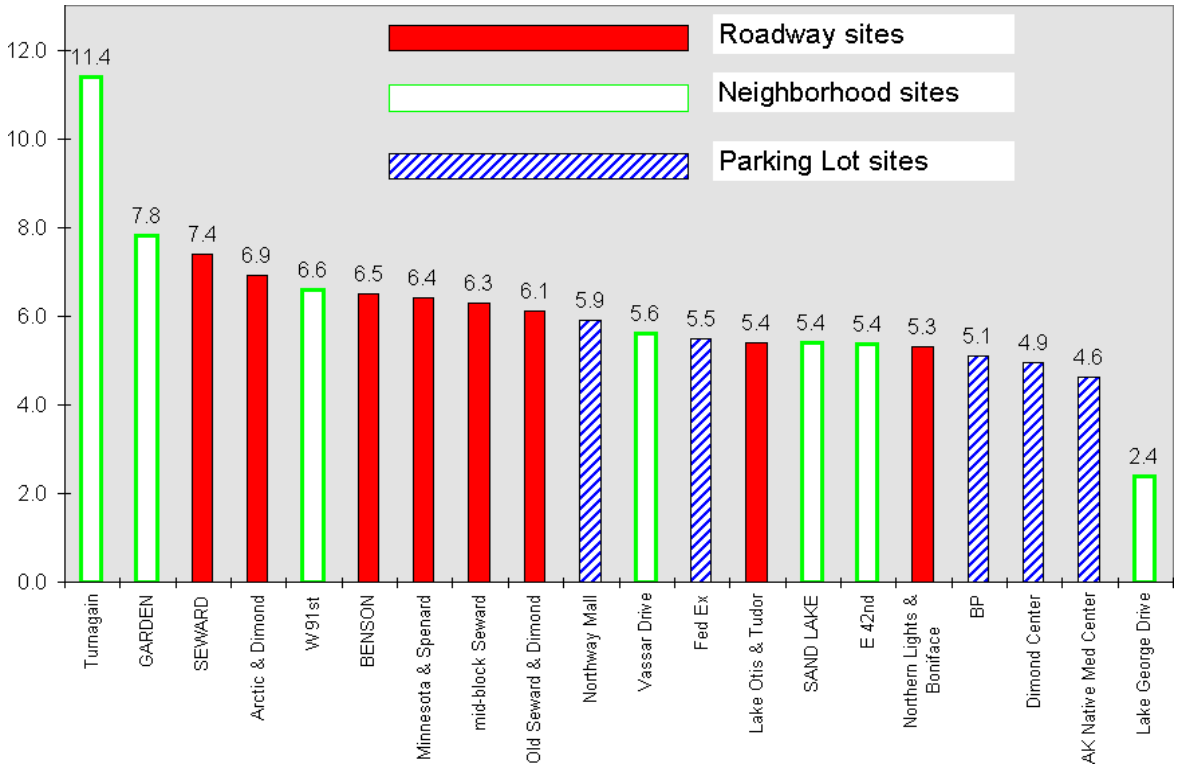
Summary of Local Research

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.

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 startups, 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 wintertime 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 ºF to +23 ºF in Anchorage and -36 ºF to +14 ºF in Fairbanks.

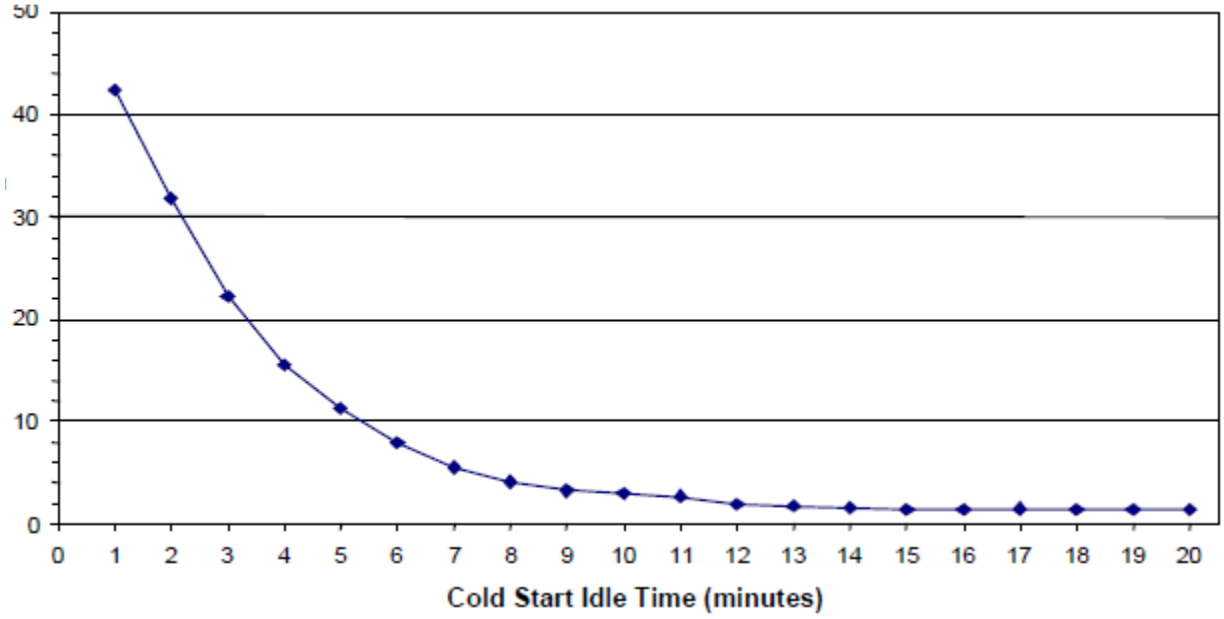
A second, follow-up vehicle emission study was conducted in Fairbanks during the winter of 2000-2001. For this study, Sierra Research procured a vehicle dynamometer that allowed vehicle emissions to be measured in simulated transient or travel mode. Sierra Research performed a gamut of tests on a sample 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 was reasonably consistent with emissions reductions predicted by the EPA model MOBILE6 but about twice what is estimated using the MOVES model.

