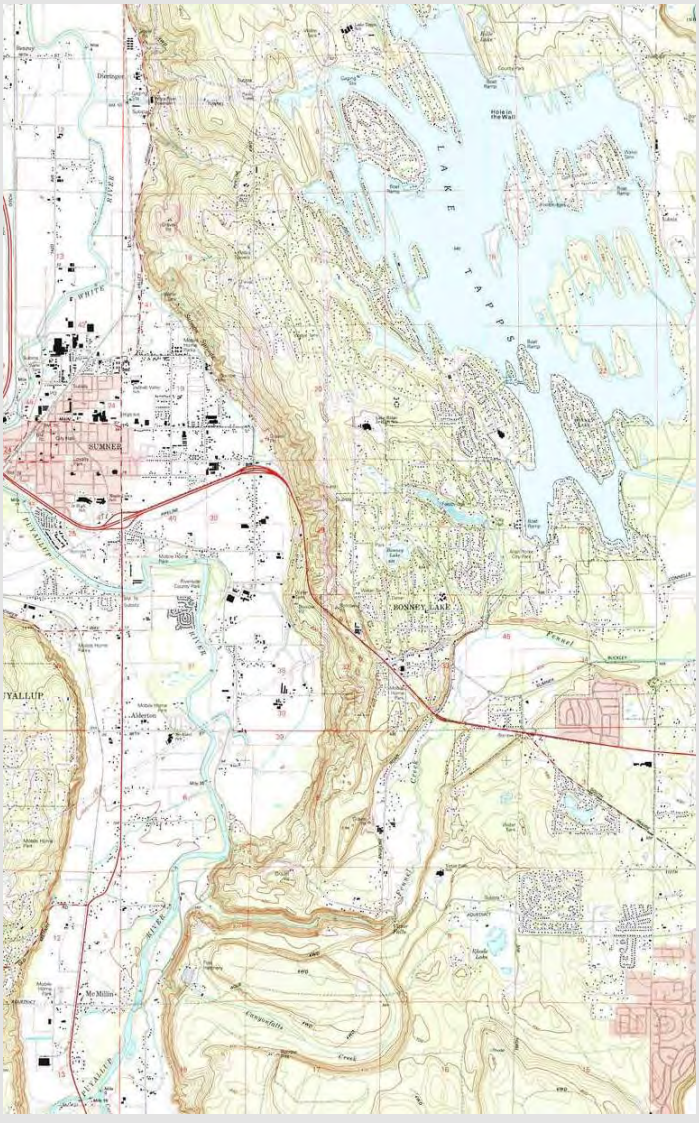
Asphalt Production Policy Health Impact Assessment

Tacoma–Pierce County Health Department & City of Sumner



Washington State Department of Health

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Asphalt Production Policy - Health Impact Assessment

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A project of Tacoma-Pierce County Health Department and the City of Sumner in collaboration with the Washington State Department of Health.

Contact: Amy Pow, Tacoma-Pierce County Health Department

Contributing Agencies/Organizations:

Tacoma-Pierce County Health Department
Michelle Fredrickson, Assessment, Planning and Development
Karen Meyer, Assessment, Planning and Development
Amy Pow, Healthy Community Planning, Principal Planner and Lead Agency Representative

City of Sumner
Eric Mendenhall, Senior Planner
Ryan Windish, Community Development Director

Washington State Department of Health
Marnie Boardman, Public Health Advisor
Rad Cunningham, Epidemiologist
Dr. Julie Fox, Epidemiologist
David McBride, Toxicologist
Dr. Lillian Morris Manahan, Epidemiologist
Len O'Garro, Toxicologist
Paula Reeves, Environmental Planner

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Executive Summary

What is a Health Impact Assessment?

A ***Health Impact Assessment (HIA)*** is a process that helps support the required review and analysis of potential health effects of a plan, project, or policy before it is built or implemented. An HIA can provide recommendations for increasing positive health outcomes and minimizing adverse health outcomes. [1]

Both the State and National Environmental Policy Acts (40 C.F.R. 1508) call for the review and analysis of the direct, indirect, or cumulative impacts of a proposed action on public health and safety as well as other factors. A primary stated purpose of the State Environmental Policy Act (RCW 43.21C.010) is to stimulate the health and welfare of human beings. Additionally, Local Health Jurisdictions in Washington have the ability to call for special studies or other actions necessary to maintain public health and safety under state law (RCW 70.05).

The HIA prepared for Tacoma-Pierce County Health Department and City of Sumner focused on a proposed policy change to revise zoning in certain areas allowing for asphalt production.

A Local Government, Tribal Nation, Washington State Department of Ecology, or other local or regional municipality may request assistance from Washington State Department of Health's Environmental Public Health Division. Types of HIA are listed in Figure 1. HIA's can be standalone documents or integrated into environmental impact statements. Each of these types of Health Impact Assessments follow established processes. This Asphalt Production Policy HIA is considered a ***Rapid Health Impact Review***.

Figure 1. *Health Impact Assessment Types [2]*

What type of Health Impact Assessment is right for your community?

- **Comprehensive HIA –** A comprehensive HIA examines as much evidence as possible, using:
  - An extensive search of the literature and other existing information
  - In-depth interviews
  - Community surveys
  - Some original research if appropriate
  - Input from experts and agencies

  This type of HIA can take six months or more, and can require a team to conduct it.

- **Intermediate HIA –** An intermediate HIA may combine a workshop with key stakeholders followed by desk-based work to build up a more detailed picture of the potential health impacts than would typically be identified during a rapid or "mini" HIA. It may involve a limited literature search, usually non-systematic, and relies mainly on surveillance or routine, readily available data.

- **Rapid HIA –**
  A rapid HIA uses both existing research and rapid assessment techniques. Although it could be carried out by one or two researchers, it may also involve more and can take up to three months.

- **Desktop HIA** - As the name implies, this HIA focuses mainly on existing research and remote contact with a few stakeholders. It would probably be carried out by one or two people, and may take between two to six weeks.

What were key findings of this Health Impact Assessment?

A panel of health experts from State Department of Health considered the health and safety implications related to the potential expansion of asphalt production plants in specific locations identified by the City of Sumner. The general conclusions of this HIA (See Section V. Conclusions and Recommendations, Page 36) are designed to be transferable to other parts of Pierce County. This project proposes changes to policy and regulations pertaining to asphalt plants within the areas designated Mineral Resource Lands in Low Density Residential and General Commercial zones, and Heavy Manufacturing (M-2) zones within the City of Sumner.

The health panel conducted original analysis, and identified and considered scientific articles, professional reports, and government data. It should be noted that research evidence in some areas is very limited, therefore making meaningful conclusions difficult. Based on its review, the panel offers the following summary of findings:

1. ***What are the potential health impacts of chemical agents on workers at the asphalt facilities or residents?***

   Minor symptoms of irritation and lower respiratory symptoms have been reported in workers in the asphalt industry. Evidence of cancer and non-cancer health impacts among asphalt workers is mixed and inconclusive. Residential risk is addressed as nearby populations below. **See Section II. Air Quality, Page 16**.

2. ***Are there any populations at risk of exposure to air pollution due to proximity, prevailing winds, or other environmental factors?***

   Off-site air pollution exposure levels are expected to be highest in areas closest to an asphalt plant. In modeling performed by the Department of Ecology based on several assumptions, the highest levels were found to be 37 meters (122 feet) from the source. Sources of emission on hot mix asphalt plants are typically at least 150 feet from the property boundary, so while workers at the plant would be within this area, it is not expected that residents would be within this area. **See Section II. Air Quality, Page 14**.

   Depending on the time of year, prevailing winds in the area of the proposed asphalt plants are from the west, southwest and south pushing more of the air emissions to the east, northeast, and north. However, prevailing winds, in this case, are not the only indicator of exposure because the wind direction is variable and there are frequent calm, low-wind periods indicating that the emissions could be present in other directions as well. **See Section II. Air Quality, Page 15**.

3. ***How will asphalt plants potentially affect the health of nearby populations and are there any vulnerable populations more likely to be impacted? Are health impacts distributed evenly across different population groups?***

   Health impacts are generally more likely where there are higher exposures affecting vulnerable populations. Populations that are more vulnerable to air pollution in general include people with lung diseases or respiratory infections, people with heart or blood vessel problems, people who have had a heart attack or stroke, older adults, infants, children, pregnant women and people who smoke, as well as people who are socially vulnerable due to social, economic, and environmental

conditions, For more detail on sensitive populations in the Sumner area, see Section III. Population Health, Page 28.

Increased incidence of health impacts in residents living near asphalt plants have not been identified. Emissions indicate that there is potential concern. Nuisance odors have been noted by residents living near asphalt plants.

People with pre-existing conditions such as heart and lung disease, respiratory infections, diabetes as well as infants, children and pregnant women are more likely to experience negative health effects from changes in air quality. **See Section II. Air Quality, Page 16**.

4. Are there any additional impacts to populations within the affected areas that have existing health disparities?

We do not know if there would be additional impacts in the areas proposed to have asphalt plants. Some health disparities do exist in the surrounding areas, where some populations experience higher than average rates of some poor health outcomes. In general, the Sumner / Bonney Lake region has fewer residents experiencing social vulnerabilities than Pierce County and Washington State. It is important to note that there are still families living below the poverty line, individuals with disabilities, adults without health insurance, and individuals facing unemployment in the Sumner region. These populations are at an increased risk for poor health outcomes. Health disparities are discussed in detail in the 2019 Pierce County Community Health Assessment.

Pierce County, Sumner, and Bonney Lake had higher hospitalization rates for health outcomes related to noise exposure and air pollution than Washington State. **See Section III. Population Health, Page 28.**

5. Are there any potential health effects related to lighting, noise or vibration?

Noise, light pollution and vibration originating from asphalt plants are not well researched. In general, elevated noise exposure can trigger the body's stress response, cause sleep disturbance, and increase blood pressure. There is some evidence that it can lead to adverse cardiovascular heart problems. Light pollution is not as well researched, but there is indication that light exposure in the evening can have short-term impacts on circadian rhythm. Occupational exposures to vibration have demonstrated impacts including hearing loss and musculoskeletal pain, but impacts in the general public with more typical exposures are not well-researched. **See Section II. Noise, Light and Vibration, Pages 20.**

6. Are there any potential traffic related health impacts caused by expanding operations?

Traffic impacts would result from the hauling of materials both to and from the asphalt plant facility. This traffic would primarily consist of heavy trucks, which could impact the condition of local streets as well as result in air and noise impacts as described in this document. The traffic study conducted by the City of Sumner may assess the magnitude of these impacts from increased traffic. **See Section II. Traffic, Page 21.**

7. Are there any potential impacts to water quality?

While not well researched, a limited number of studies and investigations indicate that asphalt production facilities may increase some pollutants, including polycyclic aromatic hydrocarbons (PAHs), in soils at and near the production site, although there was little association between

asphalt production and contamination of groundwater. Of the few studies identified (<5), none linked PAHs contamination of soil or water to community health effects.

