



Environmental Health  
& Engineering, Inc.  
117 Fourth Avenue  
Needham, MA  
02494-2725  
  
TEL 800-825-5343  
781-247-4300  
FAX 781-247-4305

June 22, 2009

Sandy Collins, RN, BSN  
Director of Health Care Services  
Town of Westford – Board of Health  
Town Hall  
55 Main Street  
Westford, MA 01886

Dear Ms. Collins:

Environmental Health & Engineering, Inc. (EH&E) provides this report that describes the preliminary assessment of potential health risks associated with air emissions from the asphalt plant proposed to be located in the Town of Westford. To undertake this assessment, EH&E has completed the followings tasks:

- 1) Review all of the available documentation on the location, operations, and air emissions anticipated for the plant.
- 2) Conduct a literature review of health studies of populations in the vicinity of asphalt plants.
- 3) Review potential exposures and health risks of asphalt plant-related air pollutants, including truck traffic.
- 4) Present the findings to the Town of Westford Board of Health on June 16, 2009.

EH&E reviewed all of the written materials provided by the Town of Westford Board of Health and other publicly available documents on the location, operations, and air emissions anticipated for the plant. Those items are listed in an attachment to this letter.

In addition to documents about the proposed facility, EH&E reviewed the following published scientific literature on emissions from asphalt plants and potential exposures and health risks of populations proximate to them:

- Loyo-Berrios NI, Irizarry R, Hennessey JG, Tao XG, and Matanoski G. 2007. Air Pollution Sources and Childhood Asthma Attacks in Catafio, Puerto Rico. *American Journal of Epidemiology*, 165(8):927-935.
- Srogi K. 2007. Monitoring of environmental exposure to polycyclic aromatic hydrocarbons: a review. *Environmental Chemistry Letters*, 5:169-195.
- Panev T, Tzoneva M, Nikoforova O, Georgieva T, Nikolova L. 2008. Asphalt production and asphalt road cover—Considerable source for air pollution with polycyclic aromatic Hydrocarbons (D15). *Toxicology Letters*, 180S (S32-246).
- Vanmetre PC, Mahler BJ, and Wilson JT. 2009. PAHs Underfoot: Contaminated Dust from Coal-Tar Sealcoated Pavement is Widespread in the United States. *Environmental Science & Technology*, 43(1):20-25.
- Ulvestad B, Randem BG, Andersson L, Ellingsen DG, and Barregard L. 2007. Clara Cell Protein as a Biomarker for Lung Epithelial Injury in Asphalt Workers. *Journal of Occupational and Environmental Medicine*, 49(10):1073-1078.

Finally, EH&E reviewed reports from government and non-governmental organizations regarding asphalt plants:

- American Lung Association. 2009. *Facts About Particle Air Pollution*. American Lung Association.
- American Lung Association. 2009. *State of the Air*. American Lung Association.
- ATAST. 2003. *Salisbury Air Quality Monitoring Study ATAST Investigation Numbers 01007 and 01008*. North Carolina Division of Air Quality Toxics Protection Branch, Air Toxics Analytical Support Team.
- ATSDR. 2007. *Health Consultation APAC Carolina Inc, and Associated Asphalt Inc Salisbury, NC*. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry, Division of Health Assessment and Consultation.
- EPA. 2000. *Hot Mix Asphalt Plants Emission Assessment Report*. EPA-454/R-00-019. Research Triangle Park, NC: U.S. Environmental Protection Agency Office of Air Quality Planning and Standards.
- EPA. 2004. *Emission Factor Documentation For AP-42 Section 11.1, Hot Mix Asphalt Production* Research Triangle Park, NC: U. S. Environmental Protection Agency.
- INDOT. 2009. *Certified Hot Mix Asphalt Technician Manual, Chapter 3-Hot Mix Asphalt Plant Operations*. Indianapolis, IN: Indiana Department of Transportation, Materials and Tests Division.

