The Human Health Effects of Rail Transport of Coal Through Multnomah County, Oregon

A Health Analysis and Recommendations for Further Action

Health Assessment and Evaluation

MULTNOMAH COUNTY
Health Department

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Contact:

Sonia Manhas, Director
Health Assessment and Evaluation/Office of Policy and Planning
Multnomah County Health Department
Phone: 503.988.3674 x26221
Fax: 503.988.3676
Email: opp@multco.us

Public Health
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Lillian Shirley, BSN, MPH, MPA
Director
Multnomah County Health Department
426 SW Stark, 8th Floor
Portland, OR 97204

Analysis Collaborators:
Elizabeth Clapp, MPH – Research Analyst
Moriah McSharry McGrath, MPH, MSUP – Research Analyst
Sonia Manhas, MSW – Director of Policy and Planning
Julie Maher, PhD, MS – Director of Program Design and Evaluation Services
Gary Oxman, MD, MPH – Health Officer
Amy Gredler – Program Communications Coordinator

Introduction

Balancing the potential benefits and harms of using coal as an energy source is an ongoing challenge for local communities and the global economy. Coal is a natural resource that has long been used to power a wide variety of activities. It is a non-renewable resource; the bulk of the coal mined today is about 300 million years old and will not be replaced during human existence. Though it is a naturally occurring substance, coal can be dangerous to human health, especially in its particulate form. Additionally, the extraction, transportation, and combustion of coal can have major impacts on natural, social, and economic conditions.

This health analysis considers the potential impacts and human health consequences of three proposed coal export projects that could result in rail transport of coal through Multnomah County.

The goals of this analysis are to:

- Synthesize scientific knowledge about the human health impacts of coal transportation by rail
- Identify the populations in Multnomah County who might be affected
- Describe the most likely human health impacts of coal transportation locally

To do so, the effects of the following are examined:

- Rail freight traffic in general, such as noise, locomotive emissions, and roadway congestion
- Coal as a specific cargo

The Multnomah County Health Department conducted this analysis at the request of Multnomah County Chair Jeff Cogen. As Chair and CEO of Multnomah County, Chair Cogen has responsibility for protecting the health of county residents. Based on the findings, the Health Department has identified potential actions for consideration by the County Chair and other concerned community leaders.

Overview of Analysis

This analysis considers the potential impacts of coal export projects that could result in the transport of coal through Multnomah County. Though coal would travel through the county, it would not be mined, loaded, unloaded, or burned here. This analysis considers the proposed Kinder Morgan Terminal, Millennium Bulk Terminal, and Port of Coos Bay projects. The analysis is based on descriptions of the projects provided by two sources: a white paper by the Western Organization of Resource Councils[1] and investigative research by *The Oregonian*[2] (see *Table 1*). This analysis considered the impacts of the three proposed projects together, using conservative estimates for the number of trains and volume of coal they will carry.

Table 1: *Potential Routes and Freight Volumes of Proposed Projects*

Project	Annual Coal Shipments *(est. millions of tons)*	Trains Per Day *(est.)*	Possible Route to Port
Kinder Morgan	15.0 initially, then up to 30.0	4-6	Along the north bank of the Columbia River on BNSF rails, crossing into Multnomah County on the Columbia River Rail Bridge at Hayden Island, turning northwest onto Portland & Western rail line along U.S. 30
Millennium	27.6 initially, then up to 48.5	8-9	Could travel on either bank of the Columbia River - if carried by Union Pacific, could travel along the south bank parallel to Columbia Blvd. and through Kenton before turning north on the Columbia River Rail Bridge
Coos Bay	6.6 initially, then up to 11.0	4	On Union Pacific tracks parallel to I-84, then south through the Central East Side of Portland and along Route 99E

Sources: The Oregonian[2] and WORC[1]

This analysis focuses on one specific stage of the coal cycle (transportation) by one shipping mode (rail) in one geographic location (Multnomah County). This means that the analysis does *not* consider the health impact of coal that would be carried on barges along the Columbia River or trains that might travel along the north bank of the Columbia River in Washington State. Nor does it address potential indirect effects of coal transportation which could have positive or negative health consequences.

Positive indirect effects might include economic development related to railcar construction, increased public revenue from taxes on diesel-fueled coal trains, and/or improved rail infrastructure.

Negative indirect effects might include displacement of other products carried by rail, fisheries depletion that could affect people's diets and livelihoods, or health impacts of substances sprayed on coal to reduce dust. These issues, as well as the broader implications of the extraction, transportation, and combustion of coal on climate change, are discussed in many studies and white papers in the health and environment sectors[3–6] and energy sectors.[7–9]

Methods

This health analysis used two techniques: *literature review* and *spatial analysis*. Literature review is a systematic process of synthesizing previous research on a topic. This analysis relied as much as possible on peer-reviewed scientific literature, but also used other sources such as documents produced by not-for-profit organizations, the railroad industry, and the general media.

Spatial analysis involves using mapping software to understand geographical differences. This analysis used spatial analysis

to identify and describe the populations in the county who may be most affected by coal transportation by rail. The data about the population were obtained from the U.S. Census Bureau, the Portland State University Population Research Center, and a tabulation of Census data computed by the Metro regional government called the Equity Composite.[10] *The Oregonian* provided a computer file mapping the potential routes for the proposed projects.

Literature review findings

The literature review identified six potential local environmental effects of concern related to coal transportation:

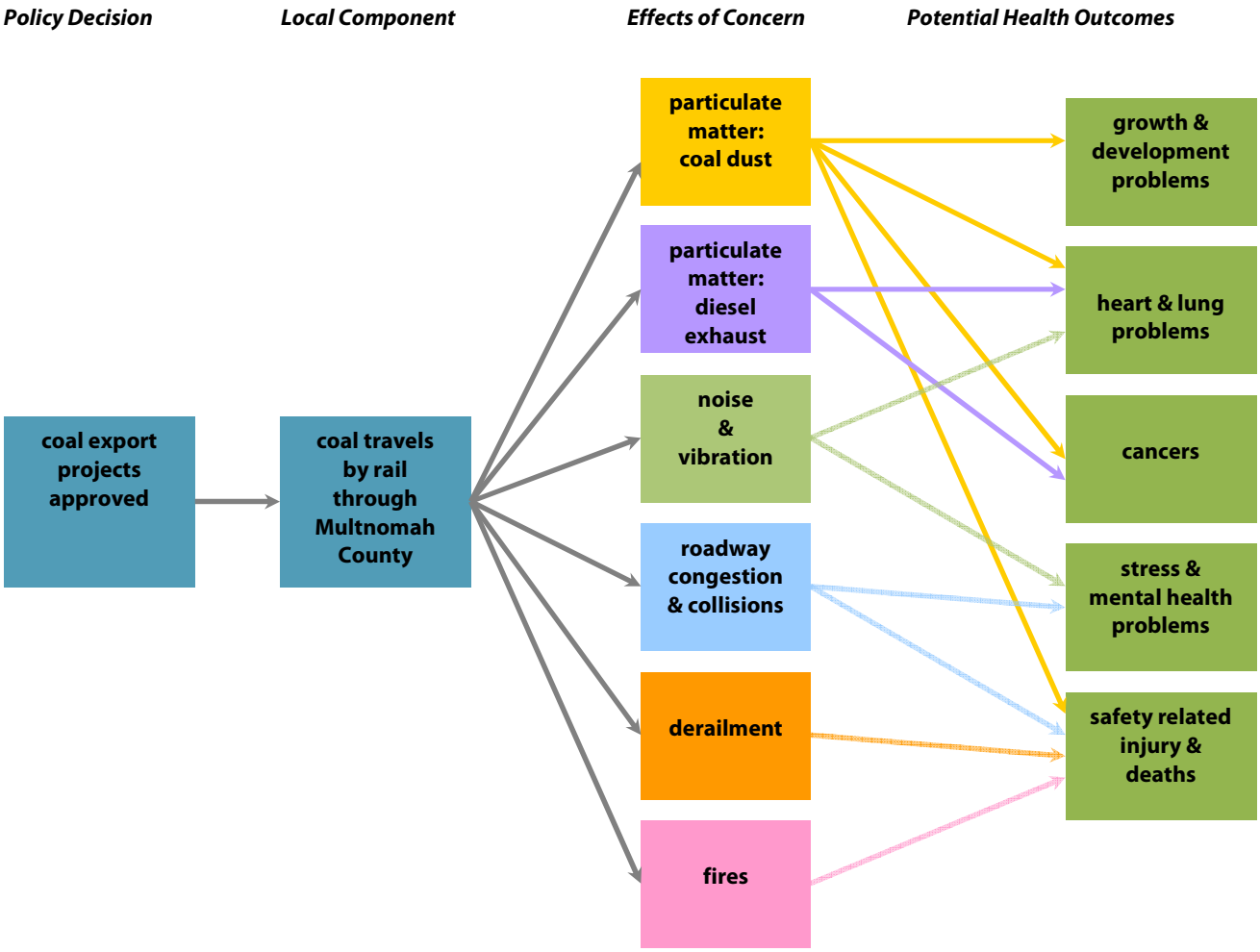
1. - Emission of particulate matter in the form of coal dust
2. - Emission of particulate matter in the form of diesel locomotive exhaust
3. - Production of noise and vibration by train movement
4. - Congestion and collisions along roadways and rail lines
5. - Train derailments
6. - Fires due to spontaneous combustion of coal

The literature review also found that the above six effects are associated with the occurrence of the following health outcomes:

- Heart and lung problems
- Cancers
- Growth and development problems
- Stress and mental health problems
- Injury
- Death

Nearly all of these health outcomes are associated with more than one of the environmental effects of concern. The schematic diagram in *Figure 1* illustrates these relationships. The colored arrows represent effects of concern; the arrows point to the health outcomes with which the effects are associated.

Figure 1: *Relationships between coal transportation by rail, environmental effects of concern, and health outcomes*



This figure does not reflect the possible cumulative or synergistic impacts of these health outcomes on individual and community-level health.

Potential effects of concern, associated health outcomes, and local implications

This section reviews each of the six environmental effects and their associated health outcomes. For each effect, this analysis examines how the three proposed coal transport projects might impact Multnomah County and provides a concluding statement that summarizes the analysis of that impact.

Emission of particulate matter: Coal dust

Associated health outcomes: *heart and lung conditions such as heart attacks, strokes, asthma, and coal worker's pneumoconiosis (black lung disease); cancers; growth and development problems; community-level health*

Particulate matter is a general term to describe small particles in the air, of which coal dust is one type. Particulate matter is toxic to human beings because it can enter the bloodstream after being inhaled. According to the World Health Organization, particulate matter is hazardous to human health even in extremely small quantities.[11]

Heart and lung conditions

Particulate matter can threaten cardiopulmonary health, the effective circulation of blood and utilization of oxygen in the body. The World Health Organization has reported that long-term exposure to particulate matter in the environment leads to a reduction in life expectancy from cardiopulmonary mortality.[12] Particulate matter is associated with a host of respiratory problems, including impaired lung functioning[13] and inhibited lung development in young people.[14] Particulate matter can exacerbate and contribute to the onset of asthma,[15–17] a disease that affects about nine percent of Multnomah County residents.[18] Young people, older adults, and people with heart conditions are especially vulnerable to these problems.

Coal dust, as one specific type of particulate matter, is associated with certain health outcomes. Extreme exposure to coal dust, such as working 10 or more years in a coal mine,[19] can lead to coal workers' pneumoconiosis (CWP), a debilitating condition that often causes death. CWP is extremely rare in Oregon. From 1968 to 2006, only one Oregonian died from CWP.[19]

Cancers

Inhalation of particulate matter in general is associated with increased risk of multiple types of cancer.[20]

Cadmium, which can be present in coal dust, has been found to contribute to risk for lung and nasal cancer.[21,22] However, an expert panel convened by the World Health Organization in 1997 found no conclusive link between coal dust and cancer.[23] Consultants reviewing the health effects of coal dust for an Australian mining company in 2005 came to the same conclusion.[24]

Growth and development problems

Coal dust may contain traces of the heavy metals, such as lead, mercury, chromium, and uranium, that are toxic to the human nervous system. Children are particularly vulnerable to

heavy metals which can lead to decreases in birth weight and children's growth rate, and intellectual development problems.[25] The amounts of these metals in a sample of coal vary depending on where the coal is mined. There is little evidence about the effect that heavy metals in coal dust may have on people exposed to coal dust in the environment.

Community-level health

There may be other effects of environmental coal dust on human health, but it is difficult to draw conclusions based on the limited research available. Most of what is known about the health impacts of coal dust on people is based on high levels of exposure—usually occurring in coal mining or processing workplaces. Little is known about people exposed to low levels, such as people who live in communities through which coal is transported. However, some studies suggest that living near coal operations has health effects. For example, research conducted near coal mines in England found that children living closer to coal mines more frequently visited physicians with respiratory complaints than did those living farther away.[26–28] However, the same research team found that, despite increased doctors' appointments, there was little conclusive evidence that children's health status was worse as a result of the increased dust levels in the community.

Studies of communities in the Appalachian region of the U.S. suggest that there are community-level health effects of coal exposure.[29–32] These studies have found that even people who do not work in mines, but live near them, may experience higher mortality rates related to heart, respiratory, and kidney problems. However, the mechanisms for these impacts are not fully understood and may be the result of other factors such as the effect of high poverty rates on community health.

