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November 18, 2013

Millennium Bulk Terminals-Longview EIS
c/o ICF International
710 Second Avenue, Suite 550
Seattle, WA 98104

Dear Co-Lead Agencies' Representatives for Cowlitz County, WA State Department of Ecology, and U.S. Army Corps of Engineers:

As a resident of Washington state, and more specifically the San Juan Islands, please accept the attached Environmental Impact Statement Scoping Comment on *The Risks of Noise Pollution, Air Pollution and Congestion Caused by Coal Freight Trains* relevant to the Millennium Bulk Terminals Longview (MBTL) permit application, developed in consultation with Al Gillespie.

Based on the findings of significant and unmitagatable adverse impacts, I ask that you deny the permit for the proposed Millenium Bulk Terminals Longview (MBTL).

Sincerely,

Ms. Sophia M. Shoen

Environmental Impact Statement Scoping Comments for the proposed Millennium Bulk Terminals Longview:

The Risks of Noise Pollution, Air Pollution and Congestion Caused by Coal Freight Trains

Sophia Shoen/Alexander Gillespie

November 5, 2013

According to the proposal by Millennium Bulk Terminals (MBT) Longview, when its coal facility is at capacity, it will be shipping a 'nominal' 44 million metric tons of coal per year.[1] To achieve this target, considerable risks will be created in the rail transport of this commodity. These risks should be examined in the Environmental Impact Statement.

1. The base problem and the need for a cumulative view

The North American railroad system has a proud lineage which dates back to 1827. Since that time, it has evolved, expanded, contracted, and rebounded. In the 21st century, this $50+ billion per year industry moves more than 2 billion tons of freight per year on 140,000 miles of track. This industry, which currently employs nearly 200,000 people nationally, is expected to expand considerably in the future. National demand for freight train capacity (aside other rail demands) is expected to double in the next 20 years. In Washington State, the increase is projected to be even greater, as 'significant additional capacity is required at our ports to meet the future forecasts for international cargo flows…' [2] This was necessary because many areas were already at, or near, capacity. For example, the Columbia River Gorge, already utilized by 32 locomotives per day, was believed to be operating at 80% of its capacity.[3] Similar projections are expected in Oregon, of which the overall forecast is for an 80% increase in freight by 2030.[4] A large amount of this growth in both States is projected to be in the transit of coal. For example, in Washington, approximately 60% of all new rail tonnage predicted to be required is attributable to coal and related intermodal freight.[5] The particular issue, (as explained for Washington alone), in their *Draft 2013 State Rail Plan* is:

> The most significant near-term development facing Washington's rail system is the introduction of additional coal traffic that would be exported from the Pacific Northwest.[6]

The current proposal regarding the Millennium Bulk Terminal (MBT) in Longview, WA is part of the overall growth trajectory for the freighting of coal in the Pacific Northwest (PNW). The current proposal will be part of a process that radically increases the scale of rail traffic in general, and of coal traffic in particular, through a number of associated areas.

[1] 2010 Washington State, Joint Aquatic Resources Permit Application: Millennium Bulk Terminals Longview. 2012, February 2nd. Available from, < http://www.ecy.wa.gov/geographic/millennium/20120222_JARPAapplication.pdf> Section 6d.

[2] See Transportation Research Board (2004). *2010 and Beyond: A Vision of America's Transportation Future Twenty-first Century Freight Mobility*. (NCHRP Project 20-24(33) A Final Report) Transportation Research Board (2011). *Impacts of Public Policy on the Freight Transportation System* (NCFRP, Report 6). Tarm, R. (2008). 'Railroads Warn of Chronic Congestion'. *The Capital Times and Wisconsin State Journal*. June 1.

[3] The quote is from Washington State Department of Transport (2009). *Washington State 2010-2030: Freight Rail Plan* (WSDT, Olympia). 9:2. The fact on the Gorge, from 3:28.

[4] Oregon Department of Transportation (2007). *Oregon Transportation Plan*. (ODT, Salem). 3.

[5] Ibid, 4:26.

[6] Washington State Department of Transport. (2013). *Washington State Rail Plan: Public Review Draft.* (WSDT, Olympia). 35.

Broad figures suggest that the number of coal freight trains reaching Longview may go from one or two per day, currently, to perhaps up to 30.

The difficulty with projections in this area is complicated by the fact that not all locomotives, involving overlapping pieces of traffic towards Longview, will end up in Longview, WA, but they may be routed towards other proposed coal ports, such as that at Bellingham, WA. To complicate the matter further, such coal trains may return (empty) via different routes. In addition, it is expected that additional types of fuels will also be freighted on the railways through these areas. This maze of freight, in terms of numbers of trains, how many wagons on each train, what freight is in the wagons, freight hazard, and its destination is very difficult to disentangle.

Each of the proposed new trains for the MBT will pull up to 150 freight wagons each day with each train nearly one third longer than the average train length in the year 2000.[7] At a speed of 50-60 mph, it would take about 3 to 4 minutes for the train, at around one and a half miles in length, to pass a stationary object such as a car at a crossing. At a speed of 35 mph, the travel time would be about 6 to 7 minutes. The impacts of the increased rail traffic will be felt all along the coal railway from Powder River Basin (PRB) to the coal terminals in the PNW. Some critical areas along the route, such as the Columbia River Gorge are particularly exposed. For this critical area, the projection is that while coal freight could go from about 10% of the total rail traffic (about 3 or 4 per day out of a total of about 34 transits currently) to perhaps 58 total transits per day, of which 22 will be for coal). In addition to such high profile areas as the Gorge, and Longview itself, dozens of other communities en-route to Longview (such as, *inter alia*, Umatilla, Irrigon, Boardman, Roosevelt, Arlington, Rufus, Maryhill, Biggs Junction, Wishram, Dallesport, the Dalles, Lyle, Rowena, Mosier, Bingen, White Salmon, Hood River, Carson River Valley, Stevenson, Cascade Locks, North Bonneville, Camas and Vancouver, and, then when making its way to From Portland to the Mouth of Columbia, Portland, Saint Helens, Columbia City, Prescott, Rainier and Cathlamet) may also have to accommodate the increases in both train volume and length.

While it is important for the Environmental Impact Statement (EIS) to assess and model the capacity and impact of the increased level of rail traffic proposed for the MBT, it is equally important for the EIS to critically evaluate the overall increase in rail demand across the board, as opposed to only considering the incremental increase posed by the development of the MBT. In this regard, two cumulative impact assessment studies are required.

The first, a cumulative impact analysis of the region and directly impacted communities within Washington State and Oregon en-route to the proposed MBT site, should include a detailed examination of the existing baseline levels, the current incremental increase proposed for the MBT and other additional traffic that may be reasonably foreseeable in the future. Only by doing this cumulative impact analysis will it be possible to reveal the true extent of the significant risks of the train traffic at hand, thereby avoiding the more myopic

[7] Murray, T. (2010). 'Where's That Coal Train Going?' *Trains* 70(4): 28-37.

analysis that would stem from focusing only upon the incremental addition of trains for the MBT. Such an analysis should consider projects such as the proposed Tesoro Savage project which seeks to transport 360,000 barrels of oil per day through the Columbia River Gorge National Scenic Area. To act otherwise and focus only on the incremental increase will lead to a false and inaccurate assessment of impact and risk.[8]

A second cumulative impact study should also be undertaken which would also work upon the existing baseline, the current proposed increase, and additional increases which are reasonably foreseeable in the future for interdependent rail issues. This is necessary, because as the Draft 2013 State Rail Plan for Washington recognized:

> Washington's rail system is expected to handle more than 260 million tons of cargo by 2035-more than double the volume carried on the system in 2010. This represents a compound annual growth rate of 3.4% for all commodities carried on the rail system. ..[of which coal is only consideration][9]

This wider cumulative study should not be restricted to Washington State as the impacts (e.g., environmental, social, economic and public health) from significantly increased rail activity will also be issues for all the other states along the potential coal shipment, including Wyoming, Montana, Idaho, and in particular, Oregon. In some cases, sections of rail in these other states will carry the biggest projected train loadings and pose the biggest risk to the efficient delivery of rail freight in the region as they contain the largest bottlenecks and choke points along the whole 4,000 mile rail transportation chain from the PRB to the PNW.[10]

This second cumulative study, with full geographical coverage of the whole rail transportation chain, will greatly assist the regional authorities in providing the necessary information to achieve meaningful, longer term planning, at reasonable cost, and in which uncertainties can be removed and effective, appropriate, and sustainable (in economic, cultural, social and environmental) choices can be made.[11]

[8] Kern v. United States Bureau of Land Mgmt., 284 F.3d 1062, 1075 (9th Cir. 2002) (quoting Churchill County v. Norton, 276 F.3d 1060, 1072 (9th Cir. 2001). Note also Fritiosfson v Alexander, 772 F2d 1225, 1243, 1245-1246, (5th Cir. 1985).

[9] Washington State Department of Transport. (2013). *Washington State Rail Plan: Public Review Draft.* (WSDT, Olympia). 42.

[10] Western Organization of Resource Councils. 'Heavy Traffic Ahead Rail Impacts of Powder River Basin Coal to Asia by way of Pacific Northwest Terminals'. July 2012. 64 p.