More significant contamination of local soil and water environments has occurred at sites where accidents, poor management practices, weak regulatory enforcement, or neglect have led to leaks and spills of fuels, solvents or contaminated waste.

Critical aquifer recharge areas as defined by Pierce County (shown in Figure 3), wells and creeks are located within the vicinity of properties being considered for re-zone. Water quality has the potential to be impacted by contaminants from various sources at industrial sites if they are not appropriately managed. **See Section II. Water and Fisheries, Page 21**.

8. Are there any potential impacts to agriculture, residential gardens or food forage including fish, shellfish, or other wildlife?

While PAHs have been monitored in fish tissue samples across the state, measured concentrations have been low. Currently no fish advisories have been issued. **See Section II. Water and Fisheries, Page 23.**

9. Are the current state and federal standards related to the infrastructure and operation of asphalt batch plants sufficient to address any potential health concerns? If not, what additional measures are needed?

Most state and federal standards, especially those related to air quality emissions, are designed to protect public health. While the regulations are established through an extensive administrative and legal process, there is sometimes a lag in incorporating current health evidence that is continually evolving. **See Section II. Air Quality, Page 18**.

Regulations with emissions standards are only one way to control emissions, and are perhaps the least responsive. In Washington State the Notice of Construction (NOC) permit application process, also referred to as Minor New Source Review, relies on a determination of Best Available Control Technology (BACT) that considers technology advances. The NOC review considers BACT and impact analysis for toxic air pollutants. The NOC process can lead to conditional permitting approvals that reflect the review standards provided by regulation.

In general, ensuring that exposures to pollutants are kept low is good public health practice. Among several options, placing requirements on zoning, plant design, operating practices, and monitoring with enforcement of compliance can help achieve this. **See Section IV. Regulating Asphalt Plants, Page 34.**

10. Are there any foreseeable community health benefits?

Manufacturers, including asphalt production operations, pay Business and Occupation (B&O) taxes in Washington that generate revenues for the state general fund. A portion of these taxes goes to municipalities. Currently, Sumner does not collect a local B&O tax. Development and operation of additional asphalt plants in Sumner or other locations in Pierce County would generate additional B&O tax revenue for the state general fund. Social determinants of health, such as jobs, education, income, and housing, could benefit from by tax revenue. **See Section II. Taxes and Municipal Budgets, Page 25.**

Asphalt plants on average generate between 20-25 permanent jobs, if production is consistent with averages. The Asphalt Manufacturing industry's national as well as state level performance closely follows developments in construction and road infrastructure building and has fluctuated over the past decade. However, the market is expected to support industry growth through 2024. **See Section II. Economic Impacts, Page 26.**

11. ***What are the potential health impacts associated with locating an asphalt plant on Sumner's Mineral Resource designated lands and Heavy Manufacturing (M-2) zone?***

    This Health Impact Assessment is somewhat limited in its ability to determine specific impacts to the proposed area for asphalt plants, mainly because there is no specific proposal on the scale and operations of a new facility. We expect that review of such a proposal under SEPA and as part of air permitting would provide more details on the environmental and public health impacts. Consider the use of TPCHD's Guide to Integrating Health into SEPA Reviews which can be found at: https://www.tpchd.org/home/showdocument?id=586.

    Though air modelling results typically provided as part of a notice of construction (NOC) application were not available, Washington State Department of Ecology's *Technical Support Document for the Asphalt Plan (Portable and Stationary) General Order* provides limited relevant data for this purpose. This resource modeled emissions estimates based on several assumptions of production (less than 300,000 tons of hot mix asphalt per year) and specific options for Best Available Control Technology. The reported data relies on a generalized scenario and it uses a screening model to estimate ambient impacts at given distances from the facility. While emissions from a given asphalt plant are highly dependent on the assumptions, the report provides some indication of the toxic air pollutants that are likely to be present in the levels of highest concern for health. It should be noted that the results in Department of Ecology's report do not reflect recently approved standards set as threshold levels or current modeling approaches. In addition, modelling in Ecology's report does not take into account significant evaluation of several contributing environmental factors, such as meteorology, which is often included in ambient analyses conducted as part of an NOC application and an Environmental Impact Statement (EIS). **See Section I. Introduction, Page 11 and Section II. Air Quality, Pages 14-20.**

I. Introduction

What are Asphalt Plants?

Asphalt plants or hot-mix asphalt plants are facilities where asphalt concrete is manufactured. Hot mix asphalt paving materials are a mixture of well-graded, high-quality aggregate and liquid asphalt cement, heated and mixed in measured quantities. Recycled Asphalt Product (RAP) may also be accepted by an asphalt plant, where it is mixed with other materials and reprocessed into usable asphalt. [3]

There are three main classes of asphalt plants: **batch heater, semi-continuous, and continuous** (or drum mix). Continuous plants have the highest throughput capacity (usually around 500 tons per hour) while batch heater plants have the lowest capacity and are used where short production runs are common. [3]

Summary of Current Regulatory Requirements

The regulating and permitting of asphalt plants is a shared responsibility between local, regional and state agencies. Local governments, under the state's Growth Management Act, have the authority to regulate siting of asphalt plants through zoning codes, as well as site design and operation through development regulations which control hours of operation, lighting, traffic movement, and building orientation.

EPA and state air quality standards (incorporated in **WAC 173-400**) set limits on allowable emissions and requirements for control technology to maintain those levels. For Pierce County and the Puget Sound Region, the Puget Sound Clean Air Agency (PSCAA) regulates air emissions and issues permits including an Order of Approval or Notice of Construction for portable asphalt production. PSCAA requires a new asphalt plant operator to comply with emissions standards, incorporate best available control technology to mitigate air emissions and demonstrate that their ambient impacts do not violate ambient air quality standards or exceed Acceptable Source Impact Levels. Facilities must also report methods they will employ for dust control. State law and regulation require compliance with the State Environmental Policy Act (SEPA) through a final SEPA determination from the lead SEPA agency prior to the Notice of Construction or Order of Approval. [4]

The Washington State Department of Ecology serves as the lead agency for a number of counties in the state regulating air quality, water quality and water resources by requiring a Sand and Gravel General Permit of asphalt plant owners/operators. This limits the discharge of pollutants to surface waters under the authority of the Federal Water Pollution Control Act. [5]

State rule (**WAC 173.60.040**) establishes maximum permissible environmental noise levels between noise sources and receiving sites, and asphalt plants are required to meet these requirements. Noise impacts are directly related to the amount of activity, as well as the time of day when this activity takes place. Accordingly, additional noise level limits are applied between the hours of 10:00 p.m. and 7:00 a.m.

See also Section II. Health Evaluation for additional information on regulatory requirements related to air and water quality.

Project Background

The Tacoma-Pierce County Health Department (TPCHD) and the City of Sumner are partnering with the Washington State Department of Health (DOH) to conduct a Health Impact Assessment (HIA), consistent with Society for Practitioners of HIA (SOPHIA) guidelines, that addresses policy and regulations pertaining to asphalt plants within the areas designated Mineral Resource Lands in Low Density Residential, General Commercial, and Heavy Manufacturing (M-2) zones within the City of Sumner. This HIA addresses a series of questions related to: toxicology, air quality, health disparities, drinking water, agriculture and aquaculture, noise, traffic related health impacts.

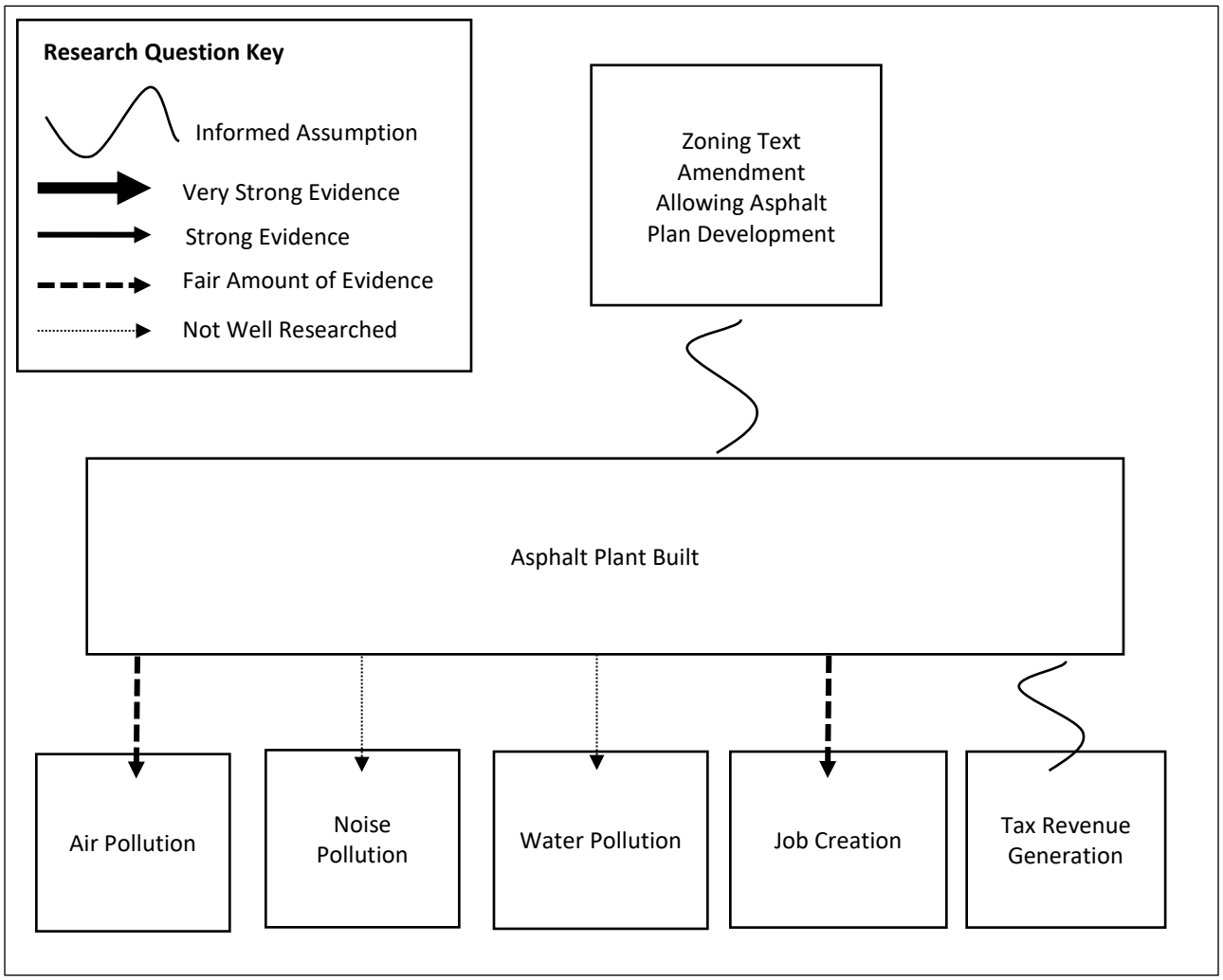
The Department of Health (DOH) has conducted a Rapid Health Impact Assessment (HIA) to provide a prompt yet thorough assessment of potential health impacts related to asphalt plants. A Rapid HIA is an analysis of how a proposed policy or budgetary change will likely impact health and health disparities. For the purpose of this review 'health disparities' have been defined consistent with state law as the differences in disease, death, and other adverse health conditions that exist between populations.