- *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

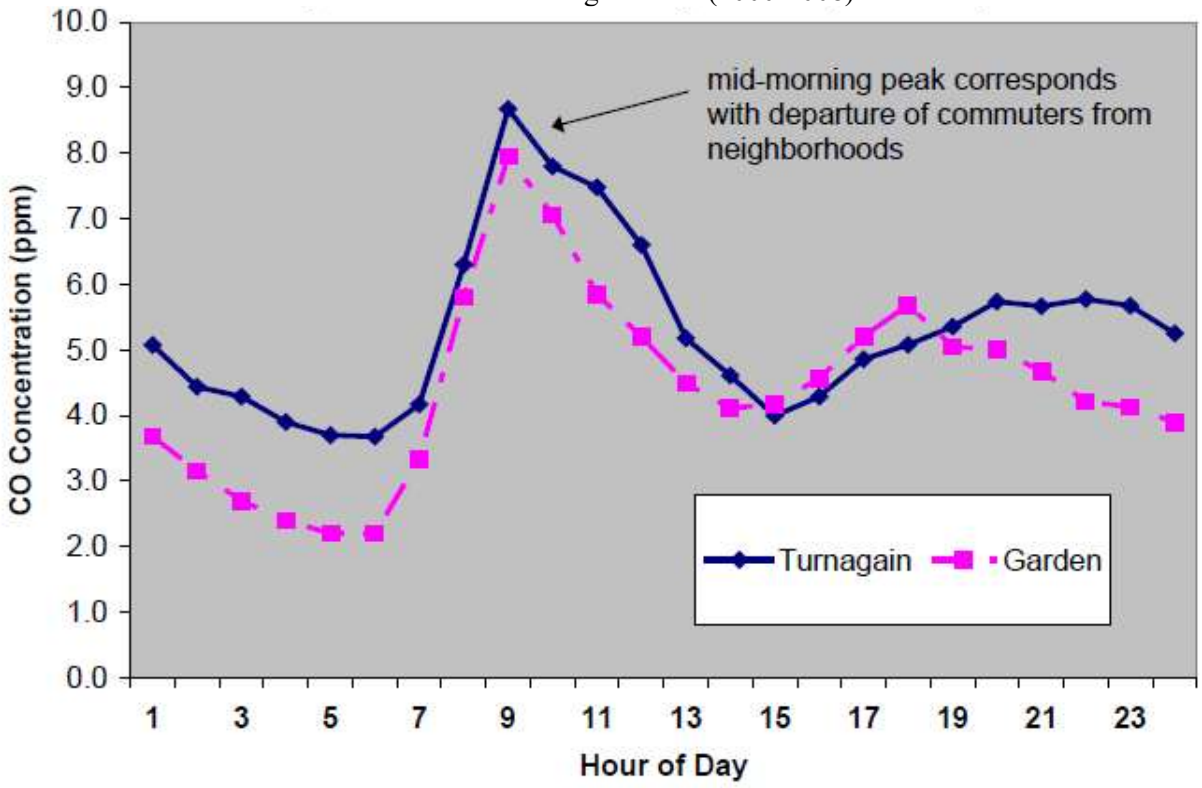
Date	8-hour Average (ppm)	Day of Week	Time of Day	Temp (□F)	Wind Speed (mph)	Sky Cover *
12/16/1998	7.69	Wed	4 PM - 12 AM	2	2	CLR
12/24/1998	8.06	Thu	4 PM - 12 AM	6	0	FEW
1/4/1999	5.90	Mon	4 PM - 12 AM	-1	4	CLR
1/6/1999	10.14	Wed	11 AM - 7 PM	2	2	FEW
2/7/1999	5.80	Sun	10 PM - 6 AM	-9	2	FEW
2/8/1999	7.31	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)

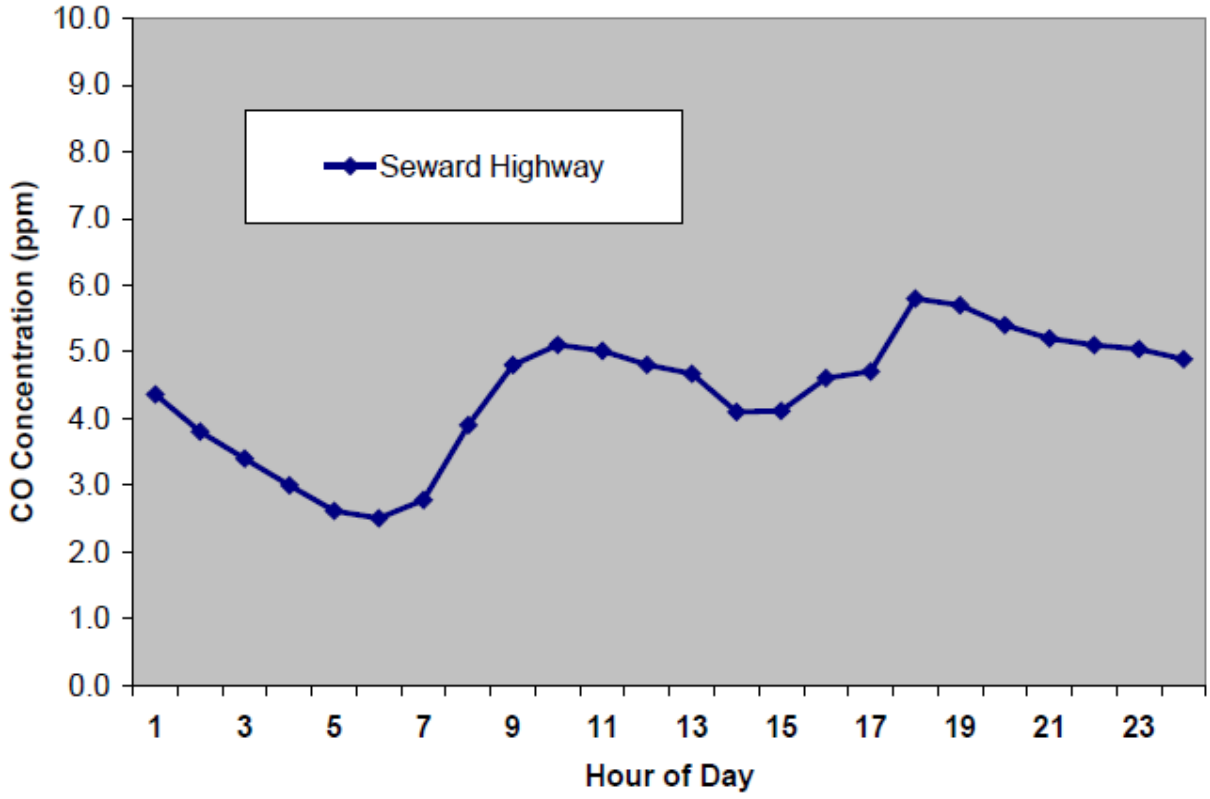


The diurnal pattern in CO concentrations near major traffic arterials is different than residential areas. Figure III.B.3-4(b) shows the diurnal pattern at the Seward Highway station, located at the busy intersection of the Seward Highway and Benson Boulevard†† Although a morning peak is present, the 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)