[11] Zhao, M. (2012). 'Barriers and Opportunities for Effective Cumulative Impact Assessment within State-Level Environmental Review Frameworks in the United States'. *Journal of Environmental Planning and Management.* 55(7): 961-978. Senner, R. (2011). 'Appraising the Sustainability of Project Alternatives: An Increasing Role for Cumulative Impact Assessment'. *Environmental Impact Assessment Review.* 31: 502-505. Hegmann, G. (2011). 'Alchemy to Reason: Effective Use of Cumulative Effects Assessment in Resource Management'. 31 *Environmental Impact Assessment Review*. 31: 484-490. Gunn, J. (2011). 'Conceptual and Methodological Challenges to Cumulative Effects Assessment'. *Environmental Impact Assessment Review*. 31: 154-160. Therivel, R. (2007). 'Cumulative Effects Assessment: Does Scale Matter ?' *Environmental Impact Assessment Review*. 27: 365-385. Burris, R. (1997). 'Facilitating Cumulative Impact Assessment in the EIA Process'. *International Journal of Environmental Studies*. 53: 1-2, 11-29. Thatcher, T. (1990). 'Understanding Interdependence in the Natural Environment: Some Thoughts on Cumulative Impact Assessment under the National Environmental Policy Act'. 20 *Environmental Law*. 611. Eckberg, D. (1986). 'Cumulative Impacts under NEPA'. 16 *Environmental Law*. 673.

This second cumulative study should be particularly cognizant of the impact that any potential rail expansion (in terms of both new infrastructure and radical expansion upon existing infrastructure) is having upon farmland, as the loss of farmland is a national, regional and local concern. The loss of the agricultural resource is already evident in both Washington and Oregon.[12] For example, Puget Sound has lost 60% of its farmland since 1950. Farmland loss is not just about land. It is about the farming communities, the environment they utilize and conserve, and the loss of traditional types rural identity.[13] Due to such concerns, both regions have developed a strong emphasis upon the protection of agricultural land. For example, the Oregon State Legislature has called for the, 'preservation of a maximum amount of the limited supply of agricultural land'.[14] It is factors such as these that should be the focus of the recommended second cumulative study.

2. Indicators of significant risk

There are a large number of relevant standards of regulatory, legislative and other legal instruments from regional, state, federal and international agencies that the MBT development must meet or at least be assessed against to achieve approval. A summary of some of the more relevant standards are provided below:

- The Clean Air Act and associated National Ambient Air Quality Standards (NAAQS)
- Associated standards for the Prevention of Significant Deterioration regulations, and the State Implementation Plan.
- Associated standards promulgated by the North West Clean Air Agency (NWCAA) and Puget Sound Clean Air Agency (PSCAA).
- International best practice on air quality standards. For example, the US standards for 24-hour average PM_{10} is 150 μg/m3 which is 200% higher than the equivalent standard of 50 μg/m3 from the World Health Organization and other OECD countries such as Australia, New Zealand, the European Union and Canada (British Columbia). California also has a State standard of 50 μg/m3, which is consistent with international best practice.
- The (Federal) Noise Control Act
- The Federal Transit Authority, in association with the EPA, Railroad Noise and Diesel Emission Standards
- The (Washington and Oregon State) Noise Control Acts and associated standards from the EPA and the Occupational Health and Safety Administration of the Department of Labor.
- Executive Order 12898, which requires federal agencies to consider the impacts of their actions on minority and low income populations.

[12] Oregon Department of Agriculture (2012). A Perpetual Investment on Oregon's Economy and Environment. (ODA, Salem). Oregon Department of Agriculture (2011). Oregon Agriculture and the Economy. (ODA, Salem).
[13] American Farmland Trust (2012). *Losing Ground: Farmland Protection in the Puget Sound Region* (AFT, Washington). 3-4, 12, 14-17.
[14] Oregon Revised Statutes 215.243.

- The Washington Transportation Plan
- The Oregon Transportation Plan
- Washington State's Department of Transportation Program to reduce congestion
- The Blue Ribbon Commission on Transportation.
- The Oregon Jobs and Transportation Act.
- The Farmland Protection Policy Act
- The (Washington State) Farmlands Preservation Executive Order 8001
- The (Oregon) Land Conservation Act
- The (Oregon) Agricultural Land Use Policy (Oregon Revised Statues 215.243).
- The (Washington State) Growth Management Act.
- The Federal Clean Water Act
- The State Water Pollution Control Act
- The Shoreline Management Act of Washington State.
- The Columbia River Gorge National Scenic Area Act
- The National Historic Preservation Act

3. The significant risks of coal freight

A. Infrastructure

The spread of coal dust is not only detrimental to people, it also impacts on the supporting infrastructure of the railway itself. Research has demonstrated that coal dust escaping from coal wagons can foul the ballast (i.e., the material that makes up the track-bed upon which railroad ties are laid) along rail lines which, in turn, can lead to weakened track structures and pose a serious threat to stability. The impacts of such dust emission are significant and have been identified as a contributing factor to derailments in some regions. [15]

B. Human Health

The air pollution created from the locomotives shipping coal to the MBT can be expected to come from two sources: the diesel powered locomotives, and the cargo they are hauling. With regards to the diesel powered engines, the evidence is already clear that diesel locomotives, especially those which are slow-running, inefficient, and/or older models, can contribute significant amounts of particulate matter to the atmosphere, thus contributing to air pollution.[16]

[15] Freme, R. (2006). 'Coal Review'. *Mining Engineering*. 58(5): 49. Anon (2005). 'Coal Dust Slows Rail'. *Logistics Today.* 46(7): 44.

[16] Huang, L. (2013). 'Composition and Integrity of Pollutants in Diesel Exhaust Particulate Matter'. *Water, Air and Soil Pollution*. 224(8): 1-14. Burchill, M. (2011). 'Monitoring and Analysis of Combustion Aerosol Emissions from Fast Moving Diesel Trains'. *Science of the Total Environment*. 409(5): 985-993. Hopke, P. (2009). 'Contemporary Threats to Air Pollution'. *Atmospheric Environment*. 43(1): 87-93. Matti, M. (2007). 'Chemical Characterization of Particulate Emissions from Diesel Engines'. *Journal of Aerosol Science*. 38(11): 1079-1118. Hutchinson, M. (2001). The Transport Sector as a Source of Air Pollution'. *Atmospheric Environment*. 35(9): 1537-1565.

Similar concerns are also evident with emissions of coal dust which leaches from the back of open wagons. Coal dust is an odorless, fine powdered form of dark brown to black dust created by the crushing, grinding, or pulverizing coal.[17] Its most explosive risk is in combustion and flammability. Coal dust also possesses the ability to cause longer term, detrimental impacts upon both humans and animals. These impacts may appear wherever coal is obtained, stockpiled and, particularly, when it is transported, dumped or otherwise handled (e.g. loading, unloading). At all of these stages there is the potential for the release of small particulate matter (i.e., dust) in significant quantities. Particulate matter, also known as particle pollution or PM, is a complex mixture of extremely small particles and liquid droplets. Particle pollution is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust (including coal dust) particles. The size of particles is directly linked to their potential for causing health problems. The EPA is particularly concerned about particles that are 10μm[18] or smaller in diameter because those are the particles that generally pass through the throat and nose and enter the lungs. Once inhaled, these particles can affect the heart and lungs and cause serious health effects.

The Environmental Protection Agency groups particle pollution into two categories: (i) "Coarse particles" or PM_{10} such as those found near roadways and dusty industries that are larger than 2.5μm and smaller than 10μm in diameter and (ii) "Fine particles" or $PM_{2.5}$ such as those found in smoke and haze, which are 2.5μm in diameter and smaller. These particles can be directly emitted from sources such as forest fires or they can form when gases emitted from power plants, industries and automobiles react in the air.[19]

At the end of 2012, the EPA finalized an update to its national air quality standards for harmful fine particle pollution (PM2.5), including soot, setting the annual health standard at 12 micrograms per cubic meter. The new standard is based on an extensive body of scientific evidence that includes thousands of studies, including many large studies which show negative health impacts at lower levels than previously understood. The EPA estimated the health benefits of the revised standard to range from $4 billion to over $9 billion per year, with estimated costs of implementation ranging from $53 million to $350 million.[20]

The routes of human exposure to coal dust are inhalation, ingestion, and eye contact. These exposures are most well documented with workers in industries associated with coal, such as mining and/or transportation of coal, and/or use of coal. There is a considerable body of international literature about the health effects of exposure to coal dust of respirable particle size (i.e., PM_{10} and smaller). In almost every case, the studies and associated reported health effects relate to coal miners and coal mine sites, either underground or open-cast, with links

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[17] Commonly, it is identified by its content of silicon dioxide which is most commonly found in nature with sand or quartz, with it containing less than 5% of free silica.

[18] One μm is a measure of length and is one-millionth of a metre (or 1/34 millionth of an inch)

[19] *Source: US Environmental Protection Agency Particulate Matter, viewed 27 December 2012, http://www.epa.gov/air/particlepollution/* Also, Querol, X., et al. (1999). 'Characterisation of Atmospheric Particulates Around a Coal-fired Power Station. *International Journal of Coal Geology.* 40: 175–188.

