Air Quality Analysis Protocol

Detroit Intermodal Freight Terminal

Environmental Impact Statement

Updated March 2005

1.0 Introduction

Under the National Environmental Policy Act (NEPA), federal agencies are required to identify and describe the potential impacts to the human and natural environments as a result of their action(s), including those to air quality. This paper describes the air quality analysis that will be performed for the Detroit Intermodal Freight Terminal project (DIFT) environmental impact statement.

The DIFT project proposes to enhance development of intermodal (truck/rail) terminals operated by the four Class I Railroads[1] that serve Michigan to provide improved intermodal service to business, industry and the military. Four intermodal terminals are included in the DIFT EIS: the Livernois-Junction Yard in Southwest Detroit (operated by CSX and Norfolk Southern); Canadian Pacific's Expressway terminal behind the Michigan Central Depot just north of Bagley (temporarily closed as of June 2004); the CP/Oak Terminal located in the northwest corner of the intersection of I-96 and the Southfield Freeway; and, the Canadian National/Moterm Terminal on the Wayne County/Oakland County border north of 8 Mile Road between I-75 and Woodward Avenue.

Because of the concentrated activities of heavy-duty diesel trucks, locomotives, and container-handling equipment with the DIFT project, air toxics and fine particulate matter ($PM_{2.5}$[2]) are of particular interest. There are no established regulatory standards specifying harmful concentration levels of air toxics, no attainment area designations, and no analysis protocol for evaluating air toxics impacts for transportation projects. Nevertheless, given community concern for air toxics, FHWA recognizes the need to address several key air toxics along with $PM_{2.5}$ (fine particulates) and the other NAAQS pollutants, through the protocol described here.

2.0 Analysis Elements

The DIFT air quality analysis will cover:

1. The attainment status of the project area with respect to the NAAQS, notably carbon monoxide (CO), ozone, and $PM_{2.5}$.
2. A CO hotspot analysis at key intersections in the terminal areas that will compare CO concentrations in areas of human activity to the 1- and 8-hour NAAQS.
3. Pollution trends, and a discussion of U.S. EPA measures to improve air quality.
4. A discussion of air toxics, including a qualitative discussion of health risks and current science.

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[1] A Class I Railroad has at least $250 million in revenue per year.

[2] $PM_{2.5}$ refers to particulate matter that is 2.5 micrometers or smaller in size. Sources of $PM_{2.5}$ include fuel combustion from automobiles, power plants, wood burning, industrial processes, and diesel-powered vehicles such as buses and trucks. These fine particles are also formed in the atmosphere when gases such as sulfur dioxide, nitrogen oxides, and volatile organic compounds (all of which are also products of fuel combustion) are transformed in the air by chemical reactions. Fine particles are of concern because they are so small they are able to penetrate to the deepest parts of the lungs, where the body has difficulty expelling them.

5. An estimate of the pollutant burden[3] that will be generated by each terminal under each alternative. This burden analysis will include the NAAQS pollutants and several key air toxics.
6. An estimate of the pollutant burden produced by mobile source activities on the local public roadway network near each terminal that would experience traffic volume changes. This burden analysis will include the NAAQS pollutants and several key air toxics.
7. A discussion of air quality conformity.
8. Potential mitigation that could accompany the proposed project.

The goal of the analysis is to provide decision-makers and the public with information to view the relative impacts of each alternative. The results of the analysis will not provide a means for a pass/fail comparison to standards (other than carbon monoxide).

3.0 Regional Attainment Status

The NAAQS are set at levels that U.S. EPA believes will protect public health and welfare. NAAQS are used as the basis for determining an area's air quality designation (i.e., status, as "attainment" or "nonattainment"). Generally, a nonattainment area is one that does not meet a particular NAAQS. An area may be classified nonattainment for one or more pollutants and attainment for others. It is also possible for a nonattainment area to be reclassified as attainment, if it is able to achieve the standard over time. Such areas are given a "maintenance" designation, requiring them to demonstrate continued compliance with the standard, but not requiring additional controls to reduce emissions.

