ENVIRONMENTAL HEALTH

AFFECTED ENVIRONMENT

NOISE COMPATIBILITY

The EIS noise analysis is based on a study conducted by ESA Adolfson that took noise measurements from several locations in the study area and interpreted the findings (see Appendix F).

Noise Principles and Descriptors

Noise is defined as unwanted sound. Sound, traveling in the form of waves from a source, exerts a sound pressure level (referred to as sound level) which is measured in decibels (dB), with zero dB corresponding roughly to the threshold of human hearing, and 120 to 140 dB corresponding to the threshold of pain. The typical human ear is not equally sensitive to all frequencies of the audible sound spectrum. As a consequence, when assessing potential noise impacts, sound is measured using an electronic filter that de-emphasizes the frequencies below 1,000 Hz and above 5,000 Hz in a manner corresponding to the human ear's decreased sensitivity to low and extremely high frequencies. This method of frequency weighting, referred to as "A-weighting", is expressed in A-weighted decibels abbreviated as dB(A).

Noise Exposure and Community Noise

An individual's "noise exposure" is a measure of noise over a period of time. A "noise level" is a measure of noise at a given instant in time. "Community noise" varies continuously over a period of time depending on the contributing sound sources within the community noise environment. Community noise is primarily the product of many distant noise sources, which constitute a relatively stable background noise exposure, with the individual contributors unidentifiable. The background noise level changes throughout a typical day, but does so gradually, corresponding to addition and subtraction of distant noise sources such as traffic and atmospheric conditions. What also contributes to variation is the addition of short duration single event noise sources (e.g., aircraft flyovers, motor vehicles, sirens). These successive additions of sound to the community noise environment vary the community noise level from instant to instant, requiring the measurement of noise exposure over a period of time to legitimately characterize a community noise environment. Statistical noise descriptors include the following.

Leq: the energy-equivalent sound level is used to describe noise over a specified period of time, typically one hour, in a single numerical value. The L_{eq} is the constant sound level which would contain the same acoustic energy as the varying sound level, during the same time period (e.g., the average noise exposure level for the given time period).

Lmax: the instantaneous maximum noise level for a specified period of time.

L8.3: the noise level equaled or exceeded 8.3% of the specified time period (e.g. 5 minutes per hour); it is generally similar in level to the Leq.

L10: the noise level equaled or exceeded 10% of the specified time period; similar in level to the Leq.

L90: the noise level that is equaled or exceeded 90 percent of the specified time period. The L90 represents the background noise level in most environments.

Leq (h) Hourly A-weighted noise level in decibels dB(A).

Ldn: 24-hour day and night A-weighted noise exposure level which accounts for the greater sensitivity of most people to nighttime noise by weighting noise levels at night ("penalizing" nighttime noises). Noise between 10:00 p.m. and 7:00 a.m. is weighted (penalized) by adding 10 dBA to take into account the greater annoyance of nighttime noises.

As a general rule, in areas where the noise environment is dominated by traffic, the L_{eq} during the peak-hour is generally equivalent (plus or minus 2 decibels) to the Ldn at that location.

Effects of Noise on People

The effects of noise on people can be placed into three categories:

- subjective effects of annoyance, nuisance, dissatisfaction;
- interference with activities such as speech, sleep, learning; and
- physiological effects such as hearing loss or sudden startling.

Environmental noise typically produces effects in the first two of these categories. There is no wholly satisfactory way to measure subjective effects of noise, or reactions of annoyance and dissatisfaction. There is a wide variation in individual thresholds of annoyance, and different tolerances to noise tend to develop based on an individual's past experiences with noise. Thus, an important way of predicting a human reaction to a new noise environment is the way it compares to the existing environment to which one has adapted: the so called "ambient noise" level. In general, the more a new noise exceeds the previously existing ambient noise level, the less acceptable the new noise will be judged by those hearing it. With regard to increases in A-weighted noise level, the following relationships occur:

- except in carefully controlled laboratory experiments, a change of 1 dB(A) cannot be perceived;
- outside of the laboratory, a 3 dB(A) change is considered a just-perceivable difference;
- a change of at least 5 dB(A) is required before any expected noticeable change in human response; and
- a 10-dB(A) change is subjectively heard as a doubling in loudness, and can cause adverse response.

These relationships occur in part because of the logarithmic nature of sound and the decibel system. The human ear perceives sound in a non-linear fashion. Because the decibel scale is based on logarithms, two noise sources do not combine in a simple additive fashion. For example, if two identical noise sources produce noise levels of 50 dB(A), the combined sound level would be 53 dBA, not 100 dB(A).