[20] See http://yosemite.epa.gov/opa/admpress.nsf/bd4379a92ceceeac8525735900400c27/a7446ca9e228622b85257ad400644d82!OpenDocument (site visited, January 3rd, 2013).

between workers exposed to various types of dust, overlapping with type, time, amount and location. In excessive amounts, coal dust can cause either acute or chronic impacts. Acute symptoms to excessive amounts of coal dust include coughing, wheezing, and shortness of breath. Chronic exposure to coal dust may result in symptoms of, *inter alia*, pneumoconiosis, bronchitis and emphysema. Coal dust is also a tumorigenic agent in experimental animals, with dusts being shown to be equivocal tumorigenic agents associated with lymphomas and, at the higher dose, adrenal cortex tumors in rats.[21]

Due to such dangers, when people have to work around coal dust, strict standards are enforced to control worker exposure to coal dust, including, *inter alia*, enclosure of the process and/or facility, high levels of ventilation, monitoring and personal protective equipment. Specifically, workers are required to wear respirators (if the dust exceeds prescribed exposure limits), appropriate personal protective clothing and equipment (based on the workers potential exposure to coal dust) that is effective in preventing skin contact with coal dust (e.g., gloves, sleeves, encapsulating suits) and personal hygiene procedures, whereby all clothing contaminated with coal dust is removed and cleaned, and workers are able to wash any affected skin areas with soap and water.[22]

While the scientific evidence of the effects on people working with or around coal is well documented and robust, the same cannot be said for the literature dealing specifically with environmental exposure of coal dust on the general community. This lack of evidence is problematic as it cannot be construed as a demonstration that coal dust does *not* have an impact on the general community outside the direct coal industry but rather that there have been few such specific studies as they are difficult to undertake and results can often be inconclusive. However it is a widely accepted fact that when coal is transported in open-top freight wagons, there are a number of ways by which a considerable amount of coal dust may be lost en-route to and from its destination, including spillage when loading, escaping from doors or seams, or by being blown out of the top of open wagons which the most common mechanism by far.

Although the published literature on the amount of fugitive dust that leaves standard, open wagons is not extensive, general figures would suggest that between 0.05% and 1% (and potentially up to 3%) of each coal wagon is lost as fugitive dust over a 600 mile trip.[23] For coal wagons such as those presently proposed for coal freight, this would be in the region of 500 pounds to a ton of coal dust, from mine to ship.

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[21] United States Department of Labor. (2012). Occupational Safety and Health Guideline for Coal Dust (< 5% SiO2). 2-5. Jennings, R. and Flahive, M. (2005). *Review of Health Effects Associated With Exposure to Inhalable Coal Dust*. (Coal Services Pty Ltd). Finkelman, R. (2002). 'Health Impacts of Coal and Coal Use'. *International Journal of Coal Geology* 50: 425–443. Attfield, M. (1997). Exposure Response for Coal Workers' Pneumoconiosis'. *The Annals of Occupational Hygiene* 41(1): 341–345.

[22] United States Department of Labor. (2012). *Occupational Safety and Health Guideline for Coal Dust* (< 5% SiO2). 6-7.

[23] Ferreira, A. (2003). 'Full-Scale Measurements for Evaluation of Coal Dust Release from Train Wagons with Two Different Shelter Covers'. *Journal of Wind Engineering and Industrial Aerodynamics* 91: 1271–1283. Lazo, J. et al. (1996). 'Community Perceptions, Environmental Impacts, and Energy policy: Rail Shipment of Coal'. *Energy Policy* 24: 531–540. OECD (1983). *Coal—Environmental Issues, Remedies* (OECD, Paris). 43-45.

Whilst studies on emissions of coal dust have not documented direct evidence of health impacts for humans or flora, fauna, crops and livestock that can be directly attributable to coal dust from wagons either inside or outside of the rail corridor, other evidence is raising serious questions about the reliability and sensitivity of such studies. Specifically, there is the risk of the unintended escape of damaging amounts of coal dust into sources of fresh water, contrary to the Clean Water Act.[24]

There is also the difficulty, identified in an increasing number of studies, of the direct link between health issues and living or working close to coal mines or facilities. For example, increases in asthma incidence in a community living 'near' an open cast coal mine site in Australia have been noted.[25] Links between respiratory ill-health in school children in parts of Britain exposed to coal dust (and other overlapping pollutants) have also been identified in at least two locations.[26] Similarly, within the United States, public health records data for nearly 16,500 persons in West Virginia have shown a negative relationship between health indicators (in terms of higher rates of cardiopulmonary disease, chronic obstructive pulmonary disease, hypertension, lung disease and kidney disease) and residential proximity to coal mining activities, including transportation.[27]

While coal dust provides a very visual source of pollution, there are other carcinogens, toxic pollutants and other harmful agents that are produced as a byproduct of rail transportation. These include, but are not restricted to, noise, diesel particulate matter, and heavy metals. Some of the documented health effects from these agents include increased cardiopulmonary mortality and overall mortality, increased severity and frequency of asthma attacks, cognitive impairment in children, increased rates of myocardial infarction, cardiovascular disease, increased blood pressure, and arrhythmia. The levels of these health impacts in people along the coal rail routes and alongside the tracks will presumably increase in direct proportion to the overall increase in the amount of rail freight carrying coal in an inefficient manner, through which coal dust causes localized pollution.

Due to the evidence that already exists in this area, and the need to take a precautionary approach when considering matters of public health, there is a justified need to conduct a formal Health Impact Assessment (HIA)[28] of the MBT project and its implications for public and environmental health. In this particular instance, the HIA should, in accordance with Executive Order 12898, specifically consider the impacts of the project to ensure that the burden of the environmental and health impact is not borne disproportionately by minority and low-income populations that the coal wagons pass through. Such an approach will help evaluate the potential health effect (including identification of which groups are likely to be impacted upon) of a plan, project or policy before it is built or implemented. It should also be

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[24] Note, Sections 230 and 404 of the Clean Water Act.

[25] Temple, J. and Sykes, A. (1992). 'Asthma and Open Cast Mining'. *British Medical Journal*. 305, 396.

[26] Department of Epidemiology and Public Health (1999). Do Particulates from Opencast Coal Mining Impair Children's Respiratory Health? (University of Newcastle-upon-Tyne). Brabin, B. et al. (1994). 'Respiratory Morbidity in Merseyside School Children Exposed to Coal Dust and Air Pollution'. *Arch Diseases in Childhood* 70: 305.

[27] Hendryx, M. (2008). 'Relations between Health Indicators and Residential Proximity to Coal Mining in West Virginia'. *American Journal of Public Health*, 98: 669-671. Harkinson, J. (2011). 'Death of a Coal Town'. *Mother Jones* 36(2):14.

[28] See http://www.cdc.gov/healthyplaces/hia.htm

able to provide recommendations to increase positive health outcomes and minimize adverse health outcomes. HIA brings potential public health impacts and considerations to the decision-making process for plans, projects, and policies that fall outside the traditional public health arenas, such as transportation and land use. Such an assessment would be consistent, for both governments and the commercial sector, with best practice in this area.[29]

C. Noise

The response of the human ear to sound depends both on the sound frequency, which is measured in Hertz, and the sound pressure on the eardrum, which is measured in decibels (dB). The unit A-weighted dB(A) is used to indicate how humans hear a particular sound. A soft whisper at one meter is about 30 dB(A). For a good night's sleep, the equivalent sound level should not exceed 30 dB(A) for continuous background noise. The sound pressure level of normal speech is about 50 dB(A). In a busy restaurant, the level is roughly equivalent to 55 dB(A), while 75 to 80 dB(A) is approximately the noise levels that can be heard at a very busy intersection or motorway. Heavy industries typically operate between 92 to 96 dB(A). A chainsaw can reach 110 dB(A). The sound level of 150 dB(A) can be found standing next to a Boeing 747 with its engines at full throttle.[30]

There is considerable variation in the type and volume of noise that is produced from a train. It will vary hugely depending on factors such as speed, locomotive and wagon type and age, size of the train (e.g., number of locomotives and wagons), load configuration and weight, type and condition of the track and, as such, it is difficult to generalize about train noise. To truly understand the noise produced by a specific train, it needs to be measured directly and empirically. That fact notwithstanding, advice from the Federal Transit Authority (FTA) has indicated that a single diesel locomotive operating at 50 mph on ballast and tie track with continuous welded rail generates a sound exposure level of 92 dB(A) at a distance of 50 feet from the track centerline. A single freight railcar or passenger car operating under the same condition produces 82 dB(A) at a distance of 50 feet from the track centerline.[31]

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[29] Negev, M. (2012). 'Integration of Health and Environment through Health Impact Assessment'. *Environmental Research*. 114: 60-67. Morgan, R. (2011). 'Health and Impact Assessment'. *Environmental Impact Assessment* 31: 404-411. Tamburrini, A. (2011). 'Enhancing Benefits in Health Impact Assessment through Stakeholder Consultation'. *Impact Assessment and Project Appraisal.* 29 (3): 194-204. Wernham, A. (2011). 'Health Impact Assessments are Needed in Decision Making'. *Health Affairs* 30(5): 947-955. Danneberg, A. (2008). 'Use of Health Impact Assessments in the United States'. *American Journal of Prev. Medicine.* 34(3): 241-255. Briggs, D. (2008). 'A Framework for Integrated Environmental Health Impact Assessment'. *Environmental Health.* 7: 61-69. Cole, B. (2007). 'Health Impact Assessment: A Tool to Help Policy Makers'. *Annual Review of Public Health.* 28: 393-412. Birley, M. (2005). 'Health Impact Assessment in Multinationals'. *Environmental Impact Assessment Review.* 25: 702-713.

[30] Coghlan, A. (2007). 'Dying for Some Peace and Quiet'. *New Scientist*, Aug. 25. At 6-9. Chepisuik, R. (2005). 'Decibel Hell'. 113 *Environmental Health Perspectives.* A35, A37. De Jong, (1996). 'Is Freight Traffic Noise More Annoying Than Passenger Traffic Noise?' *Journal of Sound and Vibration.* 193(1) 35-38. *Mercier, V. (2002). 'Is Electronically Amplified Music Too Loud?'. Noise and Health.* April 16, 48. Mercier, V. (2003). 'Sound Exposure of the Audience at a Music Festival'. *Noise and Health,* May 19. 51-58. World Health Organisation (2001). *Occupational and Community Noise.* (WHO, Geneva. WHO Doc. N°258). 8. Griefahn, B. (2004). 'Protection Goals for Residents in the Vicinity of Airports', *Noise and Health,* 51-62. Alberti, P. (2003). *Pathophysiology of the Ear.* (WHO, Geneva). 63, 66.

