CHAPTER 2 – METHODOLOGY AND COORDINATION

2.1 Air Quality

2.1.1 Regulatory Framework

Air quality in the project area is regulated by the U.S. Environmental Protection Agency (EPA) and the Vermont State Department of Environmental Conservation, Air Pollution Control Division (APCD). Under the Clean Air Act (CAA), EPA established health-based National Ambient Air Quality Standards (NAAQS) for six air pollutants: particulate matter, ozone, carbon monoxide, sulfur dioxide, nitrogen dioxide, and lead. These pollutants are monitored throughout the United States to ensure compliance with the Clean Air Act. All but one of these pollutants (lead) are monitored by the APCD. Vermont is not required to measure the concentration of lead in the ambient air.

Criteria Pollutants

The pollutants regulated by the NAAQS are referred to as criteria pollutants and are described below.

Carbon monoxide (CO) is a colorless and odorless gas that results from the incomplete combustion of gasoline and other fossil fuels. Approximately 80 percent of CO emissions are from motor vehicles. Because CO disperses quickly the concentrations can vary greatly over relatively short distances. Elevated concentrations are usually limited to locations near crowded intersections and along heavily congested roadways.

Ozone is also a colorless gas and is a major constituent of photochemical smog at the earth's surface. The precursors in the formation of ozone are volatile organic carbons (VOCs / HC) and nitrogen oxide (NO_x). In the presence of sunlight, ozone is formed through a series of chemical reactions that take place in the atmosphere. Because the reactions occur as the pollutants are diffusing downwind, elevated ozone levels are often found many miles from sources of the precursor pollutants.

Nitrogen Dioxide (NO_2) is a major component of NOx. Being a precursor to ozone, NO_2 is also a criteria pollutant under NAAQS and a pollutant under highway project consistency review for the Vermont State Implementation Plan (SIP). Nitrogen dioxides form when fuel is burned at high temperatures. The primary manmade sources are motor vehicles, electric utilities, other industrial, commercial, and residential sources that burn fuels. NO_2 is one of the main ingredients involved in the formation of ground-level ozone, which can trigger serious respiratory problems. It also contributes to: formation of acid rain; nutrient overload that deteriorates water quality; atmospheric particles; and visibility impairment in parks.

Particulate matter (PM_{10} and $PM_{2.5}$) is a broad class of air pollutants that exist as liquid droplets or solids, with a wide range of size and chemical composition. Particulate matter is emitted by a variety of sources, both natural and man-made. Major man-made sources of particulate matter include the combustion of fossil fuels in vehicles, power plants and homes; construction activities, agricultural activities, and wood-burning fireplaces. Smaller particulates that are smaller than or equal to 10 and 2.5 microns in size (PM_{10} and $PM_{2.5}$) are of particular health concern. The principal health effects of airborne particulate matter are on the respiratory system.

Sulfur dioxide (SO_2) emissions are primarily associated with the combustion of sulfur-containing fuels, oil and coal. No appreciable quantities of this pollutant are emitted from roadway project-related actions.

Lead emissions are primarily associated with motor vehicles and industrial sources that use gasoline containing lead additives. All vehicles produced in the United States after 1980 are designed to use unleaded fuel, and ambient air concentrations of this pollutant have declined significantly. Therefore, the analysis of lead emissions is not required.

National and State Ambient Air Quality Standards

As described above, the EPA has established NAAQS for the six major air pollutants. The EPA has established both primary and secondary standards. The primary standards are designed to protect the public health, and represent levels at which there are no known important effects on human health. The secondary standards are designed to protect the environment from any known or anticipated adverse effects of a pollutant, including the effects on the natural environment (soil, water, vegetation) and the man-made environment (physical structures). Table 2-1 shows the standards for these pollutants. These NAAQS and Vermont Standards have been adopted as the ambient air quality standards by the State of Vermont.

Areas that do not meet the NAAQS for a particular pollutant are classified as “nonattainment areas” for that pollutant. Areas that meet both primary and secondary standards are known as “attainment areas.” Areas determined to be in recent attainment are known as “maintenance areas.” The Clean Air Act requires each non-attainment state to submit to the EPA a State Implementation Plan (SIP) for attainment of the NAAQS. In addition, the 1990 CAA Amendment Section 176(c) requires federally sponsored or approved activities in non-attainment or maintenance areas to conform to the applicable SIP. Chittenden County and the entire state of Vermont have been designated by EPA as being in attainment of NAAQS for all criteria pollutants. As noted above, Vermont is not required to monitor ambient concentrations for lead.