Noise Attenuation

Stationary point sources of noise attenuate (lessen) at a rate of 6 to 7.5 dB(A) per doubling of distance from the source, depending on environmental conditions (such as atmospheric conditions and presence of noise barriers, either vegetative or manufactured). Typical "line" sources of noise, such as highways and busy arterial roadways, attenuate at a rate of 3.0 to 4.5 dB(A) per doubling of distance from the roadway.

Seattle Noise Regulations and Impact Criteria

The City of Seattle limits noise levels at property lines of neighboring properties. Maximum permissible noise levels apply to a single source of noise, and relate to the zoning district of the noise source and the receiving property (see Table 3-29). Sounds from motor vehicles on public roads, aircraft, trains, and unamplified sounds for public events are exempt from the property line regulations in Table 3-29. See Appendix F for other details.

Table 3-29
City of Seattle Maximum Permissible Sound Levels

	District of Receiving Property		
District of Sound Source	**Residential dB(A)**	**Commercial dB(A)**	**Industrial dB(A)**
Residential	55	57	60
Commercial	57	60	65
Industrial	60	65	70

Note: Between 10 p.m. and 7 a.m., the maximum permissible noise levels are reduced by 10 dBA for residential receiving properties. Source: City of Seattle, SMC 25.08.410, June 2007

Study Area Noise Sources

Across the study area, noise is generated by several sources that are typical of Downtown and industrial areas. Land uses and activities that generate noise include:

- Port/warehouse/industrial and commercial business traffic and loading/unloading activities
- Music/dance entertainment venues (primarily in Pioneer Square)
- Athletic facility events and associated activities
- Construction activity
- Regular maintenance activities, such as solid waste collection

Transportation-related noise sources that influence ambient noise levels in their vicinities include:

- Interstate 5 (along Chinatown, Little Saigon and south-of-Dearborn Street edge areas)
- Interstate 90 (along S. Dearborn Street and south-of-Dearborn Street edge areas)
- SR 99—Alaskan Way Viaduct traffic
- Railroad "tail track" near Alaskan Way
- Railroad tracks to/from King Street Station (vicinity ranges from S. Washington Street to S. Holgate Street)
- Railyards and other areas for loading/unloading, storage and movement of containers between transportation modes (primarily south of S. Atlantic Street near Utah Avenue S.)
- Emergency medical helicopter flights to and from Harborview Hospital
- General vehicle traffic, including truck and bus traffic, on surface streets

Typical freeway and surface street traffic noise includes sound generated by tires on pavement, brakes, engines, sirens and horns. Railroad-generated noise includes a variety of mechanical noises generated by the trains, whistles and other warning signals, and noises from loading/unloading activities. Emergency helicopter traffic affects noise levels primarily near 6th Avenue and Yesler Way, and other areas near I-5.

Indoor Residential Noise Levels

Although not included in the City of Seattle's codes, the Uniform Building Code suggests that interior noise levels due to exterior sources must not exceed an Ldn of 45 dBA in any habitable room. This level is assumed to allow for normal sleep and day-to-day activities within a residence. In high-noise environments (e.g., those above 65 Ldn) in other jurisdictions, site-specific noise studies may be conducted to inform noise insulation needs. Typical home construction reduces noise levels at least 20 dB(A) (from the outdoor noise level to the indoor noise level), which results in noise levels of 45 Ldn dB(A) only when outdoor noise levels are below 65 Ldn. Both the Federal Highway Administration (FHWA) and Federal Aviation Administration (FAA) have programs designed to help achieve indoor and outdoor noise levels consistent with these limits. However, residences near freeways, railroads and airport landing areas are often exposed to outdoor noise levels greater than 65 Ldn and need additional noise insulation to achieve an indoor noise level of 45 Ldn dB(A). Modified wall designs and sound controlling windows are typically used to achieve increased levels of sound reduction. Sound Transmission Class (STC) is a widely-used rating of noise reduction provided by windows and walls. The STC rating is roughly equivalent to the noise reduction provided, in decibels (dBA). Walls can be built to achieve noise reduction of 35-45 dBA and windows can provide a noise reduction of 40-45 dBA.

Outdoor Residential Noise Levels

Outdoor noise levels are more difficult to attenuate because, by definition, outdoor use areas are not enclosed. Outdoor use areas are considered "noise impacted" by FHWA and FAA when levels exceed approximately 65 Ldn. See Appendix F for other details.