[31] *5.8.1.1 Noise Projections in Section 5 Environmental Consequences in Springfield Rail Improvements Project Vol II. p. 5-39.* http://www.fra.dot.gov/eLib/details/L03985. Gidlof, A. (2012). 'Railway Noise Annoyance and the Importance of Number of Trains, Ground Vibration, and Building Situational Factors'. 14(59) *Noise and Health.* 190-201.

The documented and specific effects of noise pollution (not specific to rail) include: noise-induced hearing impairment, interference with speech communication, disturbance of rest and sleep, psychophysiological, mental health and performance effects, effects on residential behavior and annoyance, and interference with intended activities. To avoid acute mechanical damage to the inner ear, adults should never be exposed to more than 140 dB(A) of noise, even for very short periods. For children, the level is 120 dB(A). In terms of prolonged exposure, the evidence suggests that susceptible individuals may develop permanent effects such as hypertension and ischemic heart disease. Workers exposed to high levels of industrial noise for between five to thirty years may show increased blood pressure and an increased risk of hypertension. Cardiovascular effects have also been demonstrated after long-term exposure to air- and road-traffic with values of 65 to 70 dB(A). Prolonged exposure to very loud noise levels between 90 and 115 dB(A) has been linked to cardiovascular risks and also to suicide.[32]

Excessive (i.e., above 55 dB(A)) and especially prolonged noise can adversely affect performance of cognitive tasks. For places of learning (e.g., pre-school, school, and higher education) where understanding speech and communication of complicated ideas is critical to learning, background noise levels should not exceed 35 dB(A) during teaching sessions. An even lower sound level may be required for hearing-impaired children. In schools with noise levels exceeding these limits, children often under-perform in proof-reading, persistence on challenging puzzles, tests of reading acquisition, and motivational capabilities. Even repeated, but ad-hoc exposure, such as living in the vicinity of a major source of noise may detrimentally impact children's memory. The World Health Organization noise guidelines for areas such as hospitals are for between 30 dB(A) and 40 dB(A), depending on the time of day and the location of the hospital. If the goal is to protect patients with a susceptibility to stress, the level should not exceed 35 dB(A).[33]

In addition to the impacts of noise upon human communities, terrestrial animal communities are also vulnerable. The most observable effect of noise on wild animals appears to be behavioural changes. While many animals learn to differentiate among acoustic stimuli and to adapt and live with different types of noise pollution, others have gone in the opposite direction and have shown strong sensitivities to noise pollution. While those that are wild are able to leave an area, those that are domestic, often do not have the same option. In this regard, between findings of negligible impact of rail noise upon domesticated species, yet below findings of high impact, a middle bracket exists of moderate impacts in which breeding and/or related food production is reduced. Recent scientific evidence has shown that

[32] World Health Organization (2004). *Guidelines for Community Noise.* (WHO, Geneva). *http://whqlibdoc.who.int/hq/1999/a68672.pdf*

[33] World Health Organisation. (1999). *Guidelines for Community Noise. (*WHO, Geneva). 3. Lee, C. (2002). General Health *Effects of Traffic Noise. (*US Department of Transportation, MA). Bluhm G. (2004). 'Road Traffic Noise and Annoyance- An Increasing Environmental Health Problem'. 6(24) *Noise and Health* 43, 43. Griefahn, B. (2004). 'Disturbed Sleep Patterns and Limitations of Noise'. 6(22) *Noise and Health* 27, 31. Matsui, T. (2004). 'Children's Cognition and Aircraft Noise at Home - The West London Schools Study'. *Noise and Health* 25, 49-58. Matheson, M. (2003). 'The Effect of Chronic Aircraft Noise Exposure on Children's Cognition and Health'. 5 *Noise and Health* 31-40. Raloff, J. (1987). 'Airport Noise Linked With Heart Disease'. *Science News.* 123:19

animal reproduction, even for species common in urban areas, under noisy conditions can be reduced. These reductions may carry a direct economic cost.[34]

Finally, the impact of excessive anthropogenic noise from such sources as the coal trains en-route to the MBT upon areas which have enhanced conservation values, such as the Columbia River Gorge, need to be reconciled. This is because it has been demonstrated in a number of similar protected areas that excessive anthropogenic noise can, if not controlled, directly undermine the values that were meant to be conserved.[35]

D. Congestion

Rail is an energy-efficient and often cleaner transportation alternative to many other modes. It can also have a beneficial effect in reducing highway congestion via the reduction of competing methods of transport, such as truck traffic. However, if rail transportation is utilized in a short-sighted manner, it can end up creating the very problems it is advocated as resolving, such as transport congestion. Congestion, as the Blue Ribbon Commission on Transportation noted, is a key indicator of transportation dysfunction.[36] Traffic congestion has direct and forceful economic and social impacts.

The manifestations of this dysfunction are slower speeds, longer trips, and long lines of idling vehicles. Both Washington State and Oregon are very familiar with this type of dysfunction. Currently between 60 and 80% of all urban interstate highways are congested in Washington State and the annual average rate of congestion (i.e., 40 hours per year) is exceeded in many places. In 2010, vehicle hours of delay increased by 13% above the 2009 average, with each person spending 12% more time delayed in traffic.[37] In parts of Oregon, the problem has reached such levels, that the legislators have been forced to adopt progressive road pricing policies as ways to lessen congestion on key roads.[38]

Similar congestion problems are also appearing in parts of the rail network, with some sections already exhibiting delays comparable to the worst examples in the United States. The fear is that, without substantial foresight and planning, rail congestion could also increase

[34] Halfwerk, W. (2011). Negative Impact of Traffic Noise on Avian Reproductive Success'. *Journal of Applied Ecology*. 48: 210–219.

[35] Barber, J. (2012). 'The Costs of Chronic Noise Exposure for Terrestrial Organisms'. *Trends in Ecology and Evolution*. 25(3): 180-190. Shier, D. (2012). 'Beyond Masking: Endangered Species Respond to Traffic Noise'. *Biological Conservation* 150(1): 53-58. Barber, J. (2011). 'Anthropogenic Noise Exposure in Protected Natural Areas'. *Landscape Ecology*. 26(9): 1281-1295. Stack, D. (2011). 'Reducing Visitor Noise Levels at Muir Woods National Monument'. *Journal of the Acoustical Society of America*. 129(3): 1375-1380. Mcdonald, R. (2009). 'Urban Effects, Distance and Protected Areas in an Urbanising World'. *Landscape and Urban Planning*. 93(1): 63-75.

[36] The Blue Ribbon Commission on Transportation. *Final Recommendations to the Governor and Legislature* (adopted November 29, 2000). 6.

[37] TomTom (2012). *North American Congestion Index*. 4, 5, 24-26. Washington State Department of Transportation (2011). *The 2011 Congestion* Report. (WSDOT). 3-5. Washington State Department of Transport (2009). Washington State 2010-2030: Freight Rail Plan (WSDT, Olympia). 9:2, 3:27. The Blue Ribbon Commission on Transportation. *Final Recommendations to the Governor and Legislature* (adopted November 29, 2000). 13-14. See Transportation Research Board (2004). *2010 and Beyond: A Vision of America's Transportation Future 21st Century Freight Mobility*. (NCHRP Project 20-24(33) A Final Report) Transportation Research Board (2011). *Impacts of Public Policy on the Freight Transportation System* (NCFRP, Report 6).

[38] Li, H. (2010). 'Patterns of Traffic, Congestion in Oregon'. *Transportation Research Record*. 2178: 101-110.

rapidly in coming decades. This is especially so in the Pacific Northwest.[39] Earlier reports from 2006 identified six congested lines, 11 constrained lines and 11 lines that were expected to exceed practical capacity by 2015 across the Washington rail network, including the additional capacity gained by operating longer trains and implementing better scheduling. Growth projections suggest that the total freight tonnage moved over the Washington State and Oregon rail systems is going to increase rapidly over the next decades. Demand for freight trains alone, nationally, is expected to double in the next 20 years. In Washington State, the increase is projected to be even greater as, 'significant additional capacity is required at our ports to meet the future forecasts for international cargo flows…'.[40] The impact of this growth in demand, on top of existing high levels of congestion, is highly dependent on the rate of growth and the mitigations adopted.[41]

It has been recognized for nearly 100 years that every time there is congestion (e.g., waiting for trains to pass crossings), it causes a loss of time for those stuck. The loss of this time may have implications in terms of lost productivity on both a personal and a professional level. As it currently stands, drivers consistently demonstrate a willingness to pay, on average, $1.33 to save ten minutes travel time, or at least $8.00 per hour, just to move at a standard speed. This means that in standard situations (and not the enhanced ones that are being proposed) the annual cost of being stuck in congestion comes to about $1,000 per driver, per year. Traffic congestion is also bad for the economy costing at least $50 billion per year in lost/restricted productivity. However, this is a difficult figure to dissect, as the economic impacts of congestion are often difficult to predict as each sector in a community responds differently. Despite these differences, it is clear that businesses that rely on efficiencies of time based upon the travel time between physical locations will make active choices to avoid areas of congestion, including (dependent on the weight of other factors) by relocation of the business. The attractiveness of relocation increases as the congestion gets worse. Within Washington State, when quantifying this delay in terms of total dollars, the cost to drivers and businesses was over $750 million in 2010 based on maximum throughput speed thresholds.[42]

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[39] Leachman, R. (2011). 'Congestion Analysis of Waterborne, Containerized Imports from Asia to the United States'. *Transportation Review*. 47(6): 992-1004. Washington State Transport Commission (2010). *Washington Transportation Plan 2030. Connecting Communities for a Prosperous Future*. December 2010. Rodrigue, J. (2010). 'Comparative North American and European Gateway Logistics: The Regionalism of Freight Distribution'. *Journal of Transport Geography*. 18(4): 497-507. Washington State Department of Transport (2009). *Washington State 2010-2030: Freight Rail Plan* (WSDT, Olympia). 26, 9:2. Rodrigue, J. (2008). 'Transmodal Rail Freight Distribution in North America'. *Journal of Transport Geography* 16(4): 233-246. Washington State Transport Commission (2006). *Statewide Rail Capacity and System Needs Study*. 73 Bernstein, M. (2004). 'Supply Chains Face Peril as Rail Freight Capacity Nears Limits'. *World Trade*. 17(11): 18.

