CHAPTER 3 – EXISTING CONDITIONS

3.1 Air Quality

3.1.1 Overview of Project Study Area

Chittenden County and the entire State of Vermont have been designated by the EPA as being in attainment of NAAQS for all criteria air pollutants, including carbon monoxide (CO), 1-hour and 8-hour ozone (O_3), sulfur dioxide (SO_2), particulates (PM_{10} and $PM_{2.5}$), nitrogen dioxide (NO_2), and lead (Pb). The federal government currently does not have nationwide ambient standards for air toxics and hazardous air pollutants. However, Vermont established the health-based Hazardous Ambient Air Standards (HAAS) for air contaminants that are of major concern to the public, and continues to monitor the ambient concentrations of these contaminants. The monitored levels reflect emissions resulting from vehicles, gas stations, incinerators, wood processing plants, wood stoves, furniture strippers, and garages.

3.1.2 Regional Meteorological Conditions

The regional meteorological conditions were reviewed based upon the National Weather Service (NWS) assembled data. The prevailing wind direction in the region is south throughout the year, while the annual mean wind speed is approximately 9 miles per hour (mph). During the winter season, an average wind speed of 10 mph and a peak gust wind velocity of 62 mph were observed.

3.1.3 Existing Ambient Criteria Air Pollutant Levels

Ambient air quality is monitored by the Vermont State Ambient Air Monitoring Systems maintained by the Vermont APCD. Representative monitored criteria air pollutant concentrations for the study area in 2005 and 2006 are shown in Table 3-1. The air quality data presented are the worst-case concentration data from the nearest monitoring stations. As shown in the table, the carbon monoxide, ozone, $PM_{10,}$ sulfur dioxide, nitrogen dioxide and lead concentrations are all well below (within) the standards. The 24-hour standard for $PM_{2.5}$ was revised by an EPA final rule effective December 18, 2006, which changed the standard from 65 ug/m^3 to 35 ug/m^3 (71 FR 61144). EPA is expected to establish designations of attainment, non-attainment, or maintenance for individual regions around the country by December, 2007.

3.1.4 Existing Ambient Air Toxics and Hazardous Pollutants Levels

Based on Vermont Air Quality Control Division (APCD) studies, the top ten air toxics of concern in Vermont are acetaldehyde, formaldehyde, benzene, methylene chloride, mercury, chloroform, 1,3-butadiene, tetrachloroethylene, carbon tetrachloride, and styrene.

The Vermont APCD has monitored air toxics at several locations in the State since 1993. In areas of Chittenden County and City of Burlington, several air toxics, including acetaldehyde, acrolein, benzene, 1,3-butadiene, BAP (benzo-a-pyrene), chloroform, formaldehyde, methylene chloride, tetrachloroethylene, 1.2,4-trichlorobenzene, and others are monitored by the State for ambient levels, as shown in Table 3-2. The monitored levels generally reflect emissions resulting from vehicles, gas stations, incinerators, wood processing plants, wood stoves, furniture strippers, and garages. Among Vermont's monitored contaminants, acetaldehyde, acrolein, benzene, 1,3 butadiene, and formaldehyde are listed by EPA as priority MSAT (mobile source air toxics), which are related to vehicular emissions in this region.

For these priority MSATs monitored in Chittenden County and City of Burlington area, the contaminant levels of benzene, 1,3-butadiene, and formaldehyde have been measured at levels that exceed the health-based Vermont HAAS. However, the ambient levels of acetaldehyde and acrolein levels are within the standards.

According to the U.S. EPA publication, *Air Toxics From Mobile Sources* (EPA-400-F-92-004), motor vehicles are considered an important source of benzene emissions. Benzene is present in both evaporative emissions and in exhaust emissions from motor vehicles. Refueling of motor vehicles is another source of benzene. Benzene is also released by industries in Vermont and is a component of fossil fuel emissions, including wood stoves. Benzene in Vermont appears to be locally generated and the highest concentrations are observed in urban areas with lower concentrations in rural areas.

The Vermont Agency of Natural Resources website (http://www.anr.state.vt.us/air/AirToxics/htm/Sources.htm) provides information on air toxics from EPA's National-Scale Air Toxics Assessment (NATA), (e.g., waste incinerators and wood fires.) Based on NATA, 67 percent of 1,3-butadiene emissions come from mobile sources, and 33 percent of emissions come from stationary or area sources. The 1,3-butadiene concentrations observed from NATA appear to be locally generated as the concentrations are highest in the urban areas with levels decreasing as the sites become more rural. 1,3-Butadiene has a short atmospheric half-life of 4-6 hours, which also indicates that observed levels are locally generated, as opposed to transported from outside the state.