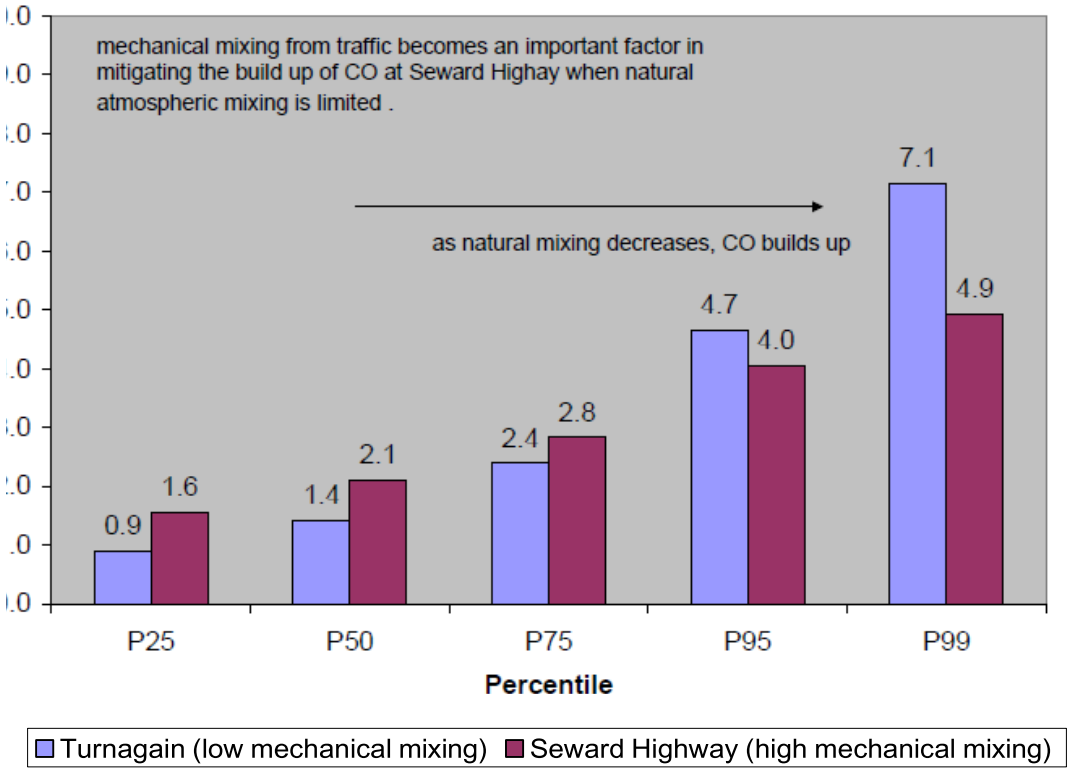
Role of Mechanical Turbulence from Vehicle Traffic in Reducing Ambient CO Concentrations during Stagnation Conditions

As noted 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 sheer 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 buildup 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



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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 operation 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

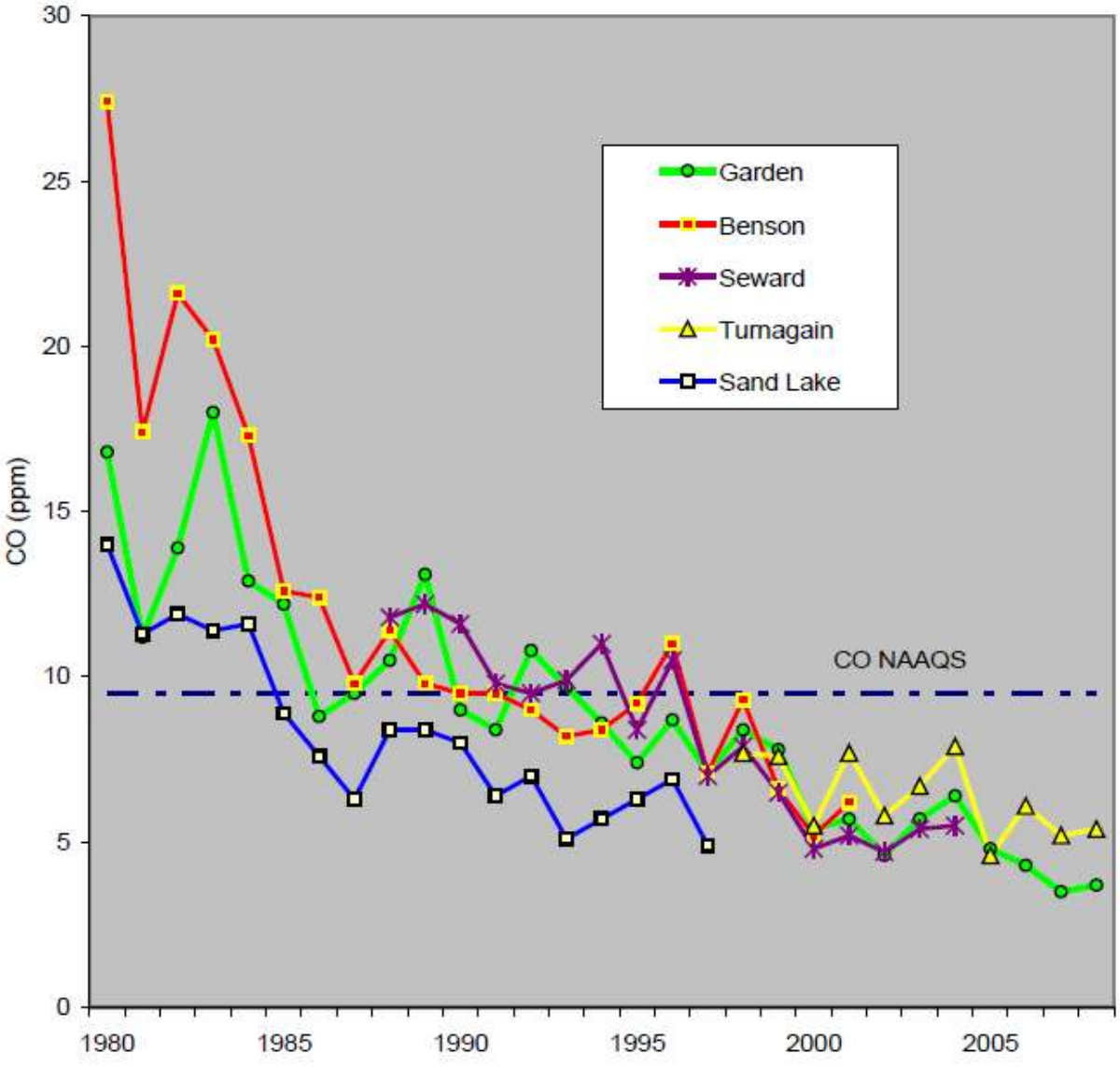
Summary of CO Data from Anchorage Monitoring Stations (1980 –2008)

	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.