The air quality analysis and report will discuss Southeast Michigan's attainment status. The study area is now a maintenance area for the CO standard and is in nonattainment of the 8-hour ozone standard. It was designated to be in nonattainment for $PM_{2.5}$ on December 15, 2004 (effective April 5, 2005). A portion of the southwest Detroit area is also a maintenance area for PM_{10}, but this is not a part on the mobile source review process on the part of SEMCOG, the Southeast Michigan Council of Governments.

4.0 CO Hotspot Analysis

Carbon monoxide (CO) hotspot analysis is performed to ensure that project-related traffic does not cause a violation of the 1- or 8-hour NAAQS for CO. Carbon monoxide is a colorless, odorless, poisonous gas produced by incomplete combustion. Traffic information for each alternative is combined with information about roadway geometry and traffic flow conditions to determine the concentrations of CO at sensitive receptors. Sensitive receptors are locations where humans might be expected to be present. This analysis is done with a computer program called CAL3QHC. This program requires emission factors for various types of vehicles operating under various speeds and conditions (such as ambient temperature and fuel type), expressed in grams per mile. These emission factors are generated using the U.S. EPA-approved model, MOBILE6.2. Input parameters that go into the MOBILE6.2 model, such the vehicle fleet mix and age, are drawn from SEMCOG (Southeast Michigan Council of Governments) in consultation with U.S. EPA and the Michigan Department of Environmental Quality (MDEQ).

5.0 Pollution Trends – NAAQS Pollutants and Air Toxics

[3] Pollutant burden means the mass of a pollutant produced in a given period of time. In this case pollutant burden is expressed in terms of tons per year.

The EIS will provide information on past trends in NAAQS pollutant emissions and regulatory measures taken by U.S. EPA to continue the downward trends. Historic data from local monitoring stations nearest to the terminals (or with the most complete records) will be documented.

Future air quality trends will be discussed based on U.S. EPA forecasts of the expected consequences of recently implemented regulations related to on-road diesel engines and fuels. Trends in passenger vehicle emissions will also be noted.

Diesel exhaust is a complex mixture of inorganic and organic compounds that occur as a blend of gases and particles. The gaseous components include nitrogen oxides, sulfur compounds, and low-molecular-weight hydrocarbons, such as the aldehydes, benzene, 1,3-butadiene, and polynuclear aromatic hydrocarbons. The particle phase of diesel exhaust consists of elemental carbon, adsorbed organic compounds and small amounts of sulfate, nitrate, metals and other trace elements. Diesel particulate matter (DPM) has been estimated to comprise about six percent of the total $PM_{2.5}$ inventory nationwide but more in urban areas, excluding natural and miscellaneous sources (U.S. EPA, 2002).

Compounds of most specific interest for the DIFT project are those found in particulate matter and, to a lesser degree, volatile organic compounds (VOCs), which are also emitted by diesel vehicles. Data from the 1996 National Toxics Inventory indicate that mobile sources account for approximately 50 percent of air toxics emissions (U.S. EPA, 2000). Several of the air toxics that EPA has identified as priority mobile source air toxics (MSATs) constitute a subset of all VOCs. The MSATs considered in the DIFT environmental impact analysis are benzene, 1,3-butadiene, formaldehyde, acetaldehyde, and acrolein. Also included on EPA's list is diesel particulate matter (DPM). These particular air toxics were selected because: 1) mobile sources, both on-road and non-road, contribute the majority of annual emissions for five of these air toxics (acetaldehyde, acrolein, benzene, 1,3-butadiene and formaldehyde) on a national basis; 2) they are representative of the complete list of gaseous mobile source air toxics; and, 3) these air toxics are some of the more important ones from a health standpoint. It is important to note that almost all of the remaining hazardous air pollutants (HAPs) emitted by mobile sources are trace metals, and compounds associated primarily with the particulate phase. Stationary and area sources account for most the nationwide emissions of these HAPS.

EPA has issued a suite of motor vehicle and fuels regulations, including: 1) tailpipe emission standards for cars, SUVs, mini-vans, pickup trucks and heavy trucks and buses; 2) standards for cleaner-burning gasoline; 3) a national low-emission vehicle program; and, 4) standards for low-sulfur gasoline and diesel fuel. By the year 2020, these requirements are expected to reduce emissions of a number of air toxics (benzene, 1,3-butadiene, formaldehyde, and acetaldehyde) from highway motor vehicles by about 75 percent and diesel particulate matter by over 90 percent from 1990 levels (U.S. EPA, 2000).