Formaldehyde emissions are caused by numerous atmospheric sources. Based on EPA and Vermont APCD studies, 49 percent of formaldehyde emissions come from mobile sources and 51 percent of emissions come from stationary and area sources. This compound is a byproduct of combustion, which covers a wide range of stationary and mobile sources from internal combustion engines to wood stoves. Formaldehyde concentrations in Vermont follow the locally generated pattern--concentrations are highest in urban areas and lower in rural locations.

The VANR APCD has also proposed the new HAAS levels that are substantially below the current HAAS levels, especially for acetaldehyde, acrolein, and 1.3 – Butadiene, etc., which would have a more than 99% decrease in allowable HAAS levels.

Table 3-1
Representative Monitored Criteria Air Pollutants (2005 and 2006)

Criteria Air Pollutant	Monitoring Station	NAAQS	Period	Concentrations 1st/2nd Highest (2005)	Concentrations 1st/2nd Highest (2006)
Carbon Monoxide (CO)	150 South Winooski Ave Burlington	35 ppm 9 ppm	1-hour 8-hour	2.4 / 2.1 ppm 1.6 / 1.3 ppm	2.0 / 1.8 ppm 1.2 / 1.1 ppm
Particulates ($PM_{2.5}$)	108 Cherry Street Burlington	35 ug/m^3 15 ug/m^3	24-hour Annual	42 / 38 ug/m^3 9.6 ug/m^3	36 / 32 ug/m^3 8.4 ug/m^3
Particulates (PM_{10})	150 South Winooski Ave Burlington	150 ug/m^3 50 ug/m^3	24-hour Annual	60 / 53 ug/m^3 20.0 ug/m^3	85 / 50 ug/m^3 19 ug/m^3
Ozone (O_3)	Proctor Maple Research Farm Underhill	0.120 ppm 0.080 ppm	1-hour 8-hour	0.089 / 0.079 ppm 0.069 ppm (4^{th})	0.081 / 0.079 ppm 0.077 / 0.070 ppm
Nitrogen Dioxide (NO_2)	150 South Winooski Ave Burlington	0.053 ppm	Annual Average	0.013 ppm	0.011 ppm
Lead (Pb)	No monitored data	1.5 ug/m^3	Quarterly Average	No monitored data	No monitored data
Sulfur Dioxide (SO_2)	150 South Winooski Ave Burlington	1300 ug/m^3 365 ug/m^3 80 ug/m^3	3-hour 24-hour Annual	39.0 / 36.4 ug/m^3 33.8 / 20.8 ug/m^3 7.8 ug/m^3	Not available

Note: ppm = parts per million
ug/m^3 = micrograms per cubic meter
Source: Vermont State Ambient Air Monitoring Systems and USEPA, AirData Web Site, Monitor Value Report.

Table 3-2
Representative Monitored Ambient Air Toxics (2005)

Air Toxics (Hazardous Air Pollutants)	Monitoring Station	Vermont HAAS (Hazardous Ambient Air Standards)	Period	Concentrations 1st/2nd Highest
Acetaldehyde (CH3CHO)	150 South Winooski Ave Burlington	1800 ug/m^3 (Proposed Revised : 0.45 ug/m^3)	Annual Mean	1.161 ug/m^3
Acrolein (C3H4O)	150 South Winooski Ave Burlington	2.50 ug/m^3 (Proposed Revised : 0.002 ug/m^3)	Annual Mean	0.046 ug/m^3
Benzene (C6H6)	150 South Winooski Ave Burlington	0.12 ug/m^3	Annual Mean	1.350 ug/m^3
1,3-Butadiene (C4H6)	150 South Winooski Ave Burlington	0.035 ug/m^3	Annual Mean	0.103 ug/m^3
Benzo-a-pyrene (BAP) (C20H12)	150 South Winooski Ave Burlington	0.00030 ug/m^3	Annual Mean	0.00053 ug/m^3
Chloroform (CHCL3)	150 South Winooski Ave Burlington	0.043 ug/m^3	Annual Mean	0.136 ug/m^3
Formaldehyde (CH2O)	150 South Winooski Ave Burlington	0.080 ug/m^3	Annual Mean	1.949 ug/m^3
Methylene Chloride (CH2CL2)	150 South Winooski Ave Burlington, Chittenden County	2.00 ug/m^3	Annual Mean	0.617 ug/m^3
Tetrachloroe-thylene (C2CL4)	150 South Winooski Ave Burlington	0.41 ug/m^3	Annual Mean	0.29 ug/m^3
1,2,4 – Trichlorobenzene (C9H12)	150 South Winooski Ave Burlington	0.15 ug/m^3	Annual Mean	0.371 ug/m^3