In this Rapid HIA, DOH provides summaries of the evidence analyzed in a logic model depicting possible pathways leading from policy change, zoning code changes, to health outcomes shown in Figure 2. The research evidence discussed in this HIA is categorized using the Washington State Board of Health, Health Impact Review criteria shown in Table 1. This process is designed to rely on the best available science, limit researcher bias, reduce literature review time, and communicate the results in an accessible way. For example, when eleven or more studies are available, the criteria shown in Table 1 is applied. However, if there are fewer studies, a stricter set of evaluation criteria is applied. Further, this method ensures that the science is generalizable to Washington State and the study design is most appropriate for this HIA.

Table 1. *Washington State Board of Health, Sample Health Impact Review Strength of Research Evidence Criteria*

90-100% of the studies support the association
Strength-of-evidence: Very strong (Note: "Very strong" implies that the premise is well accepted by the scientific community—if inaccurate, consider downgrading to "strong." Also consider downgrading if you find strong studies that do not support this).
70-89% of the studies support the association
Strength-of-evidence: Strong
60-69% of the studies support the association
Strength-of-evidence: A fair amount
<60% of the studies support the association
Not well researched

***Figure 2**. Strength of Evidence Logic Model*



*Note: Impacts of each relationship depicted in Figure 2 on public health are discussed in detail in Section II. Health Evaluation.

II. Health Evaluation

Air Quality

What air pollutants are typically emitted from asphalt plants?

Asphalt fume is an airborne mixture of several different compounds. Emissions tests by the EPA have found that asphalt plants emit a wide range of pollutants including particulate matter, sulfur dioxide (SO_2), carbon monoxide (CO), oxides of nitrogen (NO_x), polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs) and some metals. [3]

Several factors impact the amount emissions from a plant. Typical drum mixers in hot mix asphalt (HMA) plants are estimated to emit more particulate matter, VOCs, PAHs and metals than typical batch mixers, though batch mix HMA's emit more CO and SO_2. However, typical batch mix plants also have a lower production rate. [3] The fuel used in the production process contributes to the type of emissions. For example, in typical drum mix dryers that use natural gas generally have lower estimated annual emissions for various pollutants than those that use oil. [3] The primary emission sources of particulates and gases are the dryers, hot bins and mixers. [3] Fugitive emissions also typically occur from storage silos, truck load-out operations, liquid asphalt storage tanks, hot oil heaters, yard emissions, and vehicular traffic on-site.

Almost all of the air pollutants would be released through the stack, with a much smaller quantity being emitted from other sources associated with plant operations such as truck loading or conveyor belts [6]. For example, a typical asphalt processing plant that makes 500 tons of hot mix asphalt per day would emit approximately 20 pounds per day of particulate matter through the stack and 0.05 pounds per day from other plant operations. Likewise, for a plant of this capacity, approximately 10 pounds per day of VOCs would be emitted through the stack with 0.5 pounds per day being released as the result of other plant operations. [6] Levels of air pollutants would be expected to be higher at the asphalt plant, lower in the immediate vicinity of the plant, and to return to background levels farther out.

The Washington Department of Ecology modelled off-site emissions as the basis of a determination that asphalt plants are candidates for General Orders of Approval in 2011 ("Ecology's Asphalt Plant Report"). [7] In Ecology's Asphalt Plant Report, emissions were determined based on assumed production rates (annual hot mix asphalt production limited to 300,000 tons, as well as hourly and daily limits) and emissions factors from the EPA's AP-42 for asphalt plants with applied Best Available Control Technology were applied to a screening dispersion model. With these inputs and assumptions, among others, the maximum impact of emissions was found to occur at 37 meters (122 feet) from the source. The Report further indicates that there are typically 150 feet from the property boundary and any emitting unit including the drum mix dryer, storage silo, baghouse exhaust, storage tanks and load-out operations. [7]

According to the assumptions applied in Ecology's Asphalt Plant Report, the modeled results of selected criteria air pollutants at 121 feet from the point of emission are all found to be below the National Ambient Air Quality Standards (NAAQS). Selected criteria air pollutants included nitrogen

dioxide (NO_2), carbon monoxide (CO), sulfur dioxide (SO_2), particulate matter smaller than 10 µm (PM_{10}) and fine particulate matter ($PM_{2.5}$). [7]

Evaluation of toxic air pollutants in Ecology's Asphalt Plant Report is more complicated because Acceptable Source Impact Levels (ASILs) and Small Quantity Emission Rates (SQERs) that are used to screen for ASILs have been updated since the publication of the report, and the new levels went into effect on December 23, 2019. [7, 8] Based on the screening applied using the previous SQERs as shown in the report, 10 toxic air pollutants were found to exceed the SQERs, which triggered further modeling. These 10 toxic air pollutants that exceeded the previous SQERs are: volatile organic compounds (acetaldehyde, benzene, and formaldehyde), a polycyclic aromatic hydrocarbon (naphthalene), a gas (sulfur dioxide), and metals (arsenic, cadmium, hexavalent chromium, manganese and mercury). [7] For evaluated toxic air pollutants in the report, ethylbenzene would also now exceed its updated SQER, and it is also possible that other pollutants would be added for initial modelling that would be further evaluated. The emissions from each asphalt plant are dependent on a number of variables, so levels of emissions identified in Ecology's Asphalt Plant Report would not necessarily apply to a specific proposed asphalt plant, but it is likely that the pollutants indicated as the top pollutants of concern would be similar.

The ASILs are designed to be conservative by offering a margin of safety in protecting public health. Of the 11 pollutants identified with emissions greater than the SQERs in Ecology's Asphalt Plant Report, 8 of them have ASILs based on cancer risk while the ASIL's for the other 3 (sulfur dioxide, manganese and mercury) are for non-cancer impacts. ASIL thresholds for carcinogens in Washington are based on annual average concentrations and are set at the level of risk estimated to cause one case of cancer per one million people over a lifetime of exposure. For the non-cancer ASILs, a hazard quotient is applied with a ratio of one or less than one at a level where it is expected there would be no adverse health effect below a specific exposure threshold for that pollutant.

In alignment with the results from Ecology's Asphalt Plant Report, the Agency for Toxic Substance and Disease Registry (ATSDR) conducted an exposure investigation of communities near 7 asphalt plants throughout the United States. [9-11][1] Measured levels of $PM_{2.5}$, PM_{10} and hydrogen sulfide were found to be "slightly elevated" compared to background levels near several of the asphalt sites, and while some VOCs and PAH concentrations were above background concentrations they were found to be "very low". [9]

The area with air pollution levels above background levels around the plant would vary. The distance and direction that air pollution travels from the source depends on the location, the time of day or year, prevailing weather, topography, nearby land use, traffic patterns and the specific pollutant. [12] As an example from a different type of pollution, pollution levels of NO_x have been found to return to background levels within about 2000 feet from a traffic source compared to PM_{10}, which returned to background at about 600 feet. [13] Based on data from a weather station in Puyallup over the last 12 years, the prevailing winds in the Sumner and Bonney Lake area are primarily from the south/southwest October through April, and primarily from the southwest/west May through

[1] Some of the ATSDR Health Consultations are no longer available on-line, but a summary of results from the studies is available in the appendix of the Health Consultation for APAC Carolina.

September. [14] While the wind direction and speed change, this suggests that air emissions would more often be blown to the north, northeast, and east of the plant. Of note, production is often highest in Washington in summer months when conditions are dryer and more conducive to applying asphalt outdoors, as the Washington State Department of Transportation requires that hot mix asphalt not be placed for wearing course on a traveled way on wet surfaces, on cold temperatures or between October 1 and March 31st without written approval. [15] While the prevailing winds indicate dominant trends, there are a large percentage of "calm" wind periods at this location when air pollutants would not disperse as readily and may lead to higher impacts near the facility. Newer dispersion models applied as part of a Notice of Construction application would account for these calm periods.

What health effects are associated with exposure to asphalt fumes?

Fumes created from heating asphalt can be inhaled into the lungs or can condense onto exposed areas of the skin. [6] Little is known about exposure on skin, and most available information is related to inhalation of asphalt fumes. The risk of health effects that can be caused by exposure to asphalt fumes depend on the content of the fumes, the duration of exposure, the amount or concentration of exposure, and individual sensitivity to exposure.

Individuals with the highest exposures to asphalt emissions tend to be workers in the asphalt industry. The National Institute of Occupational Health and Safety (NIOSH) identifies five segments of the asphalt industry: hot mix plants, terminals, roofing, paving and roofing manufacturing. There are different ways to measure exposure to asphalt fume and PAHs. Workers in hot mix plants have lower exposures than the other asphalt industry jobs when measured in terms of exposure to benzene-soluble particulates. [16-18]

NIOSH reports that workers in the asphalt industry have experienced mild temporary symptoms of nasal and throat irritation, headache, and coughing. [16] Asphalt workers have also experienced other symptoms such as skin irritation, nausea, headaches and fatigue, but NIOSH reports that it is unclear if these are related to asphalt fume exposure. [16]

Severe health impacts specific to hot mix asphalt workers are **not well researched**. Studies of lung cancer and non-cancer impacts in the more general group of asphalt workers have conflicting findings**.** [18-25] Some research has indicated evidence of lung cancer related to occupational asphalt fume exposures [19, 20, 24], while other research has found no association with lung cancer. [23, 25] A recent investigation, that pooled together results from eight occupational studies of asphalt workers that addressed the influence of other exposures like smoking and alcohol consumption, did not identify increased risk of lung cancer, but results of other cancers were less clear. [26] There is some evidence of lower respiratory tract symptoms and bronchitis among asphalt paving workers. [16]

Evidence of elevated health impacts from air pollutants in communities living near asphalt plants is **not well researched**. In ATSDR's investigation of areas surrounding asphalt sites, they concluded that there "do not appear to be any chemicals or compounds at levels that would pose a public health hazard" off-site. [9] ATSDR also reviewed the estimated asphalt emissions from the EPA and applied toxicities for 159 chemicals that were not directly sampled and determined that "the

compounds most capable of posing a health hazard in communities" were SO_2, NO_x, and that CO, aldehydes, particulates and some metals "might also pose some concern". [9] Updated results from Ecology's technical report using modeled emissions indicate that the metal hexavalent chromium is likely the only air pollutant that would exceed threshold values. [7, 8]

Concerns about odors in the areas surrounding the asphalt sites were part of what initiated the ATSDR investigations. [27] Hydrogen sulfide was the toxic compound emitted in the largest amount from a hot mix asphalt plant in the ATSDR study. High levels of hydrogen sulfide can be immediately lethal, while lower levels can cause minor symptoms. Levels measured in the study were lower than the acutely lethal amount, but above the odor threshold. [9] Accordingly, residents living near an asphalt plant may detect odors from the plant. Odor detection depends on the emissions from the facility and the prevailing wind directions. PSCAA's complaint database has received more than 25,000 complaints about odor since January 1, 2010, of which less than two percent mentioned asphalt odor. [28] Health impacts from odors beyond direct effects related to air pollutants are not well researched though there is some evidence that unpleasant odors can induce stress [29, 30].