Implications for Multnomah County

The three proposed coal transport projects will not result in the loading and unloading of coal in Multnomah County, but might result in roughly 125,000 tons of coal moving through the county per day. Estimates of the amount of coal dust shed by trains during shipping vary from less than one percent to up to three percent of the load.[33–36]

Due to their concern about the serious threat that coal dust poses to the stability of the train structure and its rail lines, BNSF Railway has been conducting research regarding the impacts of coal dust from loaded coal cars as they depart from the Powder River Basin.[37] From these studies, BNSF Railway reports that shippers can take steps to reduce coal dust releases, including the use of a proper loading chute and the application of a dust suppression topper agent (e.g., a surfactant) to the coal shipment at the time of loading.

The company states that the proper application of certain topper agents along with the use of a modified loading chute can potentially reduce coal dust levels by at least 85 percent. However, there is no evidence of independent verification of these findings. In a series of cases before the federal Surface Transportation Board, utility companies that are required to follow BNSF Railway's rules for shipping coal have argued that there is insufficient evidence for the effectiveness of these substances and that shippers should not be responsible for the costs of applying them.[38–41]

The available research, including studies by railroads, government agencies and university researchers, suggests that many factors, such as how the coal is loaded, the speed the train is traveling, weather conditions, and the use of protective sprays, would influence the amount of coal dust released by trains traveling through Multnomah County.

Conclusion

There are well-established health risks of exposure to coal dust in occupational settings. However, there are significant gaps in the scientific literature regarding how much coal dust is shed by trains carrying coal, how far coal dust travels from rail lines, and the health effects of inhaling this environmental coal dust. This makes it difficult to conclusively state what the local impacts of coal dust might be.

Emission of particulate matter: Diesel locomotive exhaust

Associated health outcomes: *heart and lung conditions such as heart attacks, strokes, and asthma; cancer*

As discussed in the *coal dust* section above, particulate matter in the environment is dangerous to human health. Diesel particulate matter, a specific type of particulate matter that is released by engines powered by diesel fuel, has distinctive health hazards.

Heart and lung conditions

Inhalation of particulate matter is associated with several heart and lung conditions, as discussed in the *coal dust* section above.

Cancers

Inhalation of particulate matter is associated with cancers, as discussed in the *coal dust* section above. In the case of diesel particulate matter specifically, the relationship with cancer is conclusively documented. Diesel particulate matter is one of a few substances that is designated as a known carcinogen by the World Health Organization.[42]

Implications for Multnomah County

Freight train locomotives are powered by very large diesel engines. Diesel particulate matter is one of the air toxins that contributes the most to air pollution-related health risks in the Portland region. According to a recent estimate by the Oregon Department of Environmental Quality, in 2017 the region's airshed will have on average more than ten times the level of diesel particulate that is considered safe.[43] However, in general, trains contribute a relatively small percentage of total diesel particulate air pollution in our region (i.e., an estimated 7%).[44]

The three proposed coal transport projects might result in 16-19 new train trips through Multnomah County. This might represent an estimated 15-20 percent increase in total train trips in Multnomah County compared to the current number of trips. Thus, the trains carrying coal would contribute a moderate increment of train-related diesel emissions in the region.

Conclusion

By virtue of using diesel engines, rail transportation of coal through Multnomah County will result in the emission of diesel particulate matter, a known health hazard. However, coal trains would add a relatively small increase to already-high levels of diesel particulate matter in the region, the vast majority of which is released by sources other than trains.

Production of noise and vibration by train movement

Associated health outcomes: *stress and mental health problems; high blood pressure*

High blood pressure

Noise can threaten cardiopulmonary health, the effective circulation of blood and utilization of oxygen in the human body. Noise, especially at high levels, can contribute to high blood pressure, a risk factor for heart disease.[45–47]

Stress and mental health

Noise and vibration, such as that produced by trains, can affect people's stress levels and mental well-being. Stress influences health through the secretion of stress-related hormones and causing behaviors (particularly coping mechanisms) that can increase risk of disease.[47] At lower environmental noise levels, there is a weak association between noise and mental health symptoms and anxiety.[48] One study of military aircraft noise found that exposure to higher levels of noise was associated with nervousness and depression.[49] Because reaction to noise is influenced in part by the time between noises [50] and the "difference in sound pressure levels [loudness] between a noise event and background,"[51] train noise is particularly disruptive.

Implications for Multnomah County

Trains are one of many sources of noise in Multnomah County, and noise from trains has long been a concern of several county neighborhoods, such as Cathedral Park, Brooklyn, and Eastmoreland. While train vibration is felt only locally, horn noise can travel long distances and would contribute to background urban noise. As discussed above, coal trains might represent a moderate increase in freight rail traffic in the region.

Conclusion

Coal trains could produce more noise per trip than other trains as a result of their length and heavy load. However, activity near rail yards, such as loading and unloading, causes the majority of train-related noise, and these activities will not take place in Multnomah County. Therefore, trains carrying coal would likely add a relatively small increment of noise in areas that already experience industrial noise.

Traffic congestion and collisions along roadways and rail lines

Associated health outcomes: *stress; injury and deaths*

Stress

Train traffic-related congestion may cause stress. Stress influences health through the secretion of stress-related hormones and causing behaviors (particularly coping mechanisms) that can increase risk of disease.[47]

Safety-related injury and deaths

Safety concerns include train collisions with other motor vehicles, bicycles, or pedestrians; decreased visibility near rail tracks due to dust; and property damage, such as to vehicle windshields by pieces of coal falling from trains. Congestion at intersections crossed by coal trains could increase response times for emergency vehicles and/or disrupt emergency routes, which could lead to increased severity of medical problems and even death due to delayed medical care.

Implications for Multnomah County

Comparing the potential routes to federal transportation data suggests that there are approximately 50 locations where coal trains might cross public roadways in Multnomah County. Like other trains that travel through Multnomah County, each coal train would travel through several at-grade crossings per trip. Given the length and weight of coal trains, the force of a collision involving a coal train could cause major injuries and property damage. According to the Federal Railroad Administration, there were three train-involved collisions in Multnomah County in the first three quarters of 2012 (January-September). These collisions resulted in two injuries and no fatalities.[52] Over the past ten years, there have been seven deaths and 224 train-related injuries in Multnomah County for any reason. The data

for the past ten years shows that these incidents are on the decline.[53]

As trains pass through at-grade crossings, the flow of motor vehicles, bicycles, and pedestrians is disrupted and delayed. Trains are required to travel at low speeds through urban areas to decrease the risk and severity of collisions. Because of their length (up to 1 ¼ miles long) and low speed, coal trains could block roadways for relatively long periods of time. In densely settled areas, such as the city of Portland, this could result in a cumulative delay of up to two hours per day at each crossing.[54] It could also disrupt routes and increase response times for emergency vehicles called to fires, medical incidents, and other public safety crises.