Table 2-1
National and Vermont State Ambient Air Quality Standards

Pollutant		Primary Standard	Secondary Standard
Carbon Monoxide (CO)	Maximum 1-hour Average[1]	35 ppm	35 ppm
	Maximum 8-hour Average[1]	9 ppm	9 ppm
Sulfur Dioxide (SO_2)	Maximum 3-hour Average[1]	n/a	1300 ug/m^3
	Maximum 24-hour Average[1]	365 µg/m^3	n/a
	Annual Arithmetic Mean	80 µg/m^3	n/a
Respirable Particulates (PM_{10})	Maximum 24-hour[2]	150 µg/m^3	150 µg/m^3
	Annual Geometric Mean	50 µg/m^3	50 µg/m^3
Respirable Particulates ($PM_{2.5}$)	Maximum 24-hour[3]	35 µg/m^3	65 µg/m^3
	Annual Geometric Mean	15 µg/m^3	15 µg/m^3
Total Suspended Particulate (TSP) [4]	Maximum 24-hour	260 µg/m^3	150 µg/m^3
	Annual Geometric Mean	75 µg/m^3	n/a
Ozone (O_3)	1-hour Average	0.12 ppm	0.12 ppm
	8-hour Average	0.08 ppm	0.08 ppm
Nitrogen Dioxide (NO_2)	Annual Arithmetic Mean	100 µg/m^3	100 µg/m^3
Lead (Pb)	Quarterly Average	1.5 µg/m^3	1.5 µg/m^3
Sulfates [4]	Summer Seasonal	n/a	2.0 µg/m^3
	24-hour Average	n/a	2.0 µg/m^3

Notes:
1 Not to be exceeded more than once a year.
2 Not to be exceeded by 99th percentile of 24-hr PM10 concentrations in a year (averaged over 3 years)
3 Not to be exceeded by 99th percentile of 24-hr PM2.5 concentrations in a year (averaged over 3 years). The 24-hour standard for PM 2.5 was lowered from 65 µg/m^3 to 35 µg/m^3 by an EPA final rule effective December 18, 2006 (66 FR 61144)
4 TSP and Sulfates standards are Vermont State standards only.

ppm: parts per million; µg/m^3 : micrograms per cubic meter
Annual standards never to be exceeded; short-term standards not to be exceeded more than once per year.
Source: Code of Federal Regulations Title 40, Part 50, July, 1991, Ambient Air Quality Standards.
Vermont Air Pollution Control Regulations, Subchapter III, December 2003, AAQS

Mobile Source Air Toxics

In addition to the criteria air pollutants for which there are NAAQS, EPA also regulates air toxics. Most air toxics originate from man-made sources, including on-road mobile sources, non-road mobile sources (e.g., airplanes), area sources (e.g., dry cleaners) and stationary sources (e.g., factories or refineries). The entire list of air toxics currently identified by the CAA includes 188 air toxics, also known as hazardous air pollutants. The EPA has identified a group of 21 of these pollutants as Mobile Source Air Toxics (MSATs), which are set forth in an EPA final rule, *Control of Emissions of Hazardous Air Pollutants from Mobile Sources 66 Fed. Reg. 17235* (March 19, 2001). The MSATs are compounds emitted from highway vehicles and non-road equipment (e.g., volatile organic compounds, nonvolatile organics, diesel particulate matter/diesel exhaust gases, or metals). Some toxic compounds are present in fuel and are emitted to the air when the fuel evaporates or passes through the engine unburned. Other toxics are emitted from the incomplete combustion of fuels or as secondary combustion products. Metal air toxics also result from engine wear or from impurities in oil or gasoline.

