The following comments follow closely those made by a public health department on a rail line in Canada that is being considered in a similar time frame with the current proposal. The text has been modified to fit our circumstances but many of the arguments have been retained because they are entirely consistent with our situation here in Whatcom County. Please consider the details in this letter because many speak directly to our situation.

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. Health Impacts of Diesel Exhaust

. Diesel exhaust is a complex mixture of particles and gases. This product would be generated both by the ships taking coal away from the terminal and by locomotives bring products to the terminal. It contains several hundred different organic and inorganic components, including many substances that have been designated as toxic chemicals. While the specific components of diesel exhaust depend on factors such as the age and type of diesel vehicle, many of the constituents of diesel exhaust, such as particulate matter, nitrogen oxides, and air toxics, are common to all diesel vehicles and are similar to those emitted from other vehicles. Emissions from both diesel and gasoline vehicles contribute to air pollution that already exists in our area. Some pollutants such as nitrogen oxides also contribute to formation of smog. The baseline health impacts of current pollution levels from the combustion of diesel have been reviewed recently and show that there are already significant impacts to the public's health. Compared to emissions from gasoline vehicles, diesel exhaust is thought to be particularly harmful to health. Some of the scientific information available about diesel exhaust describes the impacts of the mixture as a whole. Other evidence addresses the health impacts of individual components of the exhaust mixture.

Diesel Exhaust as a Whole Mixture

There is increasing evidence that diesel emissions are associated with the development of cancer, particularly lung cancer. The International Agency for Research on Cancer classified it as a probable carcinogen in humans, the US Environmental Protection Agency (US EPA) concluded that lung cancer is included in the health risks from exposure to diesel exhaust, and the US National Institute for Occupational Safety and Health (NIOSH) concluded that diesel exhaust is a potential human carcinogen. A 2009 review by WA State Dept of Ecology concluded that diesel exhaust likely contributes to the burden of cancer in our region.

While the evidence supporting a link between diesel exhaust and cancer is most clear for lung cancer, some studies also suggest that diesel exhaust could be linked to other types of cancer. For example, a study in Finland found that occupational exposures to diesel exhaust were associated with ovarian cancer.

A review conducted by the US EPA concluded that health risks from exposure to diesel exhaust also include acute exposure-related symptoms and chronic exposure-related non-cancer respiratory effects. For example, short-term exposures to diesel exhaust are associated with irritation and inflammation of the eye, nose, and throat. A 2009 review of non-cancer effects suggests that exposure to diesel exhaust may also worsen allergies. Chronic exposures to diesel exhaust are strongly linked with lung injury in animal studies, and the U.S. EPA concluded that diesel exhaust poses a risk to respiratory health for humans.

Diesel Particulate Matter (DPM)

Diesel engines emit two sizes of particles – fine particles (PM2.5), which are those less than 2.5 micrometers in diameter, and ultrafine particles (PM0.1) which are those less than a millionth of a meter in diameter. A variety of substances can become attached to the exterior of the particles, including air toxics and metals that are both linked to health outcomes such as cancer. These substances are then inhaled into the lung along with the particles.

Until recently, most research focused on the health impacts of PM2.5. PM2.5 is a common air pollutant that contributes to smog. These small particles can be respired deep into the human lung, causing lung irritation in healthy people, and exacerbating asthma and other respiratory illnesses in at-risk groups such as children, the elderly and those with pre- existing illness. Strong evidence links PM2.5 to cardiovascular and respiratory mortality and morbidity. Recent epidemiological evidence also suggests an association between exposure to smog pollutants such as fine particles, and increased mortality from lung cancer.

There is also increasing concern about the smallest particles in diesel emissions, the "ultrafine" PM0.1. Ultrafines make up 50-90% of the particles in diesel exhaust.

Preliminary evidence suggests that these extremely small particles may be associated with many of the same type of health effects as larger particles. However, they seem to cause more inflammation and damage in the lungs than larger particles with the same chemical makeup. As well, because they are so small, they can easily move out of the lung and enter the bloodstream. This allows them to move to other parts of the body. Animal research suggests that these particles are able to move across important tissue barriers in the body, entering areas such as the brain and reproductive organs. The implications of this for human health are not yet well understood.