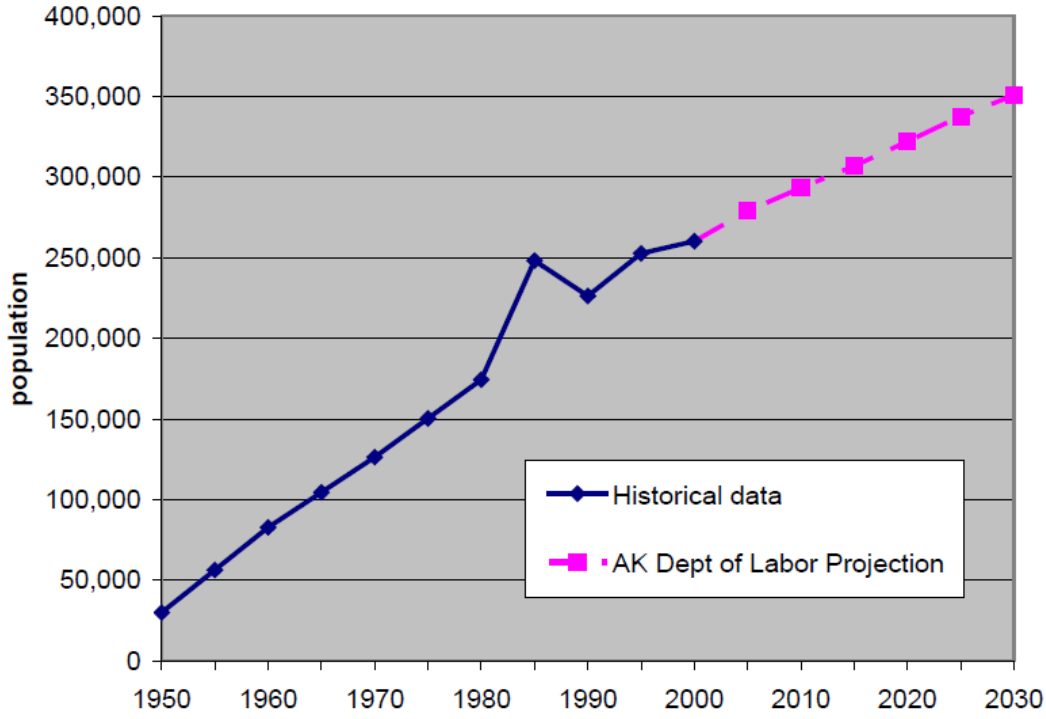
Figure III.B.3-6
Trend in 2nd Maximum 8-hour CO Concentration at Anchorage CO Monitoring Stations 1980 - 2008



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.

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

Minor revisions to this section clarify that CO monitoring will be conducted in conformance with federal regulation and provide flexibility to make changes in the CO monitoring network, subject to approval by the EPA Administrator.

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 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."

CO monitoring requirements were removed in 2026 following the end of the maintenance period. There are currently no active CO monitoring sites.

Prior to the removal of the monitoring requirements, the Anchorage CO monitoring network was comprised of ten sampling stations. The MOA used 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 was operated 24 hours a day from October 1 through March 31. Hourly averages of CO levels were provided from each station in the network. These data were uploaded to a central computer every weekday. Data were submitted to EPA on a quarterly basis for inclusion in the nationwide air quality database known as AQS. CO monitoring was conducted in conformance with guidelines established in federal regulations, EPA guidance

and instrument manufacturer recommendations. Third party instrument performance audits were 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 was to characterize the range of CO exposures experienced by Anchorage residents. By analyzing pollution concentration trends over time, CO monitoring stations also served 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 was learned about the nature of the CO problem in Anchorage, more emphasis was placed on monitoring CO levels in neighborhoods.

Table III.B.4-1

Description of Anchorage CO Monitoring Sites

Location	Site Description
Turnagain (discontinued)	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 (discontinued)	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 (discontinued)	Monitoring began at this middle-scale site in Eagle River (approx 10 miles north of Anchorage) in December 2005.
8th and L Street (discontinued)	Monitoring began at this middle-scale site in downtown Anchorage in October 2007.
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.

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.

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. The I/M program was discontinued in 2012 and moved to a contingency measure should a NAAQS violation occur.

The CO reductions from all the programs listed below were estimated for calendar year 2007 using a MOVES-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 was included in all subsequent attainment and maintenance plans approved by the EPA through 2012, including the maintenance plan approved in 2004. The MOA administered the program in cooperation with the ADEC from 1985 through 2012, when the program was discontinued as an active control measure (77 FR 1414, July 10, 2012) and changed to a contingency measure. The basic design included 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 program required biennial testing but exempted 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
AAC 52.037(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 provided significant improvements in measurement accuracy particularly at lower concentrations of CO. The upgraded 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 included an enhanced Internet-based communications system and Vehicle Information Database (VID) that facilitated the proper identification of the vehicle being tested. This system also provided for on-line oversight and scrutiny of the mechanics conducting emission tests. Presumably, these upgrades 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 implemented a number of changes to improve the effectiveness of enforcement against program evaders. ADEC conducted parking lot surveys in Anchorage[7] that suggested 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 allowed for easier and more obvious identification of vehicles that may be evading I/M requirements. The windshield sticker program supplemented 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 was part of the MOA I/M program since its inception. I/M mechanics were 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 – The EPA MOVES model was used to estimate CO reductions from I/M in 2007. In 2007, the I/M program reduced area-wide CO emissions in Anchorage by an estimated 6.1 tons per day, about 5% 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*	Passenger cars and trucks, light commercial trucks
Test type	Two-speed idle (1995 MY and older) OBDII (1996 MY and newer)
Emission cut points	More stringent than federal limits
Under hood inspection**	Comprehensive visual and functional checks
Compliance rate	90% for 1995 MY and older, 93% for 1996 MY and newer
% Reduction in vehicle emissions in 2007	4.6%
Estimated CO Reduction in Year 2007	6.1 tons per day

** Visual and functional tests were not required for 1968-74 model year vehicles. For 1996 and newer vehicles, visual and functional tests were limited to catalyst and oxygen sensor inspection. 1975-1995 vehicles received 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 were 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 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 from 1996-2008. 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
0.3 tons per day, about 0.2% 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 were 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 were emphasized in campaigns over the past several winters. In the winter of 2004, the MOA initiated the Plug@20 public awareness campaign, encouraging vehicle owners to plug-in block heaters whenever temperatures dropped below 20 ºF. Television, radio, and print media along with targeted advertising were employed.