From the group of 21 MSATs, EPA has identified six "priority MSATs." These six include: benzene, formaldehyde, acetaldehyde, diesel particulate matter/diesel exhaust organic gases, acrolein, and 1,3-butadiene. EPA has issued two regulations to reduce MSAT emissions, *Controlling Emissions of Hazardous Air Pollutants from Mobile Sources* 66 Fed. Reg. 17229 (March 29, 2001) and *Control of Hazardous Air Pollutants from Mobile Sources* 72 Fed. Reg. 8427 (February 26, 2007). Among other measures, these regulations established fuel based standards (e.g. standards for the maximum allowable benzene content in gasoline) and emissions standards for passenger vehicles when operating at cold temperatures. MSAT emissions are also projected to decrease due to other mobile source regulations, such as the reformulated gasoline (RFG) program, the National Low Emission Vehicle (NLEV) standards, Tier 2 motor vehicle emission standards and gasoline sulfur control requirements, and proposed heavy duty engine and vehicle standards and on-going highway diesel fuel sulfur control requirements. At the national level, EPA expects a 65 percent reduction in MSAT emissions from on-road mobile sources between 1999 and 2020, despite a 57 percent increase in VMT over this same time period (EPA, 2007).

Vermont regulates emissions of hazardous air contaminants (HACs) from stationary sources under Section 5-261 of the Air Pollution Control Regulations. Appendix B of the regulations lists the HACs, and Appendix C of the regulations establishes a health-based hazardous ambient air standard (HAAS) and an action level (AL) for each HAC. The HACs are categorized based on their toxicity: Category I (known or suspected carcinogens), Category II (chronic systemic toxicity due to long-term exposure), and Category III (short-term irritant effects). The Vermont has also proposed the new HAAS levels that are significantly below the current HAAS levels, especially for acetaldehyde, acrolein, and 1.3 – Butadiene, etc., which will have a more than 99% decrease in allowable HAAS levels. The State monitors air toxics in ambient air through its Hazardous Air Contaminant Monitoring Program. The monitoring program has indicated that several air toxics (benzene, 1,3-butadine, formaldehyde, methylene chloride, and acrolein) are at levels that exceed the HAAS in the Burlington and Winooski areas (Vermont Air Toxics Report, 1998). As noted above, HACs from stationary sources are regulated. HACs from mobile sources, similar to MSATs, are not regulated in Vermont.

VTrans/VANR Memorandum of Agreement on Transportation and Air Quality

VTrans and the Vermont Agency of Natural Resources (VANR) entered into a Memorandum of Agreement (MOA) regarding transportation and air quality in 2004. The MOA is a policy document which commits the agencies to preserving Vermont's attainment status under the Clean Air Act and to maintaining and improving Vermont's air quality in order to protect public health and the environment.

2006 Chittenden County Regional Plan's Air Quality Policies

To help maintain clean air in the area, the 2006 Chittenden County Regional Plan which was prepared and adopted by Chittenden County Regional Planning Commission (CCRPC), contains four policies related to air quality. These policies include:

- Development and local development policies should minimize emissions of air pollutants and greenhouse gases,
- Encourage voluntary measures to go beyond compliance in reducing emissions,
- Land development patterns should reduce reliance on motor vehicles, and
- Encourage energy conservation and use of renewable energy sources with air quality benefits.

2.1.2 Data Collection

Several types of data were collected in order to perform the air quality analyses, including air quality monitoring data, traffic data, construction data, and information on other ongoing and future projects in the project area.

Air Quality Monitoring Data – The existing and baseline air quality conditions were evaluated by reviewing APCD and EPA monitoring data for ambient criteria air pollutants and air toxics concentrations that are measured or estimated by the State and Federal agencies.

Traffic Data – Traffic data generated from the transportation analyses conducted for the project is used in the air quality analyses (See DEIS Chapter 5: *Traffic and Transportation Effects of the Evaluated Alternatives*). This data included: peak hour traffic volumes, vehicle classifications, travel speeds, turning movements, capacity, levels of service, hot/cold start estimates, saturation flow, signal timing, parking conditions, and street geometry at intersections. Also included were modeled estimates of regional vehicle miles traveled (VMT) and vehicle hours traveled (VHT).

Construction Data – Construction information required for the air quality analyses included the estimated construction duration and schedule; temporary traffic diversions and conditions; and the type, number, and operational hours of heavy vehicles and construction equipment to be utilized.

Other Ongoing and Future Projects – In order to assess cumulative effects, data regarding other nearby ongoing and future projects was obtained (See DEIS Chapter: 17 *Indirect Effects and Cumulative Impacts of the Evaluated Alternatives* for a description of the methods used to estimate future development). The effect of future land use changes on traffic patterns and congestion (and related effects on air quality) was accounted for through the use of the Chittenden County Transportation Model.