What health effects are related to the individual pollutants in asphalt fume?

Beyond considering the impacts of asphalt fume, we further consider the individual pollutants emitted from asphalt plants and evidence of health impacts for those individual pollutants. There is **strong evidence** that some of the air pollutants comprising asphalt fume, especially PM2.5, benzene and PAHs, are associated health impacts [31-41], though it is not clear that they are present at levels that would pose a health concern to the general public or to asphalt plant workers. Common minor symptoms of exposure for both particle and gas air pollution include eye, nose and throat irritation and headaches. Severe impacts vary more by pollutant, summarized briefly here.

Pooled results of a large body of published epidemiologic literature identify that exposure to elevated levels of particulate matter, both as $PM_{2.5}$ and PM_{10}, is associated with increased mortality and hospitalizations, especially for impacts related to cardiovascular disease and respiratory disease (specifically, asthma in children and COPD in people over 65). [42, 43] A study of 60 million Medicare beneficiaries found that risk of death from $PM_{2.5}$ exposures remains even at annual levels below the National Ambient Air Quality Standard level (12 $\mu g/m^3$). [32] Other health impacts are also being explored, with growing evidence indicating that $PM_{2.5}$ and PM_{10} exposures can lead to stroke [44], type 2 diabetes [45], neurological and cognitive impairment [46, 47], and pre-term and low-birth weight babies. [48, 49]

Risk of exposure to individual PAHs are often grouped together by estimating health risk relative to a single PAH, with benzo(a)pyrene (BaP) serving as an index to allow for comparison. [50] Pooled results of several studies of elevated occupational exposures to BaP that are not from asphalt fume have found an increased risk of lung cancer from long term exposures. [50]

Similar to PAHs, individual VOCs have a range of toxicities and severe impacts from exposure include damage to liver, kidney and central nervous system. (See ATSDR toxicological profiles for health effects of individual VOCs.) [51] Some VOCs are also classified as carcinogens, such as benzene that has been associated with certain types of leukemia and is classified as a known carcinogen by the

Department of Health and Human Services, the International Agency for Research on Cancer and the EPA. [52]

Health impacts from exposure to metals vary. Ecology's Asphalt Plant Report indicates that among the metals emitted from asphalt plants, arsenic cadmium, hexavalent chromium, manganese and mercury are likely to be among the metals of greatest concern. Arsenic, cadmium and hexavalent chromium are regulated based on risk of cancer. In contrast, the threshold for manganese is based on development of chronic neurological effects and the threshold for mercury is based on chronic neurological, kidney and developmental effects.

Some individuals are considered more vulnerable to health impacts from air pollution due to physical traits or higher exposures. Some of these more vulnerable groups include people with lung diseases or respiratory infections, people with heart or blood vessel problems, people who have had a heart attack or stroke, older adults, infants, children, pregnant women and people who smoke. Vulnerabilities related to social, economic, and environmental conditions, can also be important in understanding risk. As one example, a large cohort study found that men; black, Asian and Hispanic persons; and people eligible for Medicaid (interpreted as indication of low economic status) were found to have greater risk of death with exposure to $PM_{2.5}$ than the general population. [32]

In the *Baseline Health* section of this report, rates of respiratory disease, cardiovascular disease, and lung cancer are included as health impacts that have been associated with air pollution. These rates of diseases, along with factors of social vulnerability, serve as indicators of more populations in the Sumner and Bonney Lake region that are more likely to have negative health impacts with future air pollution exposure.

How are air quality impacts from asphalt plants regulated?

Local governments generally rely on regional or state agencies, such as the Puget Sound Clean Air Agency (PSCAA) covering Pierce County and the great Puget Sound Area, to ensure air quality compliance. Most local code enforcement programs are not staffed or trained to provide ongoing monitoring of asphalt plants or other point sources.

The Notice of Construction application and equipment registration process managed by PSCAA and the Sand and Gravel General Permit issued by Washington State Department of Ecology address fugitive dust, emissions, and stormwater discharges, respectively, and those agencies have enforcement authority related to these areas.

The federal standards for hot mix asphalt plants (40 CFR 60 Subpart I) include the following requirements:

- A requirement to performance test in accordance with 40 CFR 60.8
- A requirement to not discharge filterable particulate in excess of .04 gr/dscf
- A requirement to not cause or allow emissions in excess of 20 percent opacity
- A requirement to use 40 CFR 60 Appendix A, Method 5 for particulate
- A requirement to use 40 CFR 60 Appendix A, Method 9 for opacity.

Washington State Department of Ecology or the designated regional air pollution control agencies have jurisdiction to issue air permits to stationary sources per the Washington State Clean Air Act (RCW 70.94.152 and WACs 173-400 and 173-460). The general regulations for air pollution sources (WAC 173-400) includes a requirement for a source to obtain Notice of Construction Order of Approval. New Source Review permitting sets case-by-case emission limits and operational requirements for asphalt plants. Such requirements can vary given the circumstances and nature of the specific project/proposal. Table 2 shows recent limits set by PSCAA for new asphalt plants.

Table 2. *Recent limits set by PSCAA for new asphalt plants[2]. [28]*

Recent PSCAA Asphalt Plant Limits	**Limit**
Total Particulate	0.027 gr/dscf corrected to 7 percent oxygen
Filterable Particulate	0.014 gr/dscf corrected to 7 percent oxygen
Stack Opacity	5 percent no more than three minutes in any hour
Non-methane/Non-ethane VOC	0.032 lb/ton asphalt produced
Carbon Monoxide	311.0 ppmvd corrected to 7 percent oxygen
Oxides of Nitrogen	26.0 ppmvd corrected to 7 percent oxygen
Recycled asphalt and shingle handling	No visible emissions
Asphaltic Concrete Storage Silos	Enclosed and ducted to dryer/baghouse (No visible emissions)
Asphalt oil storage tanks	Passive condensers for VOC control (zero percent opacity except for one 15-minute period per 24-hours)
Truck Loading	20 percent opacity no more than three minutes in an hour

Additionally, Washington State Department of Ecology tested twenty asphalt plants in 2011 and determined emission standards based technology present at the time. The federal regulations are currently under review and may revise the requirements discussed in this Health Impact Assessment.

Another state act, in addition to the State Environmental Policy Act, that may apply to asphalt plants and the asphalt production process is the Model Toxics Control Act (MTCA). MTCA establishes rules and regulations for toxic clean-up and provides flexibility for site-specific challenges. MTCA also applies a tax on the wholesale value of hazardous substances that is used for clean-up and contamination prevention. [53] Polycyclic aromatic Hydrocarbons (PAHs), discussed in the ***Air Quality*** section of this document, are considered a hazardous substance under the Act. Testing PAHs and other toxic site contamination on industrial property, may occur under disclosure laws when the property is being sold.

Many of regulations and rules for specific air pollutants and for emissions from asphalt plants are designed to protect health and safety.

[2] These limits are an amalgam of limits imposed by PSCAA NOCs 11812, 11328 and 11175.

In the Notice of Construction (NOC), an applicant would have to demonstrate in a site specific analysis that incorporates the selected parameters of the asphalt plant production and applied BACT that the neither the NAAQS nor ASILs would be exceeded, or else the project may not be approved. If only the ASILs are exceeded, the proponent may pursue approval under Second Tier Review, which would require a site-specific risk assessment, demonstration of acceptable risk criteria, and public involvement through public notice and comment. Most projects in Washington do not undergo Second Tier Review, and this would be unlikely to occur for an asphalt plant NOC [8].

It is worth noting that air pollution regulations and standards are updated, as recently occurred for the revised Washington ASILs and SQERs used for compliance. Establishing regulations is an extensive and often contentious process. Separately, health research continues to contribute to the base of evidence of health effects related to asphalt plant emissions and the specific air pollutants in asphalt fumes, and it is possible that air pollution regulations potentially lag behind the best current evidence. As one example, there is growing evidence that health effects from $PM_{2.5}$ occur in the public even when concentrations are lower than the current NAAQS. [32, 54, 55] For this specific example, the finding in Ecology's Asphalt Plant Report that the expected $PM_{2.5}$ emissions from asphalt plants are more than 10 times less than the annual NAAQS concentration and more than 100 times less than the daily NAAQS concentration offers some reassurance that $PM_{2.5}$ from asphalt plants will not pose a great health concern.

Noise, Light & Vibration

Does noise from asphalt plants lead to health impacts?

Noise impacts result from various components of a typical hot-mix asphalt plant, i.e. ventilators, drum, pneumatic systems, etc. Traffic noise is also generated from on-site loaders and trucks bringing materials to and from the plant. Levels of noise generated at hot mix asphalt plants both onsite (for worker exposure) and off-site (for general public exposure) are **not well researched**, and it is unclear if noise from an asphalt plant could lead to health impacts.

Considering health impacts from noise exposure in general, there is **strong evidence** that noise exposure is linked to increased cardiovascular disease and hypertension. [56-67] Noise can trigger the body's stress response [68] and can cause sleep disturbance. [69, 70] Research suggests that for aircraft noise and traffic noise exposure the risk for heart conditions increases in a meaningful[3] way between 52 decibels and 75 decibels. The World Health Organization uses 50 decibels at nighttime as its threshold for high blood pressure and heart attack impacts. [71] Although the studies looked at different heart health conditions, there was agreement that for each 10 dB increase in noise there is a 6% to 8% increase in population risk for heart health outcomes. Individual risk for these outcomes increases at a much lower rate.

[3] Statistically significant result, $p < 0.05$

Studies have also found that elevated noise exposure among children can lead to poorer performance on standardized tests [72-77], and exposure in adults can lead to obesity and diabetes [78, 79], adverse reproductive outcomes and fertility problems in men and women [80], and brain tumors. [81] However, this research is not currently conclusive on these health effects.

