

Scoping Suggestions  
for the Risks  
Associated with Coal  
Freight

Alexander Gillespie

1/11/2013

## 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 21<sup>st</sup> 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.<sup>1</sup> 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...’.<sup>2</sup> The majority of this growth is projected to be in the transit of coal. That is, the current 40%, as a percentage of total freight volume, level of coal is expected to increase. Approximately 60% of all new rail tonnage predicted to be required is attributable to coal and related intermodal freight.<sup>3</sup>

The current Gateway Pacific Terminal (GPT) proposal is part of the overall growth trajectory for the freighting of coal in the Pacific North West (PNW). The current proposal aims to add between 16 to 18 trainloads (i.e., half loaded coming, half empty returning) each day on top of existing capacity. Each of the proposed new trains 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.<sup>4</sup> 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. However, two cities, Spokane, WA and Billings, MT appear to be at the forefront of this increased transit, with Spokane receiving an estimated 63 total transits per day, whilst Billings could average around 58.<sup>5</sup>

---

<sup>1</sup> 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.

<sup>2</sup> Washington State Department of Transport (2009). *Washington State 2010-2030: Freight Rail Plan* (WSDT, Olympia). 9:2.

<sup>3</sup> *Ibid*, 4:26.

<sup>4</sup> Murray, T. (2010). ‘Where’s That Coal Train Going?’ *Trains* 70(4): 28-37.

<sup>5</sup> Gibson Traffic Consultants Inc. *Cherry Point Coal Export Facility Rail Operations-City of Seattle-Preliminary Report; GTC #11-036*. February 13, 2012. Report to City of Seattle, Director Seattle Department of Transportation. 126 p.

Whilst 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 GPT, it is equally important for the impact assessment 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 GPT. Two cumulative impact assessment studies are required. The first, a cumulative impact analysis of the region, and directly impacted communities within Washington State en-route to the proposed GPT site should include a detailed examination of the existing baseline levels, the current incremental increase proposed for the GPT 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 analysis that would stem from focusing only upon the incremental addition of trains for the GPT. To act otherwise and focus only on the incremental increase will lead to a false and inaccurate assessment of impact and risk.<sup>6</sup>

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 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 routes including Idaho, Montana, Oregon, and Wyoming. 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.<sup>7</sup> 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, social and environmental) choices can be made.<sup>8</sup>

---

<sup>6</sup> 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 Fritioson v Alexander, 772 F.2d 1225, 1243, 1245-1246, (5<sup>th</sup> Cir. 1985).

<sup>7</sup> 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.

<sup>8</sup> 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-

This second cumulative study should be particularly cognizant of the impact that rail expansion is having upon farmland, as the loss of farmland is a national, regional and local concern. 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 utilise and conserve, and the loss of traditional types rural identity. In 1950, the Puget Sound region had nearly 1.4 million acres of farmland. The average annual loss over this period has been nearly 14,000 acres of farmland per year. Four counties—Pierce, King, Snohomish, and Whatcom—each lost more than 100,000 acres of farmland between 1950 and 2007, accounting for more than half the farmland loss in the region. By 2007 less than 600,000 acres remained, a 58 percent loss. Despite this rapid decline of farmland, the amount protected due to its high value, is only around five percent of the nearly 600,000 acres of farmland in the Puget Sound region, with much of the remaining land under threat of conversion.<sup>9</sup>

## 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 GPT 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).

---

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.

<sup>9</sup> American Farmland Trust (2012). *Losing Ground: Farmland Protection in the Puget Sound Region* (AFT, Washington). 3-4, 12, 14-17.

- International best practice on air quality standards. For example, the US standards for 24-hour average PM<sub>10</sub> is 150 µg/m<sup>3</sup> which is 200% higher than the equivalent standard of 50 µg/m<sup>3</sup> 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/m<sup>3</sup>, consistent with international best practice.
- The (Federal) Noise Control Act
- The Federal Transit Authority (FTA), in association with the EPA, and the Railroad Noise Emission Standards
- The (Washington State) Noise Control Act and associated standards from the EPA and the Occupational Health and Safety Administration of the Department of Labor.
- The World Health Organization.
- Executive Order 12898, which requires federal agencies to consider the impacts of their actions on minority and low income populations.
- The Washington Transportation Plan (WTP)
- Washington State's Department of Transportation Program to reduce congestion
- The Blue Ribbon Commission on Transportation.
- The Farmland Protection Policy Act
- The (Washington State) Farmlands Preservation Executive Order 8001
- The (Washington State) Growth Management Act.
- The Federal Clean Water Act
- The State Water Pollution Control Act
- The Shoreline Management Act of Washington State.