[40] Washington State Department of Transport (2009). *Washington State 2010-2030: Freight Rail Plan* (WSDT, Olympia). 4:26. Transportation Research Board (2004). *2010 and Beyond: A Vision of America's Transportation Future 21st Century Freight Mobility*. (NCHRP Project 20-24(33) A Final Report) Transportation Research Board (2011). *Impacts of Public Policy on the Freight Transportation System* (NCFRP, Report 6). Tarm, R. (2008). 'Railroads Warn of Chronic Congestion'. *The Capital Times and Wisconsin State Journal*. June 1.

[41] BST Associates & Mainline Management (2011). *Pacific Northwest Marine Cargo Forecast Update and Rail Capacity Assessment* Final Report. Prepared for Pacific Northwest Rail Coalition. 46 p.

[42] Washington State Department of Transportation (2011). *The 2011 Congestion Report.* (WSDOT). 3-5. Lavis, F. (1927). 'Grade Crossings. The Money Value of a Car-Minute'. *Annals of the American Academy of Political and Social Science*. 133: 172-177. Verheof, E. (2010). *The Economics Of Traffic Congestion*. (Edward Elgar, London). 2 Volumes. Sweet, M. (2011). 'Does Traffic Congestion Slow the Economy?' *Journal of Planning Literature* 26: 391-412. Goodwin, P. (2004). *The Economic Costs of Road Congestion*. (ESRC Transport Studies Unit University College London Arnett, R. (1994). 'The Economics of Traffic Congestion'. *American Scientist*. 82: 446-456.

Supplemental economic losses from increased congestion and the related impacts such as noise (and air) pollution from both trains and overlapping traffic are also quantifiable. These impacts can take up to 7 to 12% off the value of a standard residential house, if it is within 750 feet of a track that carries freight wagons. These figures can change dramatically depending on what amenity values are lost.[43] These private losses are supplemented by the losses to community property, such as parks, which also have an economic and social value that can be quantified.[44]

In certain instances, congestion may also prevent the flow of essential services, such as for emergencies. The loss of time may cause impatience, stress and rage for the people in the vehicle, and air pollution (owing to increased idling, braking, starting and stopping) outside the vehicle. In this regard, particulate matter emissions which can be traced back to traffic congestion in the nation's 83 largest urban areas led to more than 2,200 premature deaths in the United States during 2010, with at least $18 billion in related public health costs.[45] Congestion can also cause spill-over effects as people try to find alternate routes to their desired location, which may in turn impact upon the latter's amenity values and real estate prices.

E. Visual Impact

A final foreseeable risk, which may be significant, stemming from the coal freight going to the MBT is the impact it may have on some key aesthetic sites en-route. The foremost example of this is with the Columbia River Gorge. This is a narrow gap in the Cascade Mountains of Washington and Oregon. Cut by the flow of the Columbia River, the Gorge is approximately 190 kilometers in length, 5 kilometres wide (at river level), and 1,000 metres deep. The natural features of this area are so great that in its November/December 2009 issue, *National Geographic Traveller* ranked the Columbia Gorge region sixth internationally, and second in the nation, among "iconic destinations." The Gorge was ranked higher than all of the national parks that were surveyed in the United States, and higher than Tuscany, Italy; the Serengeti Plains; and Mount Kilimanjaro. A primary reason given by *National Geographic* for the Gorge's high ranking was the Gorge's international reputation for, 'an incredible job of protecting the views'. Another stated reason was the Gorge's

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[43] Andersson, H. (2010). 'Property Prices and Exposure to Multiple Noise Sources: Hedonic Regression with Road and Railway Noise'. *Environ Resource Econ.* 45:73–89. Arsenio E, (2006) 'Stated Choice Valuations of Traffic Related Noise'. *Transp Environ* 11(1):15–31. Baranzini A, (2005) 'Paying for Quietness: the Impact of Noise on Rents'. *Urban Stud.* 42(4):633–646. Day B, (2007) 'Beyond Implicit Prices: Recovering Theoretically Consistent and Transferable Values for Noise Avoidance from a Hedonic Property Price Model'. *Environ Resour Econ* 37(1): 211–232. Simons, R. (2004). 'The Effects of Freight Railroad Tracks and Train Activity on Residential Property Values'. *The Appraisal Journal.* 72(2): 223-233. Theebe, M. (2004). 'Planes, Trains and Automobiles: The Impact of Traffic Noise on House Prices'. *Journal of Real Estate Finance and Economics*. 28 (2): 209-234. Miedema, H (2001). 'Annoyance from Transportation Noise: Relationships with Exposure Metrics'. Environ Health Perspect 109(4):409–416. Wilhelmsson, M (2000) 'The Impact of Traffic Noise on the Values of Single-Family Houses, *Journal of Environmental Planning and Management.* 43(6):799–815. Nelson, JP (1982) 'Highway Noise and Property Values: A Survey of Recent Evidence. *Journal of Transport and Economic Policy* 16(2):117–138.

[44] Millward, A. (2011). 'Benefits of a forested urban park: What is the value of Allan Gardens to the city of Toronto, Canada?'. *Landscape and Urban Planning*. 100: 177–188.

[45] Levy, J. et al. (2011). *The Public Health Costs of Traffic Congestion: A Health Risk Assessment.* (Harvard Centre for Risk Analysis, a report for the Transportation Construction Coalition).

'[g]reat potential for 'agritourism and geotourism'.[46] Since this point, the multiple eco-tourism options within the Gorge have repeatedly brought the Gorge to international attention, for its outstanding reputation as being amongst, if not the, best sites on the planet for certain sports such as windsurfing or kiteboarding.[47]

The outstanding natural features of this gorge are so impressive that they are federally protected under the Columbia River Gorge National Scenic Area Act.[48] The purpose of the Act was to establish a national scenic area to protect and provide for the enhancement of the scenic, cultural, recreational and natural resources of the Columbia River Gorge; to protect and support the economy of the Columbia River Gorge area by encouraging growth to occur in existing urban areas and to allow future economic development in a manner consistent with this national scenic area.[49] That is, although 13 designated urban areas were retained within this National Scenic Area, the intention of this Act is to stop any developments that will have an adverse effect on the features that makes this area so unique. As a question of law, adverse effect means a reasonable likelihood of more than moderate adverse consequences for the scenic, cultural, recreation or natural resources of the scenic area.[50] Moreover, the Management Plan for the National Scenic Area requires that, 'the air quality shall be protected and enhanced, consistent with the purposes of the Scenic Area Act'.[51]

In light of the above comments, the particular adverse impact that the EIS needs to consider, in relation to the coal trains going through the Gorge is, in addition to their massively increased frequency (and what this represents to the aesthetics of the area) but also, their contribution to one of the biggest problems facing the Gorge at the moment: air pollution. Numerous urban and industrial sources in the region already emit gaseous or particulate air pollution than may contribute to light scattering in the Gorge. Pulp and paper mills, coal fired power plants, some large farming operations and some small cities in the Gorge all contribute some of the ingredients needed to help form the smog. Collectively, such sources mean that the Gorge can reach levels of air pollution only experienced in poorly regulated developing countries.[52]

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[46] http://traveler.nationalgeographic.com/2009/11/destinations-rated/north-america-text/18

[47] Sinton, D. (2002). 'Extreme Winds in the Western Columbia River Gorge'. *Northwest Science*. 76(2): 173-179.

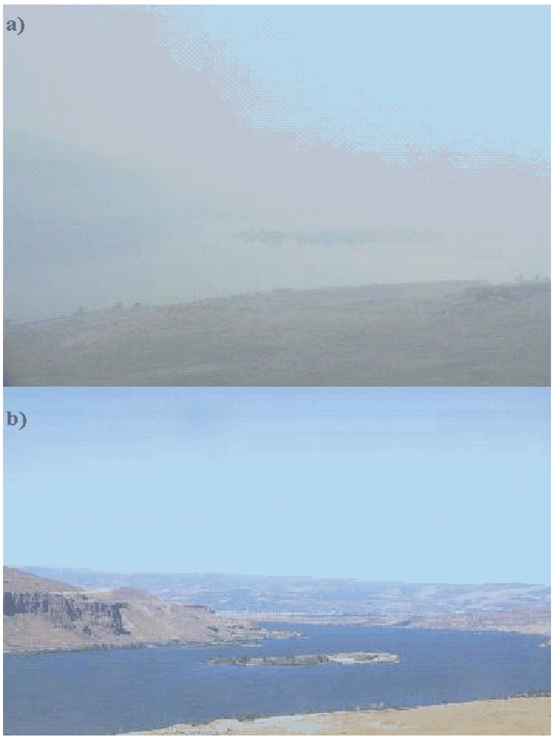
[48] 16 U.S.C ss. 544. For commentary, Blumm, M. (2012). 'The Columbia River Gorge and the Development of American Natural Resources Law: A Century of Significance'. *NYU Environmental Law Journal.* 20:1-35. Watters, L. (1993). The Columbia River Gorge National Scenic Area Act'. *Environmental Law* 23: 1126-1142.