Conclusion

Coal trains could cause significant delays and result in roadway congestion, including delays in emergency response. Coal trains could also collide with vehicles and pedestrians, but U.S. data indicates that coal train collisions are rare. In Multnomah County, train collisions (carrying all types of cargo) are infrequent and are on the decline. There is no evidence that increased coal train traffic would change this trend.

Train derailment

Associated health outcomes: *injury and deaths*

Injury and deaths

Coal dust is known to degrade railroad tracks and prevent adequate water drainage from the railbed. Poor drainage contributes to slippery and warped rails. The National Wildlife Federation reports that there were thirteen derailments of trains carrying coal in the United States in 2012, representing 1 percent of all U.S. train derailments (13 out of 930). The 930 derailments and collisions in the U.S. caused eight fatalities in 2012, none of which were in Multnomah County.

Implications for Multnomah County

According to the Federal Railroad Administration, there were five train derailments reported in Multnomah County in the first three quarters of 2012 (January–October) and there were no related injuries or deaths.[52] Two derailments occurred in rail yards and three were due to track defects.

Conclusion

These data suggest that train derailments are fairly uncommon in Multnomah County and that the introduction of coal trains is unlikely to result in many additional derailments.

Fires due to spontaneous combustion of coal

Associated health outcomes: *injury and deaths*

Injury and deaths

Coal combusts at low temperatures. Spontaneous combustion occurs because coal produces heat as it decomposes upon contact with oxygen. Fires are most likely to occur in areas where coal is stored in large piles for long periods of time without being moved, such as at power plants.[55] Spontaneous combustion is more likely in freshly-mined coal. Packing strategies such as those that compact the coal can reduce the likelihood of combustion while being transported by train.[56] Given coal's combustibility, fires and attendant injuries and property damage could also occur as a result of a train collision.

Implications for Multnomah County

Coal from the Powder River Basin would only travel through Multnomah County; it would not be stored or processed within the county. However, Powder River Basin coal may be particularly susceptible to spontaneous

combustion as a result of its chemical composition. According to discussions between mining and energy companies that handle Powder River Basin coal, there have been reports of fires in railcars and barges transporting this type of coal.[55] Based on what we know about the proposed projects, coal would be transported in uncovered cars to let heat dissipate, which would decrease the likelihood that coal would catch fire.

Conclusion

Though Powder River Basin coal may be particularly susceptible to combustion, the literature review suggests that fires in railcars carrying coal through Multnomah County are unlikely. This is because coal is most likely to catch fire where it is mined, processed, or stored and because shippers use packing techniques to prevent fires during transit.

Spatial analysis findings: Populations in Multnomah County likely to be affected

The literature review indicated that some populations in Multnomah County could be more vulnerable to the health impacts of coal transportation than others. Vulnerable populations include:

- People living close to the rail lines carrying coal
- People who are susceptible because of their age (i.e., youth and older adults)
- Populations who are at increased risk of the associated health outcomes due to their race, ethnicity, income, and/or level of exposure to other health risks.

For people who fall into several of these categories, risks may be multiplied. This section describes each of these populations to the extent that local data were available.

Populations living near rail lines that might carry coal: Census tract-level analysis

Generally, it is reasonable to expect that residents living closer to rail lines carrying coal would be exposed to higher levels of coal dust and diesel particulate matter than those living further away. Similarly, noise-related problems and traffic delays are more likely to occur among those living and working closer to railroad tracks.

As previously stated, there are significant gaps in the scientific literature regarding how much coal dust is shed by trains carrying coal, how far coal dust travels from rail lines, and the health effects of inhaling this environmental coal dust. The lack of scientific information limits the ability of this analysis to quantify the number of people potentially affected or the severity of the effects.

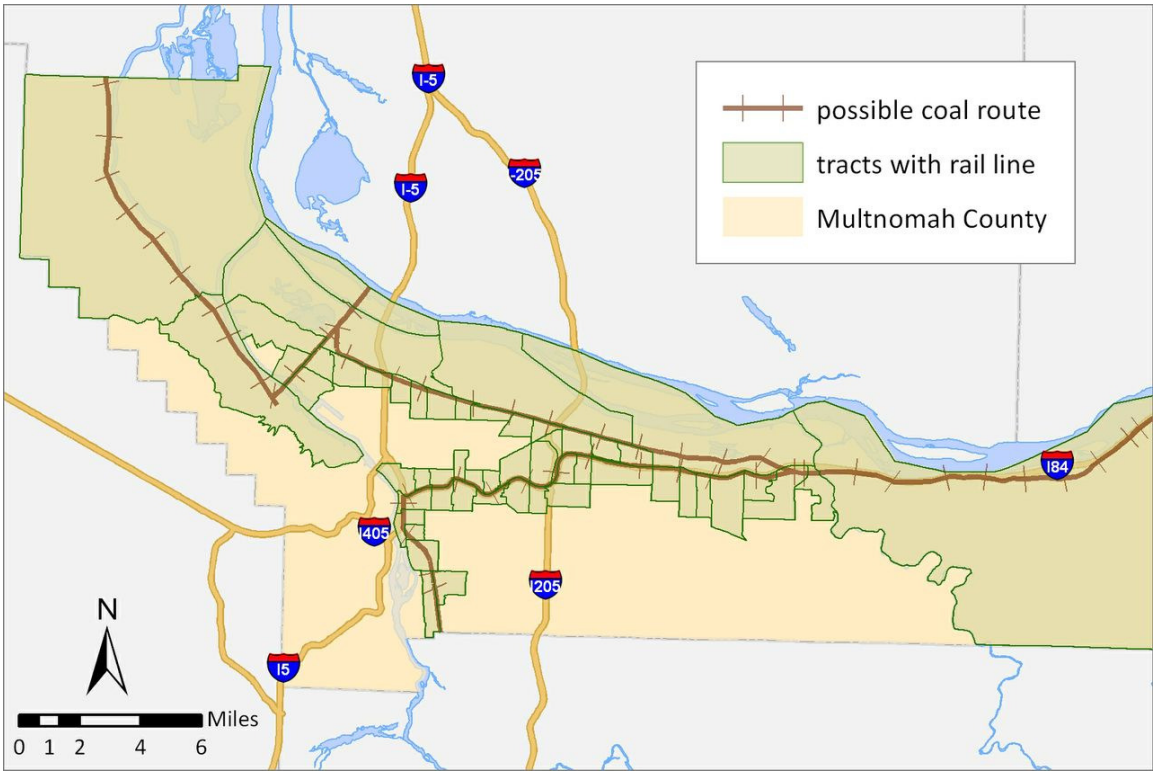
However, this analysis drew upon the available literature to estimate that coal dust may travel approximately 500 m to 2 km (1/3 to 1 ¼ miles) from the train tracks, depending on weather conditions and train speed.[57,58] Census tracts—relatively small geographic areas used for census-taking—offer a rough proxy for the 2 km distance from the rail line. Using this approximation allowed the Health Department to utilize Census Bureau data to describe potentially affected populations.