The MOA and ADEC have provided additional incentives to encourage residents to plug-in. Between 1999 and 2010, nearly 10,000 programmable electrical timers, designed to turn block heaters on two-to-three hours prior to the morning commute, were distributed free-of-charge to Anchorage residents. In addition, beginning in the winter of2002-2003, 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. When the 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 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 10ºF 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 0.9 tons per day. This amounts to a 0.7% 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) (tons per day)

I/M Program	6.1
Share-A-Ride Program (carpool and vanpool)	0.3
Engine Block Heater Promotion	0.9
Cumulative Benefit of Control Measures	**7.3**
% Reduction in Motor Vehicle Emissions	**5.8%**

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 continued 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 2012. 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 no more than a 1-in-100 chance of violating the standard in any year.

Primary CO Control Measures

Three primary control measures were 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 measurable 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. Funding was 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.‡‡‡

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††† 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

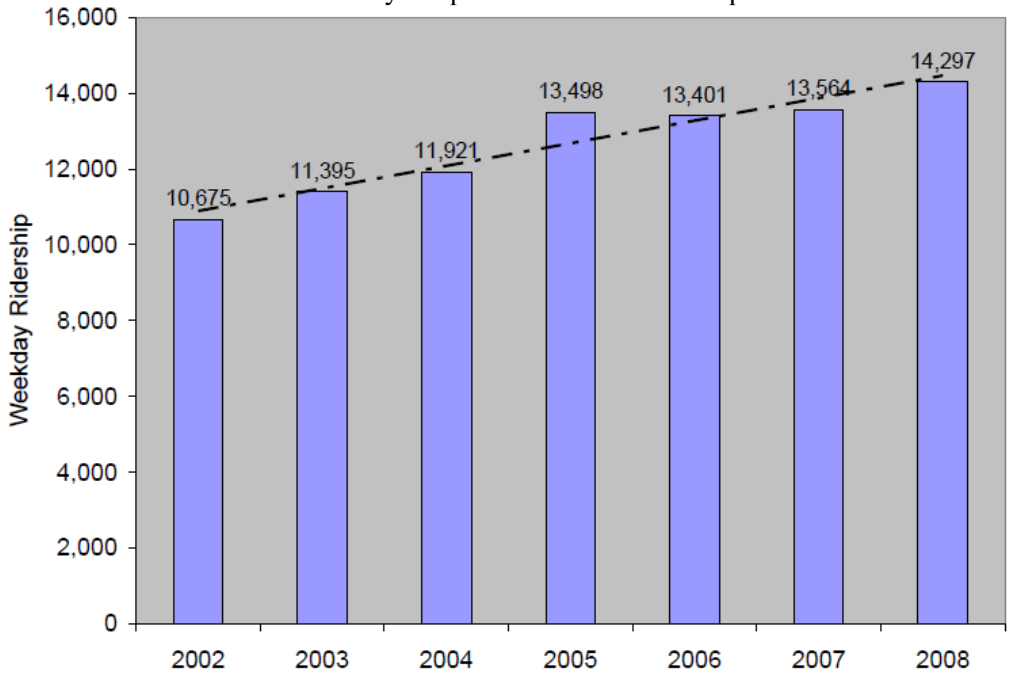
- Encouraging motorists to combine trips to reduce travel and the number of cold starts (i.e., promote trip chaining).

- 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 continued 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]

for "school age" pedestrians and bicyclists. A significant number of vehicle trips could be eliminated if more 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 continued through the 2008-2023 maintenance plan period. As noted earlier in this section, the vanpooling program has experienced considerable growth 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

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 provided tangible CO reductions in Anchorage, and they have the potential to continue providing reductions. The combined current CO reduction from these three measures is estimated to be about 1.5 tons per day, about 1% of total emissions.

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 technologies that lead to reduction of air pollutant emissions including CO_2 and diesel particulate. The Municipality is examining the purchase 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 transportation 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 developed a plan that addressed specific needs 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 then 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 2013 and beyond.§§§

Probabilistic Roll-Forward Modeling / Maintenance Demonstration
Because the Turnagain site exhibited 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.

§§§ For the purpose of this maintenance demonstration, a 2013 termination date for I/M was assumed.

§ Although not shown here, a similar analysis was also performed on data from the Garden station. Because Garden had lower CO concentrations than Turnagain, the computed probability of complying with the NAAQS was 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:

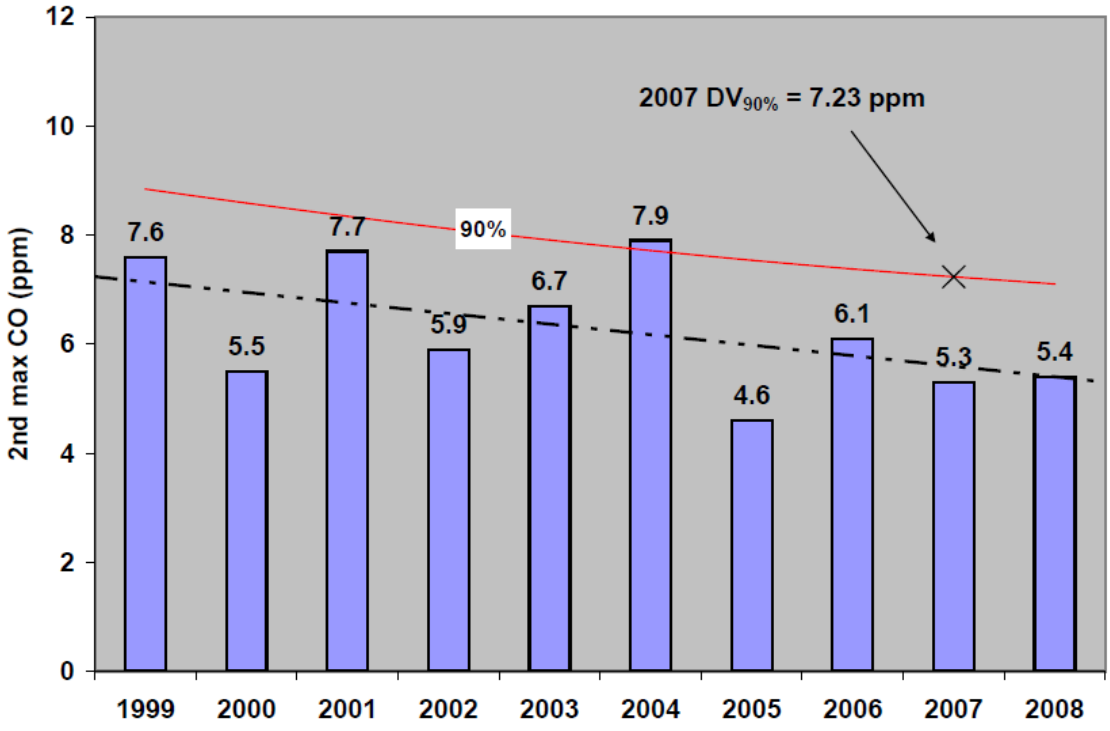
1. Compute the base year 2007 DV using the 90th percentile prediction interval from Turnagain station CO data.
2. Compile the 2007 base year CO inventory and determine the quantity of emissions generated in the nine square kilometer area surrounding the Turnagain monitoring station during a 24-hour "design 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 the EPA MOVES model to estimate mobile source CO emissions. The modeling analysis is 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	Fireplaces or Woodstoves	Space Heating	Other	**TOTAL CO EMISSIONS***
8.61	0.62	0.28	0.70	**10.20**

* Numbers do not sum due to rounding

Step 3: Use Roll-Forward Equation to Calculate Allowable Emission Increase at Turnagain 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)	2007 Emissions (tons per day)	Allowable Emissions (tons per day)
10.20	**24.5%**	**12.70**

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 MOVES 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.

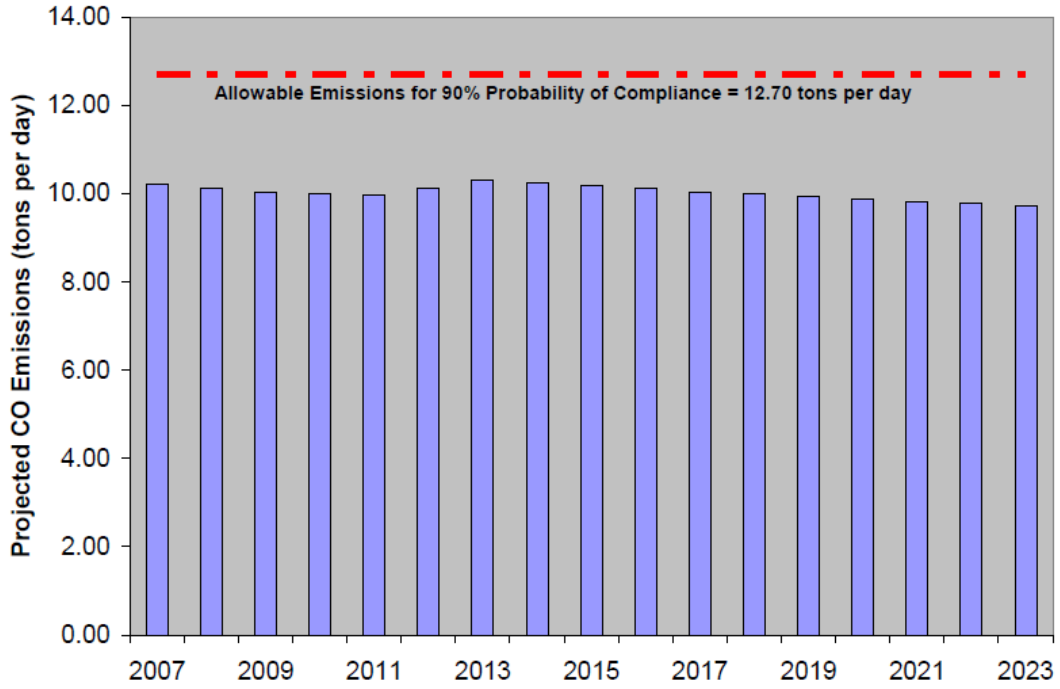
MOVES was run with the assumption that the I/M Program will change from a four-year new car exemption to a six-year exemption in January 2010 and would be discontinued prior to 2013.

As noted earlier, 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 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 2013 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.††††

†††† It should be noted that when MOVES vehicle start emission rates for Anchorage were examined, they were found to *increase* between 2007 and 2015. (Running emission rates declined as expected.). The increase in the start emissions rate appears to be an anomaly because emission rates are normally expected to decline over time due to improvements in the vehicle fleet. This is almost certainly true in this case because new cold temperature emission standards have been mandated by EPA for vehicles beginning with model year 2010. The MOVES model "anomaly" seems to be most obvious at cold ambient temperatures assumed in the Anchorage modeling. We understand that EPA is investigating and that if a problem is found it will be remedied in a future release of MOVES. The impact on the overall emission trend analysis presented here and in the CO Maintenance Plan is relatively insignificant, however.

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 greater 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 was assumed to be three times greater than projected (vehicle activity would increase by 12% between 2007 and 2023 instead of the 4% assumed);

(2) a 2% per annum growth in wood heating was assumed 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 is estimated to be greater than 98% 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

Contingency measures that would be automatically triggered by CO NAAQS violations are required for nonattainment plans per Section 172(c)(9) of the CAAA and were included in this plan through 2025 (Table III.B.7-1). These contingency measures have been removed with EPA approval following the end of the 20-year maintenance period.

Table III.B.7-1: **Contingency Measures - Discontinued**
Increase public awareness and education, transit, carpool and vanpool promotion efforts
Curtail or limit use of fireplaces, wood stoves and other wood burning appliances when high CO is predicted
Promote increase in transit ridership among commuters by offering reduced fares, or free transit fares for employees of companies that contribute to subsidy.
Reinstate block heater installation subsidy
Reinstate ethanol-blended gasoline
Reinstate I/M

III.B.8 Anchorage Emergency Episode Plan

Note: This section was repealed on [INSERT REPEAL DATE].