- Journal of Environmental Health. 2005. EH Update: Increased Suicide Rate Possibly Linked to Chemicals Released from Nearby Asphalt Plants. *Journal of Environmental Health*, April 2005, Pages 60-61.
- NHDES. 2008. *Fact Sheet: Heavy Duty Diesel Engines: Trucks and Buses, Air Quality Impacts*. New Hampshire Department of Environmental Services.

### **Proposed Asphalt Manufacturing Facility**

The asphalt manufacturing plant proposed for this facility is the Gencor 400 Ultra-skid Plant. The operation consists of a rock crushing plant, asphalt drum mix plant and a hot oil heater that produces hot mix asphalt (HMA) from combustion of natural gas and ultra-low sulfur diesel fuel. The proposed site is bounded by Route 40 to the south and Route 3 to the east, and is adjacent to the Fletcher Quarry. The plant is proposed to be capable of producing 400 tons per hour of asphalt, with 50% of the aggregate anticipated to be delivered from the adjacent quarry.

The air permit application indicates that the asphalt plant process starts at the rock crushing plant, where sand, stones and recycled asphalt/pavement (RAP) will be crushed and separated into piles based on their particle size. The crushed materials are loaded into trucks and transported to the cold aggregate bins. The aggregates are transferred to the counter-flow drum mixer to dry and mix with RAP and liquid asphalt to create HMA. The particulate matters emitted from the drum mixers are filtered through emission control devices such as a baghouse and known to be very efficient. Then the HMA is stored in the storage silo until it is loaded onto the delivery trucks.

The major types and sources of pollutants emitted to air from the proposed facility are expected to be:

- Criteria air pollutants emitted from combustion of fossil fuel for the hot oil heater and the asphalt cement storage tanks, including:
  - particulate matter that is 10 micrometers or smaller in size (PM<sub>10</sub>)
  - particulate matter that is 2.5 micrometers or smaller in size (PM<sub>2.5</sub>)
  - nitrogen dioxide (NO<sub>2</sub>)
  - sulfur dioxide (SO<sub>2</sub>)
  - carbon monoxide (CO)
- Coarse and fine particulate matter emissions from the rock crushing operation.

- Particulates, combustion products, oxides of nitrogen (NO<sub>x</sub>), SO<sub>2</sub>, CO, volatile organic compounds (VOCs), and hazardous air pollutants (HAPs) from the counter-flow drum mixer.
- Fugitive emissions of particulate matter, VOCs, and malodorous substances from the storage, transport, and loading of liquid asphalt.
- Diesel exhaust including diesel particulate matter and other mobile source air toxics from vehicles associated with the facility

The air permit application indicates that emission controls will be installed and operated at the plant including:

- Knockout box and fabric filter baghouse for collection of dust produced by the dryer drum
- Capture and recirculation of combustible vapors to the dryer drum
- Vapor condenser on the asphalt cement storage tanks
- Wet dust suppression and collection on the rock crushing equipment

### **Literature Review of Asphalt Plants, Air Quality and Health**

Several investigations of asphalt plant-related air pollutant exposure and health risk are reported in the published scientific literature. The results and conclusions of these studies are summarized here and discussed in the context of potential health risks associated with the facility proposed for Westford.

#### *Exposure Studies*

The largest study reviewed by EH&E is in fact a series of field campaigns conducted by the U.S. Agency for Toxic Substances and Disease Registry (ATSDR) between 1998 and 2004 in response to health and odor concerns expressed by communities proximate to asphalt plants. ATSDR obtained measurements of numerous hazardous substances in air including VOCs, polycyclic aromatic hydrocarbons (PAHs), hydrogen sulfide (H<sub>2</sub>S), total dust, and respirable particulate matter from seven communities in Arizona, California, Georgia, New York, North Carolina, and Utah (2). ATSDR concluded that VOCs, PAHs, and particulate matter were not detected at hazardous levels in the vicinity of the asphalt plants studied.