Almost one-third of Multnomah County's population lives in census tracts that either border or cross rail lines that may carry coal. As shown in *Figure 2*, many of these people live

near major roadways and industrial areas and probably already experience a high burden of air pollution and noise disturbance.

Accordingly, the potential burdens of the coal export projects would fall on the same populations who are already exposed to the highest levels of air toxins and industrial noise.

Figure 2: Census tracts containing or adjacent to rail lines that might carry coal



Sources: Metro,[59] Census 2010, The Oregonian[2]

Table 2, on the following page, presents the most current census data available at the tract level regarding populations who may be especially vulnerable to health impacts related to coal transport. As shown in *Table* 2, the demographics of the tracts near rail lines are similar to the county population as a whole; however, people of color make up a larger proportion of the population in tracts near rail lines than they do in the county as a whole. As a result, people of color may be disproportionately exposed to the effects coal transportation.

Not only are people of color in Multnomah County more likely to live by the rail lines that might carry coal, they may also be more vulnerable to some of the health consequences of coal transportation, such as heart disease. For example, in Multnomah County, African Americans have a higher rate of deaths caused by strokes as compared to Whites.[60]

The causes of these racial and ethnic differences are complex. A wide body of research has found that race and ethnicity are associated with health status—independent of poverty status—because of stress, access to health care, and other factors.

. ***Table 2:*** *Characteristics of population living near rail lines that may carry coal (estimates)*

	Tracts that contain or border rail lines that may carry coal Number (%)	Multnomah County overall Number (%)
Race/ethnicity *(source: Census 2010)*		
Basis of computations: Total population in 2010	229,482	735,334
People of color (Non-White + Hispanic Whites)	62,218 (27.1%)	172,913 (23.5%)
Hispanic of any race	28,503 (12.4%)	80,138 (10.9%)
Non-Hispanic		
White	167,264 (72.9%)	562,421 (76.5%)
Black	18,376 (8.0%)	41,401 (5.6%)
Asian	13,255 (5.8%)	47,950 (6.5%)
American Indian/Alaska Native	2,920 (1.3%)	7,825 (1.1%)
Native Hawaiian/Pacific Islander	1,667 (.7%)	4,029 (.5%)
Age *(source: Portland State University 2011 Population Estimates)*		
Basis of computations: Estimated population in 2011	231,413	741,961
Over 65 yrs.	25,841 (11.2%)	79,977 (10.8%)
Under 18 yrs.	47,832 (20.7%)	154,840 (20.9%)
Other social characteristics *(source: American Community Survey 2006-2010)*		
Basis of computations: Population for whom poverty status is determined, 2006-10 estimate (Table S1701)	216,063	697,596
With incomes at or below 200% of federal poverty level	78,264 (36.2%)	239,753 (34.4%)
Basis of computations: Population 5 years and over (Table SF4 DP02)	210,532	667,150
Speak English less than very well	19,920 (9.5%)	62,241 (9.3%)

Populations who might experience the greatest effects: Census block group-level analysis

Of people who live within 2 km of rail lines carrying coal, those who live within 500 m are even more likely to be affected. An estimated 82,000 people, or about one in nine Multnomah County residents, live within 500 m of the rail lines that might carry coal.* This is close enough to predict that these people would experience some, if not many, of the effects of coal transportation.

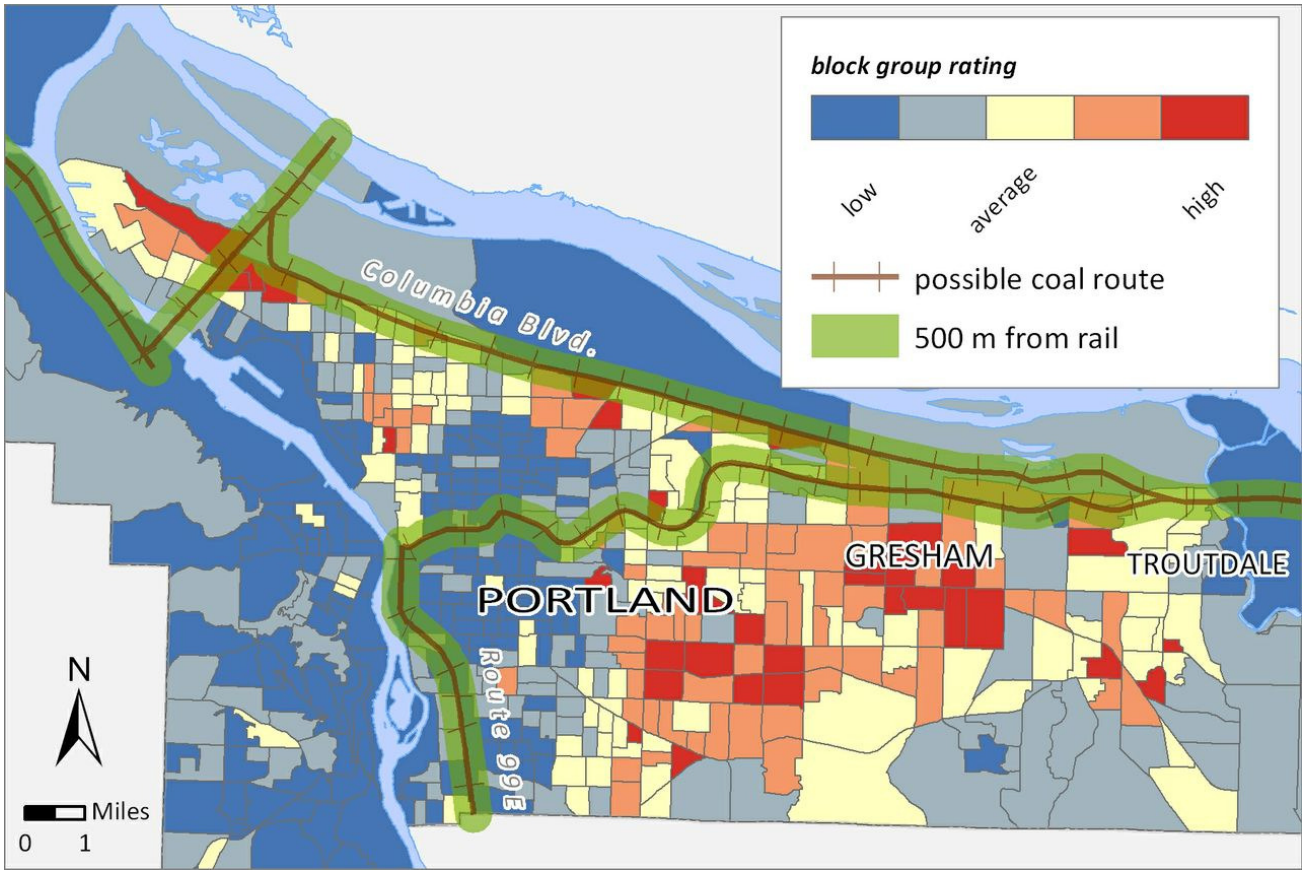
To describe the population living within 500 m of the proposed coal routes, this analysis used a recent analysis conducted by Metro, called the Equity Composite.[10] Metro used data at the census block group level to identify populations that have historically experienced social and health disadvantages based on race, ethnicity, age, or income and compared it to other areas in the metropolitan area. Block groups are geographic units created by the Census Bureau that are one level smaller than census tracts. The map of the demographic measure from the Equity Composite provides a rough illustration of the characteristics of the population living within 500 m of the potential coal train routes.

