INTERSTATE 5 COLUMBIA RIVER CROSSING

Air Quality Technical Report for the Final Environmental Impact Statement

May 2011

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Cover Sheet

Interstate 5 Columbia River Crossing

Air Quality Technical Report for the Final Environmental Impact Statement:

Submitted By:

Air Sciences, Inc.

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ACRONYMS

Acronym	Description
ADA	Americans with Disabilities Act
AQMA	Air Quality Maintenance Area
BNSF	Burlington Northern Santa Fe Railroad
CD	collector-distributor
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO	Carbon Monoxide
CRC	Columbia River Crossing
CTR	Commute Trip Reduction (Washington)
C-TRAN	Clark County Public Transit Benefit Area Authority
DAHP	Washington Department of Archaeology and Historic Preservation
DE	diesel exhaust
DEIS	Draft Environmental Impact Statement
DEQ	Oregon Department of Environmental Quality
DLCD	Oregon Department of Land Conservation and Development
DOT	U.S. Department of Transportation
DSL	Oregon Department of State Lands
ECO	Employee Commute Options (Oregon)
Ecology	Washington Department of Ecology
EPA	U.S. Environmental Protection Agency
FEIS	Final Environmental Impact Statement
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
HEI	Health Effects Institute
I-5	Interstate 5
IDOT	Illinois Department of Transportation
InterCEP	CRC Interstate Collaborative Environmental Process group
IRIS	Integrated Risk Information System
LPA	Locally Preferred Alternative
LRV	light rail vehicle
MAX	Metropolitan Area Express
mph	miles per hour
MPO	Metropolitan Planning Organization

MSAT	mobile source air toxics
MTIP	Metropolitan Transportation Improvement Plan
NAAQS	National Ambient Air Quality Standards
NATA	National Air Toxics Assessment
NEPA	National Environmental Policy Act
NO_2	Nitrogen Dioxide
NOAA Fisheries	National Oceanic and Atmospheric Administration for Fisheries
NOAA	National Oceanic and Atmospheric Administration
NO_X	Nitrogen Oxides
OAQPS	EPA Office of Air Quality Planning and Standards
OAR	Oregon Administrative Rule
ODFW	Oregon Department of Fish and Wildlife
ODOT	Oregon Department of Transportation
ORS	Oregon Revised Statutes
OTC	Oregon Transportation Commission
PAH	Polycyclic Aromatic Hydrocarbons
PATA	Portland Air Toxics Assessment
PATS	Portland Air Toxics Solutions
PM_{10}	Particulate Matter (10 microns or less in size)
$PM_{2.5}$	Particulate Matter (2.5 microns or less in size)
POM	polycyclic organic matter
ppb	parts per billion
ppm	parts per million
PSU	Portland State University
ROD	Record of Decision
RTC	Regional Transportation Council
RTP	Regional Transportation Plan
SAAQS	State Ambient Air Quality Standards
SHPO	Oregon State Historic Preservation Office
SIP	State Implementation Plan
SO_2	Sulphur Dioxide
SOV	single-occupancy vehicle
SPUI	single-point urban interchange
SSL	Sample Screening Level (EPA)
SWCAA	Southwest Clean Air Agency

TCM	Transportation Control Measure
TDM	transportation demand management
TriMet	Tri-County Metropolitan Transportation
TSM	transportation system management
TSP	total suspended particulates
USACE	U.S. Army Corps of Engineers
USC	U.S. Code
USFWS	U.S. Fish and Wildlife Service
VMT	vehicle miles traveled
VOC	volatile organic compounds
WASIST	Washington State Intersection Screening Tool
WDFW	Washington Department of Fish and Wildlife
WSDOT	Washington State Department of Transportation
WTC	Washington Transportation Commission

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1. Summary

1.1 Introduction

This Air Quality Technical Report has been prepared in support of the Final Environmental Impact Statement (FEIS) for the Interstate 5 (I-5) Columbia River Crossing (CRC) project. The purpose of the report is to compare air pollutant emissions of the LPA and No-Build alternatives, describe the air quality impacts of the project alternatives, and address potential mitigation measures for impacts, if needed.

1.2 Description of the Alternatives

This technical report evaluates the CRC project's locally preferred alternative (LPA) and the No-Build Alternative. The LPA includes two design options: The preferred option, LPA Option A, which includes local vehicular access between Marine Drive and Hayden Island on an arterial bridge; and LPA Option B, which does not have arterial lanes on the light rail/multi-use path bridge, but instead provides direct access between Marine Drive and the island with collector-distributor (CD) lanes on the two new bridges that would be built adjacent to I-5. In addition to the design options, if funding availability does not allow the entire LPA to be constructed in one phase, some roadway elements of the project would be deferred to a future date. This technical report identifies several elements that could be deferred, and refers to that possible initial investment as LPA with highway phasing. The LPA with highway phasing option would build most of the LPA in the first phase, but would defer construction of specific elements of the project. The LPA and the No-Build Alternative are described in this section.

1.2.1 Adoption of a Locally Preferred Alternative

Following the publication of the Draft Environmental Impact Statement (DEIS) on May 2, 2008, the project actively solicited public and stakeholder feedback on the DEIS during a 60-day comment period. During this time, the project received over 1,600 public comments.

During and following the public comment period, the elected and appointed boards and councils of the local agencies sponsoring the CRC project held hearings and workshops to gather further public input on and discuss the DEIS alternatives as part of their efforts to determine and adopt a locally preferred alternative. The LPA represents the alternative preferred by the local and regional agencies sponsoring the CRC project. Local agency-elected boards and councils determined their preference based on the results of the evaluation in the DEIS and on the public and agency comments received both before and following its publication.

In the summer of 2008, the local agencies sponsoring the CRC project adopted the following key elements of CRC as the LPA:

- A replacement bridge as the preferred river crossing,
- Light rail as the preferred high-capacity transit mode, and
- Clark College as the preferred northern terminus for the light rail extension.

The preferences for a replacement crossing and for light rail transit were identified by all six local agencies. Only the agencies in Vancouver – the Clark County Public Transit Benefit Area Authority (C-TRAN), the City of Vancouver, and the Regional Transportation Council (RTC) –

preferred the Vancouver light rail terminus. The adoption of the LPA by these local agencies does not represent a formal decision by the federal agencies leading this project – the Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) – or any federal funding commitment. A formal decision by FHWA and FTA about whether and how this project should be constructed will follow the FEIS in a Record of Decision (ROD).

1.2.2 Description of the LPA

The LPA includes an array of transportation improvements, which are described below. When the LPA differs between Option A and Option B, it is described in the associated section. For a more detailed description of the LPA, including graphics, please see Chapter 2 of the FEIS.

1.2.2.1 Multimodal River Crossing

Columbia River Bridges

The parallel bridges that form the existing I-5 crossing over the Columbia River would be replaced by two new parallel bridges. The eastern structure would accommodate northbound highway traffic on the bridge deck, with a bicycle and pedestrian path underneath; the western structure would carry southbound traffic, with a two-way light rail guideway below. Whereas the existing bridges have only three lanes each with virtually no shoulders, each of the new bridges would be wide enough to accommodate three through-lanes and two add/drop lanes. Lanes and shoulders would be built to full design standards.

The new bridges would be high enough to provide approximately 95 feet of vertical clearance for river traffic beneath, but not so high as to impede the take-offs and landings by aircraft using Pearson Field or Portland International Airport to the east. The new bridge structures over the Columbia River would not include lift spans, and both of the new bridges would each be supported by six piers in the water and two piers on land.

North Portland Harbor Bridges

The existing highway structures over North Portland Harbor would not be replaced; instead, they would be retained to accommodate all mainline I-5 traffic. As discussed at the beginning of this chapter, two design options have emerged for the Hayden Island and Marine Drive interchanges. The preferred option, LPA Option A, includes local vehicular access between Marine Drive and Hayden Island on an arterial bridge. LPA Option B does not have arterial lanes on the light rail/multi-use path bridge, but instead provides direct access between Marine Drive and the island with collector-distributor lanes on the two new bridges that would be built adjacent to I-5.

LPA Option A: Four new, narrower parallel structures would be built across the waterway, three on the west side and one on the east side of the existing North Portland Harbor bridges. Three of the new structures would carry on- and off-ramps to mainline I-5. Two structures west of the existing bridges would carry traffic merging onto or exiting off of I-5 southbound. The new structure on the east side of I-5 would serve as an on-ramp for traffic merging onto I-5 northbound.

The fourth new structure would be built slightly farther west and would include a two-lane arterial bridge for local traffic to and from Hayden Island, light rail transit, and a multi-use path for pedestrians and bicyclists. All of the new structures would have at least as much vertical clearance over the river as the existing North Portland Harbor bridges.

LPA Option B: This option would build the same number of structures over North Portland Harbor as Option A, although the locations and functions on those bridges would differ, as described below. The existing bridge over North Portland Harbor would be widened and would receive seismic upgrades.

LPA Option B does not have arterial lanes on the light rail/multi-use path bridge. Direct access between Marine Drive and the island would be provided with collector-distributor lanes. The structures adjacent to the highway bridge would carry traffic merging onto or exiting off of mainline I-5 between the Marine Drive and Hayden Island interchanges.

1.2.2.2 Interchange Improvements

The LPA includes improvements to seven interchanges along a 5-mile segment of I-5 between Victory Boulevard in Portland and SR 500 in Vancouver. These improvements include some reconfiguration of adjacent local streets to complement the new interchange designs, as well as new facilities for bicyclists and pedestrians along this corridor.

Victory Boulevard Interchange

The southern extent of the I-5 project improvements would be two ramps associated with the Victory Boulevard interchange in Portland. The Marine Drive to I-5 southbound on-ramp would be braided over the I-5 southbound to the Victory Boulevard/Denver Avenue off-ramp. The other ramp improvement would lengthen the merge distance for northbound traffic entering I-5 from Denver Avenue. The current merging ramp would be extended to become an add/drop (auxiliary) lane which would continue across the river crossing.

***Potential phased construction option*:** The aforementioned southbound ramp improvements to the Victory Boulevard interchange may not be included with the CRC project. Instead, the existing connections between I-5 southbound and Victory Boulevard could be retained. The braided ramp connection could be constructed separately in the future as funding becomes available.

Marine Drive Interchange

All movements within this interchange would be reconfigured to reduce congestion for motorists entering and exiting I-5 at this location. The interchange configuration would be a single-point urban interchange (SPUI) with a flyover ramp serving the east to north movement. With this configuration, three legs of the interchange would converge at a point on Marine Drive, over the I-5 mainline. This configuration would allow the highest volume movements to move freely without being impeded by stop signs or traffic lights.

The Marine Drive eastbound to I-5 northbound flyover ramp would provide motorists with access to I-5 northbound without stopping. Motorists from Marine Drive eastbound would access I-5 southbound without stopping. Motorists traveling on Martin Luther King Jr. Boulevard westbound to I-5 northbound would access I-5 without stopping at the intersection.

The new interchange configuration changes the westbound Marine Drive and westbound Vancouver Way connections to Martin Luther King Jr. Boulevard and to northbound I-5. These two streets would access westbound Martin Luther King Jr. Boulevard farther east. Martin Luther King Jr. Boulevard would have a new direct connection to I-5 northbound.

In the new configuration, the connections from Vancouver Way and Marine Drive would be served, improving the existing connection to Martin Luther King Jr. Boulevard east of the interchange. The improvements to this connection would allow traffic to turn right from Vancouver Way and accelerate onto Martin Luther King Jr. Boulevard. On the south side of Martin Luther King Jr. Boulevard, the existing loop connection would be replaced with a new connection farther east.

A new multi-use path would extend from the Bridgeton neighborhood to the existing Expo Center light rail station and from the station to Hayden Island along the new light rail line over North Portland Harbor.

LPA Option A: Local traffic between Martin Luther King Jr. Boulevard/Marine Drive and Hayden Island would travel via an arterial bridge over North Portland Harbor. There would be some variation in the alignment of local streets in the area of the interchange between Option A and Option B. The most prominent differences are the alignments of Vancouver Way and Union Court.

LPA Option B: With this design option, there would be no arterial traffic lanes on the light rail/multi-use path bridge over North Portland Harbor. Instead, vehicles traveling between Martin Luther King Jr. Boulevard/ Marine Drive and Hayden Island would travel on the collector-distributor bridges that would parallel each side of I-5 over North Portland Harbor. Traffic would not need to merge onto mainline I-5 to travel between the island and Martin Luther King Jr. Boulevard/Marine Drive.

***Potential phased construction option*:** The aforementioned flyover ramp could be deferred and not constructed as part of the CRC project. In this case, rather than providing a direct eastbound Marine Drive to I-5 northbound connection by a flyover ramp, the project improvements to the interchange would instead provide this connection through the signal-controlled SPUI. The flyover ramp could be constructed separately in the future as funding becomes available.