Results of March 2007 Noise Measurements

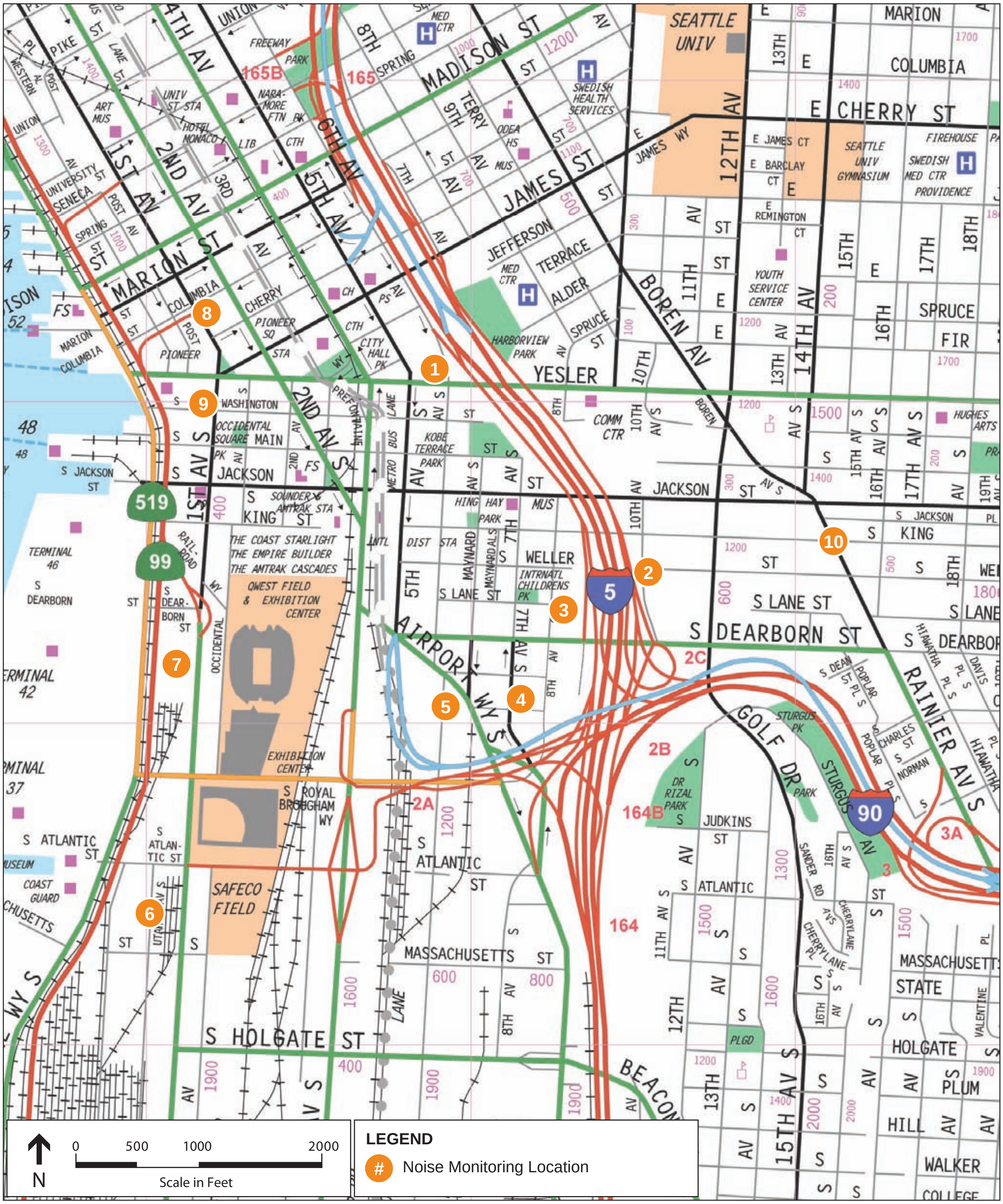
In March 2007 over two days, long-term noise measurements were made at ten locations. Also, twenty short-term noise measurements were taken—two each at the ten measurement locations (see Appendix F for other details). Table 3-30 shows the rankings of the measured sites from loudest to quietest, based on the 24-hour average noise levels measured as Ldn. Figure 3-38 shows the noise measurement locations. The data illustrate relatively loud conditions in Pioneer Square, Chinatown and Stadium Area locations that are near SR 99 and I-5, and somewhat quieter conditions in locations away from major highways.

