Executive Summary

This document is a summary of reports that assesses the health benefits of substituting biodiesel in residential heating oil- and transportation-related sources currently fueled by conventional ultra-low sulfur diesel or distillate (ULSD or diesel fuel) in selected states on both coasts and Colorado. The study author is Trinity Consultants.

Unlike previous studies that have used a "top down" analysis of overall, statewide benefits attributable to general policies, this work employed a "bottom up" approach to show community-level impacts and benefits. That is, the assessment performed robust air dispersion modeling using U.S. EPA- and CARB-approved models for specific locations to do a health risk assessment of the benefits of substituting 100% biodiesel (B100) for the petroleum diesel used in the selected locations. The emission and data sources, models, and analytical techniques for each urbanized area were selected to provide the most comprehensive, robust, and transparent analysis possible within the schedule and budget limitations of the approved project. Trinity identified the communities believed to be most impacted by the emission sources modeled and has highlighted the benefits of biodiesel to those specific communities to the degree possible. The communities and sources were selected to be as representative as possible of the broad range of facilities and sources that use large volumes of petroleum diesel or are impacted by its use. The West Coast and Colorado analysis focused on transportation sources (i.e., medium- and heavy-duty diesel-powered vehicles), while the East Coast analysis focused on residential heating oil uses. Sources evaluated included ports, railyards, freeways and interstate highways, logistics facilities, agricultural operations, residential housing developments, and urban areas.

Benefits were quantified for the modeled reductions in diesel particulate matter and other combustion by-products. The benefits were calculated in readily understandable endpoint metrics like reduced cancer risk and cancer burden, as well as avoided premature mortality, asthma exacerbation, acute respiratory symptoms resulting in "minor restricted activity days," and work loss days. These endpoints, in turn, were valuated using the corresponding standard U.S. EPA BenMAP program economic values for those endpoints. The benefits were calculated only for the study areas as shown in the attached figures; extrapolations to the entire state are feasible but would require additional calculations.

The study was designed to enable order-of-magnitude extrapolation of the results to analogous areas/sources beyond the specific ones included in the study. For example, the results associated with the ports included in the study (Ports of Los Angeles (POLA)/Long Beach (POLB), Port of Oakland in California, and Port of Seattle in Washington) can be aggregated and expressed as an intensity metric, such as reduced cancer risk (1 in 10^6) per million twenty-foot equivalent units, which can then be extrapolated for the number of TEUs typically processed at the Port of New York/New Jersey. Similar extrapolations are possible with the other sources and facilities evaluated.

Results

Researchers found that switching to 100% biodiesel in the home heating oil and transportation sectors would prevent 340 premature deaths annually; and result in 46,000 fewer sick days. In the transportation sector, benefits included a potential 45% reduction in cancer risk when heavy-duty trucks such as semis use B100 and 203,000 fewer or lessened asthma attacks. When Bioheat® fuel made from 100% biodiesel is used in place of petroleum heating oil, the study found an 86% reduced cancer risk and 17,000 fewer lung problems. The study also considered the economic cost of premature deaths, asthma cases, reduced activity due to poor health, and work impacted due to sick days

Study Overview

Question Presented

- What are the potential human health benefits (and associated economic benefits) that can be achieved by substituting B100 (100% biodiesel) for the Ultralow Sulfur Diesel (ULSD) used in transportation and residential heating oil applications for selected sites in the east and west coasts and Colorado?

Background

- The study was conducted by Trinity Consultants, a leading consulting service recognized nationally and internationally for its staff's skills, experience, and breadth of knowledge. Trinity specializes in air dispersion modeling and related health risk assessments, among its many areas of expertise. They operate 69 offices across the U.S., Canada, United Kingdom, Ireland, Australia, and China. For more than 40 years, Trinity has performed air dispersion modeling for industrial facilities, utilities, and government agencies.

Methodology

- A simplified, air toxic-based health risk assessment (HRA) of specific diesel fueled residential heating oil- and transportation-related sources in the areas selected. The analyses show the air toxic health risk benefits of fueling the modeled residential heating oil- and transportation-related sources with biomass-based diesel (B100) compared to ULSD. This analysis translates changes in toxicity values into risk metrics, including reductions in cancer risk (per million people) and cancer burden.
- Ambient concentrations from the selected sources were determined using USEPA's approved AERMOD Modeling System. The model utilized local surface and upper air meteorological data processed using EPA AERMINUTE and AERMET meteorological data processors, along with preprocessed terrain data prepared by the United States Geological Survey. AERMOD was run within Trinity's BREEZE Software modeling package.
- Health impacts were determined using the California Air Resources Board's (CARB) Hot Spots Analysis & Reporting Program (HARP) Air Dispersion Modeling and Risk Tool, which implements the risk analysis methodology of the California Office of Environmental Health Hazard Assessment (OEHHA). Risk was determined in terms of excess cancer risk above baseline values, cancer burden, and chronic hazard index. Results generated from HARP were processed using ArcGIS to generate plots of impacts over satellite imagery. A coarse receptor grid was established over the entire modeling domain to show community-level impacts, and several fine receptor grids were established around sources to determine impacts for the most affected receptors.
- Census-specific modeling risk factors are shown in p. 20-22, assumed emission reduction percentages on p. 23, and valuations for oilheat and transportation analyses on p. 23.
- The study's modeling runs were conducted at the census-tract level.

Study Locations

- Heating oil: New York City (NY), Albany (NY); Boston (MA); New Haven (CT); Providence (RI).
- Transportation: Wilmington, Carson, and West Long Beach (CA) around POLA/POLB, San Bernardino (CA), South Fresno (CA), West Oakland (CA); Portland (OR); Seattle (WA), Everett (WA); Denver (CO).
- West Coast and Colorado analyses focused on transportation sources, while the East Coast analyses focused on residential heating oil sources. Sites were selected to be as representative as possible to disadvantaged communities near airports, ports, railyards, freight logistics facilities, agricultural operations, large cities, and residential complexes.