2.1.3 Analysis Methods

As described previously, air pollution is regulated under the Clean Air Act and by the Vermont Air Pollution Control Permit process. The criteria for determining whether or not a potential source may contribute to adverse air quality is defined in the Vermont Air Pollution Control Regulations, Section 5-503. These criteria apply to any new highway project with 20,000 or more vehicles per day (Average Daily Traffic or ADT) expected within 10 years; or any action that modifies highway operations with an increase of 10,000 ADT or more within 10 years. The criteria also include new parking lots for 1,000 or more vehicles, and parking lot expansions of 500 or more vehicles. If the projects or a group of actions have the potential to exceed these screening criteria, then a detailed analysis of air quality impacts is required.

To maintain the NAAQS attainment status for the entire State, the Vermont Department of Environmental Conservation, Agency of Natural Resources (ANR), Air Pollution Control Division, established an Air Quality Implementation Plan (SIP, August 1993). In addition, to ensure consistency of highway planning and design with the air quality goals of the Vermont SIP, ANR developed the procedures for *Highway Project Consistency Review*. These documents provide the analytic framework required to evaluate criteria pollutants, including microscale analysis for future carbon monoxide, evaluation of nitrogen oxides levels, mesoscale emission burden analysis of hydrocarbon, carbon monoxide, and nitrogen oxides for the effects resulting from a highway project.

The analysis procedures used for the proposed project are consistent with the *Guideline for Modeling Carbon Monoxide from Roadway Intersections* (EPA Publication EPA-454/R-92-005); *User's Guide to Mobile6.1 and Mobile6.2: Mobile Source Emission Factor Model* (EPA Publication EPA-420/R-02-028)*; User's Guide to CAL3QHC, Version 2.0: A Modeling Methodology for Calculating Pollutant Concentrations Near Roadway Intersections*; EPA Publication AP-42; *Compilation of Air Pollutant Emission Factors, Second Edition, Mobile Source Emissions Model* (Latest Version, MOBILE6.2); *CAL3QHC or CAL3QHCR Dispersion Model;* federal procedures to estimate air toxics emissions and impacts; and *Vermont State Air Pollution Control Regulations (Section 5-503 Indirect Sources, December 2003).*

On March 10, 2006, EPA published a final rulemaking on PM2.5 and PM10 hotspot analysis for conformity, and concluded that quantitative hotspot modeling for particulate matter is not appropriate at this time, given the limitations in technical tools. (*47 FR 12498-12502*). EPA noted that:

"*we continue to believe that appropriate tools and guidance are necessary to ensure credible and meaningful quantitative PM2.5 and PM10 hot-spot analyses. Before such analyses can be performed, technical limitations in applying existing motor vehicle emission factor models for PM hot-spot analyses must be addressed, and proper federal guidance for using dispersion models for PM hot-spot analyses must be issued*."

EPA also noted numerous problems with the particulate matter emission rates in MOBILE6.2 that preclude credible hotspot analysis. Even though EPA's rulemaking discusses PM hotspot analysis for conformity, the same technical problems affect PM hotspot modeling for NEPA documents. Therefore, quantitative hotspot modeling for particulate matter is not included in this DEIS because the results would not be meaningful and would be inconsistent with the guidance of the federal agency that has jurisdiction over this issue.

Existing Air Quality Conditions

The regional existing conditions for air quality within the project area were established by obtaining and analyzing ambient air quality monitoring data for the most recent year from Vermont State and Federal data sources. The project area's compliance status, as defined by the EPA, was also ascertained. Regional meteorological conditions were also reviewed, based upon National Weather Service data.

Receptor Locations

Specific locations where pollutant concentrations are predicted are called receptors. Mobile source modeling receptors are located where maximum concentrations would likely occur because of traffic congestion, and where the general public would have access. Receptors are typically located at roadway intersections, and multiple receptors may be located at a single intersection. The receptor locations selected for this project were identified based on the results of the transportation analysis.

Microscale Air Quality Modeling

A microscale (localized) modeling analysis was conducted that estimated CO and NO_2 levels at receptor locations near heavily congested intersections that are anticipated to be affected by the project alternatives under existing, No Build, and Build Alternatives. The following locations were selected for analysis:

- Taft Corners (intersection of VT 2A and US 2)

- Five Corners (intersection of VT 2A, VT 15, VT 117)
- Williston Central School
- Circ A/B Corridor at US 2
- Allen Brook School

Figure 2-1 shows the locations of the microscale air quality analysis sites. The microscale analysis results are directly compared to the National Ambient Air Quality Standards described previously.