[49] ss. 544a, Section 3, purposes.

[50] Section 2. Determination of this is based on the context of a proposed action, the intensity of the proposed action (including the magnitude and duration of the impact and the likelihood of its occurrence); the relationship between the proposed action and other similar actions which are individually insignificantly but may have cumulatively significant impacts; and proven mitigation measures which would reduce otherwise significant affects to an insignificant level.

[51] Columbia Gorge National Scenic Area Management Plan. I:3-32-33.

[52] See Jaffe, D. (2009). 'Now You See It, Now You Don't: Air Quality in the Columbia River Gorge National Scenic Area'. *Atmospheric Chemistry Physics* 9: 7997-8005. Green, M. (2008). 'Transport of Atmospheric Aerosol by Gap Winds in the Columbia River Gorge'. *Journal of Applied Meteorology and Climatology*. 47: 15: 26. Green, M. (2007). 'Causes of Haze in the Columbia Gorge'. *Journal of Air and Waste Management Association*. 57(8): 947.
Blumm, M. (2006). 'Protecting the Columbia River Gorge: A Twenty Year Experiment in Federal Land-Use Federalism'. *Journal of Land Use*. 21 (2) 201, 224-226.



The view looking the at the Gorge is pristine, and less than ideal is other situations[53]

The obvious studies that need to be undertaken in light of the above considerations, are the potential future contribution of both the diesel powered locomotives and the dust that originates from what they haul to the problem of air pollution in the Columbia River Gorge. In the first instance, the impact of such a heavy industrial activity as coal freight which may expand from about 10% of the total rail traffic (about 3 or 4 per day, currently, out of a total of about 34 transits currently) to perhaps 58 total transits per day, or which 22 will be for coal). The impacts of this additional traffic upon a preserved landscape of outstanding aesthetic value cannot be understated[54] and needs to be studied within the obligations and goals of the law protecting the Scenic Area. In the second instance, the coal dust from the freight that is being transported needs to be examined to see what its contribution (in addition to the particulate matter generated from the locomotives) is to the air pollution problems in the Gorge which are systematically under-cuttings the latter's legally recognised values.

F. Historical Sites

Finally, the EIS needs to reconcile the potential impact of the development upon any historical sites of national significance. Within the geographical area of the Gorge to the mouth of the Columbia River, this issue is particularly important with regards to the Lewis and Clark National Historic Trail, of which the Lewis and Clark Trail Management Plan

[53] This picture is from page 23 in Green, M. (2008). 'Transport of Atmospheric Aerosol by Gap Winds in the Columbia River Gorge'. *Journal of Applied Meteorology and Climatology*. 47: 15: 26.
[54] Flad, H. (1997). 'Country Clutter: Visual Pollution and the Rural Landscape'. *Annals of the American Academy of Political and Social Science*. 553(1): 117-129.

recognises at least 18 sites that may be impacted upon by the expansion of coal traffic in this region, and numerous culturally significant sites.

4. Alternatives

The most obvious alternative is the selection of routes which do not threaten human communities or areas of high environmental and cultural values in terms of air pollution, noise emissions and traffic congestion. In this regard, alternate routes which avoid all of the key areas should be investigated.

5. Mitigation

Mitigation actions should, ideally, render potentially significant impacts insignificant. This is not possible in this situation. However, what is possible is a reduction in the magnitude of the significant risks.[55] This reduction (not elimination) of risk may be found in improving rail operations in three main areas – noise, coal dust and congestion.

A. Noise

Scheduling, time control and re-routing
Perhaps the easiest mitigation option for controlling the effect of noise emissions from freight trains on urban areas is controlling the flow in terms of times and/or speed. Subject to operational constraints, this approach can be used to timetable trains to times or places where lower noise levels are desirable, such as at night and it can be encouraged through the use of economic incentives, as is the practice in Europe. Of course this approach does not actually mitigate the noise produced by trains but only shifts the normal levels of noise to other times or places.[56]

Controlling the times that the train's horn must be used is also an effective mitigation measure. In this regard, 'quiet zones', in accordance with the new rules issued by the Federal Railroad Association, can be utilized for 'safe' stretches of tracks which do not permit whistles. 'Safe' tracks are those that are generally supplemented with safety systems such as medians, quadrant gates and pre-signals to warn vehicles and pedestrians of approaching trains. While this can be an effective mitigation measure, it is frequently a relatively expensive option as the infrastructure required to make a crossing 'safe' to comply with the 'quiet area' standards is generally large and the full cost is normally borne by the local or regional authority rather than the rail company.

[55] See Eccleston, C. (2012). *Preparing NEPA Environmental Assessments*. (Taylor and Francis, NYC). 47.
[56] European Union Directorate General for Energy and Transport. *MEMO – Rail Noise Abatement Measures.* 6 p. Federal Railway Administration (2012). *Chicago to St. Louis High-Speed Rail Program. Tier 1 Final Environmental Impact Statement Tier 2 Evaluation of Springfield Rail. Volume II - Section 5 – Environmental Consequences. 63 p.* King, A. (2011). Implementation of the EU Environmental Noise Directive'. *Journal of Environmental Management.* 92: 756-764.

Maintenance

One of the major causes of excessive train noise is poor maintenance. Enhanced maintenance of existing stock and rail to ensure everything is running efficiently should be an essential part of standard operational procedures. To better characterize this issue, it would be useful to evaluate the main sources of existing rail noise to determine the component that is due to poor or irregular maintenance. Depending on the results of this, it may be possible to improve the nature and frequency of maintenance schedules to reduce general noise. This additional maintenance would have to be met by the rail companies and, if they were not willing to comply voluntarily, it may require regulation.

Technological Options

More substantive measures involve the use of technological change. Great strides have already been made by technological developments that reduce noise emissions with motor vehicles (i.e., cars, trucks and planes are 85%, 90%, and 75% quieter than they were in 1970 respectively).[57] Similar improvements have been made with rail and potentially there is no end to where technological advances could be applied to locomotives, wagons and also to the lines themselves. The first step in this area would be an understanding of the contribution of each component part of overall train noise. This understanding would indicate what areas may be the most useful in investigating technological advancements. A good example of this can be found in Europe where regulations have supplemented technological developments in the area of brakes on freight wagons (i.e., by replacing iron brake blocks with less abrasive synthetic brake blocks) which can reduce noise levels by around 10 dB(A) or more and is cost-neutral when building new wagons. In 2003, the International Union of Railways approved the use of synthetic brake blocks in international traffic for specific types of wagons and, since then, all new railway wagons in Europe have been fitted with the new technology and thousands of old ones have been retrofitted.[58] The expected net benefit of this approach is the reduction of the perceived level of noise emissions of freight trains by about 50% by 2014. Supplemental technological mitigation measures for rail-beds could include the use of ballast mats, resiliently supported ties, tire derived aggregate, floating slabs, and special track-work at crossovers and turnouts.[59]

Another technological mitigation that should be investigated is the introduction of noise insulation around communities which are at risk of excessive noise pollution. European

[57] See International Civil Aviation Organization. (2009). *Environmental Report. (*ICAO, Chicago). 20, 24-28. U.N. Econ. & Soc Council (2006). *Inland Transportation. Committee. Report of the World Forum for Harmonization of Vehicle Regulations,* U.N. Doc. ECE/TRANS/WP.29/1056. FEHRL, (2006). *Tyre/Road Noise (Final Report SI2.408210) Vol. 1.*

[58] Anon (2011). 'Whispering Brakes Reduce Freight Train Noise'. *International Railway Journal.* 51(5): 12-16. Thompson, D. (2003). 'Brake and Wheel Design Can Cut Train Noise'. *Railway Gazette International.* 159(10): 639-644. Lunstrom, A. (2003). 'The New Policy of the European Commission for the Abatement of Railway Noise'. *Journal of Sound and Vibration* 267: 397-405. Frid, A. (2006). 'Noise Control Design of Railway Vehicles–Impact of New Legislation'. *Journal of Sound and Vibration* 293: 910–920. Leth, S. (2003). 'Train Noise Reduction Scenarios for Compliance with Future Noise Legislation'. *Journal of Sound and Vibration* 267: 675–687. Hubner, P. (2007). *Status Report and Background Information on Noise Related Track Access Changes.* (Swiss Federal Office for the Environment). 3. *Int'l Union of Ry (2007), Status Report: Noise Reduction in European Railway Infrastructure,* 4-5.