Figure 3 on the following page shows that some of the block groups near the proposed coal transportation routes have relatively high proportions of residents belonging to disadvantaged demographic groups. These block groups are shaded in red or orange and cluster along rail lines that parallel Columbia Boulevard and neighborhoods in North Portland (e.g., Kenton and St. Johns). By contrast, more advantaged block groups, shaded in blue, are common along the lines that parallel Interstate 84 and Oregon Route 99E.

This suggests that, given similar volumes of rail traffic, people who live along the Columbia Boulevard and Willamette Bridge rail lines could suffer more serious health effects than would their counterparts in other parts of the county because the racial, ethnic, income, and age composition of these areas increase their vulnerability to health problems.

* A more conservative estimate of how far coal dust might travel, based on the findings of two arcticles.[57,58]

Figure 3: *Concentration of vulnerable demographic groups in census block groups (Metro Equity Composite demographic measure) with 500-meter radius from rail lines that might carry coal*



Sources: The Oregonian,[2] Metro regional government[10,59]

Key Concerns and Recommendations for Potential Actions

The purpose of this health analysis was to help Multnomah County better understand the potential health impacts of transporting coal by rail before any of the proposed projects are implemented. Health risks attributable to coal transportation would add to the multiple effects of rail freight that Multnomah County residents already experience. A substantial increase in rail traffic–carrying coal or other freight–would likely increase the proportion of the population affected by these issues and/or the magnitude of the effects. Ultimately, it is reasonable to expect that this would likely increase the prevalence and/or severity of the associated health outcomes, as well.

In addition, coal transportation might result in cumulative and/or synergistic impacts that this analysis is unable to estimate. *Cumulative impacts* are the sum total of the various individual impacts. *Synergistic impacts* describes how combinations of environmental or health factors can strengthen, weaken, or block the effects of other factors.

Policymakers, community leaders and residents must weigh these new potential risks in light of existing risks as well as the potential positive effects of expanded rail transportation on the local economy.

Concerns

This analysis of the potential health consequences of coal transportation through Multnomah County identifies two key concerns:

Additional rail freight traffic increases health risks

Specifically, there is likely to be increased exposure to diesel particulate matter as a result of locomotive exhaust. This conclusion is based on:

- The well-established connection between exposure to diesel particulate matter and health problems
- The high likelihood that coal trains, as any other train, would emit diesel particulate matter
- The severity of the health outcomes associated with diesel particulate matter (e.g., respiratory problems, cancer)

The geographic areas of highest concern are located near the tracks by Columbia Boulevard and in North Portland neighborhoods (e.g., Kenton and St. Johns). Residents in some of these areas of concern are already exposed to relatively high levels of diesel particulate matter from living near major roadways and industrial areas. The social groups of highest concern are: communities of color, children, older adults, and people earning low incomes.

The health risk posed by coal traveling as rail cargo through Multnomah County is uncertain due to insufficient scientific evidence

Given the well-established risks of exposure to coal dust in occupational settings, the Health Department concludes that more research is needed to assess:

- How coal dust could disperse during coal transportation by rail and the extent that people would be exposed
- What the immediate, cumulative, synergistic and long-term health impacts of this dust could be on a community

Recommendations

The Multnomah County Health Department recommends the following actions for consideration by local policymakers and community leaders to address these key concerns and raise awareness about Multnomah County's potential vulnerability.

Invoke the precautionary principle

The precautionary principle holds that in the event of insufficient evidence that an action may cause harms, the burden of proof falls on those taking the action to demonstrate that it will not be harmful.[61]

Under the precautionary principle, it is reasonable for policymakers to call upon the coal industry, including rail companies who would be transporting coal, to demonstrate that coal transportation would *not* be harmful to the public's health and safety. This call to industry could catalyze further public discussion about the uncertain risk of coal transportation, the demands for more research, and the need for local planning to assure the health and safety of Multnomah County communities.

Call for a programmatic federal Environmental Impact Statement of coal export in the Pacific Northwest

The information and evidence gaps identified in this analysis reinforce the calls from other communities and organizations for a comprehensive review of the risks and threats of coal export projects by the relevant federal agencies (e.g., the Federal Bureau of Land Management and U.S. Army Corps of Engineers).

The proposed plans for transport of coal across the Pacific Northwest do not exist in isolation, but rather will affect communities throughout the region. Therefore, it is reasonable for local policymakers to call for the federal government to conduct a region-wide review of the environmental, health, and transportation issues related to exporting coal from Northwest ports. Such a "programmatic" environmental impact statement (EIS)[62] could address several potential health impacts identified through this analysis including: roadway congestion, collisions, and the disproportionate impact on environmental justice communities, such as people of color and people already exposed to the health burdens of industrial processes.

References

1. Whiteside TC, Fauth III GW, Streeter RH. *Heavy Traffic Ahead: Rail impacts of Powder River Basin Coal to Asia by way of Pacific Northwest Terminals*. Billings, Mont.: Western Organization of Resource Councils; 2012. Available at: http://www.heavytrafficahead.org/.

2. Learn S, Friesen M. Map: Possible coal train routes. *The Oregonian*. 2012. Available at: http://projects.oregonlive.com/coal/. Accessed November 5, 2012.

3. Epstein PR, Buonocore JJ, Eckerle K, et al. Full cost accounting for the life cycle of coal. *Annals of the New York Academy of Sciences*. 2011;1219(1):73–98.