EPA issued a regulation in May 2004 to control emissions from diesel-powered non-road engines, such as construction equipment and railroad locomotives. EPA also provides assistance in identifying and implementing voluntary programs, such as diesel retrofits, to achieve additional reductions.

The EPA-approved MOBILE6.2 model allows projections of future emission factors for the NAAQS pollutants and certain air toxics associated with mobile sources. The model accounts for the recent EPA regulatory changes. Emission factors vary by speed and type of vehicle. By focusing on representative vehicle types and speeds, future emission factors can be related to trends over time (i.e. 2004, 2015, and 2025). Graphics to illustrate these trends will be developed for the following conditions:

- Passenger vehicles and NAAQS pollutants at: a) 10, and b) 30mph
- Passenger vehicles and air toxic pollutants at: a) 10, and b) 30mph

- Trucks and NAAQS pollutants at: a) 10, and b) 30mph
- Trucks and air toxic pollutants at: a) 10, and b) 30mph

6.0 Air Toxics and $PM_{2.5}$ – Health Effects and Limitations on Current Science

Research is underway by EPA and others at a national level to evaluate ambient air toxics in order to understand their spatial variability in urban settings; evaluate data from mobile-source oriented monitors; and, provide data for the National Air Toxics Network maintained by EPA. One of the programs sponsored by EPA is the Detroit Air Toxics Pilot Project, which began collecting data from monitoring stations in 2001. Data from these programs may ultimately be used to develop standards to address health or environmental risks from air toxics.

Analysis of DIFT air toxics and $PM_{2.5}$ will qualitatively address health risks, the limitations of the current state of the science to quantify such risks, and potential benefits from selected mitigation measures. This approach is consistent with the CEQ NEPA regulations (40 CFR 1502.22 and 1502.24) that hold agencies accountable for the scientific integrity of sources and procedures relied upon for decision-making. Under this regulation, when the means to obtain data are unavailable (in this case, the state of the science for air toxics and $PM_{2.5}$), agencies must acknowledge such limitations, discuss the relevance to impacts on the human environment, summarize existing credible scientific evidence, and make reasoned judgments of impacts based on theoretical approaches.

Some health agencies and research institutions have reported on the health effects of air toxics and $PM_{2.5}$. Exposure to these pollutants at sufficient concentrations and durations may result in an increased chance of experiencing serious health effects. These health effects appear to include damage to the immune system, as well as neurological, reproductive (e.g., reduced fertility), developmental, respiratory and other health problems. The health effects from some air toxics may appear following a short period of exposure, while others may only appear after long-term exposure. "For these (and other) reasons, it is frequently very difficult to conclusively associate environmental levels and potentially linked public health impacts" (MDEQ, 2003). Additionally, supporting documents for the health assessment of diesel engine exhaust used in the development of EPA's non-road rules acknowledge that "the assessment's health hazard conclusions are based on exposure to exhaust from diesel engines built prior to the mid-1990s"….and "as new diesel engines with cleaner exhaust emissions replace existing engines, the applicability of the conclusions in this Health Assessment Document will need to be re-evaluated" (U.S. EPA, 2002).

In addition to the uncertainty associated with the health risks of air toxics and $PM_{2.5}$, issues related to quantifying impacts and the lack of standards have been raised. There are no NAAQS for air toxics and methods for quantifying impacts are subject to scientific debate. Unlike smokestack testing for point sources, it is not feasible to directly measure mobile source emissions, given the number of tailpipes that would constitute any inventory. Modeling approaches, however, can provide a tool to assess project impacts and to compare the relative merits of various control strategies or project alternatives. These are the pollutant burden analyses discussed in the following sections. But, although transportation and air quality models are constantly being tested and improved, credible models to calculate the dispersion of $PM_{2.5}$ and air toxics, and the resulting concentrations at any given point, have not been adopted for regulatory use.