[59] European Union Directorate General for Energy and Transport. *MEMO – Rail Noise Abatement Measures*. 6 p. Federal Railway Administration (2012). *Chicago to St. Louis High-Speed Rail Program. Tier 1 Final Environmental Impact Statement Tier 2 Evaluation of Springfield Rail. Volume II - Section 5 – Environmental Consequences.* 63 p

railways provide a good example of noise insulation programs as nearly all European countries require noise protection measures when building new or upgrading existing railway lines. The traditional method of confronting noise pollution associated with railway construction has been through adaptive measures such as building requirements and/or noise barriers. For example, in Scandinavia, protection from railway noise is primarily achieved by protecting buildings, whereas in Italy noise barriers are the preferred method. Both means of noise abatement are used in Europe and there are now tens of thousands of noise-insulated houses, mostly fitted with special-insulated windows in the vicinity of existing railway lines.[60]

B. Coal Dust

Filling and profiling

One of the most simple and widely used mitigation methods is ensuring that wagons are not overfilled above the sidewalls (ideally maintaining a 100 mm freeboard around the top edge of the wagon). Other low cost mitigation measures involve regular maintenance of wagons to ensure that the bottom discharge doors close tightly and remain so to prevent the loss of coal. Recent research by rail companies has demonstrated that, given the correct profile of coal in the wagon, the emissions of dust can be reduced considerably. Another option is to clean wagons after unloading so that no coal dust is lost on the return journey from the 'empty' wagon, which can amount to as much as 4% of the total emissions of the entire journey.[61]

Surfactants and wetting

One method that is being used more and more to reduce dust emissions is to ensure that the coal is to add surfactants to it. Surfactants are compounds that lower the surface tension (or interfacial tension) between two liquids or between a liquid and a solid. In the case of coal, surfactants are used as wetting agents, whereby making particles wet, they affix to the bulk material. In practice, each type of coal exhibits a critical moisture content around which no emissions occur. The problem, is that not all coal is the same, and different types of surfactants achieve different results. The finer the coal particle sizes, the more complex the coal particle micro structures, and the greater degree of sulphur can all influence the effectiveness of the surfactant in keeping the coal wet and the dust on the bulk material. In general, wetting performance is poor for the coal with higher volatile content due to the easier release of volatile matter and the easier formation of gas film around the particle. However, wetting can be improved if different types, or mixes, of surfactants are applied. In this regard, the differences between ionised and deionised water can be great, along with the addition of other chemicals, such as sodium dodecyl sulphate. A similar alternative is to spray the coal with a surfactant or protective layer, such as polyoxyethylene and polyglycerol-based nonionic surfactants. This is achieved through using a water additive that forms a skin over the coal, thereby keeping the dust in. In such instances, the most effective surfactants

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[60] Hubner, P. (2007). *Noise Reduction in European Railway Infrastructure. (International Union of Railways & Community of Europe). 3-4.* Manning, J. (2003). 'Noise Control in the Transport Sector'. *Noise and Health. 23:* 43-50.

[61] Katestone Environmental (2012). *Duralie Extension Project, Study of Dust Emissions from Rail Transport.* February 2012. 51 p.

increased the ability to suppress overall coal dust levels by up to 100% when compared with plain water.[62]

However, both water and protective layers can be negated by opposing forces of wind and excessive moisture (i.e., rain). If these forces are superior to the bonding agents, the fugitive dust will continue to escape, typically, downwind, only to be deposited in the receiving environment.

In addition to examining the choice and effectiveness of any surfactant that is utilized to suppress dust in the wagons, so too should studies be undertaken to on the impact of these upon the associated ecosystems of which they may eventually make their way into. This is also essential as scientific evidence is emerging that in some instances, certain surfactants may be leading to conservation concern. The difficulty is that this concern is not always direct, and may take the former of indirect impacts that may build up within species and/or ecosystems over a prolonged period of time. Accordingly, in accordance with best national and international practice in this area, it would be prudent to undertake studies, on a precautionary basis,[63] to see the size of the potential emissions of surfactants used to suppress coal dust (including going to port, and if necessary, returning from port), to examine the different conditions that loss may occur, and if the proposed surfactants have the potential to bioaccumulate, magnify and detrimentally impact upon the surrounding environment and, in particular, species and areas of particular conservation concern.[64]

Wagon covers

The most effective mitigation to control the emission of coal dust from freight wagons is sealing the wagon with a cover. Wagon lids (or tarpaulins) are already used in the transport of many materials around the world which are more perishable than coal (such as grain). They are also used for coal in northern Queensland in Australia. Such lids have shown themselves to be >99% effective in reducing coal dust emissions from the top of wagons. They are also both practical and cost-effective especially if they are included in the construction of new

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[62] Baiquan, L. (2013). 'Surface Physical Properties and Its Effects on the Wetting Behaviour of Respirable Coal Mine Dust'. *Powder Technology*. 233: 137-145. Ding, C. (2011). 'Experimental Research on Optimization and Coal Dust Suppression'. *Procedia Engineering*. 26: 1314-1321. Keystone Environmental (2011). *NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining* (Office of Environment and Heritage, KE1006953, NSW). Marsalek, R. (2008). 'The Influence of Surfactants on the Zeta Potential of Coals'. *Energy Sources*. 31(1): 66-75. Tien, J. (1997). 'Respirable Coal Dust Control Using Surfactants'. *Applied Occupational and Environmental Hygiene*. 12(12): 957-963. Kim J. (1994). 'The Effect of Added Base on Coal Wetting Ability of Non-ionic Surfactant Solutions Used for Dust Control'. *Mining Engineer,* 154: 151-155. Smitham, J. (1991). 'Physico-Chemical Principles Controlling the Emission of Dust from Coal Stockpiles'. *Powder Technology*. 64(3): 259-270.

[63] Warshaw, J. (2012). 'The Trend Towards Implementing the Precautionary Principle in US Regulation'. *Dose-Response*. 10(3): 384-13. Gillespie, A. (2011). 'Precautionary New Zealand'. *New Zealand Universities Law Review*. 24(3): 364. Hansen, S. (2011). 'Chemical Regulation and Precaution'. *Environmental Science and Policy*. 10(5): 395-404. Gouin, T. (2010). 'The Precautionary Principle and Environmental Persistence'. *Environmental Science and Policy*. 13(3): 175-184. Jostmann, T. (2007). 'The Precautionary Principle for Toxic Chemicals'. *Human and Experimental Toxicology*. 26(11): 847-849. Gillespie, A. (2007). 'The Precautionary Principle in the Twenty-first Century'. *The International Journal of Marine ad Coastal Law*. 22(1): 61. Lokke, S. (2006). 'The Precautionary Principle and Chemicals Regulation: Past Achievements and Future Possibilities'. *Environmental Science and Pollution Research Institute*. 13(5): 342-349.

[64] Capaldo, G. (2012). ' Endocrine-Disrupting Effects of Nonyphenol in the Newt, Tritus Carnifex'. *Comparative Biochemistry and Physiology*. 155(2) 352-358. Yan, W. (2012). 'Dust Suppression with Glycerin from Biodiesel Production'. *Journal of Environmental Protection*. 3(2): 218-224. Dixon, D. (2008). 'The Use of Oil Refinery Wastes as a Dust Suppression Surfactant'. *Environmental Engineering Science*. 25(8): 1189-1196.

wagons and not retrofitted, although this cost is not believed to be excessive. In addition, they reduce the aerodynamic drag of the train by up to 20% leading to fuel savings.[65] This approach has the potential to offer the single biggest improvement in coal dust emissions and is something that requires detailed consideration in the EIS.

C. Diesel Pollution from the Locomotives

It is possible to control the particulate pollution caused by diesel burning locomotives by regulating the quality of the diesel fuel which is burnt, controlling the standards of both the efficiency of the burn and the adequacy of pollution traps, controlling the times specific trains may transit, and controlling when and where they can go.[66] At the Federal level, the United States has begun to regulate in this area with particular regard to standards for new and remanufactured locomotives and locomotive engines, both in terms of permissible emissions and required fuel types.[67] The question that therefore needs to be examined in this EIS is twofold. One, what is the existing contribution of the diesel burning engines to air pollution in the associated regions and how is this likely to expand? Two, how far do the new regulations, standards and best practice in this area apply to the locomotive fleet currently in existence (that is, will the locomotives being used be able to avoid the new expectations in this area)?

D. Congestion

Scheduling and re-routing

In terms of a potential mitigation tool for noise emissions, congestion as between trains and vehicles can, most simply, be addressed by careful routing and the creation of priority systems, such as public transport trumping freight, and/or the creation of temporal restrictions on who can travel where, when, and how much (i.e., by limiting train size). However, these options have limited capacity to deliver meaningful benefits when facing exponential growth in both rail and traffic sectors and where rail operations are already congested and confined to existing and established rail lines. In this scenario, the best mitigation method against further congestion is the separation of cross-over points between rail and vehicle traffic. Such

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[65] Smith, J. (2012). 'Patent Issued for Cover System for Open Top Rail Cars'. *Ecology, Environment and Conservation*. 1533. Ferriera, A (2004). 'Wind Tunnel Study of Coal Dust Release from Train Wagons'. *Journal of Wind Engineering and Industrial Aerodynamics* 92: 565–577. Vrins, E. et al. (1998). 'Monitoring and Control of Fugitive Coarse Dust Sources'. *Journal of Aerosol Science*. 29: 709-740. Vrins, E. (1996). 'Sampling Requirements for Estimating Fugitive Dust Emissions'. *Journal of Aerosol Science*. 27(l.): 571-572. Visser, G. (1992). 'A Wind Tunnel Study of Dust Emissions'. *Atmospheric Environment* 26: 1453 1460. Hatch, C. (2008). Final Report Environmental Evaluation of Fugitive Coal Dust Emissions from Coal Trains Goonyella, Blackwater and Moura Coal Rail Systems. (Report to Queensland Rail Limited). 414 http://www.aurizon.com.au/InfrastructureProjects/Rail%20Network/Coal_Loss_Management_Project_Environmental_Evaluation.pdf

[66] Bailey, D. (2004). 'Pollution Prevention at Port: Clearing the Air'. *Environmental Impact Assessment*. 24(7): 749-774.