Carbon Monoxide (CO) – Pollutant emissions from motor vehicles are affected by many factors, including travel speed, temperature and air conditions, operating mode, and the age, type, and condition of the vehicle. Air pollutant dispersion models were used to simulate mathematically how traffic, meteorology, and geometry combine to affect pollutant concentrations. The output from the traffic analyses was organized into a mathematical model input format by traffic link(s) for the analysis years. The thermal states (hot/cold start estimates) used in emission estimates account for three possible vehicle operating conditions: cold-vehicle operation, hot-start operation, and hot-stabilized operation. Vehicles emit carbon monoxide at different rates depending on whether they are cold or warmed up. Cold vehicles emit higher emissions than hot vehicles. On-road regional and localized vehicle CO emission factors, such as idle or cruise emissions from trucks, can be calculated using MOBILE6.2.

The air quality analysis evaluated the effects of traffic generated by the alternatives on CO at intersection locations within the study corridors, and at the receptor locations where impacts were estimated to be most likely to occur. In summary, the CO analysis consists of the following steps:

- Select intersection locations and receptor sites for micro-scale analysis based on a screening analysis of traffic conditions. At each analyzed intersection, a series of multiple receptor sites were analyzed in accordance with state or federal guidelines.
- Select emission calculation methodology and worst-case meteorological conditions. Vehicular cruise and idle emissions for the dispersion modeling were computed using EPA's latest MOBILE6.2 model.
- Conduct impact calculation by using EPA's CAL3QHC dispersion model. The CAL3QHCR model need only be used at locations where the model estimates that pollutant levels would exceed standards from CAL3QHC prediction.
- Calculate maximum 1- and 8-hour CO concentrations for existing, No Build and Build Alternatives. A persistence factor of 0.7 was used to convert 1-hour CO exhaust concentrations calculated by CAL3QHC to 8-hour CO concentrations.
- Compare CO concentration levels with NAAQS standards, and compare project CO impacts with applicable thresholds.

The analysis presents a conservative estimate of CO concentrations because the highest results from the models are added to the background levels recommended by state or federal agencies to obtain the estimated total ambient concentrations at receptor locations.

The NO_2 ambient impact analyses utilized the same methodologies as CO analyses. Following the NAAQS and SIP requirement, the annual average concentrations were calculated to compare with the ambient standards and Prevention of Significant Deterioration (PSD) criteria.

Based on the EPA Guidance For Qualitative Hot-Spot Analyses for $PM_{2.5}$ and PM_{10} (EPA420-B-06-902, March 2006), particulate matter (PM) pollutants were assessed by reviewing state monitoring data in the study area, traffic conditions, and level of services (LOS) under the various alternatives, including the regional measures proposed by the State.

Mesoscale Emission Burden Analysis

Criteria Pollutants

A mesoscale (area-wide) emission analysis was conducted for CO and ozone precursors VOC (or HC, as defined by Vermont SIP) and NOx. As compared to the microscale analysis described above, the mesoscale analysis estimates emissions effects of project alternatives at a scale of an area's roadway network. The results allow a comparison of the No Build and Build Alternatives at this scale. The EPA MOBILE6.2 emission model was utilized to calculate emission factors on the roadways. The VMT (vehicle miles traveled) estimates of roadways from the project's travel model were then multiplied to the emission factors to determine total emissions on mesoscale roadway network scale. As a first step, the 2005 baseline regional nitrogen oxides (NOx) and hydrocarbons (HC / VOC) emissions and predicted future baseline 2010 and 2030 emissions were analyzed. Reductions in regional HC/VOC and NOx emissions are expected in the future due to motor vehicle engine improvements, regulations, and State programs.

Mobile Source Air Toxics

FHWA's *Interim Guidance on Air Toxic Analysis in NEPA Documents* (2006) provides a three-level analytical approach for assessing MSATs based on the probability of MSAT effects occurring, as shown in Table 2-2. The guidance also provides criteria for assessing which category applies to a particular project.