Table 3-30
Noise Levels Measured at South Downtown Sites, Ranked Highest to Lowest

Site Number	Neighborhood	Site Location	24-hour Average Noise Level, Ldn	Range of Hourly Averages, Leq
8	Pioneer Square	1st Avenue & Columbia St.	79	64-85
7	Stadium Area	WOSCA Parking Lot	79	66-78
1	Chinatown/I.D.	Yesler Way & 6th Avenue	78	65-76
2	Chinatown/I.D.	10th Ave. S. & S. Weller St.	77	65-76
9	Pioneer Square	S. Washington St. & 1st Ave. S.	76.5	63-82
4	S.-of-Dearborn	7th Ave. S. & S. Plummer St.	75	63-75
3	Chinatown/I.D.	8th Ave. S. & S. Lane St.	71	58-71
6	Stadium Area	Utah Ave betw. Atlantic & Massachusetts	70.5	59-70
5	S.-of-Dearborn	6th Ave. S. and Airport Way S.	70.5	59-70
10	Little Saigon	S. King St. & Rainier Ave. S.	68	56-65

Source: ESA Adolfson, 2007

Short-term noise measurement data indicate the relative noise levels of typical noise generators, including street and highway traffic, train horns, airplanes, helicopters, sirens, truck and bus traffic (see Table 3-31).



FILE NAME: Fig01_locations.ai
CREATED BY: JAB / DATE LAST UPDATED: 03/26/07

MAP: Rand McNally & Company, 2006.
SOURCE: ESA Adolfson.

Figure 3-38
Noise Monitoring Location Map

Livable South Downtown

0 2 4 6 8 10
Scale in 100 Feet

Several of these generators created sound in the low-to-mid 70's Leq decibels. The ranges for each location in the rightmost column of Table 3-31 also indicate which areas experience noisier conditions as measured by individual sources. The locations with the highest measured levels are those nearest and most exposed to SR99 and I-5. The location with the lowest measured levels was the Little Saigon location west of Rainier Avenue S. Findings, including graphic portrayals of the sound measurements, are shown in Appendix F. See the Noise Compatibility discussion in the following Environmental Impacts part of this section for more interpretation of the relevance of these findings.

Table 3-31
Noise Sources and Associated Noise Levels from Five-Minute Measurements

Site Number	Neighborhood	Site Location	Five-minute Leq Noise levels (dB)	Noise Sources dB(A)
1	Chinatown/I.D.	Yesler Way & 6th Avenue (west of I-5)	67, 71, 72	Bus: 72 Helicopter: 78 Freeway: 67, 70-73 Train horn: 71 Airplane: 68
2	Chinatown/I.D.	10th Ave. S. & S. Weller St. (east of I-5)	71, 72	Freeway: 70-74 Trucks: 69-73 Siren: 71 Plane: <71
3	Chinatown/I.D	8th Ave. S. & S. Lane St. (west of I-5)	64, 67	Freeway: 64-67 Street traffic: 65 Truck: 73 Airplane: 66
4	South-of-Dearborn	7th Ave. S. & S. Plummer St. (I-5, I-90)	67, 69	Freeway: 64, 68-70 Train horn: 66, 70-74 Street traffic: 70-71
5	South-of-Dearborn	6th Ave. S. and Airport Way S. (I-5, I-90)	66, 67, 70	Truck beeper: 71 Freeway truck: 71 Airplane: 65
6	Stadium Area	Utah Ave betw. Atlantic & Massachusetts	65, 67, 68	Traffic: 67 Trucks: 70.5 Siren: 73 Train horn: 70-73
7	Stadium Area	WOSCA Parking Lot (east of SR 99)	76, 77	Traffic: 75, 73-78 (w/train horn audible)
8	Pioneer Square	1st Avenue & Columbia St.	70, 72	Street traffic: 70-75, 73 Bus: 77
9	Pioneer Square	S. Washington St. & 1st Ave. S.	70, 71	Viaduct/local traffic: 72
10	Little Saigon	S. King St. & Rainier Ave. S.	61, 65	Airplanes: 65-67 Street traffic: 61-65

Source: ESA Adolfson, 2007

HAZARDOUS SUBSTANCES

A large portion of the study area has a documented history of industrial and commercial uses. Most of the former tidelands in the study area were filled in the first decade of the 1900s, typically using soils from other re-grading efforts elsewhere in the city. The diverse range of activities in the southern portion of the study area has included sawmills, railroad operations, steel manufacturing, iron foundries, machine shops, warehouses, garages and fueling stations. Underground fuel tanks, heating oil tanks, past use of solvents and metals in production processes, operation, maintenance and storage of heavy vehicles, and presence of asbestos and lead-based paints in old buildings are a few of the elements and activities that have contributed to probable residual presence of contaminants in soils and groundwater from these activities.