[67] Emission regulations for locomotives and locomotive engines can be found in the US Code of Federal Regulations, 40 CFR Parts 85, 89 and 92. Note, Tier 0-2 standards: 17 December, 1997. 63 FR 18997-19084/16 Apr, 1998. Tier 3-4 standards: 14 March 2008. 73 FR 88 25098-25352/6 May 2008.

separation reduces both the risk of accidents, and increases efficiencies in the utilization of time, often for both sectors.[68]

It has been evident for a long time that the best way to solve these problems in existing areas is through the utilization of tunnels and overpasses that separate the two modes of transportation and reduce both vehicle commuter and train congestion. This method has the added benefit of also improving safety, reducing noise (eliminating the need for train whistles) and reducing air pollution (exacerbated by idling engines). Although these mitigation techniques require large amounts of foresight, capital and commitment, it is evident that many of the multiple benefits noted above can be achieved if the benefits of the overpass, in terms of traffic efficiency, environmental amenity and traffic safety, trump the costs of accepting increased congestion.[69] Although traffic-splitting mitigation measures have great technical promise, it is important to note that they are expensive to pursue. Given the high costs, it would be useful to know, for the purposes of clarity, upon whom these costs will fall and what models currently exist to divide these costs equitably between the private and public sectors at the local, state and national levels.[70]

8. Recommended research programs

Based on the assessment in this report of the various risks posed by increased rail traffic from the proposed MBT and a consideration of potential mitigation options, eight research programs are recommended to help in understanding and evaluating the impacts of the MBT and its associated rail traffic. Four studies are required for decision makers to reach a full and informed conclusion with regard to assessing the significant risks and impacts to human communities of coal freight trains and four further studies are required to assess the possibilities of mitigation options in this area.

[68] Anon (2013). 'Better Use of Infrastructures to Reduce Environmental and Congestion Costs'. *OECD Economic Surveys*. 10: 75; Mu, S. (2011). 'Scheduling Freight Trains Traveling on Complex Networks'. *Transportation Research Part B*. 45(7): 1103-1123; Kuo, A. (2010). 'Freight Train Scheduling With Elastic Demand'. *Transportation Research Part E*. 46(6): 1057-1070; Godwin, T. (2010). 'Tactical Locomotive Fleet Sizing for Freight Train Operations'. *Transportation Research Part E*. 44(3): 440-454; Dinwoodie, J. (2006). 'Rail Freight and Sustainable Urban Distribution: Potential and Practice'. *Journal of Transport Geography*. 14(4): 309-320.

[69] Singstad, O. (1927). 'The Relation of Tunnels and Bridges to Traffic Congestion'. *Annals of the American Academy of Political and Social Science* . 133: 67-77. Bektas, T. (2011). 'The Pollution-Routing Problem'. Transportation Research. 45: 1232–1250. National Cooperative Highway Research Programme (2007). *Railfreight Solutions to Roadway Congestion* (NCHRP, Report 586). Section 2.4.4. Busch, T. (2003). 'Where the Rail Meets the Road'. *Public Roads* 66(5): 44-47. Vantuono, W. (1994). 'Crisis at the Crossing?'. Railway Age 195(2): 35-42. See Triantis, K. (2011). 'Traffic Congestion Mitigation: Combining Engineering and Economic Perspectives'. *Transportation Planning and Technology*. 34(7): 637-645. Sohn, K. (2008). 'A Systematic Decision Criterion for the Elimination of Useless Overpasses'. *Transportation Research*. 42(8): 1043-1055. Pooley, C. (2005). 'Coping with Congestion: Responses to Urban Traffic Problems in British Cities 1920–1960'. *Journal of Historical Geography* 31 (2005) 78–93. Welsh, J. (2002). 'For Community-Railroad Cooperation, Look to Auburn, Washington'. Trains 62(12): 24. Cordeau, J. (1998). 'A Survey of Optimization Models for Train Routing and Scheduling'. *Transportation Science*. 32(4): 380-390. Fremont, A. (2010). 'Hinterland Transportation in Europe: Combined Transport Versus Road Transport'. *Journal of Transport Geography* 18(4): 548-556. Rodrigue, J. (2010). 'Comparative North American and European Gateway Logistics: The Regionalism of Freight Distribution'. *Journal of Transport Geography*. 18(4): 497-507. Thomas, B. (1999). 'Environmental Benefits from Better Freight Transport Management'. *Transportation Research Part D*. 4(1): 45-64. Ira, L. (2001). 'Issues and Initiatives Surrounding Rail Freight Transportation'. *Transportation Journal* 41(2): 23.

[70] Such as with the Congestion Mitigation and Air Quality Programme of the Intermodal Surface Transportation Efficiency Act.

Research programs to support decision-makers

i. A first cumulative impact analysis should study rail activity in the region for the directly impacted communities within Washington State and Oregon both entering and exiting from the proposed MBT site. This should start with the existing baseline levels and expand to include the current proposed incremental increase from the MBT and any additional traffic that may be reasonably foreseeable in the future. The particular facts that must be collected from this study should include:

   a. Quantification of levels of coal dust deposited, diesel emissions from the engines, and noise emitted by existing, future and projected rail traffic (while documentation of historic patterns of traffic, cargo type, rail operating conditions, train length, composition, risk, and times of data collection).
   b. A focus on both small and larger sizes of particulate matter.
   c. Differentiation between a comparable (urban) situation without the emission source and juxtaposition to the current, proposed and future expectations.
   d. Measurements of coal dust should be both constant and extensive in their coverage.
   e. Specific target monitoring around potential hotspots of concern, such as schools, hospitals, daycare, eldercare, residential communities, disadvantaged communities and/or minorities in particular.
   f. Measurement and examination of the impact of the locomotives going through the Columbia River Gorge, especially in terms of air and noise pollution.
   g. Measurement and examination of the impact of the coal dust leaching from the wagons going through the Gorge airshed, along railways, and into the shoreline.

ii. In association with the first cumulative impact analysis, noise pollution and air pollution should both be clearly examined within a HIA. This HIA should include studies on:

   a. Determinations as to whether there is a significant impact on human health from the emissions of noise and/or air pollution from coal dust and diesel emissions and associated heavy metals from the coal freight trains. Particular regard must be given to communities which are critical hotspots of concern such schools, hospitals, daycare, eldercare, residential communities, disadvantaged communities and/or minorities in particular.

   b. The implication of these impacts for different sections in society especially the young, elderly, and sick, as well as the general population, over the short and long term.

iii. A third study should focus on the cumulative impact of coal dust and its ability to foul rail line ballast and the potential for weakened track structure, reduced track stability and the threat of derailments. This study should focus on what are adequate safety standards in this area.

iv. A fourth study should also be undertaken that portrays the cumulative current and future congestion patterns, working upon the existing baseline, the current proposed increase, and additional increases which are reasonably foreseeable in the future for interdependent rail issues. This study should cover the full geographical coverage of the whole rail transportation chain from the PRB to the PNW. This study should include assessments of:

a. existing and projected demand for rail in the PNW.
b. lines that are presently or expected to become congested, constrained or to exceed practical capacity, in five, ten and twenty year periods.
c. the overlay of the current and future demands in both rail and vehicle traffic and models of congestion expectations in five, 10 and 20 year periods.
d. the quantification of the economic implications of this congestion for the commercial sector, individual citizens and residential communities.
e. the impact that rail expansion is having upon farmland.

Note, while economic cost is not an explicit consideration within NEPA, issues such as employment and availability of services are clearly part of the 'human environment' that section 102 of the NEPA requires to be examined. In this regard, although there is an expectation that issues of cost will be considered through processes outside of NEPA, good practice within the application of the NEPA means that it should also be included. This ambiguity around the inclusion of economic considerations within the NEPA assessment is not present within the (Washington) State Environmental Policy Act (SEPA). Within the SEPA, the requirement, 'that presently unquantified environmental amenities and values will be given appropriate consideration in decision making *along with economic ... considerations*' is explicit. This is particularly so because it overlaps with the other requirement of the Legislature for examination of impacts which have a, 'relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity'.[71]

Research programs to investigate mitigation options

v. The first step in this area would be an understanding of the contribution of each component part of overall train noise. To better characterize this issue, it would be useful to evaluate the main sources of existing rail noise to determine the

[71] SEPA, Chapter 43.21C RCW.

component that is due to issues such as speed, horns, locomotion and wagon design, rail design, and poor or irregular maintenance.

vi. With regards to noise pollution, studies need to be undertaken in consideration of scheduling, time control and re-routing, and the benefits of enhanced and regular maintenance of the rail stock and lines. More substantial technological options to be investigated involve the use of different brake pads, ballast mats, resiliently supported ties, tire derived aggregate, floating slabs, special track-work at crossovers and turnouts. Finally, the use of noise insulation and noise barriers around parts of the community which require additional standards should be investigated.

vii. With regards to coal dust, the main options that need to be studied are limits on overfilling, suitable and effective surfactants and the effectiveness and economics of wagon covers. The study on surfactants should focus on both their effectiveness in this instance, and their possible environmental impacts.

viii. With regards to congestion, the main options that need to be examined are scheduling and re-routing, and more importantly, the utilization of tunnels and overpasses in separating the two modes of transportation. Although traffic-splitting mitigation measures have great technical promise, it is important to note that they are expensive to pursue. Given the high costs, it would be useful, for this study, and for the purposes of clarity, to not only estimate the economic costs involved, but also, point out to whom these costs will fall upon, and what models (if any) exist to equitably divide these costs between the private and public sectors, at the local, state and national levels.