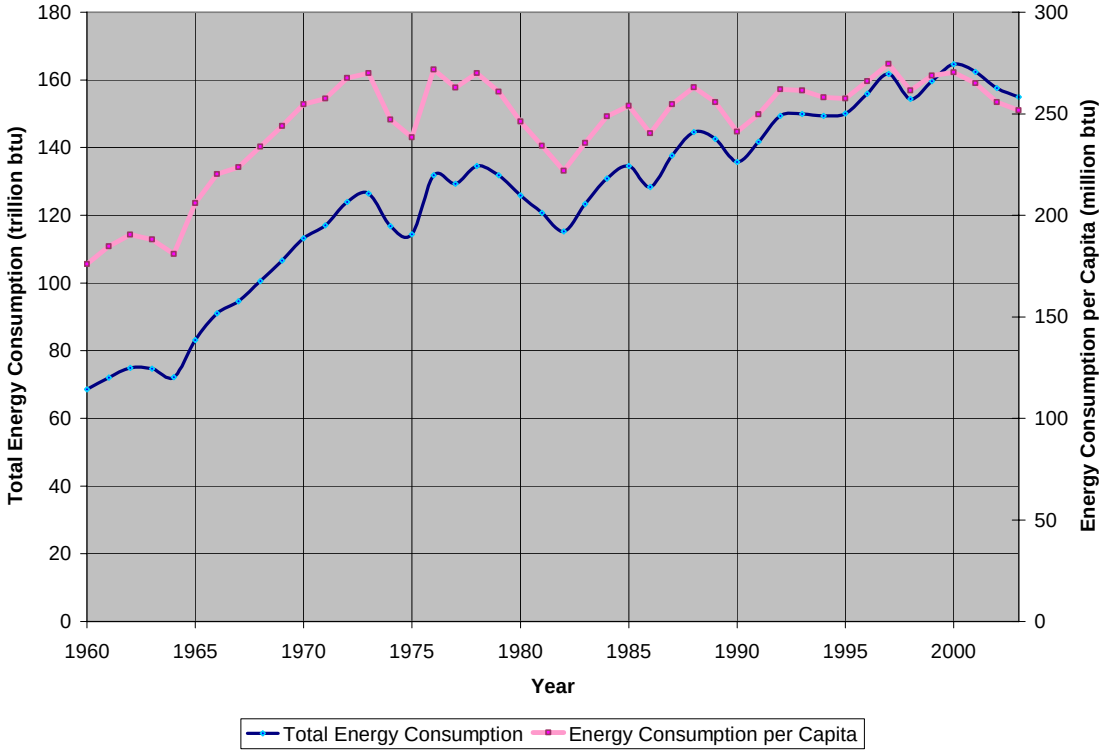
Note: ug/m^3 = micrograms per cubic meter
Source: Vermont APCD Monitoring Systems (2005)
USEPA, AirData Web Site, Monitor Value Report – Hazardous Air Pollutants, 2005

3.2 Energy

3.2.1 Energy Consumption

Total energy consumption in Vermont was estimated to be 155 trillion BTU for 2003, while per capita energy consumption was 251.6 million BTU (EIA, 2003). Figure 3-1 shows trends in total and per capita energy consumption since 1960. Total energy consumption and per capita energy consumption both increased steeply during the mid-1960s to early 1970s. Total energy consumption fluctuated during the 1970s and 1980s, but leveled off in the vicinity of 250 trillion BTU during the 1990s. Total energy consumption grew by 19.3 trillion BTU or 12.5 percent from 1990 to 2003. During this same time period, per capita energy consumption grew at a slower rate, 10.5 million BTU or 4.2 percent.

Figure 3-1
Vermont Total Energy Consumption and Energy Consumption per Capita, 1960-2003