Groups considered particularly susceptible to the effects of noise include smokers, children, the elderly, shift-workers, and individuals with sleep disorders, mental disorders, and physical illnesses. Information about rates of cardiovascular disease and hypertension in the Sumner and Bonney Lake area are provided in Section III. Population Health, as an indicator of populations that might be more vulnerable to negative impacts of noise.

Light

Light pollution is sum of negative impacts of artificial light is a growing area of research. The most studied impacts to human health from light pollution is disruption of circadian rhythm, sleep patterns and alertness [82-84]. There is indication that two-hour exposures to light in the evening can disrupt circadian rhythm, but melatonin levels marking this recover within about 15 minutes, indicating the negative impact has a very short duration [82]. Several questions about light exposure impacts remain, such as how much the wavelength or color changes the impact, like blue light vs. white or red light [82]. We are not aware of data that indicates the levels of light generated from asphalt plants.

Vibration

Health impacts in workers exposed to vibration, mainly through the use of tools, equipment and vehicles, have been studied for decades and have identified hearing loss and musculoskeletal impacts [85]. More recent studies of workers indicate that vibration could also be related to development of peripheral and cardiovascular disorders and gastrointestinal problems among others [86]. Vibrational impacts in workers generally occur after years of high level exposures. We are not aware of evidence of vibration resulting from off-site exposures from asphalt plants with exposure levels that would occur in the general public.

Sumner Municipal Code Chapter 18.16.080 establishes performance standards for commercial districts and states that an operation shall not create noise, light, glare, vibration, or odor that would disturb the peace, quiet, and comfort of neighboring residents, retail uses, lodging and restaurant uses.

Traffic and Mobility

Traffic impacts would result from the hauling of materials both to and from the asphalt plant facility. This traffic would primarily consist of heavy trucks, which could impact the condition of local streets as well as result in air and noise impacts as described in this document. The traffic study conducted by the City of Sumner may assess the magnitude of these impacts from increased traffic.

Water and Fisheries

The manufacture of hot-mix asphalt may involve use of bitumen, aggregate or possibly recycled asphalt, fuels and oil stored and used to operate equipment at the site, and asphalt release agents[4] used to clean plant equipment and truck beds. Classes of pollutants associated with some of the materials in asphalt production may include polycyclic aromatic hydrocarbons (PAHs), aliphatic hydrocarbons (ACHs), volatile organic compounds (VOCs), chlorinated solvents and metals (if recycled asphalt is as an ingredient), and other chemicals which have the potential to contaminate soils, water, and sediment if released into the environment.

Following a database search of health sciences literature, it appears that asphalt production facilities - as a specific source of pollutants in soils, surface water or groundwater - **are not well researched**. A literature search identified only four papers: findings from two government investigations testing for hazardous contaminants at current and former asphalt production and testing sites (Salisbury, NC and Fort Bragg, NC); one study examining the relationship between hot mix asphalt production and soil pollution (Port Harcourt, Nigeria); and one study that used laboratory methods to examine the potential for recycled asphalt to leach contaminants in water.[5]

Both hazardous site investigations studied contaminants at sites that had been used for not only asphalt production but also for asphalt testing, which involved the use of chlorinated solvents.[4] Two of four studies found no evidence of PAHs in groundwater, but did find chlorinated solvents and other contaminants. [87, 88] Three of four studies detected PAHs, ACHs, VOCs and/or total petroleum hydrocarbons in surface soils in the immediate vicinity of asphalt plants. [87-89] One study found evidence of pollutants in surface water, where bitumen had been directly piped into the waterway. [87]

Given the limited number of studies found, the evidence is inconclusive regarding the influence of asphalt production plants on contamination of surface and groundwater. Still, the two site investigations from North Carolina, the field study from Port Harcourt, and the laboratory study are instructive. First, they suggest that many of the materials used in asphalt production and potential contaminants like PAHs have lower water solubility and more readily adsorb in soils. Second, though it would be inappropriate to broadly generalize about the likelihood of asphalt production plants to contaminate either soils or waters based on findings from these papers, these cases do illustrate how site neglect or mismanagement of hazardous materials have the potential to contaminate soils and water at the site.

[4] Historically, it was common practice to use diesel fuel, other petroleum products or chlorinated solvents as an asphalt release agent, but that is no longer an acceptable practice in the industry. More recently asphalt release agents are formulated to be biodegradable.

[5] There is a more robust literature base regarding contamination of soils and waters attributable to asphalt pavement and storm water runoff from roadworks. Those papers were excluded, however, as this HIA focuses on questions pertaining to zoning for an asphalt production facility, rather than materials used in roadworks.

Human health impacts associated with asphalt plants due to contamination of drinking water are likewise **not well researched.** ATSDR provided a consultation regarding the potential health risks and impacts from estimated exposures to contaminants in drinking water identified during the site investigation in Salisbury, North Carolina. That report concluded that human exposures to the concentration of contaminants detected at this particular site were not expected to cause adverse health effects. [90] This study taken on its own does not provide sufficient evidence to draw more generalized conclusions.

Comprehensive reviews of the scientific evidence regarding human health effects of exposure to various PAHs, VOCs, ACHs, and chlorinated solvents provide a broader picture of potential health risks from these agents, but do not specifically examine asphalt production facilities as sources of exposure. A review of the evidence for health effects of PAHs conducted to establish Canadian soil quality guidelines describes adverse effects based on exposure type and dose. [91] In 2009, the EPA published a peer-reviewed report summarizing approaches to understanding health effects of complex mixtures of aliphatic and aromatic hydrocarbons. [92] A comprehensive review of bitumen (asphalt) conducted by a panel of experts under the World Health Organization and published as part of the International Chemical Assessment Series, noted the lack of data or studies of asphalt concentrations in environmental media, including drinking water and foodstuffs. [93]

Asphalt production plants have not been well studied as a specific source of pollutants in fish or shellfish. While PAHs have been monitored in fish tissue samples across the state, measured concentrations have been low and currently no fish advisories have been issued. PAHs are more likely to bioaccumulate in shellfish tissues. Unlike Washington's marine shellfish, freshwater shellfish are considered unsafe. The Department of Fish and Wildlife prohibits harvest of freshwater clams and mussels from all Washington freshwater sources, contaminated freshwater shellfish are therefore an unlikely source of human exposure.

How are water quality impacts from asphalt plants regulated?

In Washington, the Sand and Gravel General Permit regulates discharges to surface waters and groundwater by industrial mining and processing operations, and covers activities related to hot mix asphalt plants production (NAICS 324121) and asphalt recycling (ECY001). [5]

Facilities operating under the permit must manage and monitor pH, turbidity (NTU), total suspended solids (TSS), total dissolved solids (TDS) and oil sheen in any process water, mine dewatering water, and stormwater discharges. Discharges of process water from asphalt production (NAICS 324121) to surface waters is not allowed and discharge from wet scrubbers to groundwater is not allowed (see Sand & Gravel General Permit, Table 2). Monitoring of groundwater discharges of process water from asphalt production facilities for pH is required quarterly with allowable pH between 6.5 and 8.5. Permittees must manage the site to prevent unauthorized activities (e.g., illegal dumping or spills) that could discharge pollutants to waters of the state.

Facilities must submit and follow a Site Management Plan that includes four main components: an Erosion & Sediment Control Plan (ESCP), a Monitoring Plan, a Stormwater Pollution Prevention Plan (SWPPP), and a Spill Control Plan. The permit requires facilities to implement Best Management Practices (BMPs) to provide all known, available, and reasonable methods of prevention, control and treatment (AKART).

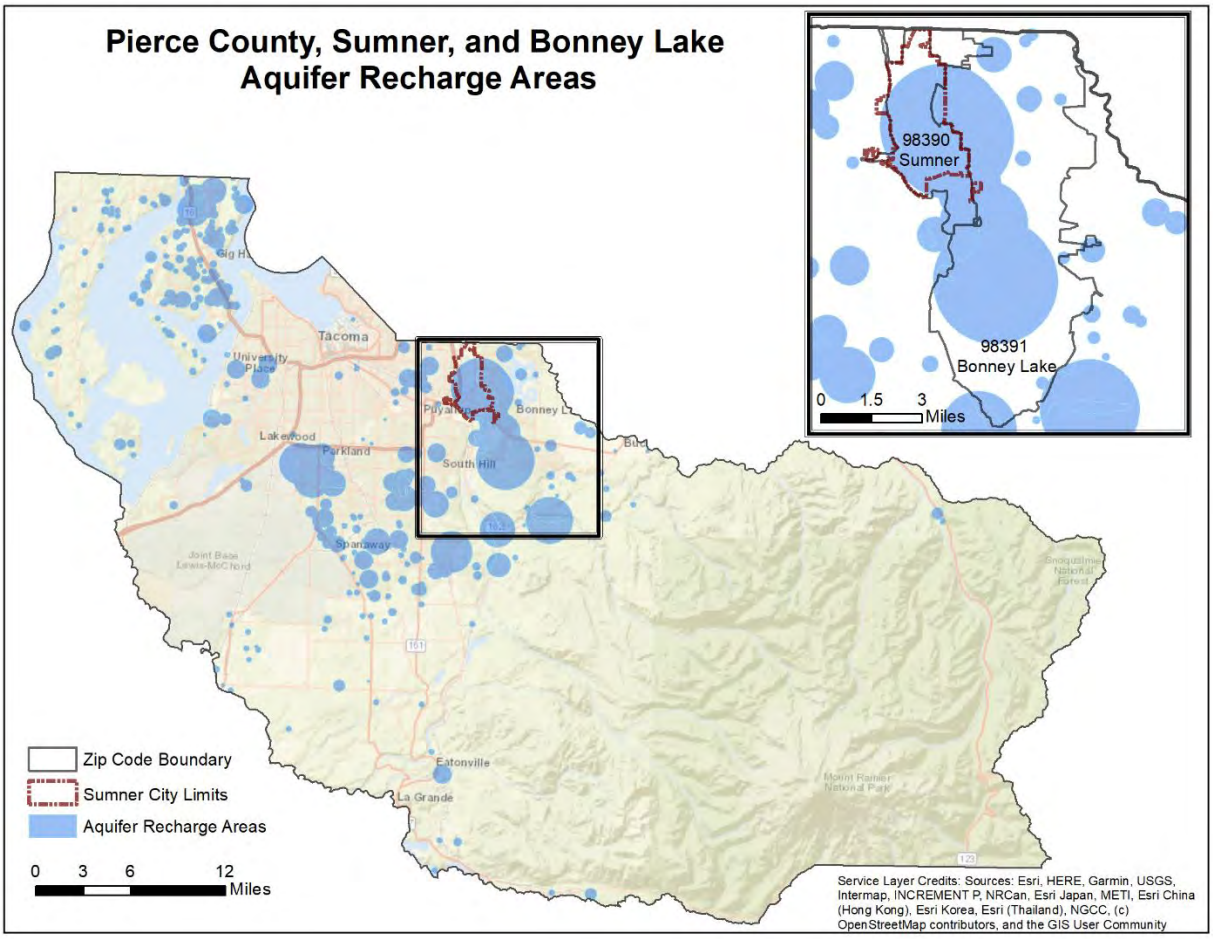
A facility's Stormwater Pollution Prevention Plan must inventory any materials exposed to precipitation or run-off at the site, including toxic materials or chemicals, fuels, and other petroleum products, and identify BMPs that will be used to comply with stormwater discharge limits. The updated 2019 Stormwater Management Manual for Western Washington describes approved prevention, treatment and flow control BMPs as well as additional protective measures (APMs).