Individual Air Toxics in Diesel

While hundreds of different air toxics may be present in the gas phase of diesel exhaust, some of the most commonly identified are formaldehyde, benzene, 1,3-butadiene, and polycyclic aromatic hydrocarbons (PAHs):

- Formaldehyde is carcinogenic to humans. It is also a highly reactive substance that can be irritating to the nose, eyes, skin, throat and lungs at fairly low levels of chronic exposure.

- Benzene is considered to be carcinogenic to humans. Chronic exposure to benzene leads primarily to disorders of the blood.

- 1,3-Butadiene is linked to cancers of the blood and lymph systems, including leukemia. It has also been linked to disorders of the heart, blood and lungs, and to reproductive and developmental effects.

- Some PAH are carcinogenic to humans. Because this group of compounds covers a wide range of physical-chemical properties, some PAH are found in air on particles while others are gaseous. PAH of both forms may be deposited in the lungVulnerable groups who are especially at risk from traffic-related air pollution include children, pregnant women, and the elderly. Research suggests that people who work outdoors or exercise near areas of high traffic density are also at increased risk for the health effects of air pollution from vehicles.

- **Health Impacts of Residential Proximity to Transportation Corridors and Hubs**

- There is substantial evidence that shows that people living or working close to high- traffic areas experience more adverse effects than people who are further away. The combustion of gasoline or diesel fuel in the engines of cars, trucks, trains

> and/or ships is a significant source of pollution in high traffic areas. Numerous recent studies have shown that those who live near busy transportation corridors and hubs (e.g., major highways, rail yards and ports) are at significantly greater risk of adverse health impacts than the general population. The health impacts observed include increased prevalence and severity of asthma and other respiratory diseases, diminished lung function, adverse birth outcomes, childhood cancer, and increased mortality. Those who live near major regional transportation routes can be identified as a highly susceptible population, subject to adverse health effects from transportation-related pollution.

Studies of the health impacts of living close to highways, rail yards and ports can be used to suggest potential health impacts from a busy diesel rail line. However, direct comparisons cannot be made, due to differences in engine types, operating conditions and traffic volumes. For example, rail yards experience constant locomotive activity, while rail lines experience locomotive activity every few minutes, and the daily volumes and emissions profiles of automobile and truck traffic on a highway are very different from what is expected of a rail corridor.

For highways, evidence indicates that residential proximity to traffic can be associated with the adverse health effects described above. Steep concentration gradients for several traffic-related pollutants may exist near highways. The results of these gradients are that adverse health impacts are found at distances up to 200 m, but generally not more. A second important factor controlling traffic exposure, and hence, adverse health impacts is traffic density. Adverse effects have been reported for highway traffic densities as low as 5,500-9,000 vehicles/day. Effects are more serious and more frequently reported at greater traffic densities, and have not been reported at lower traffic densities.

The California Air Resources Board has completed health risk assessments of the PM component of diesel exhaust from several rail yards. Rail yards experience constant locomotive activity from moderately high numbers of visiting locomotives (e.g., >30,000/year at the J.R. Davis Yard in Roseville), each spending 10 hours or more at the railyard27. Locomotive operations at the J.R. Davis Yard in Roseville emitted an estimated 23 tonnes of diesel PM in 2000, approximately 50% from moving locomotives, 45% from idling and 5% from testing. Emission factors used to estimate PM emissions range from 0.14 to 9.12 g/bhp-hr, indicating a wide range of engine technologies and operating conditions. Health impacts resulting from these emissions were predicted for the entire greater Roseville area. Based on these results, the California Air Resources Board determined that both long and short-term mitigation measures were needed to reduce diesel PM emissions from the Yard.

Air Quality Assessment –Using air dispersion modeling to estimate the changes in air concentrations under the proposed project of selected diesel exhaust components. It could be used to establish existing ambient air quality, predict future local air quality and predict future regional air quality. These studies could also compare the predicted air concentrations to applicable government air quality standards. The chemicals to be assessed are:

- Combustion gases – carbon monoxide, nitrogen dioxide and sulphur dioxide;
- Particulate matter – respirable (PM2.5) and inhalable (PM10);
- Volatile organic compounds (VOCs) – formaldehyde, acetaldehyde, 1,3- butadiene, benzene and acrolein;
- Total polycyclic aromatic hydrocarbons (PAHs); and
- Greenhouse gases – carbon dioxide, methane and nitrous oxide.

