

Appendix G

Air Quality Analysis



MEMORANDUM

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To: I-35E AUAR Report **Copy:** **File:**
– *Appendix E.*

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Subject: I-35E AUAR Mobile Source Air Quality Analysis

This technical memorandum provides the air quality analysis for the Lino Lakes AUAR. The analysis was conducted for 2030 Land Use Development Scenario 3 – Residential Emphasis. This scenario generates the most trips of the three scenarios evaluated, thereby representing a worst-case scenario with respect to mobile source air quality impacts. Through an intersection screening process, three intersections with the highest delay within the I-35E Transportation Network were identified and analyzed for air quality impact. These intersections are:

- . • CSAH 14 (Main Street)/CSAH 21 (20th Avenue North).
- . • CSAH 14 at Otter Lake Road
- . • CSAH 21 at 80th Street East

The results of the air quality analysis concluded that resulting concentrations of Carbon Monoxide (CO) for all three intersections considerably less than the State Standards, which are the maximum allowable concentrations. Based on the analysis, no CO impacts will occur in the entire project area as a result of traffic-related activities.¹

The full analysis is provided in the remainder of this technical memorandum.

It should be noted that based on MnDOT project guidance, an air quality analysis is not needed unless the total intersection approach volume exceeds 77,000 vehicles per day. However, in the interest of the community, it was decided to conduct the analysis to address any environmental concerns with respect to traffic related air quality impacts.

1. 1.0 METHODOLOGY AND ASSUMPTIONS

2. 1.1 Air Emissions

1.1.1. Airborne Pollutants

Ambient air quality is a function of many factors, including climate, topography, meteorological conditions and the production of airborne pollutants by natural or artificial sources. The major airborne pollutant of interest from traffic is carbon monoxide.

Carbon monoxide is an odorless, colorless gas formed by the burning of fuels containing carbon. Motor vehicles are the principal source of CO emissions in urban areas. Maximum concentrations usually occur near intersections and other areas of traffic congestion, and decrease rapidly with distance from the source.

1.1.2. Regulatory Requirements

The Clean Air Act, which was last amended in 1990, requires Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards for pollutants considered harmful to public health and the environment. The state of Minnesota ambient air quality standards are shown in Table 1. These standards set the maximum allowed concentration of carbon monoxide (CO) for the state.

Table – 1. Minnesota State Standards

Pollutant	Averaging Period	State Standards
		Primary
Carbon Monoxide (CO)	8-hour	9 ppm ¹⁾ (10 mg/m ³)
	1-hour	30 ppm (34 mg/m ³)

1) parts per million (ppm)

1.1.3 Microscale Air Quality

The local air quality analysis consists of a microscale hot spot investigation for violations of the ambient air quality standards for CO. Vehicular traffic is the most significant source of CO emissions in the region. Because CO emissions dissipate rapidly with increasing distance from the source, the highest concentrations are likely to occur in the vicinity of roadway intersections or other locations where motor vehicles tend to idle for a period of time.

The methodology for identifying potential local air quality impacts follows the EPA-recommended procedure for CO microscale impact analysis. The general evaluation

procedure, outlined in the *Guideline for Modeling Carbon Monoxide from Roadway Intersections* (EPA, 1992), includes a microscale CO analysis with MOBILE 6.2 emission model and the CAL3QHC line-source dispersion model.

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A multiple intersection screening analysis is used to identify locations in the project vicinity requiring further analysis for CO hot spots. The intersection screening process includes the following steps:

- . • Identify the signalized intersections in the project vicinity that will be impacted by the project alternatives
- . • Determine the delay and level-of-service (LOS) for those intersections
- . • Determine total intersection delay as the product of average delay and total intersection approach volume
- . • Rank the intersections according to delay and select the intersections with the highest vehicle delay for analysis

The selected intersections then are evaluated using a microscale analysis procedure. The procedure is used to estimate maximum 1-hour and 8-hour CO concentrations in the vicinity of each intersection for comparison with the state air quality standards. If microscale analysis does not identify significant local air quality impacts at the selected intersections, then impacts would be unlikely at any other location in the project vicinity.

The microscale analysis procedure includes the following steps:

- . • Assemble the required data for the analysis, including meteorological conditions, site characteristics, traffic parameters and emission variables.
- . • Estimate the future background CO concentration based on monitoring data and the expected change in regional emissions.
- . • Identify receptor locations near the intersection for simulation of future ambient CO concentrations.
- . • Compute the worst-case 1-hour CO concentration using CAL3QHC.
- . • Estimate the worst-case 8-hour CO concentration by applying a suitable persistence factor to the computed 1-hour concentration. The use of a persistence factor is intended to reflect the relationship between 1-hour and 8-hour traffic and meteorological conditions.
- . • Compare the results with the ambient air quality standards to identify adverse impacts, including new or aggravated violations.

The sidewalk averaging method, recommended by the EPA, was used for the analyzed intersection. In this method, the receptors are located along each sidewalk or side of the intersecting streets at approximately 10 meters and 50 meters from the edge of the intersecting roadway. The CO concentration at each of the receptors was modeled. The

highest, or worst case, average CO concentrations for each receptor site was then calculated.

The sidewalk averaging method results in higher predicted CO concentrations than would be expected at nearby receptors.

After all the necessary parameters and assumptions had been defined for the selected intersection, the CAL3QHC model was run for the project analysis scenario 3 (Build Year 2030).