EH&E's review of the ATSDR multi-site report found that concentrations of total dust and respirable particulate matter were substantially elevated above reported background levels for some of the locations. The monitoring methods employed by ATSDR were not specific to PM<sub>10</sub> or PM<sub>2.5</sub>, thus direct comparison with National Ambient Air Quality Standards (NAAQS) for those air pollutants is not possible. Nevertheless, the ATSDR results indicate that potential emissions of particulate matter from the facility proposed for Westford should be considered carefully. The importance of the particulate matter finding from the ATSDR work is emphasized by the fact that a threshold for adverse effects of exposure to PM<sub>10</sub> and PM<sub>2.5</sub> has not been identified.<sup>1</sup> Populations with existing respiratory and cardiovascular illness are at greatest risk of adverse effects from exposure to PM<sub>10</sub> and PM<sub>2.5</sub>.

ATSDR also reported that H<sub>2</sub>S was among the materials emitted from the plants likely to be the cause of odor concerns. In at least one study location, the liquid asphalt terminal was thought to be the source of H<sub>2</sub>S emissions that produced malodorous levels in the surrounding community. These results indicate that emissions of H<sub>2</sub>S and other materials from storage tanks and other operations that involve liquid asphalt are a potential cause of adverse effects of an asphalt plant on surrounding areas.

A detailed review of the design and operations of the asphalt plants in the locations of the ATSDR multi-site study was beyond the scope of the current assessment. However, a comparison of those plants to the facility proposed for Westford would be warranted if the Board of Health decided to investigate potential health risks further.

In addition to the ATSDR exposure study, a number of reports on occupational exposure to PAHs and other materials for asphalt workers have been published in the scientific literature. Panev et al. (2008) reported that inhalation exposures to benzo(a)pyrene and other PAHs for a cohort of asphalt applicators were 40 to 100 times greater than a control group of office workers. In a similar study, Ulvestad et al. (2007) found elevated levels of a marker of bronchiolar inflammation in a population of asphalt pavers in comparison to asphalt plant operators and asphalt engineers and concluded that the technique could be a useful biomarker for lung injury in exposed workers. In a detailed review paper, Srogi (2007) identified asphalt production as one of several anthropogenic sources of PAHs in the environment.

---

<sup>1</sup> Pope CA, Dockery DW. 2006. Health effects of fine particulate air pollution: lines that connect. *Journal of the Air and Waste Management Association*. 56(6):709-42.

### *Health Studies*

In a nested case-control study of asthma in Puerto Rico, Loyo-Berrios (2007) reported that the incidence of asthma attack was significantly associated with increasing proximity to point sources of air pollution including a grain mill, petroleum refinery, asphalt plant, and power plant. In particular, the risk of an asthma attack increased by approximately 20% for each 1-kilometer distance closer to a source. As noted by the authors, the close proximity of multiple types of point sources prevented the identification of a specific source as the sole cause of increased asthma attack. For example, the asphalt plants in this study were close to petroleum refineries and a grain mill. The size and operations of the asphalt plants included in this study are not reported in the paper and hence are unknown at this time. Ascertainment of their emissions characteristics relative to the facility proposed for Westford would be warranted if the Board of Health decided to investigate potential health risks further. Despite the limited specificity of this study to asphalt plants and the facility proposed for Westford in particular, the results serve to identify asphalt plants as a potential hazard to respiratory health in communities that surround them.

EH&E also identified a news item regarding a report of suicide rates in a community surrounding an asphalt plant in North Carolina (Journal of Environmental Health 2005). That work does not appear to have been published in a peer-reviewed scientific journal.

### **Air Quality Modeling for the Proposed Asphalt Plant**

Air dispersion modeling conducted for the proposed site is detailed in the air permit application. Two emission sources were considered in the modeling: 1) exhaust from the drum dryer exhaust stack and 2) exhaust from the hot oil heater. Emissions and dispersion of criteria pollutants, metals and hydrocarbons were simulated with the model in accordance with requirements set forth by the Massachusetts Department of Environmental Protection (MADEP). Twenty-four hour average and annual average concentrations of those species were predicted for approximately 1,630 receptor locations within 3 miles of the proposed facility, including receptors at the nine homes nearest to the plant. Five years of meteorological observations from Bedford Hanscom Field were used in the model.