The limitations preclude at this time the DIFT project from conducting a quantitative pass/fail comparison to standards for air toxics and $PM_{2.5}$. Nevertheless, in order to gain some insights into the relative differences among the alternatives with regard to air toxics and $PM_{2.5,}$ this document proposes estimating the pollutant burdens of the proposed alternatives both on terminal sites and on the surrounding roadway network. This approach is consistent with the requirements of 40 CFR 1502.22 and 1502.24.

7.0 Terminal Pollutant Burden Estimates

For each terminal, an area has been defined that covers the existing yard and any area of potential acquisition (Figures 1, 2, 3 and 4). Within these areas the total pollution emitted will be calculated for 2004, 2015, and 2025. The estimate will cover terminal activity, travel on streets that would be incorporated into a terminal (for example John Kronk), and activity on land that would be incorporated into a terminal. This approach allows comparison of the burdens generated by the alternatives for a common geographic area. More specifically, the pollution estimates will address:

- Visitor and employee traffic on the rail yard.
- Truck activity on the rail yard related to container delivery and pickup.
- Container handling on the yard - moving containers between delivery points and trains.
- Locomotive idling and movement on the yard.
- Fugitive dust from paved and unpaved yard areas.
- Vehicular travel on sites of businesses to be acquired.
- Vehicular travel on streets that would no longer be public streets with project development: John Kronk and a section of Lonyo.
- Fugitive dust from business sites and the public streets that would be closed.

The pollutant burden will be calculated for the following NAAQS pollutants and precursors: carbon monoxide (CO), hydrocarbons (HC), oxides of nitrogen (NOx), particulates of 10 microns or smaller (PM_{10}), particulates of 2.5 microns or smaller ($PM_{2.5}$), and volatile organic compounds (VOC). It will likewise be performed for the following air toxics: benzene, acetaldehyde, formaldehyde, 1,3-butadiene, acrolein, and diesel particulate matter.

This information will be estimated for both on-road and non-road mobile sources. The emission factors (in grams/mile) for on-road sources (cars and trucks) will come from MOBILE6.2. An emission factor for an average speed of 2.5 miles per hour will be used to estimate idling conditions on the terminal yards because MOBILE6.2 does not generate emission factors for vehicle idling. The burden for on-road activity will be based on vehicle miles of travel on the site.

Emission factors for CO, NOx, HC and PM for locomotives will be obtained from EPA's 1997 "Emission Factors for Locomotives" (EPA420-F-97-051). $PM_{2.5}$ emissions estimates will be derived using a $PM_{2.5}$ fraction of 0.97 as recommended by EPA in April 2004. VOC emissions estimates will be calculated using a 1.005 VOC/HC ratio. Emission factors for locomotive air toxics will be derived from the 1999 National Toxics Inventory technical documents. A load factor (representing the portion of the engine's horsepower needed for an activity) will be applied to the emission factors in order to obtain realistic emission estimates. The burden for locomotives will be based on the number of hours of operation on the site.

Figure 1

Livernois-Junction Terminal

Air Quality Impact Analysis Study Area

Figure 2

Expressway Terminal

Air Quality Impact Analysis Study Area

Figure 3

CP Oak Terminal

Air Quality Impact Analysis Study Area

Figure 4

CN Moterm Terminal

Air Quality Impact Analysis Study Area

Non-road mobile sources in addition to locomotives include terminal tractors, hostlers, and cranes loading and unloading trailers from the trains. Emissions from terminal tractors, hostlers and cranes will be estimated using *Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling – Compression-Ignition*, EPA420-P-04-009, April 2004 and other technical guidance that support EPA's NONROAD model. Emission factors for non-road air toxics will be taken from technical documents supporting EPA's 1999 National Toxics Inventory, in consultation with EPA and SEMCOG.

The burden analysis will include estimates of emission sources located outside the terminal areas, but within the expansion areas. For example, traffic on the property of businesses that would be relocated would be added to the base-year total, but subtracted from the build alternatives (when such facilities are removed by an alternative). And, the emissions from roads that will be closed and included within the footprint of a terminal yard would similarly be included in the base year, but subtracted from the alternatives that close them. Examples are John Kronk and Lonyo.