4. LaFontaine P, Callero N, Tillmann P. *The True Cost of Coal*. Reston, VA: National Wildlife Federation; 2012. Available at: http://www.nwf.org/News-and-Magazines/Media-Center/Reports/Archive/2012/07-31-12-True-Cost-of-Coal.aspx. Accessed December 14, 2012.

5. NewFields Companies. *Health Impact Assessment for proposed coal mine at Wishbone Hill, Matanuska-Susitna Borough Alaska*. Anchorage, Alaska: State of Alaska; 2012. Available at: http://www.epi.alaska.gov/hia/WishboneHillDraftHIA.pdf. Accessed December 14, 2012.

6. Walker E, Payne D. *Health Impact Assessment of Coal and Clean Energy Options in Kentucky*. Berea, Ky.: Kentucky Environmental Foundation; 2012. Available at: http://kyenvironmentalfoundation.org/cleanair.html. Accessed December 14, 2012.

7. Brenner MH. Health benefits of low-cost energy: an econometric case study. *EM, the Magazine for Environmental Managers*. 2005:28–33.

8. Klein DE, Keeney RL. *Mortality Reductions from Use of Low-cost Coal-fueled Power: An Analytical Framework*. McLean, Va.: Twenty-first Century Strategies; 2002. Available at: http://www.coalcandothat.com/images/content/MortalityRed.pdf. Accessed December 14, 2012.

9. National Coal Council. *The Urgency of Sustainable Coal*. Washington, D.C.: National Coal Council; 2008. Available at: http://www.nationalcoalcouncil.org/Documents/Urgency_of_Sustainable_Coal.pdf. Accessed December 14, 2012.

10. Metro Regional Government. *2014-15 Regional Flexible Fund Allocation Transportation Equity Analysis*. Portland, OR: Metro Regional Government; 2012. Available at: http://www.oregonmetro.gov/index.cfm/go/by.web/id=19681. Accessed December 14, 2012.

11. World Health Organization. *Health aspects of air pollution with particulate matter, ozone and nitrogen dioxide*. Bonn: World Health Organization; 2003.

12. World Health Organization. Outdoor Air Pollution. *Global Health Observatory*. Available at: http://www.who.int/gho/phe/outdoor_air_pollution/en/index.html. Accessed January 31, 2013.

13. Thaller EI, Petronella SA, Hochman D, et al. Moderate increases in ambient PM2.5 and ozone are associated with lung function decreases in beach lifeguards. *Journal of occupational and environmental medicine*. 2008;50(2):202–211.

14. Gauderman WJ, Avol E, Gilliland F, et al. The effect of air pollution on lung development from 10 to 18 years of age. *The New England Journal of Medicine*. 2004;351(11):1057–1067.

15. Brook RD, Rajagopalan S, Pope III CA, et al. Particulate matter air pollution and cardiovascular disease: An update to the scientific statement from the American Heart Association. *Circulation*. 2010;121(21):2331–2378.

16. HEI Panel on the Health Effects of Traffic-related Air Pollution. *Traffic-related Air Pollution: A Critical Review of the Literature on Emissions, Exposure, and Health Effects*. Boston: Health Effects Institute; 2010.

17. Pandya RJ, Solomon G, Kinner A, Balmes JR. Diesel exhaust and asthma: hypotheses and molecular mechanisms of action. *Environmental Health Perspectives*. 2002;110(Suppl. 1):103 –12.

18. Garland R. *Burden of Asthma in Oregon: 2010*. Portland, OR: Oregon Health Authority; 2010.

19. Mazurek JM, Laney AS, Wood JM. Coal workers' pneumoconiosis-related years of potential life lost before age 65 years - United States, 1968-2006. *Morbidity and Mortality Weekly Report*. 2009;58(50):1412–1416.

20. Pope III CA, Burnett RT, Thun MJ, et al. Lung cancer, cardiopulmonary mortality, and long-term exposure to fine particulate air pollution. *Journal of the American Medical Association*. 2002;287(9):1132–1141.

21. Sunderman FW. Nasal toxicity, carcinogenicity, and olfactory uptake of metals. *Annals of Clinical & Laboratory Science*. 2001;31(1):3–24.

22. Verougstraete V, Lison D, Hotz P. Cadmium, lung and prostate cancer: a systematic review of recent epidemiological data. *Journal of Toxicology and Environmental Health, Part B*. 2003;6(3):227–255.

23. IARC Working Group on the Evaluation of the Carcinogenic Risks to Humans. *Silica, Some Silicates, Coal Dust and Para-aramid Fibrils*. Lyon: International Agency for Research on Cancer; 1997. Available at: http://monographs.iarc.fr/ENG/Monographs/vol68/index.php.

24. Jennings M, Flahive M. *Review of Health Effects Associated with Exposure to Inhalable Coal*. West Perth, Australia: Coal Services Pty Limited; 2005. Available at: http://www.hstrust.com.au/MessageForceWebsite/Sites/326/Files/Jennings_20420_Inhlalable_Coal_DustFinalReport.pdf. Accessed December 14, 2012.

25. Hu H. Human Health and Heavy Metals Exposure. In: McCally M, ed. *Life Support: The Environment and Human Health*. Cambridge, Mass.: MIT Press; 2002.

26. Howel D, Pless-Mulloli T, Darnell R. Consultations of children living near open-cast coal mines. *Environmental Health Perspectives*. 2001;109(6):567–71.

27. Moffatt S, Pless-Mulloli T. "It wasn't the plague we expected." Parents' perceptions of the health and environmental impact of opencast coal mining. *Social Science & Medicine*. 2003;57(3):437–451.

28. Pless-Mulloli T, Howel D, King A, et al. Living near opencast coal mining sites and children's respiratory health. *Occupational and Environmental Medicine*. 2000;57(3):145–151.

29. Hendryx M, Ahern MM, Nurkiewicz TR. Hospitalization patterns associated with Appalachian coal mining. *Journal of Toxicology and Environmental Health, Part A*. 2007;70(24):2064–2070.

30. Hendryx M, Fedorko E, Anesetti-Rothermel A. A geographical information system-based analysis of cancer mortality and population exposure to coal mining activities in West Virginia, United States of America. *Geospatial Health*. 2010;4(2):243–256.

31. Hendryx M, Ahern MM. Relations between health indicators and residential proximity to coal mining in West Virginia. *American Journal of Public Health*. 2008;98(4):669–671.

32. Hendryx M. Mortality from heart, respiratory, and kidney disease in coal mining areas of Appalachia. *International Archives of Occupational and Environmental Health*. 2009;82(2):243–249.