The modeling results predicted the highest concentrations at the quarry property and to the southeast of the property on the western side of Route 3. The modeling results presented in

Table 2 and 3 of the air permit application indicate that the highest predicted concentrations of criteria pollutants will be below the U.S. Environmental Protection Agency (EPA) National Ambient Air Quality Standards (NAAQS). Similarly, the highest predicted concentrations of non-criteria air pollutants are below the Massachusetts Threshold Effects Exposure Limits (TEL) and Allowable Ambient Limits (AAL). The predicted concentrations at all nine receptor points representing the homes closest to the proposed plant were below the background level, the NAAQS for the criteria air pollutants and TEL and AAL for the non-criteria pollutants.

While the results for criteria air pollutants presented in the air permit application may meet the requirements imposed by MADEP for permitting a new source, they are not sufficiently complete to support a quantitative assessment of potential health risks of emissions from the proposed facility for several reasons. First, the modeling results presented in the permit application do not reflect a realistic and complete inventory of sources expected for the plant based on the description of operations provided by the Applicant. For example, the modeling results are based on combustion of No. 2 fuel oil instead of natural gas, even though fuel oil is described as a backup fuel to be used in the event that the sufficient quantities of the primary fuel, natural gas, are not available. Second, the modeling described in the air permit application considered emissions from only the drum dryer and hot fuel tank; MADEP does not require consideration of other sources at the plant. According to the EPA, material handling and road dust are the largest sources of PM<sub>10</sub> emissions for a typical drum HMA facility.<sup>2</sup> The absence of air modeling results for these sources limits an assessment of potential health risks given that a threshold for adverse effects of PM<sub>10</sub> and PM<sub>2.5</sub> exposure has not yet been established.<sup>3</sup> The absence of modeling results for hazardous air pollutant and hydrogen sulfide emissions from the asphalt storage tanks and loading operations further limits an assessment of potential health risks.

EH&E believes that atmospheric deposition of air emissions from the plant is unlikely to be a serious threat to local land and water resources based on the air dispersion modeling available at this time.

---

<sup>2</sup> EPA. 2000. *Hot Mix Asphalt Plants Emission Assessment Report*. EPA-454/R-00-019. Research Triangle Park, NC: U.S. Environmental Protection Agency Office of Air Quality Planning and Standards.

<sup>3</sup> Pope CA, Dockery DW. 2006.

## **Air Quality Impacts from Increase in Vehicle Traffic**

EH&E reviewed a Traffic Impact Assessment for the proposed asphalt plant that was prepared by Greenman-Pedersen, Inc. The existing traffic volume on Groton road adjacent to the proposed site is reported to be approximately 13,000 vehicles per day. The traffic assessment also indicates that traffic volume is expected to increase by 1.5% on an annual basis. The proposed facility is reported to generate an average of 120 trips per day. On a peak day, the proposed site is predicted to generate an additional 234 trips per day, while the number of truck trips to the proposed asphalt operation reportedly will be limited to an average of 30 trucks per day.

An increase in traffic count and volume is expected to produce a net increase in mobile source emissions of air pollutants along Groton Road between the proposed facility and Route 3, assuming that all other factors are held constant over time. Numerous studies of mobile source emissions from highways have shown that measurable impacts of traffic emissions on air quality are limited to within approximately 100 meters of a road. Recent research of mobile source impacts completed by EH&E replicated that finding along I-93 in the Assembly Square area of Somerville, Massachusetts. In that detailed measurement and modeling study, EH&E found that an increase in traffic of approximately 3,000 vehicles per day was associated with only a 0.35% increase in concentrations of black carbon (a marker of diesel particulate matter emissions) and NO<sub>2</sub>. The amount of vehicle traffic on Groton Road predicted for the asphalt plant (120 vehicles trips per day; peak day 234 vehicles trip per day) is comparatively small to the increment in traffic evaluated in Assembly Square. As a result, EH&E anticipates that any change in traffic-related air pollutant levels in the vicinity of Groton Road as a result of activity related to the proposed asphalt plant would be correspondingly small.