Table 2-2
Three Levels of MSAT Analysis for FHWA NEPA Documents

Level	Category Name	Type of Analysis Required	Criteria
1	Exempt Projects or Projects with No Meaningful Potential MSAT Effects	None	▪ Projects qualifying as a categorical exclusion under 23 CFR 771.117(c); ▪ Projects exempt under the Clean Air Act conformity rule under 40 CFR 93.126; or ▪ Other projects with no meaningful impacts on traffic volumes or vehicle mix
2	Projects with Low Potential MSAT Effects	Qualitative	▪ Any projects not meeting the threshold criteria for higher potential effects (Level 3) and not meeting the criteria to be exempt (Level 1).
3	Projects with Higher Potential MSAT Effects	Quantitative	▪ Create or significantly alter a major intermodal freight facility that has the potential to concentrate high levels of diesel particulate matter in a single location; or ▪ Create new or add significant capacity to urban highways such as interstates, urban arterials, or urban collector-distributor routes with traffic volumes where the AADT is projected to be in the range of 140,000 to 150,000, or greater, by the design year; And also ▪ proposed to be located in proximity to populated areas or in rural areas, in proximity to concentrations of vulnerable populations (i.e., schools, nursing homes, hospitals).

Source: *Interim Guidance on Air Toxic Analysis in NEPA Documents* (FHWA, 2006)

Based on the FHWA Guidance, the proposed project is not a Level One (exempt) project. The proposed project is also not required to conduct a Level 3 (quantitative) analysis, since the potential AADT for the Build Alternatives are well below the 140,000 to 150,000 AADT criteria. Therefore, the proposed project could be categorized as a Level 2 (qualitative analysis) project.

Despite the proposed project qualifying for a Level 2 (qualitative) analysis for MSATs, a Level 3 (quantitative) analysis was conducted to provide a higher level and more critical analysis of the project alternatives. Reasons for conducting a quantitative analysis included the proximity of the Build Alternatives to one or more schools, and the potential for litigation. The FHWA Guidance notes that "projects with high potential for litigation on air toxics issues may also benefit from a more rigorous quantitative analysis to enhance their defensibility in court" (FHWA, 2006). The Level 3 analysis of alternatives uses mesoscale emissions modeling utilizing a 5-step process as described below.

The 5-step mesoscale emissions' modeling was conducted by following FHWA Quick-Start Guide as follows:

Step 1 – Identify the Affected Transportation Network.
The affected transportation network was identified, including operational improvements to the existing corridor and the introduction of new routes. The affected network is expected to cause changes in traffic volumes and speeds on other roadways not directly affected by the alternatives. In addition, FHWA recommends a 5 percent change in traffic volumes (No Build versus Build) as a threshold for deciding which roadway links should be included in the transportation analysis network.

Step 2 – Calculate VMT
Vehicle-miles-traveled (VMT) is the product of traffic volume and segment length for each of the links in the affected transportation network. VMT is calculated by the project transportation model for each alternative, including existing conditions (2005), No Build and Build (2010) Alternatives.

Step 3 – Parameters to Characterize Travel Activity
To capture the emissions changes due to each alternative, parameters are established to characterize travel activity, including hourly speeds, or at a minimum, AM peak, PM peak and off-peak speeds. These parameters are necessary to capture the benefit from a sharp decline in emissions between 2.5 and 20 mph typical of a congestion relief project.

Step 4 – Predict MSATs Emission Factors
Using MOBILE6.2 modeling, MSATs emission factors were estimated for automobile emissions which corresponded to the VMT analysis. The analyzed MSAT contaminants were Benzene, 1,3 butadiene, Formaldehyde, Acetaldehyde, and Acrolein. These contaminants are listed by EPA as the priority MSAT and are also the most concerned toxics resulting from mobile sources in the region based on Vermont APCD monitoring levels.

Diesel particulate matter (DPM) is a constituent of air toxics, and is also a main part of the criteria pollutants PM10 and PM2.5. While the ambient PM pollutant concentrations monitored in study area are far below (within) NAAQS levels, Vermont has also adopted several control programs that will further reduce the DPM levels. These programs include:

a) Motor Vehicle Inspection and Maintenance Program to maintain proper function of equipment relevant to emission control such as catalytic converter, fuel tank cap, on-board diagnostic system;

b) Vermont's Roadside Diesel Testing Program to ensure heavy duty diesel vehicles will not emit excessive DPM and smoke;

c) Low Emission Vehicle Program.

With these efforts, the current DPM levels will continue to be in compliance with the standards in the future. Therefore, a qualitative assessment is included in Chapter 4 to address the particulates issue.

Step 5 – Compute MSATs Emissions (Burden Analysis)
To compute the MSATs emission burdens for the various alternatives, MSATs emission factors from MOBILE 6.2 analyses were multiplied by VMT for each link.