Hayden Island Interchange

All movements for this interchange would be reconfigured. The new configuration would be a split tight diamond interchange. Ramps parallel to the highway would be built, lengthening the ramps and improving merging speeds. Improvements to Jantzen Drive and Hayden Island Drive would include additional through, left-turn, and right-turn lanes. A new local road, Tomahawk Island Drive, would travel east-west through the middle of Hayden Island and under the I-5 interchange, improving connectivity across I-5 on the island. Additionally, a new multi-use path would be provided along the elevated light rail line on the west side of the Hayden Island interchange.

LPA Option A: A proposed arterial bridge with two lanes of traffic, one in each direction, would allow vehicles to travel between Martin Luther King Jr. Boulevard/ Marine Drive and Hayden Island without accessing I-5.

LPA Option B: With this design option there would be no arterial traffic lanes on the light rail/multi-use path bridge over North Portland Harbor. Instead, vehicles traveling between Martin Luther King Jr. Boulevard/Marine Drive and Hayden Island would travel on the collector-distributor bridges that parallel each side of I-5 over North Portland Harbor.

SR 14 Interchange

The function of this interchange would remain largely the same. Direct connections between I-5 and SR 14 would be rebuilt. Access to and from downtown Vancouver would be provided as it is today, but the connection points would be relocated. Downtown Vancouver I-5 access to and from the south would be at C Street rather than Washington Street, while downtown connections to and from SR 14 would be made by way of Columbia Street at 4th Street.

The multi-use bicycle and pedestrian path in the northbound (eastern) I-5 bridge would exit the structure at the SR 14 interchange, and then loop down to connect into Columbia Way.

Mill Plain Interchange

This interchange would be reconfigured into a SPUI. The existing “diamond” configuration requires two traffic signals to move vehicles through the interchange. The SPUI would use one efficient intersection and allow opposing left turns simultaneously. This would improve the capacity of the interchange by reducing delay for traffic entering or exiting the highway.

This interchange would also receive several improvements for bicyclists and pedestrians. These include bike lanes and sidewalks, clear delineation and signing, short perpendicular crossings at the ramp terminals, and ramp orientations that would make pedestrians highly visible.

Fourth Plain Interchange

The improvements to this interchange would be made to better accommodate freight mobility and access to the new park and ride at Clark College. Northbound I-5 traffic exiting to Fourth Plain would continue to use the off-ramp just north of the SR 14 interchange. The southbound I-5 exit to Fourth Plain would be braided with the SR 500 connection to I-5, which would eliminate the non-standard weave between the SR 500 connection and the off-ramp to Fourth Plain as well as the westbound SR 500 to Fourth Plain Boulevard connection.

Additionally, several improvements would be made to provide better bicycle and pedestrian mobility and accessibility, including bike lanes, neighborhood connections, and access to the park and ride.

SR 500 Interchange

Improvements would be made to the SR 500 interchange to add direct connections to and from I-5. On- and off-ramps would be built to directly connect SR 500 and I-5 to and from the north, connections that are currently made by way of 39th Street. I-5 southbound traffic would connect to SR 500 via a new tunnel underneath I-5. SR 500 eastbound traffic would connect to I-5 northbound on a new on-ramp. The 39th Street connections with I-5 to and from the north would be eliminated. Travelers would instead use the connections at Main Street to connect to and from 39th Street.

Additionally, several improvements would be made to provide better bicycle and pedestrian mobility and accessibility, including sidewalks on both sides of 39th Street, bike lanes, and neighborhood connections.

***Potential phased construction option*:** The northern half of the existing SR 500 interchange would be retained, rather than building new connections between I-5 southbound to SR 500 eastbound and from SR 500 westbound to I-5 northbound. The ramps connecting SR 500 and I-5 to and from the north could be constructed separately in the future as funding becomes available.

1.2.2.3 Transit

The primary transit element of the LPA is a 2.9-mile extension of the current Metropolitan Area Express (MAX) Yellow Line light rail from the Expo Center in North Portland, where it currently ends, to Clark College in Vancouver. The transit element would not differ between LPA and LPA with highway phasing. To accommodate and complement this major addition to the region's transit system, a variety of additional improvements are also included in the LPA:

- Three park and ride facilities in Vancouver near the new light rail stations.
- Expansion of Tri-County Metropolitan Transportation District's (TriMet's) Ruby Junction light rail maintenance base in Gresham, Oregon.
- Changes to C-TRAN local bus routes.
- Upgrades to the existing light rail crossing over the Willamette River via the Steel Bridge.

Operating Characteristics

Nineteen new light rail vehicles (LRV) would be purchased as part of the CRC project to operate this extension of the MAX Yellow Line. These vehicles would be similar to those currently used by TriMet's MAX system. With the LPA, LRVs in the new guideway and in the existing Yellow Line alignment are planned to operate with 7.5-minute headways during the "peak of the peak" (the two-hour period within the 4-hour morning and afternoon/evening peak periods where demand for transit is the highest) and 15-minute headways during off-peak periods.

Light Rail Alignment and Stations

Oregon Light Rail Alignment and Station

A two-way light rail alignment for northbound and southbound trains would be constructed to extend from the existing Expo Center MAX station over North Portland Harbor to Hayden Island. Immediately north of the Expo Center, the alignment would curve eastward toward I-5, pass beneath Marine Drive, then rise over a flood wall onto a light rail/multi-use path bridge to cross North Portland Harbor. The two-way guideway over Hayden Island would be elevated at approximately the height of the rebuilt mainline of I-5, as would a new station immediately west of I-5. The alignment would extend northward on Hayden Island along the western edge of I-5, until it transitions into the hollow support structure of the new western bridge over the Columbia River.

Downtown Vancouver Light Rail Alignment and Stations

After crossing the Columbia River, the light rail alignment would curve slightly west off of the highway bridge and onto its own smaller structure over the Burlington Northern Santa Fe (BNSF) rail line. The double-track guideway would descend on structure and touch down on Washington Street south of 5th Street, continuing north on Washington Street to 7th Street. The elevation of 5th Street would be raised to allow for an at-grade crossing of the tracks on Washington Street. Between 5th and 7th Streets, the two-way guideway would run down the center of the street. Traffic would not be allowed on Washington between 5th and 6th Streets and would be two-way between 6th and 7th Streets. There would be a station on each side of the street on Washington between 5th and 6th Streets.

At 7th Street, the light rail alignment would form a couplet. The single-track northbound guideway would turn east for two blocks, then turn north onto Broadway Street, while the single-track southbound guideway would continue on Washington Street. Seventh Street will be converted to one-way traffic eastbound between Washington and Broadway with light rail operating on the north side of 7th Street. This couplet would extend north to 17th Street, where the two guideways would join and turn east.

The light rail guideway would run on the east side of Washington Street and the west side of Broadway Street, with one-way traffic southbound on Washington Street and one-way traffic northbound on Broadway Street. On station blocks, the station platform would be on the side of the street at the sidewalk. There would be two stations on the Washington-Broadway couplet, one pair of platforms near Evergreen Boulevard, and one pair near 15th Street.

East-west Light Rail Alignment and Terminus Station

The single-track southbound guideway would run in the center of 17th Street between Washington and Broadway Streets. At Broadway Street, the northbound and southbound alignments of the couplet would become a two-way center-running guideway traveling east-west on 17th Street. The guideway on 17th Street would run until G Street, then connect with McLoughlin Boulevard and cross under I-5. Both alignments would end at a station east of I-5 on the western boundary of Clark College.

Park and Ride Stations

Three park and ride stations would be built in Vancouver along the light rail alignment:

- Within the block surrounded by Columbia, Washington 4th and 5th Streets, with five floors above ground that include space for retail on the first floor and 570 parking stalls.
- Between Broadway and Main Streets next to the stations between 15th and 16th Streets, with space for retail on the first floor, and four floors above ground that include 420 parking stalls.
- At Clark College, just north of the terminus station, with space for retail or C-TRAN services on the first floor, and five floors that include approximately 1,910 parking stalls.

Ruby Junction Maintenance Facility Expansion

The Ruby Junction Maintenance Facility in Gresham, Oregon, would need to be expanded to accommodate the additional LRVs associated with the CRC project. Improvements include additional storage for LRVs and other maintenance material, expansion of LRV maintenance bays, and expanded parking for additional personnel. A new operations command center would also be required, and would be located at the TriMet Center Street location in Southeast Portland.

Local Bus Route Changes

As part of the CRC project, several C-TRAN bus routes would be changed in order to better complement the new light rail system. Most of these changes would re-route bus lines to downtown Vancouver where riders could transfer to light rail. Express routes, other than those listed below, are expected to continue service between Clark County and downtown Portland. The following table (Exhibit 1-1) shows anticipated future changes to C-TRAN bus routes.

Exhibit 1-1. Proposed C-TRAN Bus Routes Comparison

C-TRAN Bus Route	Route Changes
#4 - Fourth Plain	Route truncated in downtown Vancouver
#41 - Camas / Washougal Limited	Route truncated in downtown Vancouver

C-TRAN Bus Route	Route Changes
#44 - Fourth Plain Limited	Route truncated in downtown Vancouver
#47 - Battle Ground Limited	Route truncated in downtown Vancouver
#105 - I-5 Express	Route truncated in downtown Vancouver
#105S - I-5 Express Shortline	Route eliminated in LPA (The No-Build runs articulated buses between downtown Portland and downtown Vancouver on this route)

Steel Bridge Improvements

Currently, all light rail lines within the regional TriMet MAX system cross over the Willamette River via the Steel Bridge. By 2030, the number of LRVs that cross the Steel Bridge during the 4-hour PM peak period would increase from 152 to 176. To accommodate these additional trains, the project would retrofit the existing rails on the Steel Bridge to increase the allowed light rail speed over the bridge from 10 to 15 mph. To accomplish this, additional work along the Steel Bridge lift spans would be needed.

1.2.2.4 Tolling

Tolling cars and trucks that use the I-5 river crossing is proposed as a method to help fund the CRC project and to encourage the use of alternative modes of transportation. The authority to toll the I-5 crossing is set by federal and state laws. Federal statutes permit a toll-free bridge on an interstate highway to be converted to a tolled facility following the reconstruction or replacement of the bridge. Prior to imposing tolls on I-5, Washington and Oregon Departments of Transportation (WSDOT and ODOT) would have to enter into a toll agreement with U.S. Department of Transportation (DOT). Recently passed state legislation in Washington permits WSDOT to toll I-5 provided that the tolling of the facility is first authorized by the Washington legislature. Once authorized by the legislature, the Washington Transportation Commission (WTC) has the authority to set the toll rates. In Oregon, the Oregon Transportation Commission (OTC) has the authority to toll a facility and to set the toll rate. It is anticipated that prior to tolling I-5, ODOT and WSDOT would enter into a bi-state tolling agreement to establish a cooperative process for setting toll rates and guiding the use of toll revenues.

Tolls would be collected using an electronic toll collection system: toll collection booths would not be required. Instead, motorists could obtain a transponder that would automatically bill the vehicle owner each time the vehicle crossed the bridge, while cars without transponders would be tolled by a license-plate recognition system that would bill the address of the owner registered to that license plate.

The LPA proposes to apply a variable toll on vehicles using the I-5 crossing. Tolls would vary by time of day, with higher rates during peak travel periods and lower rates during off-peak periods. Medium and heavy trucks would be charged a higher toll than passenger vehicles. The traffic-related impact analysis in this FEIS is based on toll rates that, for passenger cars with transponders, would range from $1.00 during the off-peak to $2.00 during the peak travel times (in 2006 dollars).

1.2.2.5 Transportation System and Demand Management Measures

Many well-coordinated transportation demand management (TDM) and transportation system management (TSM) programs are already in place in the Portland-Vancouver Metropolitan region and supported by agencies and adopted plans. In most cases, the impetus for the programs is from state-mandated programs: Oregon's Employee Commute Options (ECO) rule and Washington's Commute Trip Reduction (CTR) law.

The physical and operational elements of the CRC project provide the greatest TDM opportunities by promoting other modes to fulfill more of the travel needs in the project corridor. These include:

- Major new light rail line in exclusive right-of-way, as well as express bus and feeder routes;
- Modern bicycle and pedestrian facilities that accommodate more bicyclists and pedestrians, and improve connectivity, safety, and travel time;
- Park and ride lots and garages; and
- A variable toll on the highway crossing.

In addition to these fundamental elements of the project, facilities and equipment would be implemented that could help existing or expanded TSM programs maximize capacity and efficiency of the system. These include:

- Replacement or expanded variable message signs or other traveler information systems in the CRC project area;
- Expanded incident response capabilities;
- Queue jumps or bypass lanes for transit vehicles where multi-lane approaches are provided at ramp signals for entrance ramps;
- Expanded traveler information systems with additional traffic monitoring equipment and cameras, and
- Active traffic management.