Generalizing the results of studies conducted elsewhere suggests a minimal change in traffic-related air quality is likely to result from the traffic projected for the proposed asphalt plant. However, numerous epidemiological studies published in the scientific literature have reported increased risks of various adverse respiratory and cardiovascular outcomes for populations who reside in close proximity to major roads in comparison to the general population. Thus, the Board of Health may wish to conduct a more complete assessment of potential traffic impacts of the proposed asphalt plant. Such an assessment could include an evaluation of current levels of traffic-related air pollutants along Groton Road and a modeling study of air pollutant emissions

and concentrations anticipated to result from traffic related to the asphalt plant. Emissions modeling tools for mobile sources developed and maintained by the EPA are available for this type of analysis. The fleet of vehicles and its speed and load characteristics should be an explicit component of any such modeling.

### **Review of Letter from MA Department of Public Health**

In addition to the aforementioned materials, EH&E also reviewed a letter submitted to the Board of Health by Suzanne Condon, Director, Bureau of Environmental Health, Department of Environmental Health, Commonwealth of Massachusetts. Similar to EH&E's findings in regard to the limited number of sources on the proposed asphalt plant that were modeled for purposes of the air permit application, Ms. Condon suggested that the Board of Health consider requesting further analysis of air pollutant emissions from all plant operations including loading and truck traffic.

Ms. Condon also suggested that the Board consider requesting information on potential risks to vulnerable populations in the vicinity of the proposed facility. As noted above, populations that are most susceptible to the adverse effects of air pollution have been shown to include individuals with pre-existing illness, such as children with asthma or other respiratory illness, and elderly people with a history of respiratory or cardiovascular conditions. Information on the prevalence of pediatric asthma in Massachusetts schools provided by Ms. Condon also introduces concern about the potential for local air quality to influence respiratory illness in the vicinity of the proposed facility. In particular, the prevalence of asthma among students in the Rita E. Miller Elementary School during 2006-2007 was reported to be statistically significantly greater than for the state as a whole. In consideration of this information, additional investigation of the causes and triggers of asthma in this community may be warranted.

Analytical methods for estimating health risks of exposure to  $PM_{2.5}$  and  $PM_{10}$  that are fully described in the scientific literature could be used to conduct a quantitative assessment of health risks associated with emissions from the asphalt plant, including risks to sensitive populations. EH&E has conducted numerous analyses of that type, an example of which was

recently published in the scientific literature.<sup>4</sup> The Board may wish to consider requesting information on how this type of analysis could be conducted in Westford.

Ms. Condon further suggested that the Board of Health should consider requesting information on air dispersion modeling using local meteorology and upper-bound exposure conditions. EH&E believes that site-specific meteorology is generally superior to other sources of meteorological information for purposes of dispersion modeling. However, EH&E repeatedly finds that any differences in results of air quality modeling based on the use of different, but comparable, sources of meteorological data are small. Nevertheless, the Board should consider requesting that meteorological data collected at the site by the Applicant be shared with the public.

Finally, Ms. Condon suggests that the Board of Health may want to consider requirements for mitigating air pollutant exposures in Westford. EH&E supports this suggestion and recommends that the Board work to identify opportunities for reducing air pollutant emissions from the proposed facility, with particular emphasis on emission sources that can reasonably be anticipated to result in the largest increments in exposure to members of the community.

## **Conclusions**

EH&E recommends that the Westford Board of Health consider obtaining additional information to help ensure that the asphalt plant proposed to be sited on Groton Road will not have an adverse impact on the surrounding community. Items of interest at this time include:

- Emissions and air dispersion modeling of particulate matter, VOCs, PAHs, and malodorous substances from emission points other than hot fuel tank and dryer drum including the rock crushing, liquid asphalt handling, loading operations.
- Emissions and air dispersion modeling of particulate matter, combustion gases, and mobile source air toxics from plant-related vehicle traffic and road dust.