Several past studies provide information for properties along the 1st Avenue S. corridor. Residual contaminants that may be present include solvents, gasoline and petroleum products such as diesel and fuel oils, metals such as mercury, silver, lead, zinc, copper, and other contaminants. Also, poly-chlorinated biphenyls (PCBs) are identified as present or reasonably predictable in a few locations. In addition, creosote, timber and woody debris are present in some areas due to remnant pilings at former tideland properties. Numerous properties in the Pioneer Square and Chinatown neighborhoods also have past use patterns involving a variety of businesses and industries that suggest the likely presence of residual contaminants. These characterizations of past use and contaminant presence also extend to the south-of-Dearborn vicinity.

In Little Saigon, industrial uses are known to have occupied the S. Dearborn Street vicinity, and current use patterns in the neighborhood include a diversity of commercial and light industrial activities, warehousing and automobile-related uses. This pattern suggests the probable presence of residual contaminants in soils in this vicinity as well. For example, an evaluation prepared for the "Dearborn Street" (a.k.a. Goodwill properties) mixed-use center proposal indicates potential residual contaminants in soil and groundwater, including petroleum hydrocarbons, chlorinated solvents and heavy metals (Dearborn Street Draft Supplemental EIS, Appendix 1, 2006). (Other sources include: SR 99 Alaskan Way Viaduct & Seawall Replacement Project Draft EIS, 2004 and Supplemental Draft EIS, 2006; Football/Soccer Stadium and Exhibition Center Project Draft EIS, 1998; Geotechnical and Environmental Report for Baseball Stadium, 1996.)

AIR POLLUTANT EMISSIONS AND PUBLIC HEALTH

Odor/Air Quality

Air pollutant and odor sources in the study area are similar to those described for noise: transportation activities along highways (I-5, I-90 ramps, SR 99) and surface streets, and industrial and port activities in the broader SODO vicinity. Railroad, truck, bus, ship and automobile traffic are probable sources.

Fine particulates known as PM 2.5 (less than 2.5 micrometers in size), typically associated with wood-burning and diesel fuel exhaust, are a primary vehicle-generated pollutant of interest to the Puget Sound Clean Air Agency (PSCAA). This kind of fine particulate can behave more like a gaseous substance and less like dust in its movement in air. Nitrogen oxides (NOx), volatile organic compounds (VOC) and carbon monoxide are other pollutants of interest. Particulates can have negative public health effects such as exacerbation of respiratory problems (asthma, decreased lung function) as well as contributing to risk of cancer and heart attack.

Research data suggest that due to proximity to industrial and transportation activities, air pollutant levels in some portions of the study area are probably elevated compared to other neighborhoods in the city, especially within approximately 100 feet of major transportation facilities. This is the distance where particulates are most likely to circulate in the air and alight on building and ground surfaces. Elevated sources such as the I-90 ramps probably also result in the casting of particulates further than 100 feet, and swirling winds may have similar effects. While Port-related ship activities generate air pollutant emissions, available data do not allow for precise mapping of effects on localized air quality conditions (PSCAA, 2007).

Available monitoring data from PSCAA equipment at Beacon Hill (near Jefferson Park) and East Marginal Way south of Spokane Street are the best indicators of local conditions for PM 2.5 particulates. The current federal standard for PM 2.5 particulates is 65 $\mu g/m^3$ (micrograms per cubic meter) and the proposed federal standard is 35 $\mu g/m^3$ for the three-year average of the 98th percentile of daily concentrations. At the Beacon Hill monitor site, the concentrations remained at approximately 24-25 $\mu g/m^3$ from 2001-2005, while at the Marginal Way monitor site, concentrations slightly decreased from approximately 34 $\mu g/m^3$ to around 30 $\mu g/m^3$ during that period (PSCAA 2005 Air Quality Data Summary, 2006). These data suggest a slight trend to improved air quality conditions for particulates.

Land use characteristics with respect to mixing of residential and industrial uses are summarized below.

