3.9.2.2 $PM_{2.5}$ Hot-Spot Analysis

Project-level conformity must be established for projects located in a $PM_{2.5}$ nonattainment area. A hot-spot analysis is required in $PM_{2.5}$ and PM_{10} nonattainment or maintenance areas for projects that are determined as project of air quality concern (40 CFR 93.123[b][1]). A $PM_{2.5}$ hot-spot analysis was performed using the latest emission factor model and procedures outlined in the memorandum, "Transportation Conformity Guidance for Quantitative Hot-spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas" (USEPA, 2010a) to estimate annual $PM_{2.5}$ concentrations in the project area. A hot-spot analysis is only required for the pollutants and averaging periods for which the area is in nonattainment. In this case, only annual $PM_{2.5}$ was evaluated because the project is located in the DuPage County and Cook County annual $PM_{2.5}$ nonattainment areas.

The USEPA published the Quantitative PM Hot-spot Guidance and announced the approval of USEPA's Motor Vehicle Emission Simulator (MOVES) for hot-spot analyses in the Federal Register notice on December 20, 2010, which also started a two-year conformity grace period to implement the quantitative methodology using MOVES. Air quality analyses that start within the grace period are not required to perform a quantitative analysis, and a qualitative analysis is acceptable. This project was discussed during an interagency consultation meeting on September 10, 2010 (CMAP, 2010a), where it was determined by the group to be a project of air quality concern. In anticipation of the release of final guidance, it was also determined that the $PM_{2.5}$ hot-spot analysis would be completed quantitatively.

Overview of the Analysis

The technical details of the PM hot-spot analysis, Mobile Source Air Toxic (MSAT) analysis, and greenhouse gas emissions estimates are included as Appendix I. The following sections summarize the methodology and results.

The dispersion modeling technique in the project area was USEPA's CAL3QHCR model and emission factors from USEPA's MOVES model. Model inputs were selected according to guidance (USEPA, 2010a). MOVES inputs incorporated local registration mix and fuel data provided by IEPA that are consistent with the regional emissions analyses for conformity determinations in the Transportation Improvement Program (TIP) and Plan. Other CAL3QHCR model inputs include local meteorological data and traffic data specific to each roadway section. Details regarding inputs are included in Appendix I.

The PM hot-spot analyses examine the air quality impacts for the relevant PM NAAQS in the areas substantially affected by the project. Hot-spot analyses typically include the entire project; however, since this project is so expansive, the PM hot-spot analysis focuses on the locations with the highest likelihood of new or worsened PM NAAQS violations. If conformity is demonstrated at these locations, then it will be extrapolated that conformity is met in the entire project area. This is consistent with Section 3.3.2 of the quantitative hot-spot modeling guidance (USEPA, 2010a).

Through consultation with the Illinois Interagency Workgroup on February 25, 2011, four locations were chosen to represent the locations expected to the have the highest air quality concentrations, as a result of high projected traffic volumes and sensitive receptor locations. Interchanges were chosen for analysis because they have the highest traffic volumes concentrated in a given area.

The four locations modeled for the $PM_{2.5}$ hot-spot analysis were:

- Elgin O'Hare and West Bypass corridors
- Elgin O'Hare corridor and I-290
- Elgin O'Hare corridor and Roselle Road
- West Bypass corridor and I-90