The burden analysis for $PM_{2.5}$ will consider fugitive dust emissions. Project-related dust emissions are important in this analysis because the build alternatives are expected to reduce PM emissions by covering unpaved roads and exposed soil in terminal areas. Road/soil dust tends to have a lower percentage of $PM_{2.5}$ than diesel particulate matter; however, the sheer size of the unpaved terminal areas (e.g., at the Livernois-Junction Yard) represents a significant part of the total PM emissions (including $PM_{2.5}$) that could be eliminated or minimized by paving these areas. In the case of the Livernois-Junction Yard, analyses may show that $PM_{2.5}$ from road/soil dust to be *more significant* to DIFT neighbors because road/soil emissions are cool and not as buoyant as diesel emissions so they tend to disperse over a more localized area, albeit in higher concentrations. Diesel emissions are hot and buoyant so they tend to rise in the atmosphere and disperse over a wider area in relatively lower concentrations. EPA's "Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume 1: Stationary Point and Area Sources" (EPA 1995, revised December 2003) will be the source of emission factors for fugitive dust emissions. The approximate acreage of unpaved area on each terminal will be calculated using GIS mapping tools. The estimates will include individual emission calculations for roads as well as unpaved yards, as appropriate.

8.0 Public Roadway Pollutant Burden Estimates

A network of local roads near each terminal that could be influenced by the project will be identified. These include roads that would be used by new DIFT traffic, that would have traffic changes due to the closure of Lonyo, or that would experience changes in auto and truck traffic as businesses are relocated to make way for the DIFT.

The traffic changes resulting from each alternative are summarized as follows:

- Alternative 1, No Action
  ✓ Background auto and truck traffic will grow 25 percent between 2000 and 2025.
- Alternative 2, Improve/ Expand Existing Terminals
  ✓ Livernois-Junction Yard – DIFT trucks will use either Wyoming or Livernois. (Under one scenario that maintains the Dix/Waterman/Vernor gate, traffic could use Livernois/Dragoon south of Dix, but in other scenarios, all traffic would be to/from the north on Livernois and connect with and I-94.)

✓ Expressway Terminal – Traffic would link directly to Michigan Avenue, rather than using 14th Street.
✓ Oak Terminal – A new entrance direct to Evergreen and the ramps linking to I-96 would be created, ending use of the Southfield freeway frontage roads and such local streets as Artesian.
✓ Moterm Terminal – Traffic would be eliminated from the residential areas served by Fair and Chesterfield Streets as the intermodal yard will be accessed directly south of 8 Mile Road into the State Fairgrounds.

- Alternative 3, Consolidate – DIFT truck traffic would use Wyoming and Livernois (north of the yard gate). Local traffic on Lonyo would shift to Central and to a lesser extent Wyoming, when Lonyo is closed at the rail yard boundaries. Intermodal traffic would be eliminated at other terminals.
- Alternative 4, Composite – The approach would be similar to Alternative 3 at the Livernois-Junction yard and the same as Alternative 2 at Moterm, as CN operations would not be consolidated, but expand into the State Fairgrounds.

Using available information on background traffic levels, traffic shifts will be calculated, with new DIFT traffic added, and traffic from displaced businesses removed. The vehicle miles of travel will be available by link, and using estimated speeds on each link, the pollutant burden will be calculated. Burden estimates will include NAAQS pollutants, plus diesel particulate matter and the previously identified air toxics. These estimates will be aggregated for autos and trucks, and then combined to get totals for each terminal area under each 2025 scenario. Data will be expressed in tons per year.

9.0 Air Quality Conformity

The Clean Air Act requires each state to have a *State Implementation Plan* (SIP) to demonstrate how it will attain and/or maintain federal air quality standards. SEMCOG, the Southeast Michigan Council of Governments, collaborates with the Air Quality Division of the Michigan Department of Environmental Quality (DEQ) on the work needed to prepare and/or update a SIP. SEMCOG is responsible for mobile source (vehicular) emissions in Southeast Michigan. SEMCOG's *2030 Regional Transportation Plan* (RTP) must undergo a quantitative analysis demonstrating that emissions levels associated with implementing planned projects are below designated emissions level limits (budgets) set forth in the SIP. In so doing, SEMCOG is managing and facilitating the transportation air quality conformity process in Southeast Michigan. The DIFT project is subject to air quality transportation conformity review through SEMCOG's inclusion of any DIFT roadway improvements in its RTP.