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The microscale modeling process requires a number of parameters and assumptions. The model inputs listed below are consistent with current EPA recommendations, and are intended to represent reasonable worst-case Ds at the selected intersections.

- Meteorological, Fuel and Vehicle Characteristics -Absolute Humidity: 75.0 grains/lb. -Altitude: Low Altitude -Evaluation Month: January -Speed Class: Uniform Arterial Speed -Minimum Temperature: 16 degrees Fahrenheit -Maximum Temperature: 38 degrees Fahrenheit -Fuel Program: Conventional Gasoline East -Fuel Reid Vapor Pressure: 9.0 lbs./square inch -Oxygenated Fuels: Alcohol with 99.9 Percent Market Share and 2.7

Percent Oxygen Content -Vehicle Age: Based on data provided by the MPCA - Averaging Time: 60 minutes -Surface Roughness: 108 cm -Settling Velocity: 0 cm/sec - Deposition Velocity: 0 cm/sec -Wind Speed: 1.0 m/sec -Stability Class: D -Mixing Height: 1,000 meters -Wind Direction: 360 degrees at 10 degree increments

- Traffic Characteristics

- Lane configuration, link volume, signal cycle length, red time and lost time were taken from the traffic analysis completed for the project area (Build Year 2030).

- Signal timings are optimized for each scenario. Optimization maximizes the capacity at each intersection while maintaining coordination with adjacent signalized intersection. The level of service of an intersection could show an improvement from no-build to the build scenarios even though traffic volumes have increased due to this optimization.

- Site Characteristics

- Intersection layouts and roadway geometry were determined from maps and aerial photographs of the study area, and match those used in the traffic analysis.

- Emission Characteristics

- Running emission rates were generated with MOBILE 6.2. The posted

- speed limit was used for all roadway links
- Idle emission rates were calculated by converting the 2.5 mph MOBILE 6.2 running rate from grams per mile to grams per hour
- The EPA-recommended default persistence factor of 0.7 was used to estimate 8-hour CO concentrations

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1. **2.0 EXISTING CONDITIONS**
2. **2.1 Background Carbon Monoxide**

Areas similar to the project area typically have very low background CO levels. The background CO levels have been assumed to 3.0 ppm for the one-hour average, and 2.0 ppm for the eight-hour average.

3.0 IMPACT ANALYSIS

3.1.1. Intersection Screening

Using the results from the project traffic study, the potential intersection for analysis were identified, ranked and selected for further evaluation.

The three intersections within the study area was selected for air quality analysis based on the projected future traffic delay are:

- . • CSAH 21 (20th Avenue North) at CSAH 14 (Main Street)
- . • CSAH 14 at Otter Lake Road
- . • CSAH 21 at 80th Street

3.2 Carbon Monoxide Modeling Location

The selection of these intersections is used as a method to determine if the CO concentrations exceed state standards at the worst-case intersection. If the conclusion can be drawn that no exceedances of the state standards will occur at the worst intersection as a result of the project area, no impacts would be expected at the other intersections within the study area as a result of the project.

3.2.1. Predicted Intersection Carbon Monoxide Levels

Table 2 provides the results of the CO modeling at the selected intersections. The table shows the highest predicted 1-hour and 8-hour CO concentrations. No violations were encountered. Because the selected intersection represents the worst location in the study area in terms of traffic volume and vehicular delay, it is reasonable to conclude that other locations in the study area would not

experience violations of the ambient CO standards under any of the proposed alternatives.

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Table 2. Maximum Predicted CO Concentrations for 2030 Development Scenario 3

Intersection	Averaging Period	Maximum Concentration (ppm) ^{a,b}		
		State Standards	2030	Violation
CSAH 21 / CSAH 14	1-hour 8-hour	30 9	5.9 4.1	None None
CSAH 14 / Otter Lake Road	1-hour 8-hour	30 9	6.2 4.2	None None
CSAH 21 / 80 th Street East	1-hour 8-hour	30 9	7.7 4.6	None None

Source: URS Corporation

Notes:

^a. Results include estimated background CO levels of 3.0 ppm (1-hour) and 2.0 ppm (8-hour).

^b. The applicable State ambient CO standards for the 1-hour and 8-hour averaging periods are 30 ppm and 9 ppm, respectively.

The applicable Federal ambient CO standards for the 1-hour and 8-hour averaging periods are 35 ppm and 9 ppm, respectively

3.2.2. Impact Summary

No-Build Alternative

The No-Build Alternative would have no mobile source impacts on microscale air quality.

Build Alternative

The mobile source air quality analysis completed for the project demonstrates that all applicable state and federal regulations are satisfied and 2030 Development Scenario 3 will not cause CO standard exceedances at this worst-case location, under worst-case conditions.

Future year concentrations typically decrease due to improved emission controls of the vehicle fleet. This often occurs even with increased traffic volumes and intersection delay.

1. **4.0 MITIGATION OPTIONS**
2. **4.1 Carbon Monoxide**

The Build Alternative will have no adverse impacts to air quality. Therefore, no specific mitigation plan is recommended.

1. **5.0 CONCLUSIONS**
2. **5.1 Carbon Monoxide Conclusions**

The intersections with the highest delay were analyzed for air quality impacts for 2030 Development Scenario 3 and no impacts were found. Based on this analysis of the worst-case location(s), no carbon monoxide impacts will occur in the entire project area as a result of traffic-related activities.

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