It was determined that the concentrations of $PM_{2.5}$ would be evaluated at all four locations for both the Build Alternative and the No-Build Alternative. Section 2.8 of the quantitative hot-spot modeling guidance indicates that if a project is being developed in two stages and the entire two-stage project is being approved, two analysis years should be modeled: one to examine the impacts of the first stage of the project and another to examine the impacts of the completed project (USEPA, 2010a). Because this project is being constructed in two phases, analyses were conducted for 2030 (i.e., after the initial construction phase would be completed), and 2040 (i.e., after construction of the entire project would be completed). The initial construction phase would include improvements for the entire project corridor, but with fewer travel lanes and reduced interchanges. The 2030 interim year represents the year of peak capacity after the initial construction phase would be complete, and it was modeled because it was likely to produce the peak emissions associated with that phase. The PM hot-spot analyses included only directly emitted $PM_{2.5}$ emissions. $PM_{2.5}$ precursors are not considered in PM hot-spot analyses, since precursors take time at the regional level to form into secondary PM. Exhaust, brake wear, and tire wear emissions from on-road vehicles are always included in a project's $PM_{2.5}$. For this analysis, only running exhaust was considered because start exhaust is unlikely to occur on the roadways included in the model domain.

Re-entrained road dust was not included because the SIP does not identify that such emissions are a significant contributor to the $PM_{2.5}$ air quality in the nonattainment area. Emissions from construction-related activities were not included because they are considered temporary, as defined in 40 CFR 93.123(c)(5) (i.e., emissions that occur only during the construction phase and last five years or less at any individual site).

Model output was used to determine a design value, which is a statistic that describes a future air quality concentration in the project that can be compared to a particular NAAQS. The design value was determined by combining modeled $PM_{2.5}$ concentrations from the project and a representative monitored background $PM_{2.5}$ concentration provided by IEPA. Refer to Appendix I for details on how the model results were used to determine the appropriate value to use in the design value.

Background concentrations representing the cumulative $PM_{2.5}$ emissions of other sources in the area were added into the predicted local concentrations for $PM_{2.5}$ emissions at locations where the general public could have extended access. Because of this inclusive analysis methodology, the forecast impacts represent cumulative air quality impacts.

This total concentration was compared to the annual $PM_{2.5}$ NAAQS of 15 $\mu g/m^3$.

Results

The 1997 annual $PM_{2.5}$ design value is currently defined as the average of three consecutive years' annual averages, each estimated using equally-weighted quarterly averages. This NAAQS is met when the three-year average concentration is less than or equal to the 1997 annual $PM_{2.5}$ NAAQS (15.0 $\mu g/m^3$).

The receptor with maximum annual average $PM_{2.5}$ concentration was identified for each model run for each year of meteorological data, and the associated design value was determined for comparison to the NAAQS. The annual $PM_{2.5}$ design value for the receptor with the maximum concentration for each scenario is presented in Table 3-23. $PM_{2.5}$ concentrations ranged from 13.2 µg/m³ to 13.8 µg/m³ for the 2040 No-Build Alternative and 13.4 µg/m³ to 14.0 µg/m³ for the 2040 Build Alternative. The annual concentrations of $PM_{2.5}$ for the 2030 interim year ranged from 13.4 µg/m³ to 13.8 µg/m³.

TABLE 3-23
Annual $PM_{2.5}$ Design Value Concentrations in µg/m³

Location	2040 Build Alternative	2040 No-Build Alternative	2030 Interim Year
Elgin O'Hare and West Bypass corridors	14.0	13.2	13.8
Elgin O'Hare corridor and I-290	13.5	13.8	13.6
Elgin O'Hare corridor and Roselle Road	13.4	13.4	13.4
West Bypass corridor and I-90	13.6	13.8	13.8

Notes: All concentrations include background concentration of 13 µg/m³; Annual $PM_{2.5}$ NAAQS is 15 µg/m³; µg/m³ = micrograms per cubic meter. Concentrations are for the receptor with highest concentration for each scenario.

The results of the analysis show that the modeled localized $PM_{2.5}$ concentrations do not exceed the annual $PM_{2.5}$ NAAQS for the Build Alternative, No-Build Alternative, or 2030 interim year of the Build Alternative.

The local hot-spot analysis demonstrates that the project would not:

- Cause or contribute to a new violation of any air quality standards in any area;
- Increase the severity or frequency of an existing violation of any standard in any area;
- Delay timely attainment of any standard, required interim emission reductions, or milestones in any area.