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MEMORANDUM

January 10, 2003

TO: Mike Brady
FROM: Doug Eisinger, Tom Kear, Deb Niemeier
SUBJECT: Diesel PM Project-Level Analysis

This memo responds to your December 31, 2002 request for technical input concerning transportation project-level analyses related to the particulate matter (PM) fraction of diesel exhaust. You asked for the assistance in the context of the proposed Willits Bypass transportation project. Caltrans District staff responsible for the Willits Bypass project recently received a request from the Mendocino County Air Quality Management District (MCAQMD) that Caltrans model diesel exhaust PM emissions and resulting concentrations from the proposed bypass project, and prepare a health risk assessment based on the modeled diesel PM concentrations.

Our comments fall into two categories: (1) background technical concerns with existing diesel PM emission factors included in the EMFAC model, and (2) potential next steps that Caltrans may wish to pursue to address diesel PM at the project level, if Caltrans elects to perform an analysis.

Concerns with Existing EMFAC Diesel PM Emission Factors

The EMFAC model currently includes emission factors created from trip-based data sets that do not adequately represent facility-specific conditions. Caltrans and the state Air Resources Board (ARB) have long recognized this problem, and over the past several years U.C. Davis, Caltrans, and ARB have been jointly engaged in a model improvement program (the Caltrans/ARB Modeling Program, or CAMP) to develop facility-specific speed correction factors for emissions modeling. The CAMP work effort is still in progress, and has focused solely on light-duty, gasoline-powered vehicles. Consequently, facility-specific diesel PM emission factors do not yet exist for California. We are concerned that using the existing diesel PM emission factors may set a precedent for the inappropriate application of trip-based emission rates for specific roadway links when performing diesel PM modeling. This would create problems similar to those historically experienced by Caltrans and transportation planners who have modeled facility-specific carbon monoxide conditions using trip-based EMFAC tools.

Potential Next Steps to Address the Diesel PM Issue at the Project Level

Caltrans is fielding an increasing number of requests for diesel PM-related information similar to the request from the MCAQMD. These requests are a function of ARB's listing of diesel PM as a toxic air contaminant, and the assessment by ARB and other California air agencies that diesel PM is the single most important contributor to air toxics-related health risks. Given the increasing attention being focused on diesel PM, it is especially important that any project-level analyses conducted by Caltrans or other agencies utilize appropriate technical information and modeling tools to best characterize emissions, concentrations, and potential health risks. Emission factors included within the existing EMFAC model version (EMFAC2002) would not best represent project-level impacts for a specific proposed facility such as the Willits Bypass.

If Caltrans decides to prepare project-level diesel PM analyses, we suggest consideration of three potential next steps to improve the ability to adequately address diesel PM at the project scale. The three options are briefly described below.

Option One: Employ the Principles Embodied in the U.C. Davis Qualitative PM₁₀ Analysis Protocol for Diesel PM Project-Level Assessments

Under Caltrans and Federal Highway Administration sponsorship, U.C. Davis is currently completing a qualitative analysis protocol for transportation project-level PM₁₀ impacts. Although there are important differences between PM₁₀ and air toxics analyses, some of the principles embodied in the U.C. Davis protocol may be of value to project analysts. For example, one of the PM₁₀ protocol approaches involves a build vs. no-build "relocate and reduce" analysis approach, where analysts consider whether relocating traffic from existing roads to a proposed facility reduces the expected worst-case PM₁₀ concentrations. It is conceivable that some projects, perhaps the Willits Bypass is a good example, will relocate diesel PM emissions away from populated areas, and reduce diesel PM emissions by smoothing heavy-duty diesel vehicle (HDDV) traffic flow. When Caltrans provides the qualitative PM₁₀ analysis protocol to transportation project analysts, Caltrans might consider providing analysts with suggestions on how to use the PM₁₀ protocol as a qualitative guide for fielding diesel PM inquiries. This option could be implemented relatively quickly, given that the PM₁₀ protocol is nearly complete and has already been reviewed by both Caltrans and FHWA.

Option Two: Estimate Diesel PM Emission Factors Based on Existing Literature

Various researchers around the U.S. have already obtained limited HDDV emission data using dynamometer tests that employ various driving cycles (e.g., research has been conducted by faculty and staff at West Virginia University and the Colorado School of Mines). Although the data obtained to date are not necessarily California-specific, enough information may be available to construct approximations of facility-specific emission factors. The ability to estimate, even roughly, facility-specific emissions would mark a substantial improvement over existing tools, and the information could be refined over time as additional data was obtained. Independent of the Willits Bypass project, performing such a literature review would be a useful effort to assist Caltrans in the longer-term. This option could be implemented within the next six months or so. The literature review work could be

completed over the next several months, with follow-up work to develop approximate emission factors completed following the literature review.

Option Three: Heavy-Duty Diesel Vehicle Dynamometer Testing

This option would involve the recruitment and dynamometer testing of several HDDVs. Designing and implementing the study would be a longer-term effort that could be accomplished over approximately the next two years. The research objective would be to identify emission rates for different driving conditions (driving cycles) representative of travel behavior on different facilities (freeways, major arterials). A limited research program, testing a few late-model vehicles with a limited number of driving cycles, would enable Caltrans and others to approximate how emissions vary with speeds on specific facilities. As with Option Two, the ability to roughly estimate facility-specific emissions would be a substantial improvement over existing tools.

We could assist Caltrans in providing more technical detail about each of the three options depending upon agency interest. We can also provide you with a briefing memo documenting the limitations of using existing emission factors to represent diesel PM emissions from various transportation facilities. (Note that Caltrans already communicated many of the limitations of the EMFAC emission rates when Caltrans commented on ARB's proposed diesel risk reduction plan shortly after the adoption of diesel exhaust as a TAC.) Let us know what additional information would be most helpful.