---

<sup>4</sup> MacIntosh DL, Minegishi T, Kaufman M, Baker BJ, Allen JG, Levy JI, Myatt TA. 2009. The benefits of whole house in-duct air cleaning in reducing exposures to fine particulate matter of outdoor origin: a modeling analysis. *Journal of Exposure Science and Environmental Epidemiology*. Epub ahead of print available on-line.

- An evaluation of operations and emissions of the asphalt plants included in the ATSDR and Loyo-Berris studies in comparison to the facility proposed for Westford
- Results of annual average and 24-hour average  $PM_{10}$  and  $PM_{2.5}$  concentrations predicted for homes and schools within 3-miles of the facility as a result of anticipated emissions from the proposed asphalt plant.

EH&E hopes that the information provided in this letter report is helpful to the Board of Health. Please me contact me if you wish to discuss the content of this letter or any other public health matter related to the proposed facility.

Sincerely,

A handwritten signature in black ink, appearing to read 'D. MacIntosh', with a long horizontal line extending to the right.

David L. MacIntosh, Sc.D.  
Principal Scientist

cc Zac Cataldo, Westford Board of Health Chairman

## REVIEWED MATERIALS PROVIDED BY TOWN OF WESTFORD BOARD OF HEALTH

- Cavanaugh Tocci Associates, Inc. 2009. *Sound Levels Evaluation in Accordance with Acoustical Criteria of Town of Westford, Chelmsford, and Massachusetts Department of Environmental Protection*. Dated May 14, 2009.
- Landtech. 2009. *Site Plan Asphalt Manufacturing Facility, 540 Groton Road (Route 40), Westford, Massachusetts*. LandTech Consultants. Dated April 6, 2009.
- Landtech. 2009. *Appendix G: Storm Water Report Asphalt Manufacturing Facility, 540 Groton Road, Westford, Massachusetts*. LandTech Consultants. Dated April 6, 2009.
- Landtech. 2009. *Supplemental Data Report Asphalt Manufacturing Facility, 540 Groton Road, Westford, Massachusetts*. LandTech Consultants. Dated April 6, 2009.
- Newport Materials LLC. Letter from Douglas C. Deschenes to Westford Zoning Board of Appeals. *Special Permit Application*. Dated January 27, 2009.
- Newport Materials LLC. Letter from Douglas C. Deschenes to Westford Planning Board. *540 Groton Road Application for Site Plan Review*. Dated April 6, 2009.
- Newport Materials LLC. *Massachusetts Department of Environmental Protection, Air Plan Approval Submittal*. Dated March 19, 2009.
- Route 40 Clean Air Coalition. *Fact Sheet: Asphalt Manufacturing Facility Proposed for 540 Groton Road, Westford (Route 40)* Route 40 Clean Air Coalition.
- Route 40 Clean Air Coalition. *Log of Questions Asked by Community Members*. Route 40 Clean Air Coalition. 2009.
- Town of Westford. Letter from the Conservation Commission to Westford Planning Board. *Request for Comments Proposed Asphalt Manufacturing Facility, 540 Groton Road*. Dated May 20, 2009.
- Town of Westford. Letter from the Zoning Board of Appeals to Newport Materials LLC. *Record of Proceedings and Notice of Decision*. Dated February 24, 2009.
- Town of Westford. Zoning Board of Appeals Approval of Meeting Minutes. *Meeting Minutes February 11, 2009*. Dated April 15, 2009.
- Town of Westford. Letter from Ross Altobelli, Town Planner. *Proposed Asphalt Plant at 540 Groton Rd*. Dated March 6, 2009.
- Town of Westford. Letter from Ross Altobelli, Town Planner. *540 Groton Rd Asphalt Plant*. Dated March 18, 2009.
- June 15, 2009, letter from Suzanne Condon, Director, Bureau of Environmental Health, Department of Public Health, Commonwealth of Massachusetts.