The City of Sumner has adopted the 2012 Ecology Stormwater Manual, which requires capture and treatment of all surface runoff from onsite activities, and establishes regulations with the aim of protecting downstream waters. The City also maintains an emergency spill response team to address accidental spills. The Sand & Gravel General Permit also requires spill kits on site at all stationary fueling stations, fuel transfer stations, mobile fueling units, and used oil storage/transfer stations.[5] Lack of spill kits may result in a permit violation.

Sumner Municipal Code (SMC) Chapter 13.48 describes the City of Sumner's Stormwater Management Regulations, the purpose of which is to protect public health, safety and general welfare by establishing requirements for control of adverse impacts associated with increased stormwater runoff and water quality degradation for all sites receiving a city permit for land altering development.

The City of Sumner has also adopted Chapter 16.56 Wildlife Habitat Areas as part of the Sumner Municipal Code. The purpose of this chapter is to regulate development and the use of land in order to preserve and protect areas of critical and endangered fish and wildlife habitat; and to conform to the Washington State Growth Management Act.

Figure 3. *Critical Aquifer Recharge Areas as Defined by Pierce County (buffer distance 100 feet)*



Taxes and Municipal Budgets

There is **limited research** on the complex relationship between taxes, municipal budgets and health outcomes. Most of the research focuses on health care spending. However, there is a growing body of evidence on social determinants of health (the conditions in which people are born, grow, live, work and age), and how they are influenced by taxes through municipal budgets. [94, 95] So, in this way tax revenue generation does positively impact public health.

Tax Base and the Social Determinants of Health

More directly, there is a **fair amount of evidence** showing that stronger tax base and higher property values are related to more public services and infrastructure investments. [96] The research suggests that people with higher incomes are more likely to experience place-based health benefits, meaning that their health and longevity is positively influenced by the conditions and assets in their living environment. [94, 97, 98] Even after adjusting for income and other attributes of individuals and households, health benefits appear to be associated with where people reside.

There is also **strong evidence** showing the inverse relationship. People with low incomes are more likely to live in poorer neighborhoods with weaker tax bases, thus reducing local resources that

support public schools and other social services. [99] Entrenched patterns reflecting long-standing disadvantage often perpetuate cycles of socioeconomic failure and an inability for low-income neighborhoods to recover. Public policies have historically led to disinvestment in these neighborhoods, causing persistent segregation, fewer economic opportunities, increasing crime, and negative health impacts. [100] For example, one study found that "healthy adults residing in socioeconomically deprived neighborhoods died at a higher rate than did people in relatively less deprived areas, even after accounting for individual-level socioeconomic status, lifestyle practices, and medical history." Smoking, diabetes, and other conditions are more common for people living in poor neighborhoods, independent of their income. [101]

Local jurisdictions can address health disparities through direct investment of resources in low-income or historically underserved areas.

Does tax generation from new development improve public health?

Manufacturers, including asphalt production operations, pay Business and Occupation (B&O) taxes in Washington. These B&O taxes generate revenues for the state general fund, a portion of which goes to municipalities. Currently, Sumner does not collect a local B&O tax.

Development and operation of additional asphalt plants in Sumner or other locations in Pierce County would generate additional B&O tax revenue for the state general fund. However, it is important to note that Washington's counties appropriate budgets differently, according to their particular needs and goals. [102] Identifying how or if increased tax revenue distributed to Pierce County would be spent on programs, policies or investments directly linked with health indicators is speculative and difficult to forecast. The Pierce County 2019 Budget shows approximately twelve percent of the total County budget going to support health and social services with 60 percent of those resources coming from local sources. Local tax revenues do directly support a substantial amount of the public health services across Pierce County.

Another important consideration is the relationship between tax revenue and economic development strategies and policies. While many public officials and economic development professionals promote real-estate development as a strategy to expand tax base, this does not always occur. New developments, including manufacturing, can also have negative impacts on tax base, vacancy rates, property values, business investment, infrastructure costs, as well as the social determinants of health, if not planned and executed strategically. [103]

Recent research finds, based on International City/County Management Association Survey of over 11,000 municipalities and all counties across the US, those municipalities actively considering environmental sustainability and health equity have more successful economic development strategies and require lower levels of financial business incentives. These places are also more likely to have economic development plans that have involved the community in the planning process. [104-106]

Economic Impacts

Do Asphalt Plants Create Jobs?

In general, manufacturing remains a vital part of the American economy employing 12.75 million workers and generating broader spillover effects throughout the economy. At the same time, the nature of manufacturing is shifting with the introduction of advanced technologies and the growth of the "made locally" movement. The viability of this evolving manufacturing sector depends on the availability of industrial sites and conditions that allow manufacturers to operate efficiently and profitably. It also depends on the availability of adequate labor. In recent years a growing number of manufacturing jobs throughout the country have gone unfilled, representing a lost opportunity for businesses that cannot take advantage of economic growth and for longtime city residents who might access these jobs. [107]

The relationship between asphalt production and job creation **is not well researched**. Therefore, this discussion relies heavily on actual data from the US Census and state databases as well as market research reports.

The nation has around 3,500 asphalt plants, at least one in every congressional district with a total of 14,923 employees in asphalt mix production and 67,367 employees in production of liquid asphalt. On average, an asphalt plant in may employ 20-25 people. Each year, these plants produce a total of about 400 million tons of asphalt pavement material worth in excess of $30 billion. The asphalt manufacturing industry supports employment for more than 400,000 Americans in the asphalt production, aggregate production, and road construction sectors. Asphalt pavement material is a product composed of about 95 percent stone, sand, and gravel by weight, and about 5 percent asphalt cement, a petroleum product. [108]

According to the Washington State Department of Ecology database (PARIS), there are 163 active asphalt plants in the state with an estimated workforce of over 2000 employees engaged in production.

The Asphalt Manufacturing industry's national as well as state level performance closely follows developments in construction and road infrastructure building. The industry experienced revenue declines from 2010 to 2015. However, construction has recovered from 2015 to 2019. [109] There has been a strengthening demand from markets including a rebound in crude oil prices and an industry acceptance of new technologies and organic and chemical additives that have increased stability and sustainability of the industry. The market is expected to support industry growth through 2024. [110]

Do these jobs in asphalt manufacturing improve public health?

In general, there is **a fair amount of research** on the relationship between employment and health, with some studies showing a positive effect of work on health and others showing no relationship or isolated effects. [95]

There is **strong evidence** of an association between unemployment and poorer health outcomes, but research is limited on the inverse relationship, work causing improved health. While

unemployment is almost universally a negative experience and the strength of evidence is strong in the research linking unemployment to poor outcomes, especially poor mental health outcomes, employment may be positive or negative, depending on the nature of the job (e.g., stability, stress, hours, pay, etc.). [111]

Further, most studies note major limitations in our ability to draw broad conclusions on health and work, including job availability and quality. These are important considerations in how work affects health. Making a transition from unemployment to poor quality or unstable employment options can be detrimental to health. Limited job availability or poor job quality may moderate or reverse any positive effects of work. [112]

Generally, community health improves and morbidity declines as the economy has shifted from industrial jobs (which are often inherently more dangerous) to services jobs (where risk of injury is lower). However, job transitions on the individual level are highly variable, and depend largely on social support networks and resources such as retraining. [113]

III. Population Health

This section of the HIA describes population characteristics, including social determinants of health and baseline health conditions in Sumner with comparisons to Pierce County and Washington State.

Health Determinants

The range of personal, social, economic, and environmental factors that influence health status are known as social determinants of health. Social vulnerability is a term that describes people or populations that are at risk for poor health because of their particular social, economic, and environmental conditions. The social determinants of health presented here are basic indicators of health that are not directly related to the proposed project. The social determinants of health data are from the American Community Survey (ACS), which is an annual survey by the United States Census Bureau that collects information from a subset of the population.

This HIA includes 10 measures related to social determinants of health. These data are at the census tract level and roll up information from 2013 to 2017. Seven census tracts were combined defining the Sumner / Bonney Lake region, which is shown in Figure 4. In addition to the percentage of the population, the 90% confidence intervals are also displayed for each measure and region. Confidence intervals allow for statistical comparison between Washington State, Pierce County and the Sumner / Bonney Lake region. When the confidence intervals overlap, the values are considered statistically similar, which means there is not a meaningful difference between the two. Smaller populations typically have wider confidence intervals, which means that even values that appear to be very different may not be statistically significant.

Comparisons of 10 social determinants of health between Washington State, Pierce County, and the Sumner / Bonney Lake area are shown in Figure 5. Some notable differences include:

- A higher percentage of adults over 18 years old in Sumner / Bonney Lake have health insurance than in Pierce County and Washington State.
- There are fewer people living with a disability in Sumner / Bonney Lake compared to Pierce County and Washington State.
- There are fewer adults and children living in poverty in Sumner / Bonney Lake than Pierce County and Washington State.
- A higher percentage of the Sumner / Bonney Lake population has high school degrees than Pierce County and Washington State.
- Sumner / Bonney Lake has a smaller fraction of overcrowded and unaffordable housing than Pierce County.
- The percentage of people in Sumner / Bonney Lake that report speaking English less than “very well” is lower than in Pierce County and Washington State.
- Sumner / Bonney Lake has a higher percentage of single parent households than Washington State.