- Within the study area, a variety of industrial, warehouse and distribution activities occur in the 1st Avenue S. vicinity, small-scale industrial uses and the City’s Charles Street Yards in the south-of-Dearborn vicinity, and small-scale industrial and distribution activities in the King and Weller Street vicinity east of 12th Avenue S. in the Little Saigon area.
- The industrial and transportation-oriented areas nearest the study area include the Port’s Terminal 46, the SIG Railyard between Alaskan Way and Utah Avenue S., railyards between Occidental Avenue S. and 3rd Avenue S., general industrial/commercial uses along 4th Avenue S., King County Metro bus yard facilities south of S. Royal Brougham Way, and an industrial area east of I-5 along Rainier Avenue S.
- A few residential uses are located near the areas dominated by industrial and commercial uses. These include the William Booth Center housing at S. Charles Street in the south-of-Dearborn vicinity; the Victorian Row Apartments on S. King Street east of 12th Avenue S., and a small number of other single-family homes in Little Saigon.

The available information suggests that air quality should be a consideration in evaluating overall land use compatibility, especially where residential uses would be located in proximity to highways, railroads, port and industrial sources. A distance of at least 100 feet from such facilities can be defined as the area of greatest concern about negative effects on environmental health of potential residents, plus an additional distance (of at least 100 feet) from elevated highways that may cast particulates over greater distances. This would be of greatest interest to the south-of-Dearborn vicinity, 1st Avenue S. corridor, International District properties nearest I-5 and Pioneer Square properties nearest SR 99.

PUBLIC HEALTH BENEFITS AND URBAN GROWTH PATTERNS

A body of research, including studies by University of British Columbia professor Larry Frank, has recently focused on the relative advantages to public health of living within mixed-use in-city areas, as contrasted to low-density suburban areas. In suburbs, the typically longer distances between homes and services often require residents to use automobiles to conduct daily activities. This leads to suburban residents walking less and exercising less often, and increased incidence of obesity and other health afflictions. In contrast, research suggests that in-city residents are able to walk more often and may more frequently substitute walking in place of automobile trips for some of their daily activities.

These research findings help support the City's urban village strategy for long-term growth. By encouraging the evolution of multi-purpose mixed-use neighborhood centers with denser residential occupation and more diverse range of available services, communities are more walkable and can satisfy the needs of residents with less frequent use of automobiles. This is good not only for the form and quality of the urban environment, but also encourages healthy patterns of living for in-city residents. However, factors such as local air quality should also be considered in broad assessments of public health, at least for areas in close proximity to freeways and railroads.

ENVIRONMENTAL IMPACTS

NOISE COMPATIBILITY

<u>All Alternatives</u>

As indicated by the noise measurement data, several portions of the study area in general proximity to highways and railroads are subject to relatively high noise levels ranging from 70 to 79 Ldn dBA. Noise from freeways, trucks, general street traffic, sirens, train horns, helicopters and airplanes all contribute to noise in this area. Locales within roughly one block of the SR 99 Viaduct are the areas subject to the highest noise levels, at 79 Ldn dBA, and the Yesler Way/6th Avenue vicinity and S. Weller Street/10th Avenue S. vicinity, both near Interstate 5, are subject to levels of 77 to 78 Ldn dBA. Future noise levels along SR 99 would relate to the road and highway configuration that is achieved in that vicinity.

Future residential development in these vicinities would likely face the greatest adverse exposure to high noise levels. This is probable because the 20 dBA noise reduction provided by typical residential construction methods would not likely reduce the average interior noise level to the preferred 45 Ldn dBA level. Comparing the alternatives, Alternatives 1 and 3 would accommodate residential development in the northern portion of the WOSCA property, which would likely be subject to high noise levels from SR 99 traffic and other nearby sources such as railroad traffic. A few potential infill development sites near SR 99 in Pioneer Square would also be subject to such effects. Denser levels of residential development could also occur in the other cited locations under most alternatives—the most impacted of these being under Alternative 1 near Yesler Way/6th Avenue, and under Alternative 2 near S. Weller Street/10th Avenue S. Similarly, future residential development in several other vicinities would also likely be unable to meet a 45 dBA interior noise level using typical construction techniques.