### 3. The significant risks of coal freight

#### A. Air pollution and significant impacts on associated communities

Coal dust is an odorless, fine powdered form of dark brown to black dust created by the crushing, grinding, or pulverizing coal.<sup>10</sup> Its most explosive risk is in combustion and flammability. Coal dust also possesses the ability to cause, longer term, detrimental impacts

---

<sup>10</sup> 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.

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  $10\mu\text{m}$ <sup>11</sup> 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 EPA groups particle pollution into two categories: (i) “Coarse particles” or  $\text{PM}_{10}$  such as those found near roadways and dusty industries that are larger than  $2.5\mu\text{m}$  and smaller than  $10\mu\text{m}$  in diameter and (ii) “Fine particles” or  $\text{PM}_{2.5}$  such as those found in smoke and haze, which are  $2.5\mu\text{m}$  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.<sup>12</sup> At the end of 2012, the EPA finalized an update to its national air quality standards for harmful fine particle pollution ( $\text{PM}_{2.5}$ ), 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.<sup>13</sup>

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

---

<sup>11</sup> One  $\mu\text{m}$  is a measure of length and is one-millionth of a metre (or 1/34 millionth of an inch)

<sup>12</sup> 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.

<sup>13</sup> See <http://yosemite.epa.gov/opa/admpress.nsf/bd4379a92ceceac8525735900400c27/a7446ca9e228622b85257ad400644d82!OpenDocument> (site visited, January 3<sup>rd</sup>, 2013).

international literature about the health effects of exposure to coal dust of respirable particle size (i.e., PM<sub>10</sub> 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 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, whilst 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.<sup>14</sup> 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.<sup>15</sup>

Whilst 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 to 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, 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

---

<sup>14</sup> United States Department of Labor. (2012). Occupational Safety and Health Guideline for Coal Dust (< 5% SiO<sub>2</sub>). 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.

<sup>15</sup> United States Department of Labor. (2012). *Occupational Safety and Health Guideline for Coal Dust (< 5% SiO<sub>2</sub>)*. 6-7.

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.<sup>16</sup> For coal wagons such as those presently used by the BNSF rail company for coal freight, this would be in the region of 500 pounds to a ton of coal dust, from mine to ship. BNSF implemented coal dust emissions standards in 2011 and recommended mitigation techniques (e.g., using an approved surfactant and/or by using an approved profile of the coal in the wagon) that it says will reduce coal dust emissions by 85%. However, these new standards will require enforcement to be effective and, even if they are successful to the levels stated, there will still be coal dust escaping from thousands of loaded and unloaded wagons each year. These measures may reduce the coal dust problem but they will not remove it.

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.<sup>17</sup> There is also the difficulty that an increasing number of studies are beginning to directly link health issues with 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.<sup>18</sup> 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.<sup>19</sup> 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,

---

<sup>16</sup> 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.

<sup>17</sup> Note, Sections 230 and 404 of the Clean Water Act.

<sup>18</sup> Temple, J. and Sykes, A. (1992). ‘Asthma and Open Cast Mining’. *British Medical Journal*. 305, 396.

<sup>19</sup> 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.

chronic obstructive pulmonary disease, hypertension, lung disease and kidney disease) and residential proximity to coal mining activities, including transportation.<sup>20</sup>

While coal dust provides a very visible 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. Given that the national demand for freight trains alone is expected to double in the next 20 years<sup>21</sup> and that the increase is likely to be considerably higher in Washington State, then this region could see at least double the rates of these pollutants and associated health impacts within the community within the next 20 years and perhaps even earlier.

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)<sup>22</sup> of the GPT 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. 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 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

---

<sup>20</sup> Hendryx, M. (2008). 'Relations Between Health Indicators and Residential Proximity to Coal Mining in West Virginia'. *American Journal of Public Health*, 98: 669-671. Also, Harkinson, J. (2011). 'Death of a Coal Town'. *Mother Jones* 36(2):14.

<sup>21</sup> See Transportation Research Board (2004). 2010 and Beyond: A Vision of America's Transportation Future 21<sup>st</sup> 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 already crowded rail system is expected to get worse. *The Capital Times and Wisconsin State Journal*. June 1.

<sup>22</sup> See <http://www.cdc.gov/healthyplaces/hia.htm>

transportation and land use. Such an assessment would be consistent, for both governments and the commercial sector, with best practice in this area.<sup>23</sup>

## B. Dust emissions and significant impacts upon 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. As it stands, landslides on Puget Sound railroad tracks are reaching near record levels (with 40 to 50 slides big enough to affect rail traffic in 2012 alone).<sup>24</sup> The impacts of such dust emission are significant and have been identified as a contributing factor to derailments on the line out of the PRB. On the basis of this finding, BNSF have since implemented new standards for coal dust emissions and associated mitigation measures and, as an indication of the importance that BNSF puts on this issue, they developed an extra tariff for coal shippers that do not meet the emission standards.