Construction Impact Evaluation
Temporary construction air quality impacts were qualitatively assessed based on the construction activities typically associated with roadway projects. Construction management practices were also identified that could minimize potential impacts.

2.1.4 Agency Consultation and Coordination

Coordination and consultation with relevant regulatory authorities, including EPA and APCD, occurred to develop the scope of work, analysis procedures and protocols. These regulatory authorities concurred with the approaches and procedures for the air quality analyses.

2.2 Energy

2.2.1 Regulatory Framework

Projects subject to Act 250 review are required to demonstrate planning and design that "reflect[s] the principles of energy conservation and incorporate[s] the best available technology for efficient use or recovery of energy" (10 V.S.A. § 6086).

Closely interrelated to the topic of energy consumption and efficiency is the emission of greenhouse gases and their contribution to global climate change. Vermont has established a general goal of greenhouse gas reduction and requires that VANR develop a climate change action plan. After implementation of the plan, and to facilitate compliance with the goal, state agencies are to consider, whenever practicable, any increase or decrease in greenhouse gas emissions in their decision-making procedures (10 V.S.A. § 578).

To date, no national standards have been established regarding greenhouse gases, nor has EPA established criteria or thresholds for greenhouse gas emissions. On April 2, 2007, the Supreme Court issued a decision in Massachusetts et al v. Environmental Protection Agency et al that the USEPA does have authority under the Clean Air Act to establish motor vehicle emissions standards for CO2 emissions. The USEPA is currently determining the implications to national policies and programs as a result of the Supreme Court decision. However, the Court's decision did not have any direct implications on requirements for developing transportation projects.

2.2.2 Data Collection and Methodology

Data Collection

Energy generation and consumption data specific to Chittenden County is not available; therefore energy data for Vermont as a whole was obtained from the U.S. Energy Information Administration (EIA). In reporting information on existing energy conditions, 2003 year data was generally used, except for motor fuel consumption, for which 2004 data was available.

Vermont trends in VMT were obtained from data published by the VTrans Highway Research unit.

Operational Energy Consumption

Greenhouse gas emissions from motor vehicles are directly proportional to fuel consumption.[1] Therefore, estimates of the operational fuel consumption of transportation projects can also be utilized to compare the relative transportation-related greenhouse gas emissions under the No Build and Build Alternatives.

Future (2030) fuel consumption was calculated for the No Build and Build Alternatives based on outputs from the Chittenden County Transportation Model for the AM and PM peak periods. For each link in the model network, average speeds on each network link were converted into average fuel economy, based on empirical studies of the relationship between fuel economy and speed. In general, fuel economy is the lowest at very low speeds, and increases as speed increases, up to approximately thirty mph, where fuel economy levels off. At speeds above fifty-five mph, fuel economy begins to decrease again (Department of Energy, 2002).

Vehicle miles traveled (VMT) was calculated by multiplying the length of each model link by the total traffic volume on that link. VMT was divided by the calculated average fuel economy on each link to obtain average fuel consumption in gallons on each link. Fuel consumption was summed for all the links in the model network to obtain total AM and PM peak fuel consumption under each alternative. The results do not include estimates of fuel consumed during off-peak hours.

Construction Energy Consumption

The construction costs for each alternative were used as a benchmark to assess relative construction energy consumption. Typically the factors that drive construction costs (construction methods, schedule, amount of cut and fill, etc.) also drive the amount of energy used. Energy use can be estimated as a function of the type of project and the total cost using the U.S. Department of Labor price index for highway and street construction (WSDOT, 2004). The factors used for the analysis of construction energy consumption are shown in Table 2-3. The construction costs of each alternative in 2007 dollars were converted to 2002 dollars using the Consumer Price Index for the purposes of the construction energy consumption analysis.

[1] ICF Consulting. NCHRP 25-25, Task 17—Assessment of Greenhouse Gas Analysis Techniques for Transportation Projects, 2006.

Table 2-3
Construction Energy Consumption Factors (2002 Dollars)

Facility Type	Alternatives	Factor (MBTU / 1000 dollars)
Rural Freeway	16a, 16b, 16c and 17	26.5
Rural Conventional Highway	2, 3, 22, 18, 19, 23	25.2

Source: WSDOT Alaskan Way Viaduct DEIS Energy Technical Memorandum, 2004 based on U.S. Department of Labor, 2002.