1.2.3 LPA Construction

Construction of bridges over the Columbia River is the most substantial element of the project, and this element sets the sequencing for other project components. The main river crossing and immediately adjacent highway improvement elements would account for the majority of the construction activity necessary to complete this project.

1.2.3.1 Construction Activities Sequence and Duration

The following table (Exhibit 1-2) displays the expected duration and major details of each element of the project. Due to construction sequencing requirements, the timeline to complete the initial phase of the LPA with highway phasing is the same as the full LPA.

Exhibit 1-2. Construction Activities and Estimated Duration

Element	Estimated Duration	Details
Columbia River bridges	4 years	• Construction is likely to begin with the bridges. • General sequence includes initial preparation, installation of foundation piles, shaft caps, pier columns, superstructure, and deck.

Element	Estimated Duration	Details
Hayden Island and SR 14 interchanges	1.5 - 4 years for each interchange	• Each interchange must be partially constructed before any traffic can be transferred to the new structure. • Each interchange needs to be completed at the same time.
Marine Drive interchange	3 years	• Construction would need to be coordinated with construction of the southbound lanes coming from Vancouver.
Demolition of the existing bridge	1.5 years	• Demolition of the existing bridges can begin only after traffic is rerouted to the new bridges.
Three interchanges north of SR 14	4 years for all three	• Construction of these interchanges could be independent from each other or from the southern half of the project. • More aggressive and costly staging could shorten this timeframe.
Light rail	4 years	• The river crossing for the light rail would be built with the bridges. • Any bridge structure work would be separate from the actual light rail construction activities and must be completed first.
Total Construction Timeline	6.3 years	• Funding, as well as contractor schedules, regulatory restrictions on in-water work, weather, materials, and equipment, could all influence construction duration. • This is also the same time required to complete the smallest usable segment of roadway – Hayden Island through SR 14 interchanges.

1.2.3.2 Major Staging Sites and Casting Yards

Staging of equipment and materials would occur in many areas along the project corridor throughout construction, generally within existing or newly purchased right-of-way or on nearby vacant parcels. However, at least one large site would be required for construction offices, to stage the larger equipment such as cranes, and to store materials such as rebar and aggregate. Suitable sites must be large and open to provide for heavy machinery and material storage, must have waterfront access for barges (either a slip or a dock capable of handling heavy equipment and material) to convey material to the construction zone, and must have roadway or rail access for landside transportation of materials by truck or train.

Three sites have been identified as possible major staging areas:

1. Port of Vancouver (Parcel 1A) site in Vancouver: This 52-acre site is located along SR 501 and near the Port of Vancouver's Terminal 3 North facility.
2. Red Lion at the Quay hotel site in Vancouver: This site would be partially acquired for construction of the Columbia River crossing, which would require the demolition of the building on this site, leaving approximately 2.6 acres for possible staging.
3. Vacant Thunderbird hotel site on Hayden Island: This 5.6-acre site is much like the Red Lion hotel site in that a large portion of the parcel is already required for new right-of-way necessary for the LPA.

A casting/staging yard could be required for construction of the over-water bridges if a precast concrete segmental bridge design is used. A casting yard would require access to the river for barges, including either a slip or a dock capable of handling heavy equipment and material; a large area suitable for a concrete batch plant and associated heavy machinery and equipment; and access to a highway and/or railway for delivery of materials.

Two sites have been identified as possible casting/staging yards:

1. Port of Vancouver Alcoa/Evergreen West site: This 95-acre site was previously home to an aluminum factory and is currently undergoing environmental remediation, which should be completed before construction of the CRC project begins (2012). The western portion of this site is best suited for a casting yard.
2. Sundial site: This 50-acre site is located between Fairview and Troutdale, just north of the Troutdale Airport, and has direct access to the Columbia River. There is an existing barge slip at this location that would not have to undergo substantial improvements.

1.2.4 The No-Build Alternative

The No-Build Alternative illustrates how transportation and environmental conditions would likely change by the year 2030 if the CRC project is not built. This alternative makes the same assumptions as the build alternatives regarding population and employment growth through 2030, and also assumes that the same transportation and land use projects in the region would occur as planned. The No-Build Alternative also includes several major land use changes that are planned within the project area, such as the Riverwest development just south of Evergreen Boulevard and west of I-5, the Columbia West Renaissance project along the western waterfront in downtown Vancouver, and redevelopment of the Jantzen Beach shopping center on Hayden Island. All traffic and transit projects within or near the CRC project area that are anticipated to be built by 2030 separately from this project are included in the No-Build and build alternatives. Additionally, the No-Build Alternative assumes bridge repair and continuing maintenance costs to the existing bridge that are not anticipated with the replacement bridge option.

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2. Methods

2.1 Introduction

The U.S. Environmental Protection Agency (EPA) has developed national ambient air quality standards (NAAQS) for six criteria pollutants: carbon monoxide (CO), lead, ozone, nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and particulate matter (PM). There are well-developed standards and analysis methods for air quality impacts from criteria pollutants. The states have State Ambient Air Quality Standards (SAAQS) that are at least as stringent as the NAAQS.

On recent transportation projects, mobile source air toxics (MSAT) pollutants have caused more concern than criteria pollutants. Despite the concerns, there are no NAAQS for MSAT pollutants, nor are there specific regulatory analysis requirements, and the analysis methods for these pollutants are still being developed.

The methodology used for the CRC project analysis had two goals: 1) to show if potential violations of the NAAQS are expected from LPA and No-Build alternatives, and 2) to compare the emissions of the project alternatives so that the public and decision-makers have reasonable information about the relative air quality effects of the project alternatives even where there are no standards for determining impacts. Greenhouse gases impacts were considered under the Cumulative Impacts Technical Report.

2.2 Study Area

Air quality impacts are closely tied to traffic impacts. Regional and subarea emissions estimates were provided by Metro using their software developed for regional conformity analysis and the Portland Air Toxics Solutions (PATS) program. PATS is the Oregon Department of Environmental Quality’s (DEQ’s) first geographical area program intended to reduce air toxics pollution in the Portland area. Air quality was evaluated on a regional emissions basis and a subarea emissions basis. The regional area includes Multnomah, Clackamas, Washington, and Clark Counties. The subarea boundaries extend from NE 99th Street to East 39th Street, East 39th Street to SR 14, SR 14 to Columbia Boulevard, and Columbia Boulevard to the I-405 junction. A map of the four subareas is included in the Long-term Effects section of this report (Figure 5-3). To evaluate the local effects of the LPA and No-Build alternatives, CO concentrations were estimated at poorly performing intersections affected by the project alternatives and compared to the CO NAAQS.

2.3 Effects Guidelines

The NAAQS and SAAQS are shown in Exhibit 2-1. An air quality impact would occur with a violation of the NAAQS or SAAQS.

Exhibit 2-1. State and Federal Ambient Air Quality Standards[a]

Pollutant	Averaging Time	Federal	Oregon	Washington
CO	8-hour[b]	9 ppm	9 ppm	9 ppm
	1-hour[b]	35 ppm	35 ppm	35 ppm
Lead (pre-2008)	Calendar Quarter		1.5 μg/m^3	1.5 μg/m^3
Lead (2008 to present)	3-Month Rolling Average	0.15 μg/m^3	0.15 μg/m^3	-
Ozone	8-hour[c]	0.075 ppm	0.075 ppm	
	1-hour			0.12 ppm
Nitrogen Dioxide	Annual Arithmetic Mean	0.053 ppm	0.053 ppm	0.05 ppm
	1-hour (April 12, 2010)[d]	0.100 ppm	-	-
Sulfur Dioxide	Annual Arithmetic Mean	0.03 ppm	0.02 ppm	0.02 ppm
	24-hour	0.14 ppm	0.10 ppm	0.10 ppm
	3-hour	0.5 ppm	0.50 ppm	-
	1-hour Average (Annual)	-	-	0.4 ppm
	1-hour Average (7 day period)	-	-	0.25 ppm
	1-hour Average (June 2, 2010)[e]	0.075 ppm	-	-
Total Suspended Particulates (TSP)	Annual Geometric Mean	-	-	60 μg/m^3
	24-hour Average	-	-	150 μg/m^3
PM_{10}	3-year Average of Annual Arithmetic Mean	-	- -	50 μg/m^3
	24-hour Average	150 μg/m^3	150 μg/m^3	150 μg/m^3
$PM_{2.5}$	3-year Average of Annual Arithmetic Mean	15 μg/m^3	15 μg/m^3	-
	3-year Average of 98th Percentile of 24-hour concentrations	35 μg/m^3	35 μg/m^3	-

Note: ppm = parts per million; μg/m^3 = micrograms per cubic meter; PM_{10} = particulates with an aerodynamic diameter of less than or equal to 10 micrometers; $PM_{2.5}$ = particulates with an aerodynamic diameter of less than or equal to 2.5 micrometers.

a Sources: EPA Office of Air Quality Planning and Standards (OAQPS); Oregon Department of Environmental Quality (DEQ); Washington Administrative Code (WAC 173, Sections 470, 474, 475).

b Not to be exceeded more than once per year.

c The 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm. The federal 1-hour ozone standard was revoked in June 2005. The 8-hour standard is revised to 0.075 ppm effective May 27, 2008.

d The 3-year average of the 98th percentile daily maximum 1-hour average NO_2 concentrations must be less than 100 parts per billion (ppb). http://www.epa.gov/ttn/naaqs/standards/nox/fr/20100209.pdf

e The 3-year average of the annual 99th percentile of 1-hour daily maximum concentrations. Must be less than 75 ppb. http://www.epa.gov/ttn/naaqs/standards/so2/fr/20100622.pdf

The U.S. Environmental Protection Agency (EPA) just announced that it will supplement the current annual NO_2 standard by establishing a new 1-hour NO_2 standard of 100 parts per billion (ppb) based on the 3-year average of the 98th percentile of daily maximum 1-hour concentrations. EPA also established requirements for an NO_2 monitoring network. For cities with at least 1 million people, there must be one station to monitor NO_2 concentrations representing the neighborhood or larger spatial scales. For areas with at least 500,000 or more persons, one microscale near-road NO_2 monitoring station should be sited near a major road with high annual average daily traffic (AADT) counts. An additional near-road NO_2 monitoring station is required for any area with a population of 2,500,000 persons or more, or in any area with a population of

500,000 or more persons that has one or more roadway segments with 250,000 or greater AADT counts. EPA will require new monitors be placed by January 2013. Attainment status will be set by January 2012 using the existing community scale monitors. When 3 years of air quality data are available from the new monitors, EPA intends to redesignate areas as appropriate. Based on the community-wide monitor at the SE Lafayette Station, as shown in Chapter 4, the Portland area will likely be declared an attainment area for the new standard. Current monitoring also suggests the roadway NO_2 concentrations are below the proposed standard. However, these monitors are not within 50 meters of a roadway, so additional monitoring will be needed to evaluate the full extent of roadway NO_2 impacts.

On June 2, 2010, EPA revised the primary SO_2 standard, designed to protect public health, to a level of between 75 ppb measured over 1 hour (Exhibit 2-1). The other existing primary SO_2 standards are 140 ppb measured over 24 hours, and 30 ppb measured over an entire year. Since the transportation sector is not a major contributor to SO_2 in the region, it is anticipate that the CRC project will not be impacted by this new standard.

In 2008, EPA lowered the 8-hour ozone standard from 0.08 ppm to 0.075 ppm. EPA is now proposing to strengthen the 8-hour "primary" ozone standard, designed to protect public health, to a level within the range of 0.060-0.070 ppm. EPA is currently in the public comment phase and expected to promulgate the new standard later in 2010. The impact of this proposed standard on the CRC project is expected to be minimal as the project is already included in estimates of ozone precursor emissions as part of the Portland Ozone Maintenance Area plan.

Exhibit 2-2. Proposed Federal Ambient Air Quality Standards

Pollutant	Averaging Time	Proposed Standard (NAAQS)
Ozone	8-hour[a]	0.06 - 0.07 ppm

Sources: Environmental Protection Agency (EPA) Office of Air Quality Planning and Standards (OAQPS)

Note: ppm = parts per million; μg/m3 = micrograms per cubic meter; PM10 = particulates with an aerodynamic diameter of less than or equal to 10 micrometers; PM2.5 = particulate with an aerodynamic diameter of less than or equal to 2.5 micrometers.

a To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm.

Geographic areas where pollutant concentrations exceed the ambient air quality standards (do not attain standards) are classified as nonattainment areas. Previously designated nonattainment areas now in compliance with air quality standards are classified as maintenance areas, as they have maintenance plans in place to prevent backsliding in air quality conditions. Areas that meet the standards (attain standards) are classified as attainment areas. Federal regulations require states to prepare State Implementation Plans (SIPs) that identify emission reduction strategies for nonattainment and maintenance areas.