33. Emmitt GD. Fugitive coal dust: An old problem demanding new solutions. *Port Technology International*. 1999;9:1.

34. BNSF Railway. Coal dust frequently asked questions [2011 version]. 2011. Available at: [no longer available].

35. De Place E. At least the website is clean: What the railroads don't want you to know about coal dust. *Sightline Daily*. 2011. Available at: http://daily.sightline.org/2011/08/10/at-least-the-website-is-clean/. Accessed December 14, 2012.

36. Szabo MF. *Environmental assessment of coal transportation*. Cincinnati, Ohio: Environmental Protection Agency; 1978. Available at: nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=9100T7M9.txt. Accessed December 14, 2012.

37. BNSF Railway. Summary of BNSF/UP Super Trial 2010. Available at: http://www.bnsf.com/customers/pdf/coal-super-trial.pdf. Accessed February 10, 2013.

38. Voorhees J. Railroads, utilities clash over dust from coal trains. *Greenwire*. 2010. Available at: http://www.eenews.net/public/Greenwire/2010/01/25/2. Accessed November 14, 2012.

39. Anon. *Arkansas Electric Corporation - Petition for declaratory order*. 2011. Available at: http://www.stb.dot.gov/decisions/ReadingRoom.nsf/WEBUNID/79B5382AE20F7930852578480053111F. Accessed November 15, 2012.

40. Anon. *Reasonableness of BNSF Railway Company coal dust mitigation tariff provisions*. 2011. Available at: http://www.stb.dot.gov/decisions/readingroom.nsf/fc695db5bc7ebe2c852572b80040c45f/3bdd891ff0ccc1fb8525794f006db7c9. Accessed November 15, 2012.

41. Learn S. Coal clash: Dust up over how much blows off on trains through Oregon, Washington. *The Oregonian*. 2012. Available at: http://www.oregonlive.com/environment/index.ssf/2012/06/coal_clash_dust_up_over_how_mu.html. Accessed December 18, 2012.

42. World Health Organization. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans Volume 105: Diesel and Gasoline Engine Exhausts and Some Nitroarenes. 2012. Available at: http://www.iarc.fr/en/media-centre/iarcnews/2012/mono105-info.php. Accessed February 5, 2013.

43. Oregon Department of Environmental Quality. *Portland Air Toxics report*. Portland, OR: Oregon Department of Environmental Quality; 2012. Available at: http://www.deq.state.or.us/aq/planning/patsReport.htm.

44. Oregon Department of Environmental Quality. *Portland area pollutant summary sheets/maps for air toxics*. Portland, OR: Oregon Department of Environmental Quality; 2012. Available at: http://www.deq.state.or.us/aq/toxics/pats.htm.

45. Babisch W. *Transportation Noise and Cardiovascular Risk: Review and Synthesis of Epidemiological Studies, Dose-effect Curve and Risk Estimation*. Berlin: Federal Environmental Agency (Germany); 2006. Available at: http://circa.europa.eu/Public/irc/env/noisedir/library?l=/health_effects_noise/cardiovascular_transport/_EN_1.0_&a=d. Accessed December 14, 2012.

46. Passchier-Vermeer W, Passchier WF. Noise exposure and public health. *Environmental Health Perspectives*. 2000;108(Suppl 1):123–131.

47. Van Kempen EEMM, Kruize H, Boshuizen HC, et al. The association between noise exposure and blood pressure and ischemic heart disease: A meta-analysis. *Environmental Health Perspectives*. 2002;110(3):307–317.

48. Stansfeld SA, Matheson MP. Noise pollution: non-auditory effects on health. *British Medical Bulletin*. 2003;68(1):243–257.

49. Hiramatsu K, Yamamoto T, Taira K, Ito A, Nakasone T. A survey on health effects due to aircraft noise on residents living around Kadena airport in the Ryukyus. *Journal of Sound and Vibration*. 1997;205(4):451–460.

50. Berglund B, Lindvall T. Community noise. *Archives of the Center for Sensory Research*. 1995;2(1):1–195.

51. Berglund B, Thomas L, Schwela DH. *Guidelines for Community Noise*. Geneva: World Health Organization; 1999.

52. Office of Safety Analysis, Federal Railroad Administration. Total Accidents/Incidents, Jan-Sep (2012 preliminary). 2013. Available at: http://safetydata.fra.dot.gov/OfficeofSafety/publicsite/summary.aspx. Accessed December 14, 2012.

53. Office of Safety Analysis, Federal Railroad Administration. Ten Year Accident/Incident Overview by Railroad/Region/State/County. 2013. Available at: http://safetydata.fra.dot.gov/OfficeofSafety/publicsite/Query/tenyr2a.aspx. Accessed January 31, 2013.

54. Learn S. Coal clash: Potential for more coal trains in the Northwest raises congestion, pollution concerns. *The Oregonian*. 2012. Available at: http://www.oregonlive.com/environment/index.ssf/2012/06/coal_clash_trains_roll_slowly.html. Accessed November 5, 2012.

55. Hossfeld R, Hatt R. *PRB coal degradation: Causes and cures*. Chicago: paper for PRB Coal Users' Group Annual Meeting; 2005. Available at: http://www.prbcoals.com/pdf/paper_archives/56538.pdf. Accessed October 25, 2012.

56. Assistant Secretary for Environment, Safety & Health. *The Fire Below: Spontaneous Combustion in Coal*. Washington, D.C.: U.S. Department of Energy; 1993. Available at: http://www.hss.energy.gov/publications/esh_bulletins/BULL0094.html. Accessed December 14, 2012.

57. Trivedi R, Tewary BK, Chakraborty MK. Dust dispersion modeling using fugitive dust model at an opencast coal project of Western Coalfields Limited, India. *Journal of Scientific and Industrial Research*. 2009;68:71–78.

58. Brabin B, Smith M, Milligan P, et al. Respiratory morbidity in Merseyside schoolchildren exposed to coal dust and air pollution. *Archives of Disease in Childhood*. 1994;70(4):305–12.

59. Metro Data Resource Center. Regional Land Use Information System. Available at: http://rlisdiscovery.oregonmetro.gov/. Accessed December 20, 2010.

60. Bhat M. *Report card on racial and ethnic health disparities 2011*. Portland, OR.: Multnomah County Health Department; 2011. Available at: http://web.multco.us/health/reports.

61. Martuzzi M, Tickner JA eds. *The Precautionary Principle: Protecting Public Health, the Environment and the Future of our Children*. Copenhagen: World Health Organization, Regional Office for Europe; 2004.

62. Task Force on Improving the National Environmental Policy Act. *Modernizing NEPA Implementation: The NEPA Task Force Report to the Council on Environmental Quality*. Washington, DC: Executive Office of the President of the U.S., Council on Environmental Quality; 2003.