In general, the Sumner / Bonney Lake region has a smaller proportion of residents experiencing social vulnerabilities than Pierce County and Washington State. It is important to note that there are still families living below the poverty line, individuals with disabilities, adults without health insurance, and individuals facing unemployment in the Sumner / Bonney Lake region. These populations are at an increased risk for

poor health outcomes. Health disparities are discussed in more detail in the 2019 Pierce County Community Health Assessment. [114]

***Figure 4**. Map of Sumner city limits and census tracts labeled with census tract numbers that define the Sumner / Bonney Lake region for the social determinants of health assessment*

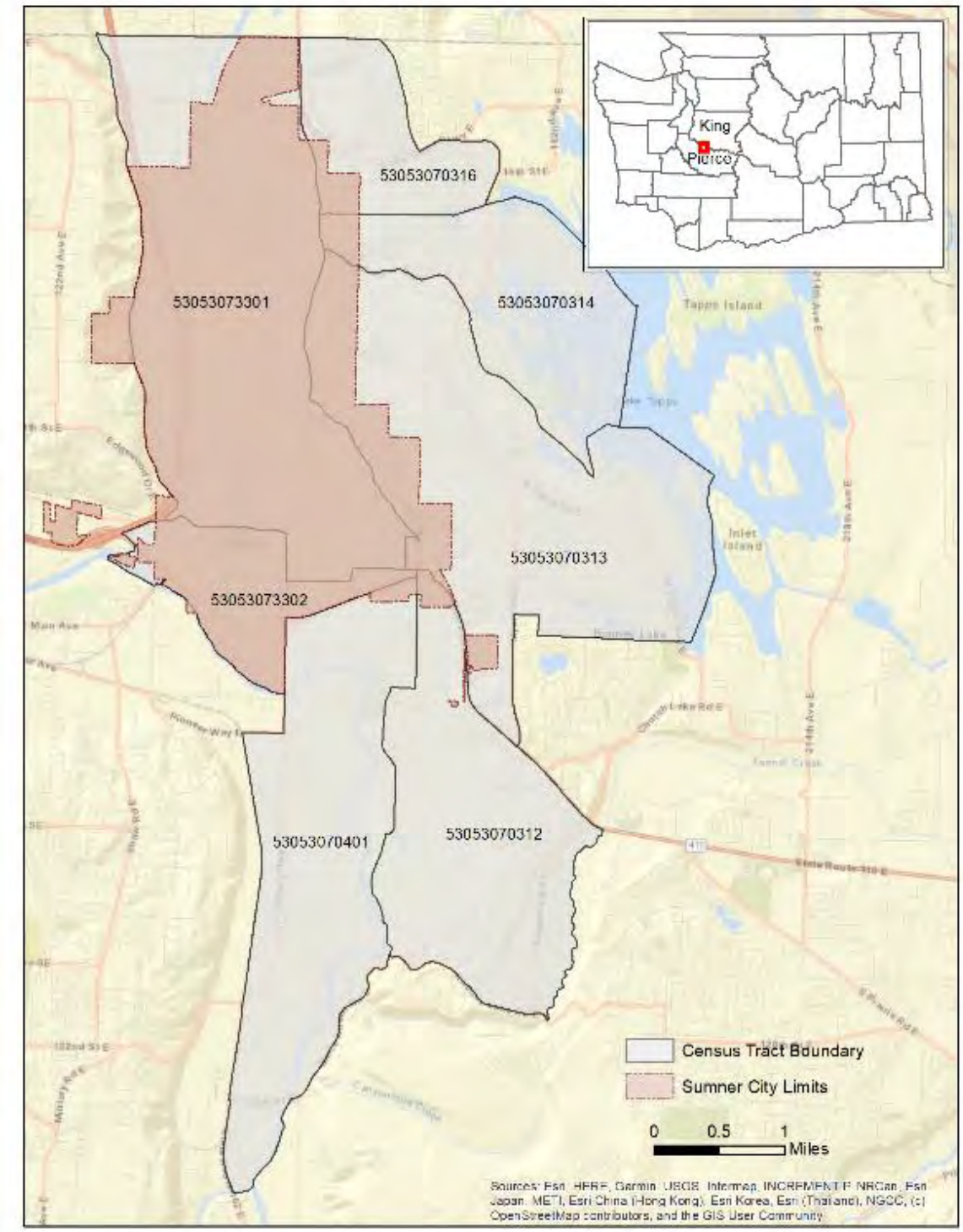
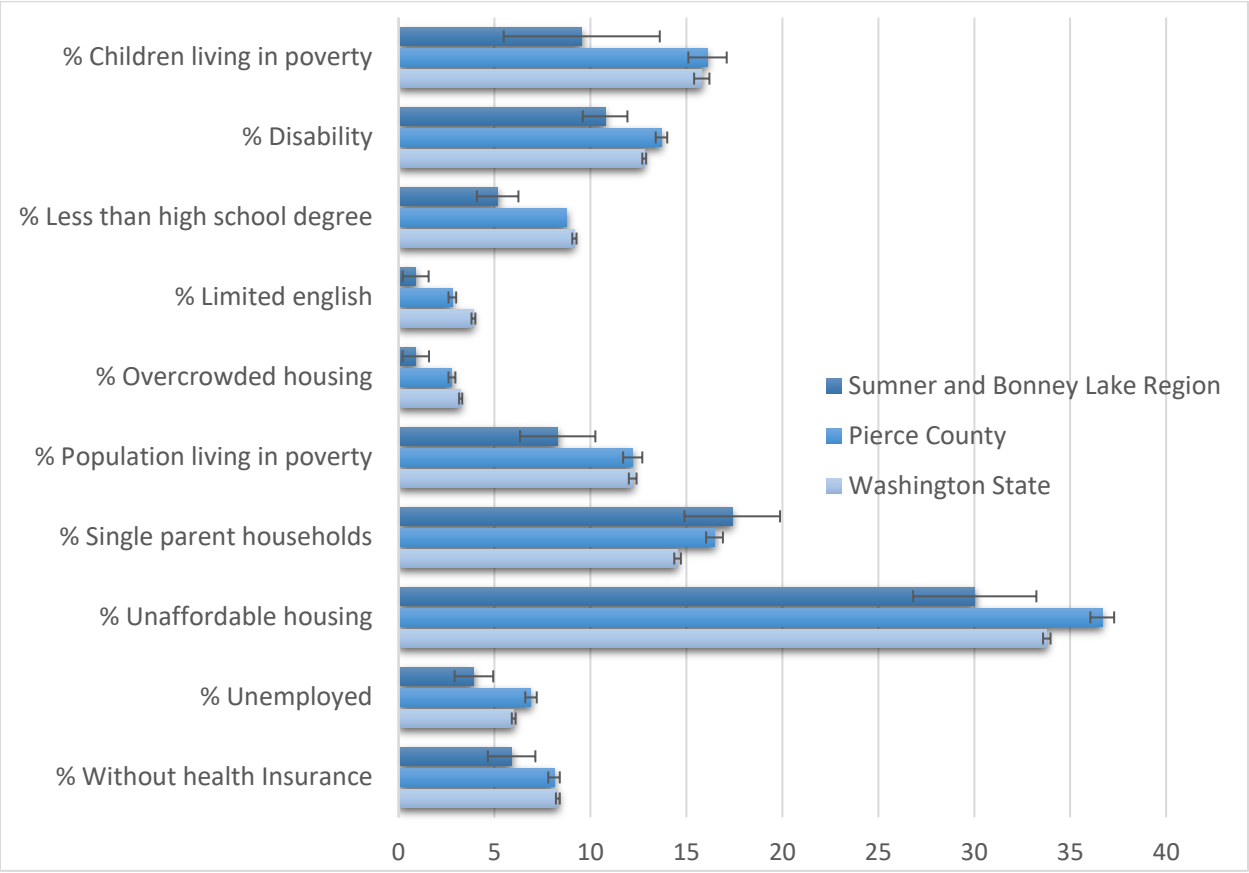


Figure 5. *Summary of social determinants of health in Sumner / Bonney Lake region, Pierce county, and Washington State with 90% confidence intervals. [115-121]*



Baseline Health

Washington State Department of Health reviewed health conditions and diseases related to exposure to noise and air pollution. Figure 7 shows hospitalization rates that were age-adjusted for Washington State, Pierce County, Sumner, and Bonney Lake. Sumner and Bonney Lake were defined using zip codes shown in Figure 6, which is the finest geography available for hospitalization data. Age-adjustment is a standard approach to allow for comparison of different populations (state vs. county vs. neighborhood) that might have different age structures, like elderly or younger people, that would change the expected rate of outcomes. This analysis combines 3 years of data (2016 to 2018) to provide higher numbers that would allow for better comparisons in smaller populations. The 95% confidence intervals allow for statistical comparison between these regions. When the confidence intervals overlap, the rates are considered statistically similar, which means there is not a clear difference between the two. Smaller populations typically have wider confidence intervals, which means that even rates that appear to be very different may not be statistically significant. Findings include:

- Hospitalization for acute myocardial infarction and diseases of the respiratory system are more prevalent in Bonney Lake than Pierce County and Washington State.

- Hospitalization for cardiac dysrhythmias is more common in Bonney Lake than Sumner, Pierce County, and Washington State.
- There is not a statistically significant difference in hospitalization rates between Sumner, Bonney Lake and Pierce County for the majority of health measures evaluated.
- In general, Pierce County, Sumner, and Bonney Lake had higher hospitalization rates for health outcomes related to noise exposure and air pollution than Washington State.

Figure 6. *Map of Sumner city limits and zip codes used in the baseline health assessment*