DEQ and the Southwest Clean Air Agency (SWCAA) cooperate on management of air quality in the Portland-Vancouver metropolitan area. The Portland-Vancouver metropolitan area is currently a maintenance area for CO and ozone. DEQ updated the CO Maintenance Plan portion of its SIP in 2004 and prepared an 8-hour Ozone Maintenance Plan in early 2007. SWCAA updated their CO Maintenance Plan and prepared an 8-hour Ozone Maintenance Plan in 2006. Under EPA's 2004 ozone implementation rules (Code of Federal Regulations, 40 CFR 51.900), neither general conformity nor transportation conformity is required for areas attaining the 8-hour ozone standard. This means that new transportation projects no longer need to demonstrate that they conform to the ozone maintenance plans in the Portland-Vancouver maintenance area. Thus, CO is the only pollutant subject to specific regulatory analysis requirements because it is subject to the transportation conformity regulation analysis requirements. Other than CO and ozone, the Portland-Vancouver metropolitan area is an attainment area for all other pollutants.

The transportation conformity regulations establish criteria and procedures for determining conformity (compliance) with SIPs. This rule covers transportation plans, programs, and projects in Oregon and Washington that are developed, funded, or approved by the United States Department of Transportation (DOT) and by metropolitan planning organizations (MPOs) or other recipients of funds under Title 23 of the U.S. Code (USC) or the federal transit laws. DEQ and SWCAA have identified control strategies in their SIPs for compliance with the ambient air quality standards and the maintenance of healthy air quality in the Portland-Vancouver metropolitan area.

To demonstrate conformity for a project in the Portland area, the project must be included in a conforming Regional Transportation Plan (RTP) and Metropolitan Transportation Improvement Plan (MTIP), and a hot spot analysis must be performed to analyze potential CO impacts at intersections where traffic volumes would be affected by the proposed project. With the finding of adequacy for the Vancouver Air Quality Maintenance Area Second 10-Year Limited Carbon Monoxide Maintenance Plan by EPA in December 2007, regional conformity demonstration is no longer required for projects in Vancouver. A hot spot analysis will still be required. For proposed projects that are being reviewed in an environmental impact statement under the National Environmental Policy Act (NEPA), the conformity analysis must be completed before the Record of Decision (ROD) is issued.

In the Portland area, Metro performs the regional conformity analyses of all transportation projects included in the RTP and MTIP to address long-term impacts. Total CO emissions associated with all planned projects are evaluated to determine if the projects will cumulatively exceed the emissions budget for on-road mobile sources in the air quality SIP. If the emissions are within the CO emissions budget, then no regional adverse air quality impacts would occur as a result of the planned projects, and the RTP and MTIP are found to conform. Additional requirements for the conformity determination include an interagency process, the use of the latest planning assumptions and emissions model, and a demonstration that transportation control measures are being implemented in a timely manner.

In addition to NAAQS compliance and conformity requirements, there are a number of air quality regulations that may apply to the project directly or indirectly. These regulations include:

- SWCAA requires permitting of non-road engines that remain at “any single site at a building, structure, or installation” for more than 12 consecutive months. This regulation could affect construction equipment in Washington and requires dispersion modeling of emissions. The regulation excludes mobile cranes and pile drivers.
- Asbestos regulations administered by DEQ and SWCAA could affect demolition activities for the project. Notification and use of certified contractors is required.
- Although there is not a specific air quality regulation, except for compliance with the NAAQS, that governs emissions of lead from demolition activities on the project, control of potential lead emissions should be required by the construction contracts for the CRC project.

2.4 Data Collection Methods

Potential cumulative effects from this project are evaluated in the Cumulative Effects Technical Report.

The air quality analysis uses secondary data (traffic information) and assumptions about the local vehicle fleet to estimate regional and project subarea pollutant emissions and local CO concentrations. Pollutant emissions data were produced by Metro for regional and subarea analyses using the MOBILE6.2 model. The calculation methods used by Metro staff were consistent with those used in current conformity analysis work. These regional studies are developed in coordination with DEQ, SWCAA, and the Southwest Washington Regional Transportation Council (RTC).

2.5 Analysis Methods

The operational impacts analysis provides information to the public and decision makers on pollutant emissions for the LPA and No-Build alternatives and expected impacts. The analysis evaluates the regional and subarea pollutant emissions differences between the Full Build Alternative, the No-Build Alternative, and existing conditions, and compares the emissions to the emissions basis used in the Portland Air Toxics Solutions (PATS) modeling effort. This comparison will show the broad effects of the proposed LPA and allow a general link to information regarding potential health risks. The methods used in the analysis are consistent with the methods proposed in the CRC Air Quality Methods and Data Report.

2.5.1 Criteria Pollutants

CO is the only pollutant subject to specific regulatory analysis requirements because it is subject to the transportation conformity regulation analysis requirements. Local CO impacts were evaluated by performing hot spot analyses at three intersections in Vancouver and three intersections in Portland. The hot spot analyses include existing conditions, opening year (2018), and design year (2030) conditions.

For Oregon intersections, local CO concentrations were predicted using the MOBILE6.2 and CAL3QHC models. The MOBILE6.2 files were provided by Metro for the Portland area and are consistent with what was used for the latest conformity determination. Input assumptions used were those established in the CRC Air Quality Methods report. Assumptions used in the CAL3QHC model are shown in Exhibit 2-3.

Exhibit 2-3. Summary of CAL3QHC Input Command Options

Meteorological Variables	
Averaging Time	60 minutes
Surface Roughness	175.00 (City land-use - “Office” category)
Wind Speed	1 meter/second
Wind Angle	0 to 360 degrees in 10 degree increments
Stability Class	4 (D)
Mixing Height	1,000 meters
Persistence Factor (1-hour to 8-hour)	0.76 in Portland
Ambient Background Concentration	3.0 ppm
Site Variables	
Receptor Coordinates	At least 3 meters from each traveled roadway on both sides of the street[a] at distances of 3 meters, 25 meters, and 50 meters from the cross street. Height 1.8 meters.

a Distances are measured 3 meters from the queue line and 3 meters from the lane edge. All receptor locations will be verified to ensure that none are placed in the roadway.

For the Vancouver intersections, the Washington State Intersection Screening Tool (WASIST) was used as requested by the Washington State Department of Transportation (WSDOT). WASIST is a Microsoft Windows-based screening model used for determining worst-case carbon monoxide (CO) concentrations at signalized intersections throughout the State of Washington. WASIST incorporates the MOBILE6.2 and CAL3QHC models, along with pre-defined intersection configurations, to make a conservative estimate of project CO levels. The user selects the evaluation year (2009 to 2050) and intersection type, enters the traffic information (left, right and thru volumes, lane speeds and signal red times), and defines the receptors (maximum 10 per run) for evaluation. Assumptions used in the WASIST model runs are shown in Exhibit 2-4. Since WASIST was not programmed to evaluate 2005, the first year available (2009) was used for the existing condition. Input and output files for the hot-spots analysis are available upon request.

Exhibit 2-4. Summary of WASIST Input Command Options

Parameter	Value
County	Clark
Maintenance Area	Vancouver
I/M Program	Selected
Surface Roughness	“Office” category
Ambient Background Concentration	3.0 ppm
Receptor Coordinates	At least 10 feet from each traveled roadway on both sides of the street at distances of 10 feet, 82 feet (25 meters), and 164 feet (50 meters) from the cross street, and mid-intersection (250 and 560 feet).

Vehicles are the primary source of volatile organic compounds (VOCs) and nitrogen oxides (NO_X) emissions in the Portland-Vancouver metropolitan area. Both VOCs and NO_X contribute to ozone formation. The public has expressed concern regarding emissions of particulates, lead and air toxic pollutants. To address public concern and provide information on the relative effects of the project LPA and No-Build alternatives, regional and subarea emission estimates are provided for CO, VOCs, NO_X, PM_{10}, and $PM_{2.5}$ for the project alternatives. The subareas include the I-5 mainline and ramps in the following segments:

- NE 99th Street to East 39th Street (Subarea 1)
- East 39th Street to State Route 14 (Subarea 2)
- State Route 14 to Columbia Boulevard (Subarea 3)
- Columbia Boulevard to the Interstate 405 (I-405) junction (Subarea 4).

Vehicle lead emissions are no longer a concern since the use of lead in gasoline was phased out. Lead is not included in the emissions analysis, although it is discussed in the context of construction effects. The transportation sector is currently not the primary contributor to SO_2 emissions in the state, so emission estimates were not included for SO_2. The criteria pollutant estimates use model assumptions consistent with those used in transportation conformity planning, or for the PATS modeling (Metro 2009), depending on the pollutant. These estimates were provided by Metro.

2.5.2 Air Toxic Pollutants

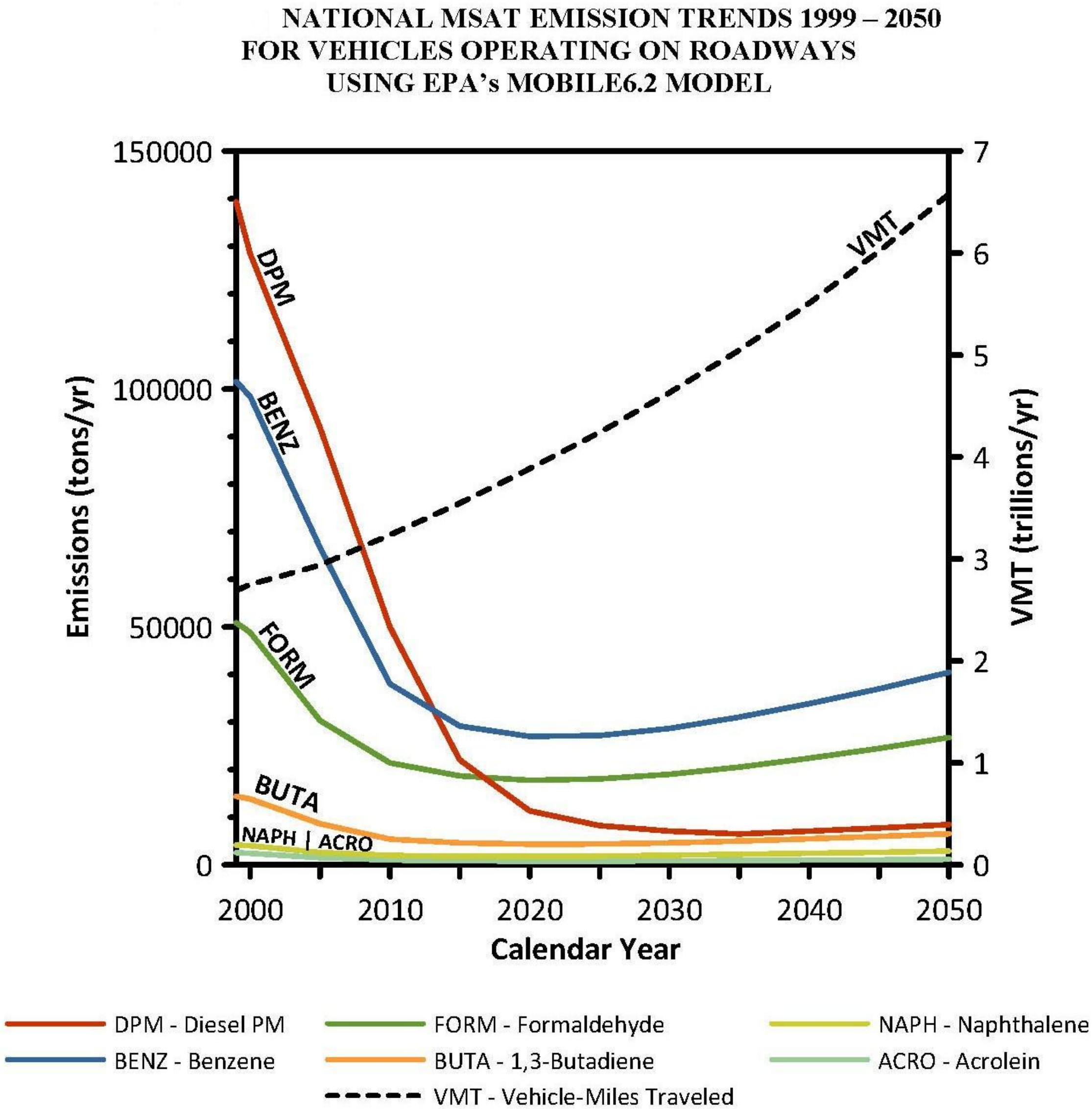
In September 2009, FHWA updated the MSAT guidance and modified the list of MSATs based on EPA recommendations (FHWA 2009). Specifically, EPA identified seven compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers from their 1999 National Air Toxics Assessment (NATA) (http://www.epa.gov/ttn/atw/nata1999/). These are acrolein, benzene, 1,3-butadiene, diesel particulate matter, formaldehyde, naphthalene, and polycyclic organic matter.