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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.

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III.B.10 Air Quality Conformity Procedures

Note: This section of the maintenance plan was revised in June 2012 as part of the preparation of a limited maintenance plan for CO. At the same time Section III.B.10 was revised, a new section (Section III.B.12) was added. Together Section III.B.10 and Section III.B.12 constitute the Anchorage CO Limited Maintenance Plan.

Transportation and general conformity requirements concluded at the end of the 20-year maintenance period in 2024.

Regional Conformity Determination Methodology

Before any regional transportation plan was adopted or amended, the metropolitan planning organization was required to make an affirmative determination that it met conformity requirements outlined in 40 CFR 93. Although EPA policy did not exempt CO LMP areas from the need to demonstrate conformity, it allowed the area to do so without completing a regional emissions analysis. EPA guidance states that "emissions budgets in limited maintenance plan areas may be treated as essentially not constraining." * The EPA concluded that for transportation purposes, the emissions in a qualifying LMP area need not be capped for the maintenance period and thus no emissions budget is required in the maintenance plan. A regional emissions analysis and associated regional conformity requirements (40 CFR 93.118 and 93.119) are no longer applicable. Similarly, federal actions subject to the general conformity rule would automatically satisfy the "budget test" specified in Section 93.158(a)(5)(i)(A) for the same reasons.

When a regional conformity determination is made for a transportation plan or improvement program it should state that a regional emission analysis is not required because the area has an approved LMP for CO. The Plan and the TIP must still be made available for public review. The interagency consultation requirements specified in 40 CFR 93.112 and under state regulation, 18 AAC 50 .715 and 50.720 still apply. To meet requirements outlined in 40 CFR 93.113, the conformity determination must also address whether the transportation control measures in the SIP are being implemented in a timely manner.

Project-Level Conformity Methodology

CO LMP areas were not exempt from project-level or "hot spot" analysis requirements outlined in 40 CFR93.116 & 123. A project-level hot-spot analysis consists of performing 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 certain types of projects in all non-attainment and maintenance areas. Thus, in Anchorage, hot-spot CO modeling needed to be performed in project-level conformity determinations for these types of projects (spelled out in 40 CFR 93.123(a)).

* Memorandum "Limited Maintenance Plan Option for Nonclassifiable CO Nonattainment Areas," Joseph W. Paisie, EPA, Oct 6, 1995

The EPA has released guidance on how the MOVES model should be used to prepare project level conformity analyses.[16†] 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 were developed in one of two ways, depending on the type of project. Through the interagency consultation process, a project was put into one of two tracks as follows:

1. Projects that did **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) followed a more routine approach to computing emission impacts using MOVES. Off-network emissions were not directly modeled in the analyses of these projects, as they did not change as a result of the project. For these types of projects, off- network emissions were accounted for in the background concentration input in CAL3QHC. The interagency consultation team determined the appropriate CO background concentration used to model the project.‡

2. Those projects that did significantly impact off-network emissions (e.g., construction of facilities like parking lots that add substantially to start emissions in the project area, or projects that are likely to affect the amount of initial idling and/or engine block heater use in the area) followed a process that incorporates off-network emissions, roadway link emissions and background concentration. The EPA MOVES guidance for project level analyses describes how off network emissions should be modeled. The interagency consultation team reviewed and approved the assumptions that are used in this modeling. The consultation team also evaluated and determined the appropriate dispersion model used to model the ambient CO impacts expected from these off-network emissions.

The interagency consultation process was the key means of ensuring that projects are placed in the correct track for calculation of emission impacts. The interagency consultation process were also important in ensuring that appropriate analyses of project emission impacts were conducted under the two scenarios listed above. Moreover, it was 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 was used to develop written guidance regarding modeling inputs and assumptions and these assumptions should be consistent with those employed in the maintenance demonstration in

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† This endnote was already included in the references section of the original Anchorage CO SIP adopted by the State of Alaska in September 2011. This footnote references an EPA document entitled: "Using MOVES in Project Level Carbon Monoxide Analyses", EPA-420-B-10-041, December 2010.

‡ Typically, background CO is estimated from background or neighborhood-scale monitors in the vicinity. However, in Anchorage, CO concentrations monitored in some residential areas are substantially *higher* than those near major roadways. For example, 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 Highway & Dimond Boulevard, or Lake Otis Boulevard & Tudor Road. CO concentrations along these major arterials were lower even though their traffic volumes were an order of magnitude higher than the neighborhood sites. Evidence suggests that mechanical turbulence from traffic effectively increases the mixing volume at intersection sites and reduces overall CO concentrations. Mechanical turbulence would have a similar effect in reducing the background CO concentration in the vicinity of projects with appreciable traffic. This was considered by the interagency consultation team when determining an appropriate background concentration.

this Plan. As always, conformity determinations were subject to the applicable public review requirements. This provided the public an opportunity to comment on the approach that is taken for the conformity determination for each plan, program, and project.

General Conformity

For projects requiring general conformity determinations, it was also important to consider the impacts of off-network motor vehicle emissions (e.g., idle emissions). Interagency consultation was used to determine whether off-network mobile source emissions were significant and what analysis of these emissions was 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.

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§§§§§ 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).

SECTION III.B ANCHORAGE CARBON MONOXIDE CONTROL PROGRAM

III.B.12. Limited Maintenance Plan for 2014-2024

Note: This section was added to the CO Maintenance Plan in 2013. Section III.B.10, which addresses CO conformity, was revised and submitted at the same time to reflect the simplified conformity process required for limited maintenance areas. Minor revisions were also made to Section III.B.4 that provide additional flexibility in the operation of the Anchorage CO monitoring network.

Background

When the EPA first approved the Anchorage CO Maintenance Plan, effective July 23, 2004, it initiated a 20-year maintenance planning period as defined in the CAA. The CAA requires the submission of a second maintenance plan eight years after the redesignation that covers the second ten years of the maintenance planning period. Thus, an updated "second 10-year maintenance plan" for Anchorage is required for the period July 23, 2014 through July 22, 2024.

The EPA provides areas with design values less than 7.65 ppm the option of preparing their second 10-year maintenance plan using the limited maintenance plan (LMP) procedure. The basic elements of the LMP procedure for CO are described in a guidance memorandum, referred to as the Paise memo.§ Anchorage has decided to use the LMP option for this second 10-year maintenance plan update.