- **Human Health Risk Assessment** – It will be essential to complete a human health risk assessment, using modeling results to predict human exposure and the resulting health risks. Two scenarios should be evaluated: 1) Future No Build, which will evaluate the potential health impacts related to air quality in the future in the absence of the proposed project; and 2) Future Build, which will evaluate the potential health impacts related to air quality in the future assuming that the proposed project goes forward. Over 100 receptor locations corresponding to some of the parks, schools, child care centers, hospitals, long term care homes and private residences that are located closest to the rail line should be evaluated through modeling. The principal exposure pathway to be evaluated is inhalation. Skin contact and ingestion exposures to particles deposited on soil should also be considered. The assessment should evaluate the hazard associated with both acute and chronic exposure durations. Cancer and non-cancer risks should be evaluated. We recommend three additional studies:

1. E**stimate particulate deposition to soil, and that skin contact and ingestion exposures to these particulates can be evaluated.** Both rural and urban gardening and active recreation occur adjacent to the rail line. Given the social and health benefits of gardening and play activities in parks, backyards and other green spaces, it is important that potential exposures associated with these activities be assessed. Many outdoor activities can result in skin contact with contaminated soil. Contaminated soil may also be incidentally ingested, or food grown in contaminated soil may become contaminated and be consumed.

2. **Undertake an ultrafine particulate matter (PM0.1) monitoring program to characterize dispersion into adjacent neighborhoods, and model future PM0.1 levels in the local airsheds.** Diesel exhaust is a known source of

PM0.1, but it is not clear how far into adjacent neighborhoods ultrafine particles will disperse; therefore, it is important to develop baseline information on PM0.1. The health effects of PM0.1 are not well understood, but the scientific community has expressed concern over the potential health impacts of PM0.1, and scientific knowledge is rapidly evolving.

3. **A risk assessment should evaluate diesel exhaust both as a whole mixture and as the sum of the individual components listed above.** The data available to support each type of evaluation are different, and the final evaluations have different strengths. Diesel has been evaluated as a whole mixture in epidemiological and occupational exposure studies. These studies capture any synergistic effects of the diesel exhaust mixture that might not be predicted based on the toxicological characterization of the individual components of diesel exhaust. However, it can be very difficult to derive a reliable estimate of toxicity from these studies. Assessments of diesel exhaust as a whole tend to examine only the critical effect that occurs at the lowest diesel exhaust exposure levels (i.e., lung cancer). Many of the components of diesel exhaust are toxic by themselves. The toxicities of these compounds and classes of compounds have been characterized individually, and these characterizations can be applied to the assessment of diesel exhaust. This strategy enables the assessor to examine more of the many effects of the diesel exhaust mixture, but it assumes that synergistic effects are not present and does not address every component of diesel exhaust.

Any air quality assessment should provide essential predictions of air quality with future expansion in train use. The risk assessments will integrate those data with toxicological information to predict adverse health effects. The results of quantitative risk assessments, as being undertaken are essential; however, risk assessments address only a narrow portion of the spectrum of health impacts associated with a project. Quantitative risk assessments are not designed to consider either the negative or the beneficial impacts on the determinants of health of a proposed project, nor do they address the distribution of those impacts. Health impact assessments are designed to address these issues. Health impact assessment should also involve the community in the process of achieving a more equitable distribution of positive and negative impacts through mitigation measures.

Predicted Air-related Health Effects of the Proposed Project

The planned increase in rail and ship traffic will burden local residents with some degree of adverse health impacts. The summary results of the human health risk assessment commissioned should indicate that acute and chronic non- cancer risks are predicted for both the baseline and cumulative future build scenarios from exposures to nitrogen oxides and VOC (specifically acrolein). An enhanced risk of cancer is predicted from the project-related emissions of another VOC (1,3-butadiene).

These health impacts will be an additional stressor to communities already burdened with a greater than average prevalence of ill health in many of the communities along the rail line. The emissions and local air quality impacts of the proposed project should be minimized using all reasonable means.

Health Impact Assessment

The World Health Organization describes health impact assessment (HIA) as “a combination of procedures, methods and tools by which a policy, program or project may be judged as to its potential effects on the health of a population, and the distribution of these effects within the population." Health impact assessment considers how a proposal or policy might affect determinants of health in order to assess the likely impact on the well-being of people. This tool has been used to review proposed projects in the transportation and other sectors.

Health impact assessment can be used to predict the health impacts of a project and the distribution of impacts. Based on these predictions, the health impact assessment can inform or influence the decision-making process, and mitigate any health impacts. The process can also provide an opportunity for affected stakeholders to contribute to the assessment, and to make recommendations that will enhance a proposal.