The 2007 EPA rule mentioned above requires controls that will dramatically decrease MSAT emissions through cleaner fuels and cleaner engines. According to an FHWA analysis using EPA's MOBILE6.2 model, even if vehicle activity (vehicle-miles travelled, VMT) increases by 145 percent as assumed, a combined reduction of 72 percent in the total annual emission rate for the priority MSAT is projected from 1999 to 2050, as shown in Exhibit 2-5.

The MSAT emissions estimates were developed by Metro using methods consistent with those used in transportation conformity planning and for the PATS (Metro 2009), depending on the pollutant.

Following the DEIS procedure, MSAT emissions from the PATS study were also included for reference. Note that modeling studies like PATS are intended to estimate air toxics concentrations and potential health risks across a regional scale and provide a useful planning tool for DEQ and the public to identify general levels of health risk and the sources of associated pollutants. However, the methods used in the study are not accurate enough to evaluate the potential health risks associated with individual transportation projects.

Exhibit 2-5. Project National MSAT Emissions 1999-2050



Note: (1) Annual emissions of polycyclic organic matter are projected to be 561 tons/yr for 1999, decreasing to 373 tons/yr for 2050.
(2) Trends for specific locations may be different, depending on locally derived information representing vehicle-miles travelled, vehicle speeds, vehicle mix, fuels, emission control programs, meteorology, and other factors

Source: Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA Documents, FHWA, September 30, 2009, Figure 1.

2.5.2.1 Unavailable Information for Project-Specific MSAT Impact Analysis

This subsection provides a basic discussion of the issues associated with MSAT emission impact analysis for projects such as the CRC. Available technical tools do not enable prediction of the project-specific health impacts resulting from the emission changes associated with the I-5 CRC project. Due to these limitations, the following discussion is included in accordance with the

Council on Environmental Quality (CEQ) regulations (40 CFR 1502.22(b)) regarding incomplete or unavailable information.

In FHWA's view, information is incomplete or unavailable to credibly predict the project-specific health impacts due to changes in MSAT emissions associated with a proposed set of highway alternatives. The outcome of such an assessment, adverse or not, would be influenced more by the uncertainty introduced into the process through assumption and speculation rather than any genuine insight into the actual health impacts directly attributable to MSAT exposure associated with a proposed action.

The U.S. Environmental Protection Agency (EPA) is responsible for protecting the public health and welfare from any known or anticipated effect of an air pollutant. They are the lead authority for administering the Clean Air Act and its amendments and have specific statutory obligations with respect to hazardous air pollutants and MSAT. The EPA is in the continual process of assessing human health effects, exposures, and risks posed by air pollutants. They maintain the Integrated Risk Information System (IRIS), which is "a compilation of electronic reports on specific substances found in the environment and their potential to cause human health effects" (EPA, http://www.epa.gov/ncea/iris/index.html). Each report contains assessments of non-cancerous and cancerous effects for individual compounds and quantitative estimates of risk levels from lifetime oral and inhalation exposures with uncertainty spanning perhaps an order of magnitude.

Other organizations are also active in the research and analyses of the human health effects of MSAT, including the Health Effects Institute (HEI). Two HEI studies are summarized in Appendix D of FHWA's Interim Guidance Update on Mobile source Air Toxic Analysis in NEPA Documents. Among the adverse health effects linked to MSAT compounds at high exposures are cancer in humans in occupational settings; cancer in animals; and irritation to the respiratory tract, including the exacerbation of asthma. Less obvious is the adverse human health effects of MSAT compounds at current environmental concentrations (HEI, http://pubs.healtheffects.org/view.php?id=282) or in the future as vehicle emissions substantially decrease (HEI, http://pubs.healtheffects.org/view.php?id=306).

The methodologies for forecasting health impacts include emissions modeling; dispersion modeling; exposure modeling; and then final determination of health impacts - each step in the process building on the model predictions obtained in the previous step. All are encumbered by technical shortcomings or uncertain science that prevents a more complete differentiation of the MSAT health impacts among a set of project alternatives. These difficulties are magnified for lifetime (i.e., 70 year) assessments, particularly because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affects emissions rates) over that time frame, since such information is unavailable. The results produced by the EPA's MOBILE6.2 model, the California EPA's Emfac2007 model, and the EPA's DraftMOVES2009 model in forecasting MSAT emissions are highly inconsistent. Indications from the development of the MOVES model are that MOBILE6.2 significantly underestimates diesel particulate matter (PM) emissions and significantly overestimates benzene emissions.

Regarding air dispersion modeling, an extensive evaluation of EPA's guideline CAL3QHC model was conducted in an NCHRP study (http://www.epa.gov/scram001/dispersion_alt.htm#hyroad), which documents poor model performance at ten sites across the country - three where intensive monitoring was conducted plus an additional seven with less intensive monitoring. The study indicates a bias of the CAL3QHC model to overestimate concentrations near highly congested intersections and underestimate concentrations near uncongested intersections. The consequence of this is a tendency to overstate the air quality benefits of mitigating congestion at intersections.

Such poor model performance is less difficult to manage for demonstrating compliance with National Ambient Air Quality Standards for relatively short time frames than it is for forecasting individual exposure over an entire lifetime, especially given that some information needed for estimating 70-year lifetime exposure is unavailable. It is particularly difficult to reliably forecast MSAT exposure near roadways, and to determine the portion of time that people are actually exposed at a specific location.

There are considerable uncertainties associated with the existing estimates of toxicity of the various MSAT, because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population, a concern expressed by HEI (http://pubs.healtheffects.org/view.php?id=282). As a result, there is no national consensus on air dose-response values assumed to protect the public health and welfare for MSAT compounds, and in particular for diesel PM. The EPA (http://www.epa.gov/risk/basicinformation.htm#g) and the HEI (http://pubs.healtheffects.org/getfile.php?u=395) have not established a basis for quantitative risk assessment of diesel PM in ambient settings.

There is also the lack of a national consensus on an acceptable level of risk. The current context is the process used by the EPA as provided by the Clean Air Act to determine whether more stringent controls are required in order to provide an ample margin of safety to protect public health or to prevent an adverse environmental effect for industrial sources subject to the maximum achievable control technology standards, such as benzene emissions from refineries. The decision framework is a two-step process. The first step requires EPA to determine a “safe” or "acceptable" level of risk due to emissions from a source, which is generally no greater than approximately 100 in a million. Additional factors are considered in the second step, the goal of which is to maximize the number of people with risks less than 1 in a million due to emissions from a source. The results of this statutory two-step process do not guarantee that cancer risks from exposure to air toxics are less than 1 in a million; in some cases, the residual risk determination could result in maximum individual cancer risks that are as high as approximately 100 in a million. In a June 2008 decision, the U.S. Court of Appeals for the District of Columbia Circuit upheld EPA’s approach to addressing risk in its two step decision framework. Information is incomplete or unavailable to establish that even the largest of highway projects would result in levels of risk greater than safe or acceptable.

Because of the limitations in the methodologies for forecasting health impacts described, any predicted difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with predicting the impacts. Consequently, the results of such assessments would not be useful to decision makers, who would need to weigh this information against project benefits, such as reducing traffic congestion, accident rates, and fatalities plus improved access for emergency response, that are better suited for quantitative analysis.

2.5.2.2 Summary of Existing Credible Scientific Evidence Relevant to Evaluating the Impacts of MSATs

Research into the health impacts of MSATs is ongoing. Many MSAT exposure-risk relationships are derived from studies examining adverse health outcomes based on emissions levels found in occupational settings or by tests on animals at high exposure doses. For many air toxics pollutants, the health effects from exposures at low concentration levels have not been well studied.

Exposure to toxics has been a focus of a number of EPA efforts. Most notably, the agency conducted the National Air Toxics Assessment (NATA) to evaluate modeled estimates of human exposure applicable at the county level. Assessments have been made for calendar years 1966, 1999 and 2002. While not intended for use as a measure of or benchmark for local exposure, the modeled estimates in the study's database best illustrate the levels of various toxics when aggregated to a national or state level.

The EPA is in the process of assessing the risks of various kinds of exposures to these pollutants. The EPA Integrated Risk Information System (IRIS) is a database of human health effects that may result from exposure to various substances found in the environment. The IRIS database can be accessed at http://www.epa.gov/iris.

The following toxicity information for the prioritized MSATs was taken from the Weight-of-Evidence characterization summaries in the IRIS database and from the Oregon DEQ's air toxics program fact pages (http://www.deq.state.or.us/aq/factsheets/05-AQ-003_AirToxics.pdf)

- Acrolein is a colorless or yellow liquid with a disagreeable odor that burns easily and evaporates quickly in the air. The major effects from long-term inhalation exposure to acrolein include general respiratory congestion and eye, nose, and throat irritation. EPA considers acrolein to be a high concern pollutant based on toxicity, and a possible human carcinogen.
- Benzene is a colorless liquid with a sweet odor. It evaporates into the air very quickly and dissolves slightly in water. It is highly flammable and is formed from both natural processes and human activities. EPA has classified benzene as a known human carcinogen.
- Formaldehyde is a colorless gas with a pungent, suffocating odor at room temperature. It is a naturally occurring substance that is also produced by human activities. Chronic exposure to inhaled formaldehyde is associated with respiratory symptoms and eye, nose, and throat irritation. EPA considers formaldehyde to be a probable human carcinogen.
- 1,3-butadiene is a colorless gas with a mild gasoline-like odor. It is formed naturally during combustion but is also manufactured. EPA has classified 1,3-butadiene as a probable human carcinogen.
- Diesel particulate matter is the microscopic soot present in the complex mixture of air pollutants emitted by diesel engines. Diesel exhaust (DE) is likely to be carcinogenic to humans by inhalation from environmental exposures. Diesel exhaust as reviewed in this document is the combination of diesel particulate matter and diesel exhaust organic gases. Diesel exhaust has been associated with an increased risk of chronic respiratory effects. Prolonged exposures may impair pulmonary function and could produce symptoms such as cough, phlegm, and chronic bronchitis.
- Naphthalene occurs as a white solid or powder that is insoluble in water and evaporates easily. Naphthalene has a strong, mothball odor. EPA has classified naphthalene as a possible human carcinogen.
- Polycyclic organic matter (POMs) are a group of compounds that are solids with high melting and boiling points, and are extremely insoluble in water. Oregon defines POMs as a set of 16 polycyclic aromatic hydrocarbons (PAHs). They are acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene. EPA has classified seven PAHs contained in POM as probable human carcinogens. POM compounds are formed primarily from combustion and are present in the atmosphere in particulate form. Sources of air emissions are diverse and include cigarette smoke,

vehicle exhaust, home heating, laying tar, and grilling meat. For mobile emissions, naphthalene makes up 80 to 90 percent of the POM emissions.

Some recent studies have reported that proximity to roadways is related to adverse health outcomes, particularly respiratory problems.[1] Much of this research is not specific to MSATs, but instead surveys the full spectrum of both criteria and other pollutants. The FHWA cannot evaluate the validity of these studies, but more important, the studies do not provide information that would lessen the uncertainties listed above do not make it possible to perform a more comprehensive evaluation of the health impacts specific to this project.

It is also worth noting that previous MSAT analyses on transportation projects have forecasted large declines in emissions over time irrespective of the project alternative chosen. Reduced emissions are projected to result from cleaner fuels and new combustion and emission control technologies in use in future years. Emissions analyses using MOBILE6.2 along with projected increases in vehicle travel typically show a 50 to 80 percent decline in study area emissions between the base year and the design year, and then some small incremental change between the LPA and the No-Build Alternative. Given this well-documented trend, using dispersion models and other advanced techniques, with their associated uncertainties, would not be expected to add information of value to the decision-making process.

[1] South Coast Air Quality Management District, Multiple Air Toxic Exposure Study-II (2000); Highway Health Hazards, The Sierra Club (2004) (summarizing 24 studies on the relationship between health and air quality); NEPA's Uncertainty in the Federal Legal Scheme Controlling Air Pollution from Motor Vehicles, Environmental Law Institute, 35 ELR 10273 (2005) with health studies cited therein.