## 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

---

<sup>23</sup> 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.

<sup>24</sup> <http://www.king5.com/news/environment/Dozens-of-mudslides-bury-railroad-tracks-between-Seattle-to-Everett-185003081.html>

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.<sup>25</sup>

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 (CWR) 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.<sup>26</sup>

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

---

<sup>25</sup> Coghlan, A. (2007). 'Dying for Some Peace and Quiet'. *New Scientist*, Aug. 25. At 6-9. Chepisiuk, 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.

<sup>26</sup> 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.

loud noise levels between 90 and 115 dB(A) has been linked to cardiovascular risks and also to suicide.<sup>27</sup>

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).<sup>28</sup>

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. Whilst 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. Whilst 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 animal reproduction, even for species common in urban areas, under noisy conditions, can be reduced. These may carry a direct economic cost.<sup>29</sup>

---

<sup>27</sup> World Health Organization (2004). *Guidelines for Community Noise*. (WHO, Geneva). <http://whqlibdoc.who.int/hq/1999/a68672.pdf>

<sup>28</sup> 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

<sup>29</sup> Halfwerk, W. (2011). Negative Impact of Traffic Noise on Avian Reproductive Success'. *Journal of Applied Ecology*. 48: 210-219.

## 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.<sup>30</sup> The manifestations of this dysfunction are slower speeds, longer trips, and long lines of idling vehicles. Washington State is well familiar with this type of dysfunction. Seattle already possesses the third worst traffic congestion of all American cities. 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.<sup>31</sup>

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 rapidly in coming decades. This is especially so given the financial requirements to meet Washington state-wide rail needs over the next 20 years, estimated at requiring between \$175 and \$200 billion by 2032.<sup>32</sup>

---

<sup>30</sup> The Blue Ribbon Commission on Transportation. *Final Recommendations to the Governor and Legislature* (adopted November 29, 2000). 6.

<sup>31</sup> 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).

<sup>32</sup> Washington State Transport Commission (2010). *Washington Transportation Plan 2030. Connecting Communities for a Prosperous Future*. December 2010. 56 p.

As it currently stands, rail congestion is already a clear issue in many parts of the PNW.<sup>33</sup> 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 rail system is going to increase rapidly over the next decade. 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...’.<sup>34</sup> 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.<sup>35</sup>

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

---

<sup>33</sup> Washington State Department of Transport (2009). *Washington State 2010-2030: Freight Rail Plan* (WSDT, Olympia). \$:26, 9:2. Washington State Transport Commission (2006). *Statewide Rail Capacity and System Needs Study*. 73 p.

<sup>34</sup> 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 21<sup>st</sup> 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.

<sup>35</sup> 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.

and businesses was over \$750 million in 2010 based on maximum throughput speed thresholds.<sup>36</sup>

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.<sup>37</sup> 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.<sup>38</sup>

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.<sup>39</sup> 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.

---

<sup>36</sup> 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.

<sup>37</sup> 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.

<sup>38</sup> 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.

<sup>39</sup> 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).

## 4. Alternatives

The most obvious alternative is the selection of routes which do not threaten the human communities 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.<sup>40</sup> 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 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.<sup>41</sup>

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

---

<sup>40</sup> See Eccleston, C. (2012). *Preparing NEPA Environmental Assessments*. (Taylor and Francis, NYC). 47.

<sup>41</sup> European Union Directorate General for Energy and Transport. MEMO – Rail noise abatement measures addressing the existing fleet. 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.

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.

### *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).<sup>42</sup> 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.<sup>43</sup> The expected net benefit of this approach is

---

<sup>42</sup> See International Civil Aviation Organisation. (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.

<sup>43</sup> 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. Ljunstrom, A. (2003). ‘The New Policy of the European Commission for the Abatement of Railway Noise’. *Journal of Sound and*

the reduction of the perceived level of noise emissions of freight trains by about 50% by 2014. Supplemental technological mitigation measures for railbeds could include the use of ballast mats, resiliently supported ties, tire derived aggregate, floating slabs, and special track-work at crossovers and turnouts.<sup>44</sup>

Another technological mitigation that should be investigated is the introduction of noise insulation around communities which are at risk of excessive noise pollution. European 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.<sup>45</sup>

## 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 BNSF and others has demonstrated that, given the correct profile of coal in the wagon, it can reduce dust emissions considerably. Another option is the cleaning of

---

*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.