We recommend that in addition to the quantitative risk assessment underway, the proponent complete a health impact assessment of the proposed project in consultation with the Health Officers of impacted counties including at a minimum San Juan, King, Skagit, Snohomish, Thurston and Whatcom as well as the Tribes impacted by the project, at a minimum Lummi and Nooksack. Health impact assessment works best when there is sufficient time to perform the assessment well, when multiple disciplines are involved, and if various options to be compared have been developed.

Health Protective Practices for Urban Rail Lines

There are various practices that the proponent and its partners could implement for this project that would increase fuel efficiency and/or reduce emissions. These practices would have the effect of reducing the public health impact of the proposed project. The most health protective option is electrification. Many of these issues apply equally to ports and ship traffic as well as to locomotives and trains.

Electrification – Electrification of the line would eliminate the diesel exhaust emissions associated with current ship and train traffic on the corridor. Electric trains and wind powered ships do not produce any direct emissions. However, the emissions associated with generating electricity to run electric trains do have the potential to cause adverse health impacts in the communities downwind of the power plants that generate electricity. Green energy sources, such as wind and solar power, would not create potential downwind health impacts. In addition to not producing direct emissions, electric trains tend to be more efficient than diesel and have the potential for much greater speed. These attributes can make electric trains more suitable than diesel for high-speed commuter service but not likely for freight. However, there are significant additional infrastructure, safety and planning requirements involved in electrifying a rail line.

Electrification is not currently part of neither the BNSF plan no the shipping companies are considering wind powered ships.

Until such time as electrification or wind powered freighters are in place, the following good practices can be applied for the protection of public health.

Hybrid locomotives/ships – The on-board rechargeable energy storage systems of hybrid locomotives store excess energy from the diesel engine and energy from regenerative braking. The stored energy is used to boost the power from the diesel engine during acceleration. This reduces energy consumption as well as emissions of diesel exhaust. The cycle of braking, idling and acceleration of trains at each stop can be inefficient and highly polluting. On-board rechargeable energy storage systems can mitigate some of the inefficiency and emissions associated with every station stop by storing the kinetic energy that would otherwise be lost with braking, and using it to supplement the diesel engine so that it does not have to operate at a high throttle to achieve acceleration.

Emission control technologies – Various emission control technologies can be applied to diesel locomotives and ships to control emissions of individual components of diesel exhaust. Some of these technologies can result in decreased fuel efficiency and/or increased emissions of another exhaust component, and they must be carefully selected. The US EPA's Tier 2 and 3 emission standards for line-haul locomotives represent currently available technologies to reduce PM and nitrogen oxides emissions. The US EPA's more stringent and health protective Tier 4 emission standards represent state of the art emissions reduction technologies that must be in use on all new line-haul locomotives in the US by 2015. Adoption of Tier 4 technologies requires the use of ultra low-sulphur diesel fuel (ULSD, 15 ppm).

Idling control – Avoidance of unnecessary idling of locomotives and ships along the corridor reduces fuel consumption and diesel exhaust emissions. Idling control benefits the rail operator because it results in fuel savings. In addition to the general fuel savings and emissions reductions, avoidance of prolonged idling prevents the creation of localized areas of highly concentrated air pollution. Automatic Engine Stop/Start Systems shut the locomotive down after no more than 30 continuous minutes of idling. These systems are required on all new or remanufactured locomotives in the US. In addition, EPA expects rail operators to develop appropriate policies detailing when it is acceptable to idle a locomotive to heat or cool the cab. Shore based electrical lines for all ships are currently required, but only if the ships already have them in place, consideration should be given to requiring only ships that are so equipped to be allowed to utilize the docks in these protected marine waters.

Ultra low-sulphur diesel – The use of ultra low-sulphur diesel (ULSD, 15 ppm) reduces emissions of sulphur oxides and PM. Controlling the fuel quality is the primary means by which sulphur oxide emissions from locomotives are reduced.

Regular track and locomotive maintenance – Regular maintenance of the track and locomotives has the potential to increase fuel efficiency and thereby reduce emissions. Regular upkeep on tracks may include assessment and maintenance of the alignment, gauge and curvature of the track. For locomotives, emission-related maintenance includes regular replacement of fuel injectors and air filters, and frequent inspection of other emission-related components to ensure proper functioning. Any maintenance that is reasonably expected to adversely affect the emissions performance of the locomotive should not be performed.

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