3. Coordination

The air quality analysis methodology was developed with input from the CRC Interstate Collaborative Environmental Process (InterCEP) group. InterCEP is a group of state and federal resource agencies that are likely to have permitting authority or approval over one or more elements of the CRC project. The CRC project team worked with InterCEP agencies early in the development of the project to form an agreement that establishes an approach for close coordination between these agencies and the project team. This agreement specifies project milestones at which InterCEP agencies are asked for formal concurrence and/or comment that inform the project team whether any decisions being made could ultimately result in a project that would be difficult for an InterCEP agency to permit or approve. The primary tenet of the InterCEP group is early and continual communication with resource agencies to ensure decisions about the transportation improvements evaluated by the CRC project are well informed of the applicable environmental regulations. InterCEP includes the following agencies:

- U.S. Army Corp of Engineers (USACE)
- U.S. Environmental Protection Agency (EPA)
- National Oceanic and Atmospheric Administration (NOAA) Fisheries
- U.S. Fish and Wildlife Service (USFWS)
- Oregon Department of Fish and Wildlife (ODFW)
- Oregon Department of Land Conservation and Development (DLCD)
- Oregon Department of Environmental Quality (DEQ)
- Oregon Department of State Lands (DSL)
- Oregon State Historic Preservation Office (SHPO)
- Washington Department of Fish and Wildlife (WDFW)
- Washington Department of Ecology (Ecology)
- Washington Department of Archaeology and Historic Preservation (DAHP)

In addition to coordination through InterCEP, contact was made with the following agencies to obtain data, or coordinate specific aspects of the air quality analysis:

- Metro
- Oregon DEQ
- Southwest Washington Regional Transportation Council (RTC)
- Southwest Washington Clean Air Agency (SWCAA)
- Washington State Department of Transportation

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4. Affected Environment

4.1 Introduction

The I-5 CRC project is located within the Portland and Vancouver CO maintenance areas and the Portland-Vancouver Air Quality Maintenance Area (AQMA). In the Portland-Vancouver metropolitan area, the primary pollutants of concern for transportation projects are NO_x, VOCs, and CO. Other pollutants of concern for transportation projects can be PM_{10}, $PM_{2.5}$ and MSATs.

The Portland-Vancouver metropolitan area has a relatively mild climate, with temperatures ranging from an average minimum monthly temperature of 35°F in January to an average maximum monthly temperature of 80°F in August. The winters are the wettest part of the year, with approximately 75 percent of the annual precipitation falling between October and March, according to the Western Regional Climate Center.

The area experiences winter inversion conditions that lead to higher concentrations of CO and PM as emissions accumulate from vehicles and home heating, particularly wood-burning. Extended periods of high summer temperatures can lead to high ozone levels with emissions of VOCs and NO_x from vehicles and industrial sources contributing substantially. A brief discussion of the human health issues associated with CO, ozone (NO_x and VOCs are ozone precursors), and PM follows. The potential health effects associated with MSATs are discussed in greater detail in the Methods section of this report.

Carbon monoxide is a colorless, odorless gas. In the body, CO binds tightly to hemoglobin (the red pigment in blood that transports oxygen from the lungs to the rest of the body). Once hemoglobin is bound to CO, it can no longer carry oxygen. Thus, carbon monoxide reduces the oxygen-carrying capacity of the blood and can result in adverse health effects. High concentrations of CO strongly impair the functions of oxygen-dependent tissues, including brain, heart, and muscle. Prolonged exposure to low levels of CO aggravates existing conditions in people with heart disease or circulatory disorders. There is a correlation between CO exposure and increased hospitalization and death among such patients. Even in otherwise healthy adults, CO exposure has been linked to increased heart disease, decreased athletic performance, and diminished mental capacity. High CO levels also affect newborn and unborn children and are associated with low birth weights and increased infant mortality.

Ozone (a component of smog) is a pungent, toxic, highly reactive form of oxygen. A new 8-hour standard protects the public against lower level exposures over a longer time period, which has been found to be more detrimental than shorter peak levels. The long-term exposure effects include breathing problems such as loss of lung capacity and increased severity of both childhood and adult asthma. Ozone causes irritation of the nose, throat, and lungs. Exposure to ozone can cause increased airway resistance and decreased efficiency of the respiratory system. In individuals involved in strenuous physical activity and in people with pre-existing respiratory disease, ozone can cause sore throats, chest pains, coughing, and headaches.

Fine particulate matter (PM_{10} and $PM_{2.5}$) consists of solid particles or liquid droplets that are less than 10 microns in diameter (PM_{10}) or less than 2.5 microns in diameter ($PM_{2.5}$), respectively. Particles in these size ranges are of great concern because they can be inhaled deeply into the lungs where they can remain for years. The health effects of particulate matter vary with the size, concentration, and chemical composition of the particles. Relationships have been shown between exposure to high concentrations of PM and increased hospital admissions for respiratory infections, heart disease, bronchitis, asthma, emphysema, and similar diseases.

4.2 Monitoring Data

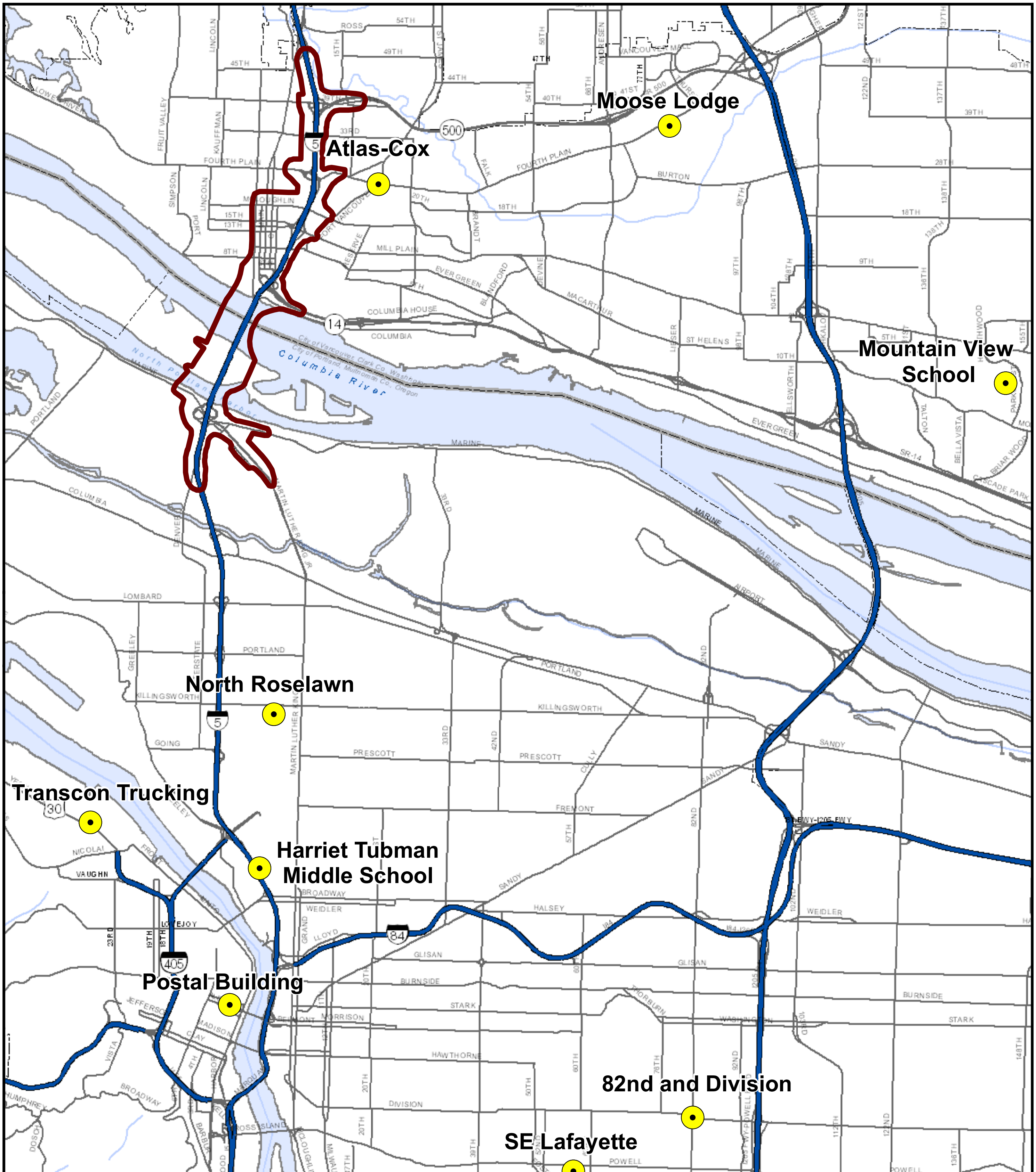
Exhibit 4-1 shows locations in the general vicinity of the project where pollutants either are currently measured or where a monitoring station has been located in the past. The trends and patterns shown by air pollutant data collected at these locations are discussed in the following report sections.

4.2.1 Air Quality Trends

During the 1970s, pollutant concentrations in the Portland-Vancouver metropolitan area exceeded the standards for CO on one out of every three days, and ozone levels were often as high as 50 percent over the federal standard. Programs and regulations put into effect to control air pollutant emissions have been effective, and air quality in the area has improved. The area was redesignated from a nonattainment area to a maintenance area in 1997. Exhibit 4-2 depicts air quality trends for CO at the Portland sites. The data for CO show the highest concentrations from Portland area monitoring stations, while monitoring stations in Vancouver show similar trends with slightly higher (but still well below the NAAQS) concentrations for CO. Because the CO values were so low, SWCCA discontinued CO monitoring in October 2006.

Exhibits 4-3 and 4-4 show the air quality trends for PM_{10} and $PM_{2.5}$ in Portland. For PM_{10}, values in Vancouver are comparable to those in Portland, both of which are about a third of the standard. Given these lower values, SWCAA discontinued monitoring PM_{10} monitoring in 2006. For $PM_{2.5}$, the Vancouver values are higher than those in Portland, having several days with concentrations above the standard. This monitoring site is about 3.5 miles from I-5. SWCAA monitoring indicates these high days are during the cold winter weather periods and are associated with wood smoke from residential fireplaces and stoves. To begin to address the problem, SWCAA in 2009 received a grant of $260,000 to replace old, uncertified wood stoves with new, cleaner burning units for some Vancouver residents. Even with these elevated values, the 3-year average of the 98th percentile is just below the standard, so the area is still in attainment with the $PM_{2.5}$ standard.

Exhibit 4-1. Air Quality Monitoring Locations



N
W E
S

0 0.4 0.8
Miles

Air Monitoring Location

Project Area of Primary Impacts

Columbia River CROSSING

Analysis by J. Koloszar; Analysis Date: Apr. 24, 2010; File Name: Exhibit1_5_LH131.mxd