In order to adequately respond to these significant adverse noise conditions if residential uses are to be present, the use of STC-rated construction materials and methods for exterior enclosure in future residential development likely should be required. (STC-rated construction is already required by the Building Code for interior walls between dwelling units.) The objective would be to reduce interior noise levels in residential uses to approximately 45 Ldn dBA, which would likely necessitate the use of higher STC-rated materials and methods for exterior enclosure at the noisiest locations. This approach would also require consideration of whether, in the highest-impacted vicinities, operable windows may be present and if not, whether adequate ventilation systems for cooling and air circulation would be present. These approaches are possible to implement through future Master Use Permit reviews, on a case-by-case basis.

Interpretation of noise analysis findings with respect to zoning and land use compatibility suggests that residential uses with preferred interior noise levels are possible to develop in proximity to SR 99, I-5 and I-90 if sufficiently noise-mitigating construction materials and methods are used. However, the high noise levels are a negative when evaluating the overall compatibility of zoning options that would allow residential uses in these locations.

HAZARDOUS SUBSTANCES

All Alternatives

The probable presence of contaminants in soil and/or groundwater across many portions of the study area means there is a heightened interest in the risks of potential exposure to hazardous substances with future development. There could be increased risks of contaminant disturbance and potential for releases during future construction activities in several locations under any alternative, including the No Action Alternative. Similarly, demolition of buildings throughout the study area could generate risks associated with the presence of contaminants such as lead and asbestos.

Differences among the zoning alternatives would enable residential uses to be present in certain locations where other alternatives' zoning would not allow for residential use. Conceptually, this might increase the worst-case potential risks of exposure due to the long-term presence of residents. This worst-case risk assumes that contaminants, to the degree they are present, would manifest an elevated health risk to residents. Under this scenario of potentially elevated risk, the most relevant differences among the alternatives are:

- The permission of residential uses in the northern portion of the WOSCA property (and immediate vicinity) under Alternatives 1 and 3; and
- The permission of residential uses in the "south-of-Dearborn" vicinity under Alternative 3.

However, it must also be acknowledged that current regulatory practices associated with hazardous materials would dictate further site-specific assessments of actual conditions and remediation actions implemented prior to or during construction. This could include various forms of on-site investigations, records research, cleanup plans and compliance with regulatory processes. Such actions would in all probability result in cleanup or remediation to required levels, tailored to the individual circumstances of future development proposals. It would take into account whether residential uses would be present, which could entail a higher level of cleanup. This would help avoid the potential for worst-case impacts under almost any scenario involving future construction in the affected area.

Based on the interpretation above, this EIS does not identify a significant adverse impact of this type for any of the EIS zoning alternatives, nor is there any substantial difference in potential for worst-case impacts among the alternatives. However, these conclusions should not be interpreted as negating the need for proper evaluation of hazardous substances in later phases of review, e.g., future site-specific development proposals.

ODOR/AIR QUALITY

All Alternatives

The available information about air quality and public health effects in this area does not provide definitive evidence of significant air quality problems, but does provide advisory guidance on the possible proximity of residential uses to transportation and port facilities. Maintaining a distance of at least 100 feet between residential uses and such facilities for the purposes of avoiding adverse exposure of residents to air pollutants is a recommended means of maintaining compatibility. The following observations can be made at a programmatic level as to the impacts of the alternatives.

1st Avenue S. Corridor: Alternatives 1 and 3 include allowing residential uses in the northern portion of the WOSCA property. If such uses occurred, they would be located adjacent to SR 99 and the railroad "tail track" and relatively near (at approximately 180-200 feet) to the Port's Terminal 46 property. Each of these transportation and port facilities would continue to generate particulates and other air pollutants. The proximity of these pollutant-generating activities, particularly the train activity and highway traffic, to the WOSCA property suggests an adverse exposure of potential future residents to air pollutants would occur if residential uses are present. Over the long-term, such exposure would increase the risks for adverse effects on residents' health.

In locations south of S. Royal Brougham Way, the additional presence of two railyards, truck traffic on local streets, and SR519 connections to I-5 and I-90 suggest that additional multiple air pollutant sources would contribute to adverse air quality-related health effects on residents if residential uses were present. However, since the Livable South Downtown EIS alternatives do not include residential uses in this area, this impact is not attributed to any of the EIS alternatives.

Chinatown/I.D. near I-5: The Alternative 1, 2 and 3 proposals would increase the potential for future residential development in proximity to I-5, on both the east and west sides. The area of greatest concern includes the properties that are within 100-200 feet of I-5, which are essentially those directly abutting and others nearby that are most exposed to the I-5 right-of-way. Within this most-exposed area, the risks of adverse air quality-related environmental health effects would be greatest, if residential uses are present. With increasing distance, the probable concentrations of particulates and other vehicle-traffic-related air pollutants and the potential for these significant health risks would diminish.