Air quality conformity analyses for mobile sources in Southeast Michigan currently involve two major pollutants: ozone (and its precursors, volatile organic compounds and nitrogen oxides) and carbon monoxide (CO). A new standard will require such analyses for $PM_{2.5}$ by April 2006.

Currently, transportation conformity analyses are required for all regions designated by EPA as either nonattainment or maintenance for the one-hour ozone, CO, or PM_{10} standards. Conformity requirements for the two new NAAQS - eight-hour ozone and $PM_{2.5}$ - are now being established. The DEIS will report on the attainment status of the region, as follows:

One-hour Ozone - In 1995, the region was redesignated from nonattainment to maintenance for the one-hour ozone standard. At that time, a maintenance plan was developed establishing emissions budgets for the two precursors of ozone: volatile organic compounds (VOCs) and nitrogen oxides (NOx). In order for a conformity determination to be made with regard to the one-hour ozone standard, VOCs emissions cannot exceed the mobile source emissions budgets of 218 tons/day for years 2004-2014, and 173 tons/day for years 2015 and beyond. For NOx, emissions cannot exceed the budget of 413 tons/day in any analysis year. The 8-hour standard (see below) now supplants the 1-hour standard, but until an 8-hour emissions budget is established, conformity will be the same as for 1-hour.

Eight-hour ozone - On April 15, 2004, (effective June 15, 2004) the EPA officially designated Southeast Michigan a moderate nonattainment area for the 8-hour ozone standard. On September 15, 2004, EPA "bumped down" the designation to marginal, which means that the area must attain the new standard by June 15, 2007. A SIP is currently being developed to address this issue. As noted, for the time being the test of 8-hour conformity remains the same as that used to demonstrate conformity for one hour.

Carbon monoxide - In 1999, the region was redesignated from nonattainment to maintenance for CO. Similar to ozone, a positive conformity determination for CO requires that emissions in any future year remain at or below the approved mobile source emissions budget of 3843 tons/day. On January 28, 2005, (effective March 28, 2005) EPA approved a revised CO budget of 1946 tons /day.

PM_{10} - As Southeast Michigan currently meets the NAAQS for this pollutant, a regional conformity analysis is not required.

$PM_{2.5}$ - EPA designated seven counties in Southeast Michigan as nonattainment for this new standard December 15, 2004. Conformity determinations for $PM_{2.5}$ will be required by April 5, 2006.

10.0 Mitigation

The DIFT analysis will include a discussion of practical mitigation measures that would be considered to lessen air quality impacts, including from $PM_{2.5}$ and air toxics. Mitigation includes new technologies and strategies to reduce pollution from heavy-duty vehicles (trucks and locomotives) as well as off-road equipment. Some of the major technologies/strategies that will be evaluated are described below:

- Engine Idling Reduction Programs for trucks and locomotives, such as auxiliary power units for trucks and automatic shut-off devices for idling locomotives
- Use of electrified truck parking areas
- Use of alternative fuels for handling equipment, e.g. natural gas and hybrids

The railroads that will participate in the DIFT have expressed an interest in mitigation. In fact, CSX Corp. is a Charter Partner in the SmartWay Transport program, which is voluntary program that incorporates idle reduction, improved logistics management and other strategies to reduce pollution.

It is anticipated that the FEIS will contain agreements that mandate specific air quality mitigation measures, which will be defined as the project advances. Additionally, the paving of the Livernois-Junction Yard is part of the Alternatives 2, 3, and 4.

11.0 Technical Report

The DIFT Air Quality Impact Analysis Technical Report prepared for the DIFT EIS will include results from the above-stated methodology that characterize the communities around each terminal site. The report will show the locations of residential areas, schools, day care facilities, parks, and hospitals relative to the DIFT terminals. The type of activities that would occur at rail yards that could impact these nearby facilities (100 to 300 meters away) will be discussed. An evaluation of the potential health effects on population is beyond the scope of this analysis. Nevertheless, to the extent the data will foster a productive discussion, the occurrence of asthma hospitalizations for sensitive age groups (i.e. the very young and/or seniors) compiled by the Michigan Department of Community Health will be included in the report. This discussion will recognize that use of such information does not allow conclusions to be drawn about a specific project or alternative.

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