Exhibit 4-2. Carbon Monoxide Trends

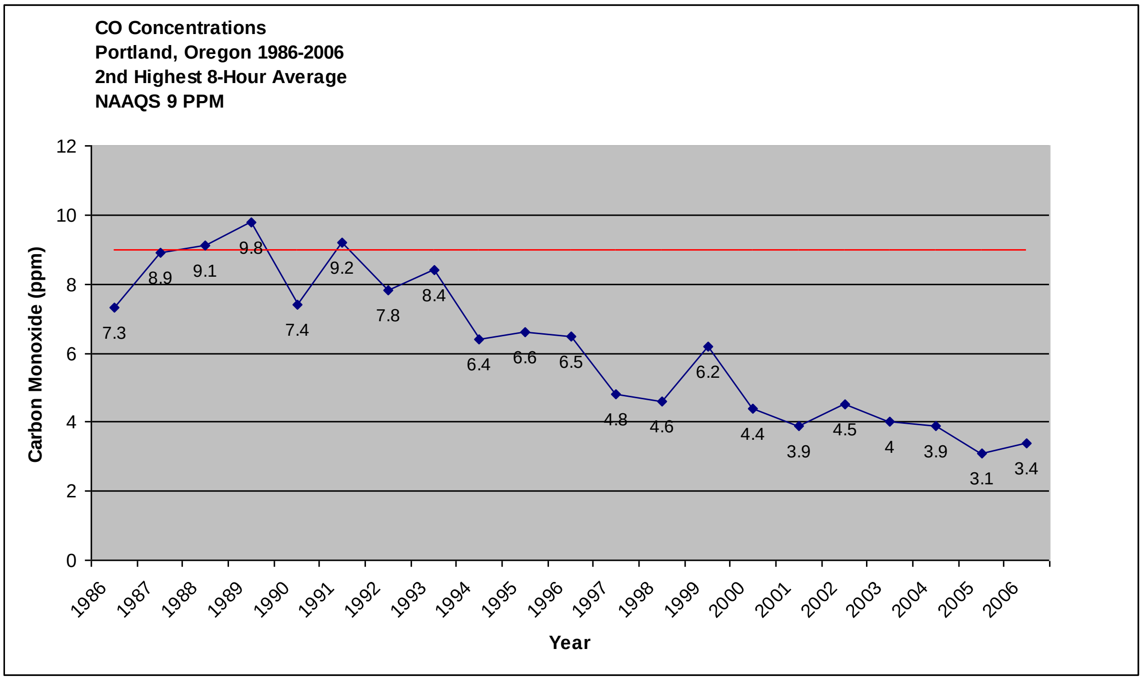


Exhibit 4-3. Coarse Particulate Matter (PM_{10}) Trends

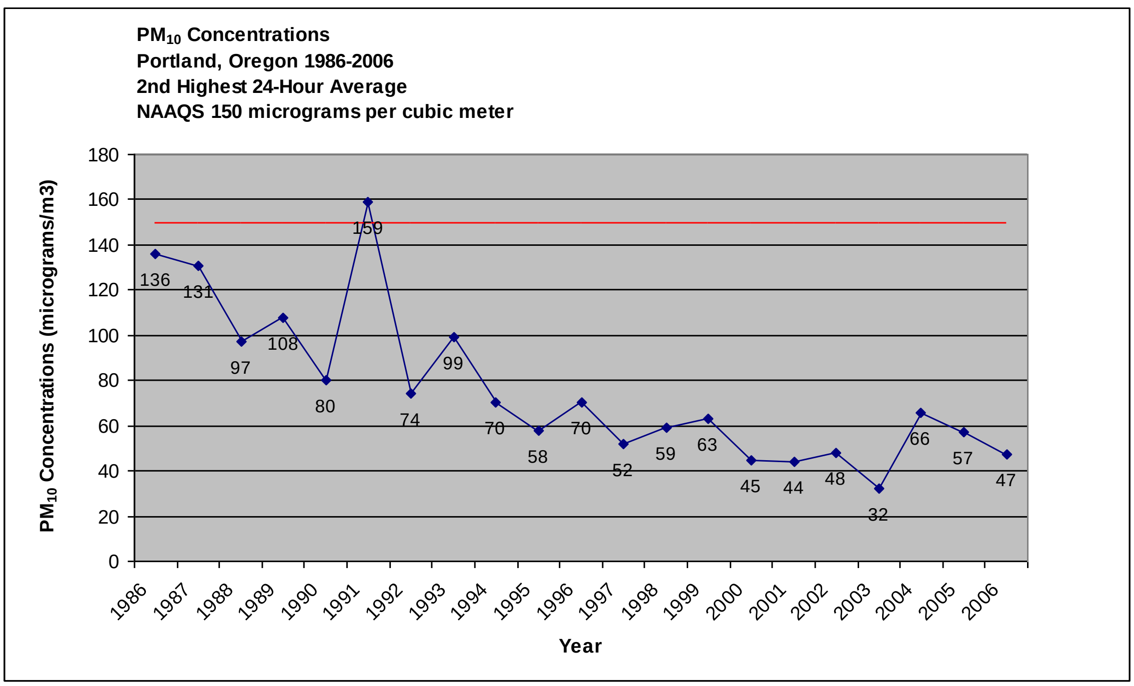


Exhibit 4-4. Fine Particulate Matter ($PM_{2.5}$) Trends

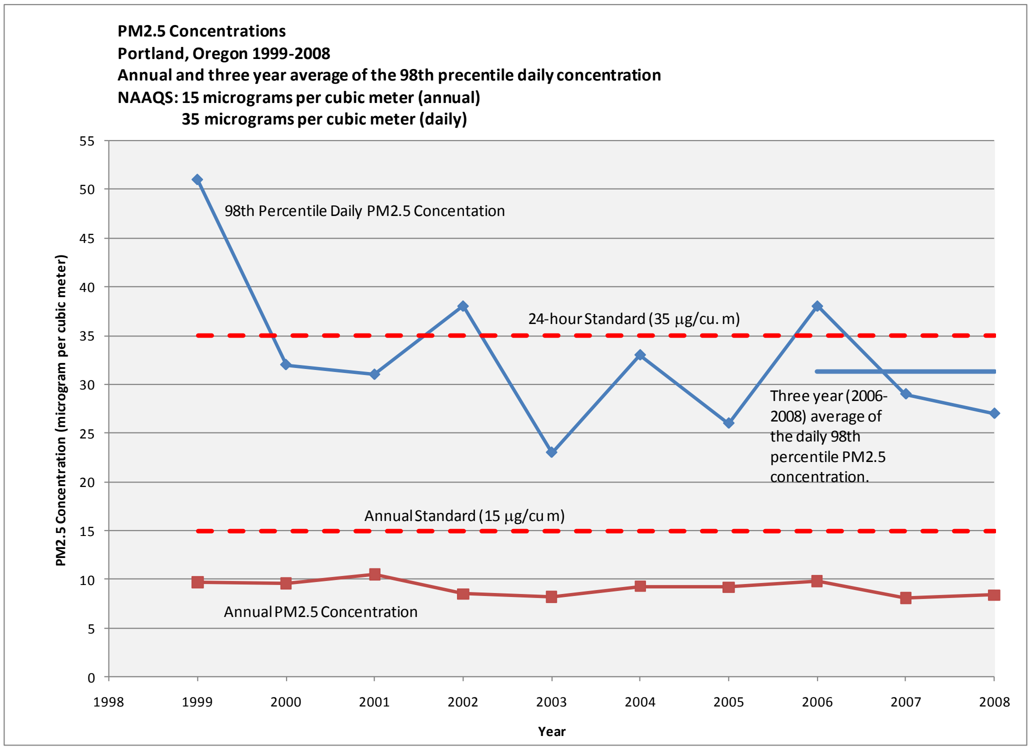


Exhibit 4-5 shows the 2008 measured NO_2 and SO_2 concentrations from the S.E. Lafayette station in Portland. For SO_2, the measured concentrations are much lower than the current standards. The primary SO_2 sources are power production and industrial processes, which account for about 90 percent of the SO_2 emissions. The transportation sector is currently not the primary contributor to SO_2 emissions in the state and will not be considered further.

For NO_2, the annual concentration is considerably less than the annual standard. As mentioned above, EPA established a new 1-hour NO_2 standard of 100 ppb, based on the 3-year average of the 98th percentile of daily maximum 1-hour concentrations. EPA also established new requirements for an NO_2 monitoring network that will include monitors within 50 meters of major roadways. Exhibit 4-5 shows the short term NO_2 concentrations measured at SE Lafayette and at Portland State University (PSU). The PSU station is in the south part of Downtown Portland near the I-405 and Highway 26 freeways. Although these monitors are not within 50 meters of the road, the concentrations are lower than the new standard. Thus additional monitoring will be needed to evaluate the full extent of NO_2 emissions from the roadways. Based on the community-wide monitor at the SE Lafayette Station, the Portland area will likely be declared an attainment area for the new standard.

Exhibit 4-6 shows ozone data from Carus, Oregon, which has the highest ozone concentrations in the Portland-Vancouver metropolitan area. NO_x and VOCs are ozone precursors for ozone formation. The area is currently in attainment with the standard, but depending on where EPA sets the proposed ozone standard, future attainment status could change.

Oregon DEQ has been monitoring air toxics since 1999. Exhibits 4-7 and 4-8 show the quarterly benzene and aldehyde (acetaldehyde and formaldehyde) concentration trends, respectively, as measured at the DEQ's North Portland site. The other MSATs were either not monitored or trendable data were not available. These figures indicate that benzene and aldehyde concentrations are gradually decreasing over time. Benzene and acetaldehyde levels are currently above their Oregon benchmark values, while formaldehyde concentrations at this station are less than the Oregon benchmark.

Exhibit 4-5. NO_2 and SO_2 Measured Concentrations from Portland

Pollutant	Averaging time	Value (ppb)	Standard (ppb)
NO_2	Annual	11	53
	1-hour second high	52	100
	1-hour PSU three year 4th high[a]	73	100
SO_2	Annual	1	30 / 20[b]
	24-hour	4	140 / 100[b]
	3-hour	7	500

a Data from the Portland State University Horizons data archive from 7/21/2006 to 6/5/2009 (http://www.nextgen.pdx.edu/).

b Federal/State Standards.