<sup>44</sup> European Union Directorate General for Energy and Transport. MEMO – Rail noise abatement measures addressing the existing fleet. 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

<sup>45</sup> Hubner, P. (2007). *Noise Reduction in European Railway Infrastructure*. (International Union of Railways & Community of European Railways and Infrastructure Companies). 3-4. Manning, J. (2003). Noise Control in the Transport Sector, *Noise and Health*. 43.

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.<sup>46</sup>

### *Surfactants and wetting*

One method that is being used more and more to reduce dust emissions is to ensure that the coal is made moist so that the particles are affixed to the bulk material. All tests show a strong response in reduction of dust emissions with increasing total moisture content. Each coal exhibits a critical moisture content around which no emissions occur. Assuming the correct amount and type of moisture is applied to the correlated particle then dust, if it is not exposed to excessive wind, can be greatly reduced. 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. If applied effectively, dust emissions can be reduced, in theory, by between 80 to 99%.<sup>47</sup> However, both water and protective layers can be negated by opposing forces of wind and excessive moisture (i.e., rain), and this, in turn, is influenced by considerations of both the speed of the train and the length of the journey. If these forces are superior to the bonding agents, the fugitive dust will continue to escape, typically, out of the rear end of the wagons. While this approach is used on loaded wagons, it is not generally used on empty but unclean wagons which can contribute a significant amount of coal dust on the return journey.

### *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 wagons and not retrofitted, although this cost is not believed to be excessive. In addition, they

---

<sup>46</sup> Katestone Environmental (2012). Duralie Extension Project, Study of Dust Emissions from Rail Transport. February 2012. 51 p.

<sup>47</sup> Katestone 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). 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..

reduce the aerodynamic drag of the train by up to 20% leading to fuel savings.<sup>48</sup> 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. Congestion

### *Scheduling and re-routing*

As proposed as a mitigation tool for noise emissions, congestion 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 separation reduces both the risk of accidents, and increases efficiencies in the utilization of time, often for both sectors.

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. This trade-off was evident in some of the cities which were facing difficulties over the issue of automobile traffic delays partially related to BNSF's 1996 reopening its Stampede Pass line. The solution which alleviated much of the

---

<sup>48</sup> 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(1.): 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](http://www.aurizon.com.au/InfrastructureProjects/Rail%20Network/Coal_Loss_Management_Project_Environmental_Evaluation.pdf)

problem in some particular areas, involved a combination with the private sector, dedicating a new \$32 million overpass of the rail line in a particularly congested area.<sup>49</sup> 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.<sup>50</sup>

## 6. Recommended research programs

Based on the assessment in this report of the various risks posed by increased rail traffic from the proposed GPT and a consideration of potential mitigation options, eight research programs are recommended to help in understanding and evaluating the impacts of the GPT. 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.

### *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 en-route to the proposed GPT site. This should start with the existing baseline levels and expand to include the current proposed incremental increase from the GPT, and the additional traffic that may be reasonably foreseeable in the future. The particular facts that must be collected from this study should include:

<sup>49</sup> 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.

<sup>50</sup> Such as with the Congestion Mitigation and Air Quality Programme of the Intermodal Surface Transportation Efficiency Act.

- a. Quantification of levels of coal dust deposited, diesel emissions from the engines, and noise emitted, by existing, future and projected rail traffic (whilst being aware of historic patterns, and differences between locations, operating conditions, train length and composition, and times of data collection).
  - b. 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 should be both constant and the coverage extensive.
  - e. Specifically target monitoring around potential hotspots of concern such as education establishments and hospitals, as well upon residential communities, and disadvantaged communities and/or minorities in particular.
- ii. Associated with the first cumulative impact analysis, noise pollution and air pollution should both be clearly examined within a Health Impact Assessment (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 had to communities which are critical hotspots of concern such as education establishments and hospitals, as well upon residential communities, and disadvantaged communities and/or minorities in particular.
  - b. The implications of these impacts for different sections in society especially the young, elderly, and sick, as well as the general population, over the short, and longer, term.
- iii. A third study should focus on the cumulative impact of coal dust and its ability to foul rail line ballast and lead to weakened track structure, reduce stability and thereby contribute to 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, also 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, whilst 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 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’.<sup>51</sup>

#### *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

---

<sup>51</sup> SEPA, Chapter 43.21C RCW.

be useful to evaluate the main sources of existing rail noise to determine the component that is due to issues such as, *inter alia*, 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.
- 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.