The Paise memo identifies five core provisions that should be included in the LMP. These are: (1) an attainment inventory; (2) a maintenance demonstration, (3) monitoring to verify continued attainment of the CO NAAQS; (4) a contingency plan; and (5) conformity determination requirements under an LMP. These are discussed in more detail below.

Discussion of Core LMP Provisions

1. Attainment Inventory

The Paise memo states that "the State should develop an attainment emissions inventory to identify the level of emission in the area which is sufficient to attain the NAAQS." A comprehensive inventory was prepared for base year 2007 that showed that motor vehicle emissions were responsible for approximately 79% of all CO emissions in the Anchorage bowl inventory area. The emission inventory was prepared for a "CO design day" when CO concentrations are the highest. In Anchorage, the highest CO concentrations tend to occur on mid-winter weekdays when temperatures are near zero. The assumptions and computations involved in producing this inventory are described in detail in Section III.B.3 and its appendix.

Results of 2007 emission inventory are re-summarized in Table III.B.12-1.

Table III.B.12-1
Sources of Anchorage CO Emissions in 2007 Base Year

§ Memorandum "Limited Maintenance Plan Option for Nonclassifiable CO Nonattainment Areas," Joseph W. Paisie, EPA, Oct 6, 1995

Source Category	CO Emitted (tons per day)	% of total
Motor vehicle – running emissions	40.5	25.4%
Motor vehicle – start emissions	84.8	53.4%
Motor vehicle – extended idling by combination long-haul trucks	0.3	0.1%
Subtotal – Motor Vehicles	125.6	78.9%
Ted Stevens Anchorage International Airport Operations	12.4	7.8%
Merrill Field Airport Operations	0.7	0.4%
Wood burning – fireplaces and wood stoves	6.2	3.9%
Space heating – natural gas	3.8	2.4%
Miscellaneous (railroad, marine, snowmobiles, snow removal, portable electrical generators, welding, etc.)	9.3	5.8%
Point sources (power generation, sewage sludge incineration)	1.3	0.8%
Subtotal – Other Sources	**33.7**	**21.1%**
TOTAL – ALL SOURCES	**159.3**	**100%**

2. Maintenance Demonstration

According to the Paise memo, the maintenance demonstration requirement is considered to be satisfied "if the monitoring data show that the area is meeting the air quality criteria for limited maintenance areas." Areas with design values of 7.65 ppm (85% of the CO NAAQS) or less qualify for the LMP option.**

Unlike previous CO attainment and maintenance plans prepared for Anchorage, when an LMP is prepared there is no requirement to forecast CO emissions or concentrations to demonstrate compliance with the NAAQS. When EPA approves an LMP, it concludes that it is unreasonable to expect that emission growth during the maintenance period would result in a violation of the NAAQS.

Table III.B.12.2 shows that design value as defined in the Paise memo (DV_{Paise}) has consistently met the 7.65 ppm criteria since 2006. The DV_{Paise} in base year 2007 was 6.1

** It should be noted that the Paise memo definition of design value is different than the design value defined earlier in Section III.B.6. In Section III.B.6 the design value is the upper-bound 90th percentile prediction interval value for 2007 computed from second 8-hour maximum values measured at the Turnagain CO monitor between 1999 and 2008. The design value as defined in the Paise memo, is determined by examining the second maximum 8-hour concentration recorded each year at each monitoring site in the area over a two-year period. For each site, the higher of the two values is the design value for that site for that two-year period. To determine the design value for an area for that two-year period, all monitors in the area are reviewed and the highest design value among the individual sites is the design value for the area as a whole. Because the Paise definition of the design value is different than the design value referred to in Section III.B.6, it is referred to as DV_{Paise} in this section.

ppm. In 2011, the value was 6.0 ppm. The Turnagain monitor consistently measured the highest CO concentrations in the network and thus was the controlling site in the determination of the design value.

III.B.12.2

Computed Design Values (DV_{Paise}) in Anchorage 2002 - 2011

	Highest 2nd Max 8-hr Concentration Measured in Preceding Two-Years				
	Garden	Seward Hwy	Turnagain	DHHS	**DV_{Paise}**
2002	5.7	5.2	7.7		7.7
2003	5.7	5.4	6.7		6.7
2004	6.4	5.5	7.9		7.9
2005	6.4		7.9		7.9
2006	4.8		6.1		6.1
2007	4.3		6.1		6.1
2008	3.8		5.5	3.1	5.5
2009	4.4		5.8	3.6	5.8
2010	4.4		6.1	3.6	6.1
2011	3.8		6.1	2.8	6.1

The Paise memo also notes that, as part of the maintenance demonstration, any control measures in the SIP must be continued. Current CO control measures for Anchorage are described in Section III.B.5. These primary control measures include: (1) an air quality public awareness program aimed at promoting use of engine block heaters to reduce CO cold start emissions and the promotion of bicycling walking, transit and other alternatives to the single occupancy vehicle; (2) a transit marketing program; and (3) carpooling and vanpooling.

3. Monitoring Network/Verification of Continued Attainment

The Paise memo states that the LMP should provide for continued operation of a CO monitoring network consistent with requirements outlined in 40 CFR 58. Anchorage is committed to maintaining a CO monitoring network to verify continued attainment of the NAAQS until the EPA determines that it is no longer necessary under 40 CFR 58.14(c)(1). The specifics of the CO monitoring network are discussed in Section III.B.4.

4. Conformity Determinations

Conformity determinations are not required following the end of the 20-year maintenance period in 2024.

Planning Process used to Develop the Anchorage CO LMP

The local planning process used to develop air quality plans in Anchorage is described in detail in Section III.B.1. This same process was used to develop this LMP. The first draft of this LMP was prepared in June 2012. A public review draft was released for 30-day public review by the AMATS Technical Advisory Committee on September 13, 2012. The AMATS Air Quality Advisory Committee met on October 2, 2012 to review the public review draft. Although they did not assemble a quorum, they forwarded their informal endorsement of the LMP, as drafted, to the AMATS Technical and Policy Committees. The AMATS Policy Committee recommended that the Anchorage Assembly adopt the LMP on December 20, 2012. The Assembly adopted the LMP and associated amendments to Section III.B.4 and III.B.10 on January 29, 2013.

ADEC held a public hearing on the LMP on February 12, 2013. After review and consideration of the comments received, the LMP was forwarded to the EPA.

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.

[15] "Using MOVES in Project-Level Carbon Monoxide Analyses," EPA-420-B-10-041, December 2010

The End.