South-of-Dearborn: The Alternative 3 SDM zone proposal includes the possibility of residential uses in the south-of-Dearborn vicinity. This would increase the proximity of residents to general industrial and maintenance activities within the study area (such as the City's Charles Street Yards), and their proximity to similar activities located nearby to the south. Similarly, such development could occur closer to the existing elevated Interstate 90 ramps. Within approximately 100-200 feet of the Interstate 90 ramps, the risks of adverse air quality-related health effects would be greatest, if residential uses would be present.

Stadium North Lot: In the Qwest Field north parking lot, new residential development could occur as close as 200 to 1,000 feet of the main Amtrak and commuter rail station at King Street Station. In addition, the zoning alternatives include the possibility of residential uses above the rail station facility. The future condition could continue to be an open-air rail station, or could become a facility topped and enclosed by future commercial or mixed-use development.

The proximity of future residential uses could conceivably contribute to residents' exposure to pollutant emissions from train operations. This is identified as a potential adverse environmental health impact. Locations closest to the rail station would be of most concern with respect to residential use. The relative exposure to this polluting condition would depend upon whether the rail station area is enclosed by future over-tracks development. The inclusion of mechanical systems would likely control air pollutant emissions and direct them to fans or vents. Such vents could be designed and located to avoid or minimize emissions to areas near residential uses, with a probability that related adverse health risks could be avoided.

Under the No Action Alternative (Alternative 4), no zoning changes would occur and, by definition, no impacts would occur. However, existing use patterns that place some residents relatively near Interstate 5 and SR 99 would continue to be present, contributing to possible public health concerns about chronic exposure to particulates.

PUBLIC HEALTH BENEFITS AND URBAN GROWTH PATTERNS

The research findings relating improved public health prospects to mixed-use neighborhoods and in-city living help support the Livable South Downtown planning effort's encouragement of denser residential populations in the Pioneer Square, Chinatown and Little Saigon neighborhoods. New residents would not only enliven these neighborhoods, but the residents would benefit from more active lifestyles, as well as access to regional and intracity transportation systems, as well as greater proximity to jobs, goods and services. At the same time, denser habitation in these areas in the Downtown Urban Center would help avoid the development impacts of additional development in suburban and rural-fringe areas, including effects on the natural environment and increased use of automobiles and congestion on regional transportation systems.

These public health benefits would be roughly similar under any of the alternatives studied in this EIS. Differences among the alternatives regarding overall public health benefits would be relatively subtle. On the whole, the growth patterns recommended among Alternatives 1, 2 and 3 would be expected to result in net positive impacts in terms of prospective public health benefits. The No Action Alternative (Alternative 4) would result in no impacts. However, the overall range of impact conclusions in this Environmental Health section should be noted when making judgments about overall public health prospects in the study area.

MITIGATION STRATEGIES

<u>All Alternatives</u>

Noise Compatibility

- In order to achieve interior noise levels in residential uses to 45 Ldn dBA under any alternative, future residential construction could be required on a project-by-project basis to use STC-rated construction materials and methods in exterior walls. This should be given greatest consideration in project decisions on site nearest I-5, I-90 and SR99. Noise measurements should be taken to inform future building design at a given site, and building design should incorporate assemblies (e.g. wall and window treatments, including details such as caulking) meeting a certain STC rating, to provide adequate noise reduction for residential uses.
- Future residential construction in certain high-noise areas could be required to demonstrate that operable windows would not be present and sufficient ventilation systems would be provided if operable windows are not present.

Hazardous Substances

- Given the conclusion of no identified significant adverse impacts, no mitigation strategies need to be identified. Per existing laws, implementation of remediation strategies for individual development sites would continue to be required.

Odor/Air Quality

- The ability to locate residential uses in close proximity to SR 99, I-5 and the I-90 ramps (within 100 feet) could be regulated and/or avoided through zoning choices.

SIGNIFICANT UNAVOIDABLE ADVERSE IMPACTS

Noise Compatibility

With implementation of noise mitigation strategies, where applicable, on a project-by-project basis to reduce interior sound levels to 45 Ldn dBA, significant unavoidable adverse noise impacts on future residential uses would not be expected to occur.

Hazardous Substances

None are anticipated.

Odor/Air Quality

With implementation of mitigation strategies to reduce exposure of residential uses to air pollutants, significant unavoidable adverse impacts would not be expected to occur.