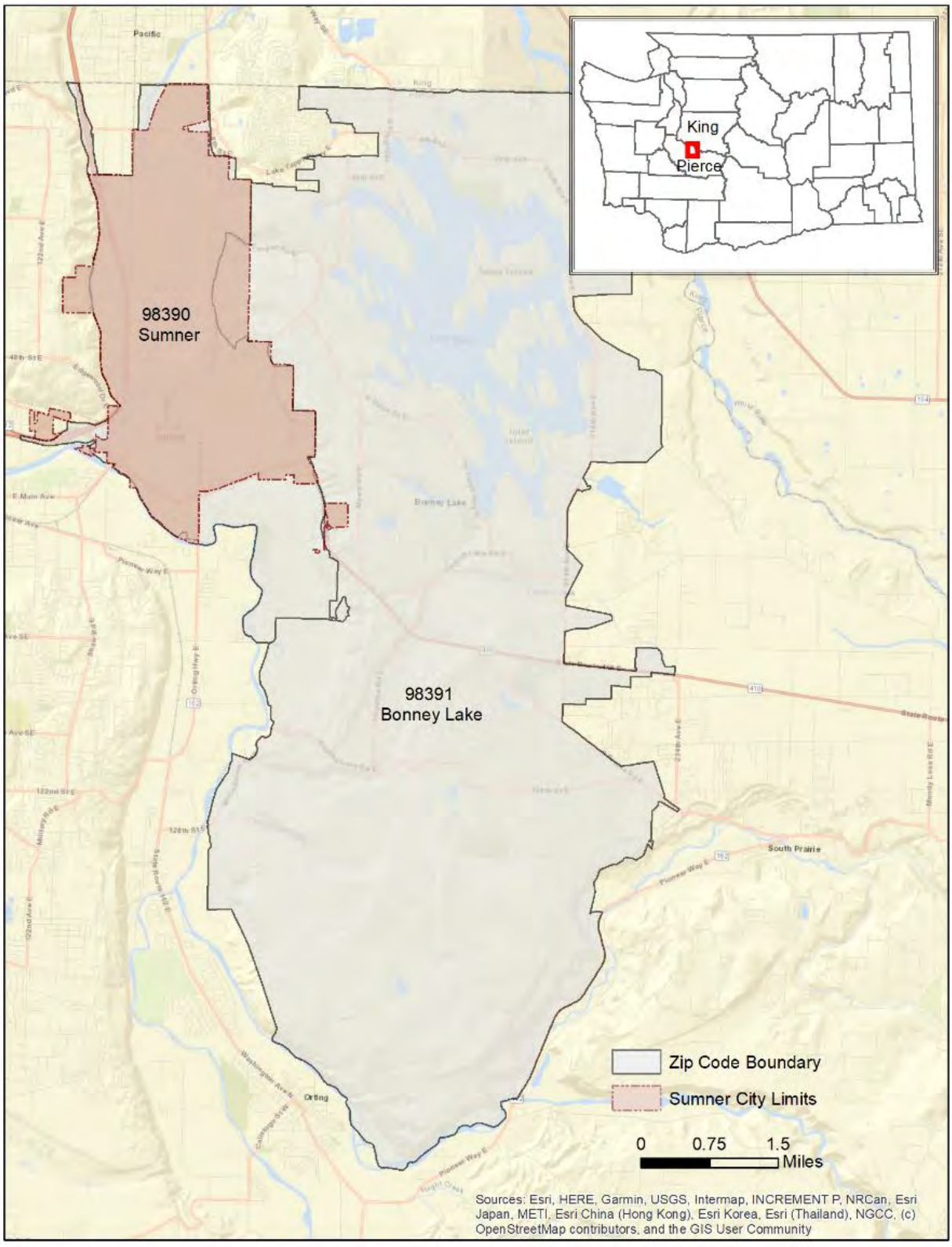
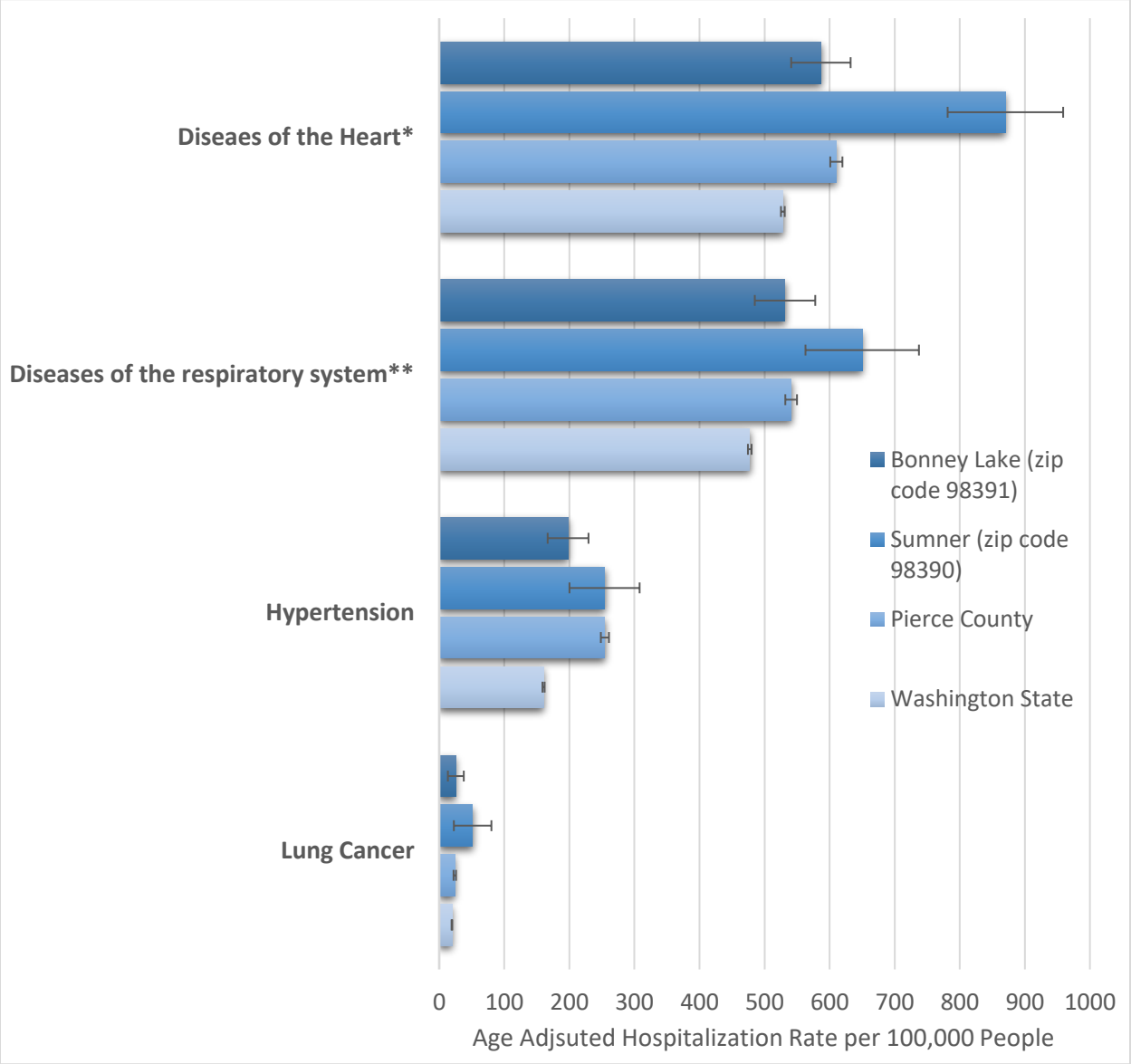


Figure 7. *Hospitalization rates for health conditions related in noise and air pollution exposure in Sumner, Bonney Lake, Pierce County and Washington State with 95% confidence intervals [122]*



*Diseases of the hearth includes ischemic heart diseases and myocardial infarction, among several other heart diseases

**Diseases of the respiratory system includes respiratory infections, chronic obstructive pulmonary disease and bronchiectasis, asthma, among several other respiratory diseases

IV. Regulating Asphalt Plants

The regulating and permitting of asphalt plants is a shared responsibility between local, regional and state agencies. Local governments, under the state's Growth Management Act, regulate siting of asphalt plants through zoning codes, and control site design and operation through development regulations including hours of operation, lighting, noise, traffic movement, and building orientation.

Ongoing Monitoring

Local governments generally rely on regional or state agencies, such as the Puget Sound Clean Air Agency (PSCAA) covering Pierce County and the great Puget Sound Area, to ensure air quality compliance. Most local code enforcement programs are not staffed or trained to provide ongoing monitoring of asphalt plants or other point sources.

The Notice of Construction Order of Approval managed by PSCAA and the Sand and Gravel General Permit issued by Washington State Department of Ecology address fugitive dust, emissions, odors and stormwater discharges, respectively, and those agencies have enforcement authority related to these areas.

Washington Administrative Code (WAC 173.60.040), establishes maximum permissible environmental noise levels between noise sources and receiving sites. While this state code provides a standard, local governments have the responsibility of noise abatement consistent with this code. It is generally enforced on the basis of complaints through a local code enforcement program.

Sumner's Development Regulations

Sumner development regulations that would be applicable to an asphalt plants include limits on outdoor storage of materials (not to exceed 40% of the building footprint or 15% of the lot area) and requiring materials to be wrapped or enclosed to prevent windblown debris. Other performance standards address lighting, odor (no use shall be permitted which creates annoying odor in such quantities as to be readily detectable beyond the boundaries of the site), vibration, and visual quality of fencing (if chain link, then black or green coated only). [123]

Specifically, Sumner Municipal Code Chapter 8.14 addresses noise control. This chapter sets decibel (dBA) limits at the property line. In Chapter 8.14.050 there is a table showing dBA limits per environmental designation for noise abatement classification. Chapter 8.14.080 establishes a 10 dBA reduction between 10:00pm and 7:00am.

Sumner Municipal Code Chapter 18.16.080 establishes performance standards for commercial districts and states that an operation shall not create noise, light, glare, vibration, or odor that would disturb the peace, quiet, and comfort of neighboring residents, retail uses, lodging and restaurant uses.

Asphalt plants within Sumner are currently permitted in the M-1 and M-2 industrial districts, however they may be prohibited, or may be limited in size, scope or location to minimize incompatibilities or health and safety concerns where a Planned Mixed-use Development occurs within M-1 or M-2 industrial district. [123]

Buildings within an M-1 or M-2 zone are required to be setback 50 feet from any common boundary with a residentially zoned property, and a required landscaped setback of 25 foot and 35 foot, respectively. Accessory outdoor storage of materials within the M-1 district are screened from adjacent properties by a 12-foot landscaped buffer consisting of at least 50% evergreen species. [123]

V. Conclusions and Recommendations

This section is intended to provide a summary of health related recommendations that are generalizable and transferable to asphalt plants and the asphalt production process as regulated in Washington State and Pierce County.

In spite of a robust regulatory and permitting process with shared responsibility at the local, regional and state levels, asphalt production may still have the potential for impacts, particularly due to equipment failure, human error, and lack of ongoing monitoring.

Recommendations to Prevent Health Related Impacts:

The following options are within local jurisdiction and intended as recommendations to expand existing regulations beyond current federal, state regulations, and local requirements including but not limited to City of Sumner Noise Code (SMC 8.14), zoning code regarding lighting and vibration, and federal, state, and local stormwater and water quality requirements.

- Require submittal of regular, on-going air or noise monitoring, or monitoring well reports documenting compliance to be submitted to the Code Compliance Officer.
- Require that stockpiled materials be handled in specific ways that reduce particulate, fugitive dust, and odors (i.e, fully enclosed in a structure, covered). [91].
- Require capture or minimization of emissions in place, such as requiring refrigerated control on condensers used to limit emissions and enclosure of the truck load-out process to reduce fugitive emissions. These would be evaluated during Best Available Control Technology review.
- Require capture or minimization of emissions from asphalt or materials on vehicles transporting these to and from the asphalt production plant.
- Limit hours of operation based on further study could minimize noise impacts and exposure to air pollution. (Environmental review at the time of permitting could provide additional information about noise and other factors).
- Limit the amount of hot mix asphalt produced or produced in specific areas based on further study.
- Comply with the 2019 Stormwater Management Manual by requiring prevention, treatment and flow control BMPs as well as additional protective measures (APMs).
- Prevent water quality impacts in the area by properly maintaining the well structures and coverings and keeping contaminants at least 100 feet away from well openings.
- Asphalt plants should not be sited in FEMA Flood Zones.
- Require the use of best practices in use of sustainable materials and production practices as well as management practices to minimize spills and leaks in asphalt manufacturing.

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