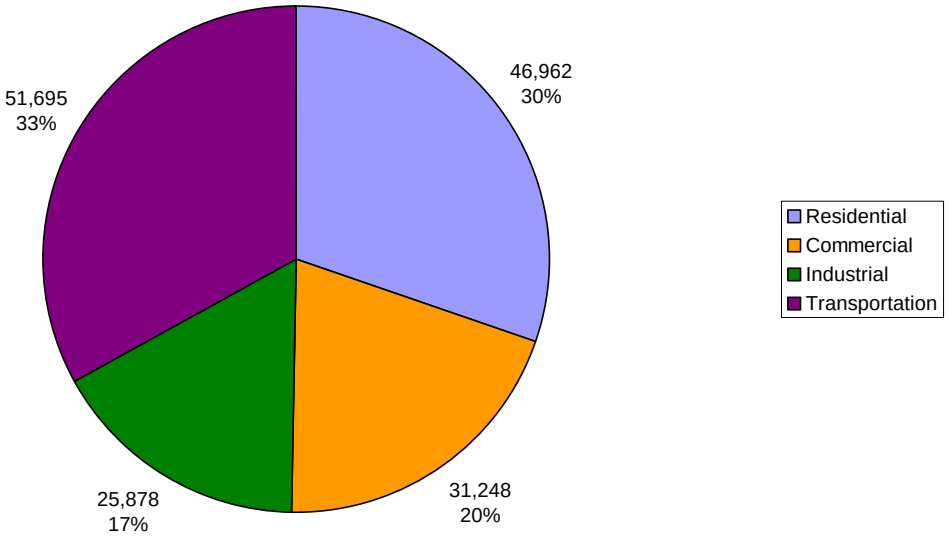


Source: Energy Information Administration, State Energy Data System, 2003

Figure 3-2 shows Vermont energy consumption by end use sector. The transportation and residential sectors consumed the most energy, 33 percent and 30 percent of total consumption respectively.

Petroleum products accounted for the largest part of Vermont energy consumption in 2003, approximately forty-five percent. Within the petroleum products category, most of the energy consumed was in the form of motor gasoline or diesel fuel. Nuclear electric power accounts for twenty-five percent of Vermont's energy consumption, a larger proportion than any other state in the U.S. (EIA, 2003). Vermont exports approximately 15.7 trillion BTU of electricity more than it imports every year.

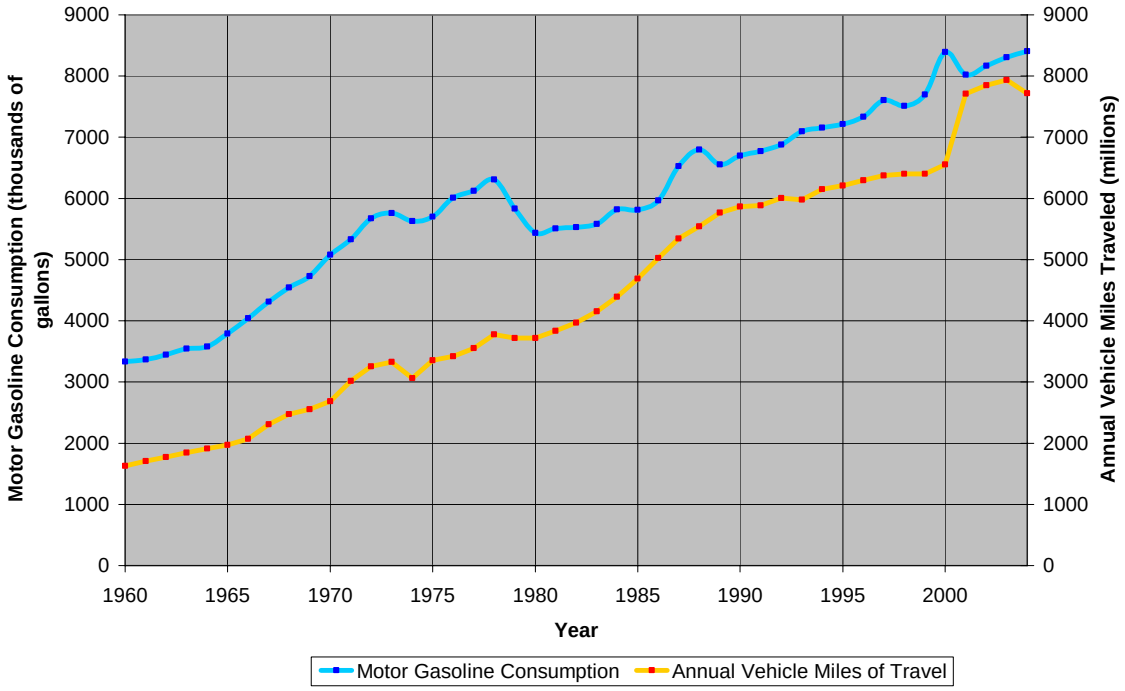
Figure 3-2
Vermont Energy Consumption by Sector (Billion BTU), 2003



Source: Energy Information Administration, State Energy Data System

The consumption of motor gasoline is of particular relevance to transportation projects and has increased faster than total energy consumption in Vermont. Figure 3-3 shows Vermont motor gasoline consumption and annual vehicle miles of travel (VMT) from 1960 to 2004. In 2004, motor gasoline consumption was 8,407 thousand gallons and annual VMT was 7,717 million miles. Both indicators have increased fairly steadily since 1960. Motor gasoline consumption increased by 1,711 thousand gallons, or 20.4 percent from 1990 to 2004, while VMT increased by 1,852 million miles or 24.0 percent over this same time period.

Figure 3-3
Vermont Motor Gasoline Consumption and Annual Vehicle Miles of Travel, 1960-2004



Sources: Motor Gasoline Consumption—Energy Information Administration, State Energy Data System, 2006.
Annual Vehicle Miles of Travel—VTrans Highway Research Data Electronic Publications, 2006.