Exhibit 4-6. Ozone Trends

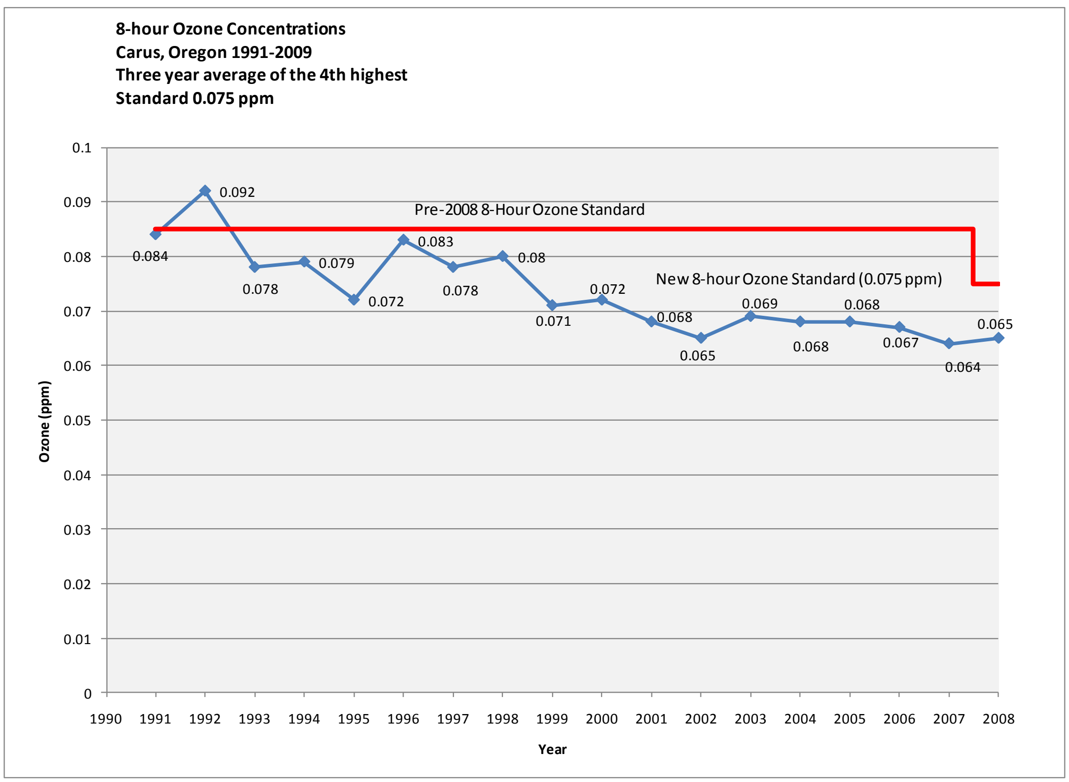


Exhibit 4-7. Quarterly Medium Benzene Concentrations in North Portland

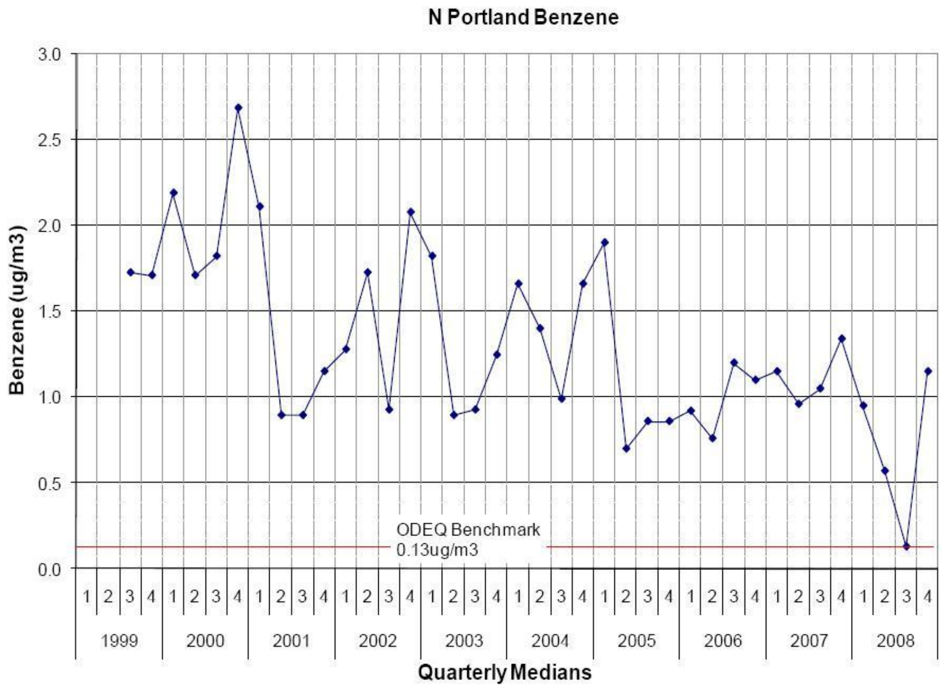
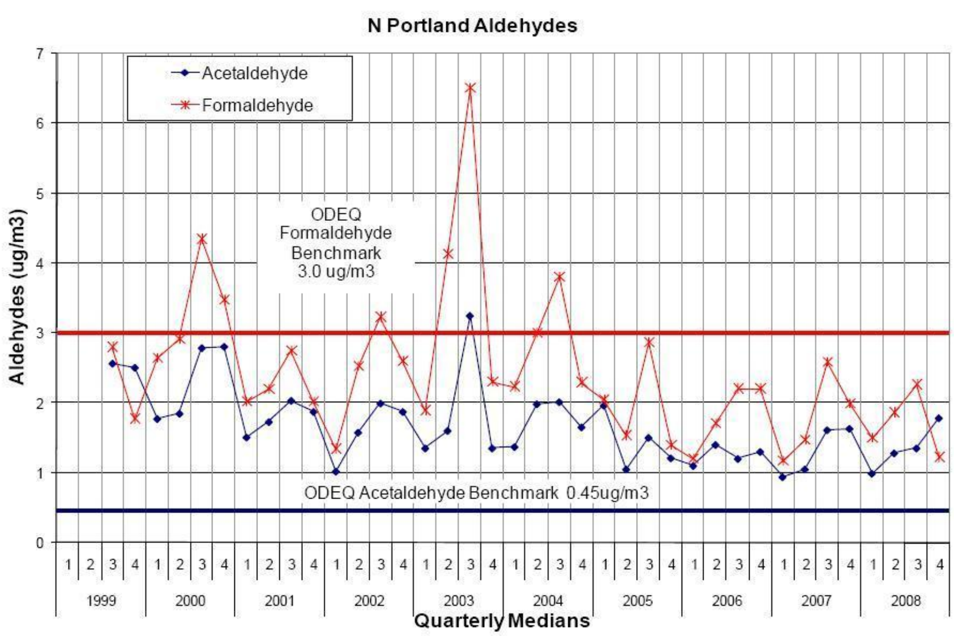


Exhibit 4-8. Quarterly Medium Aldehyde Concentrations in North Portland



Starting in the early 1970s, EPA promulgated numerous regulations to control air pollutant emissions from motor vehicles. Recent regulations promulgated in the early 2000s, and most recently in February 2007, adopted controls on heavy-duty diesel on-road and off-road vehicles, sulfur in fuels, and air toxic emissions from mobile sources through control of fuel formulations. The gasoline reformulation rules will reduce benzene emissions. While these standards will not apply directly to the CRC project alternatives, they apply to all vehicles on the highway system and are the regulatory controls responsible for substantial reductions in vehicle emissions since the 1970s and for additional projected vehicle emissions reductions over the next 25 to 30 years.

4.2.2 EPA's Schools Monitoring Initiative: Harriet Tubman Middle School

Starting in 2009, EPA, states, and local air agencies began collecting air monitoring information in communities near schools across the U.S. The purpose of this study was to determine whether certain pollutants in outdoor air around selected schools might be a health concern for school-age children, school staff, or the surrounding community. A sampling site was located at Harriet Tubman Middle School on N Flint Street in Portland. The school is adjacent to I-5 and south of Legacy Emmanuel Hospital, as shown in Exhibit 4-1.

The monitors measured two types of pollutants in the outdoor air: gaseous pollutants such as benzene, and particulate pollutants, including metals such as hexavalent chromium, manganese and lead. The monitors sampled air on 10 different days during a 60-day period. The samples were analyzed by the laboratories EPA uses for air quality analysis. EPA has posted the results to their website (http://www.epa.gov/schoolair/). Exhibit 4-9 shows the maximum, minimum and average values for the MSAT pollutants. EPA did not sample diesel PM or acrolein. A table with data for all the other air toxic pollutants is provided in Appendix A. For each pollutant monitored, EPA included an individual "sample screening level" (SSL) to provide the Agency and the community with an indication of what the data are showing. EPA developed these screening levels using established toxicological databases to represent the level below which the short-term health risks are not expected to be a concern. However, if a sample shows a pollutant level above the SSL, it does not mean that there is a risk to children and adults at the school. It is a signal for EPA to further evaluate those and subsequent results for that pollutant. Appendix A and Exhibit 4-9 show that for this study, all of the measured MSAT and air toxic pollutant concentrations were well below their SSLs, in many cases by several orders of magnitude.

Exhibit 4-9. MSAT Samples from the Harriet Tubman Middle School Site

	Sample Screening Level	Sample (μg/m^3)		
MSAT	(μg/m^3)	Max	Average	Min
1,3-Butadiene	20	0.268	0.087	0.029
Benzene	30	2.247	0.861	0.432
Formaldehyde	50	5.321	3.091	1.831

Source: http://www.epa.gov/cgi-bin/broker?_service=data&_program=dataprog.school_report.sas&site=410515502

4.2.3 Portland Air Toxics Solution (PATS)

The Portland Air Toxics Solutions (PATS) is the DEQ’ s first geographical region program, established as part of the state’s air toxics program in order to reduce air toxic pollutant concentrations in Oregon. PATS used an updated version of the computer model originally developed for the Portland Air Toxics Assessment (PATA) analysis. PATS used an updated 2005 air emissions inventory for the Portland and Vancouver areas. This modeling was designed to estimate and assess the risk from 19 air toxics in the Portland area, including the seven MSATs. The purpose of the assessment is to provide more refined estimates of the most significant air toxics in the Portland area. Such estimates allow DEQ to better characterize the risks from air toxics, to understand local patterns of air toxics exposure, and to identify locations with elevated risk. DEQ can also evaluate how changes in emissions from the various source categories will alter the concentrations to develop emission reduction strategies. It should be noted that the PATS modeling is not connected to the CRC project and that the PATS model is not intended for project level analyses. ODEQ has provided the results for information purposes only.

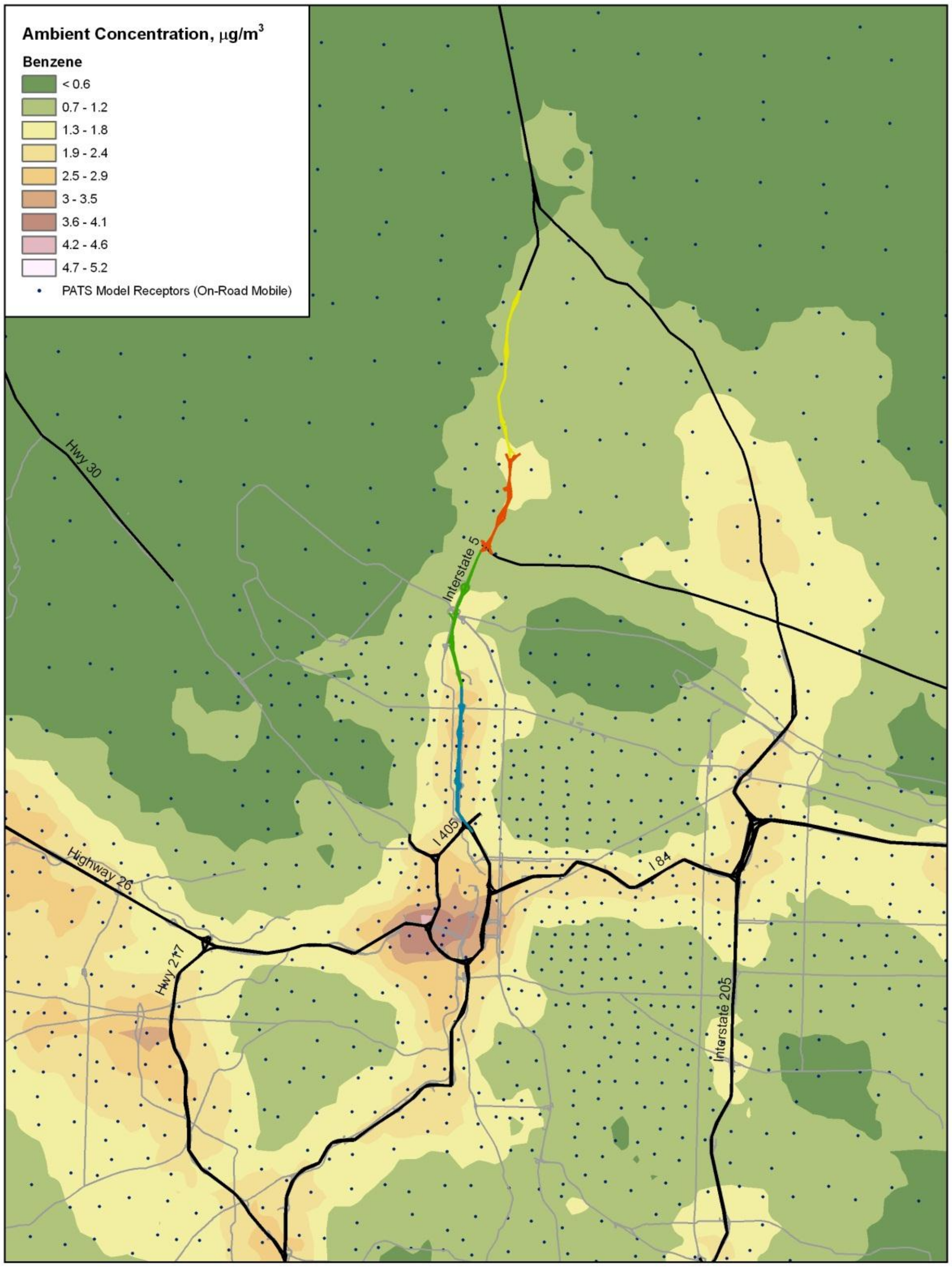
The PATS modeling is currently in progress. Initial runs using the original PATA receptor grid have been completed. A review of the results identified several source categories that required additional scrutiny. For example, the initial runs indicated that wood smoke emissions from residential heating may have been overestimated and these estimates are being re-evaluated and refined. The point source inventory is also being updated. In addition to changes, the PATS modeling also doubled the number of receptors in the modeling domain to fill in areas not adequately sampled by the census tract receptors. This will lead to better concentration estimates in areas of lower populations (e.g., along the Columbia River). The mobile source categories (on-road and off-road) runs have been completed with the denser receptor grid, and the results are presented below. Concentration levels, rather than risk levels, are presented since the final risk levels are not yet available from DEQ. Furthermore, concentrations are more reflective of pollutant levels at a particular geographic location while risk incorporates population travel patterns which may obscure local influences. For example, if a person lives in an area of low concentration but works in an area of high concentration, the risk in that tract can be elevated due to the exposure from another tract.

Exhibits 4-10 and 4-11 show the modeled annual benzene concentrations across the region for on-road mobile and combined mobile sources, respectively. Note that the same concentration scale is used for both figures. Freeways are identified by black lines, major arterials by gray lines, and the four project subareas (described in Chapter 5) are identified with blue, green, red, and yellow lines. Modeled receptors are shown as dots. For on-road mobile sources (Exhibit 4-10), elevated concentrations are found along the freeways. The highest concentrations occur in downtown Portland where I-405 meets Hwy 26 and in the Beaverton/Hillsboro areas. For the project area, concentrations are highest along the southern portion of the project area, and decrease to the north as traffic volumes decrease. For combined mobile sources, highest concentrations are again in the downtown region, and more pronounced in the Beaverton/Hillsboro area due to construction and rail activity. There are also elevated concentrations along the river corridor due to train, ship, and construction activities, which are likely being under-predicted due to lack of receptors. For the project area, concentrations are highest along the southern portion of the project area, with a peak around Lombard, and decrease to the north as traffic volumes decrease.

Exhibits 4-12 and 4-13 show the modeled annual formaldehyde concentrations across the region for on-road mobile and combined mobile sources, respectively. Note that the same concentration scale is used for both figures. Like benzene, the on-road mobile formaldehyde is greatest along the freeways and major highways, with the peak in the downtown Portland area. For combined mobile sources, the peak concentration is at the airport, with other peaks downtown and in the Beaverton/Hillsboro area.

Exhibits 4-14 and 4-15 show the modeled annual diesel PM concentrations across the region for on-road mobile and combined mobile sources, respectively. Like the other pollutants, the on-road mobile diesel PM is greatest along the freeways and major highways, with the peak in the downtown Portland area. Much of the project area is in the lower concentration range (less than 1.4 $\mu g/m^3$). Adding the off-road mobile sources (Exhibit 4-15) increases the diesel PM concentrations across the entire region. The highest concentrations are in the Beaverton/Hillsboro area, with other peaks in downtown Portland and in the industrial/commercial area north of Lombard.

Exhibit 4-10. Annual Benzene Concentration (□g/m3) from On-Road Mobile Source as Predicted by PATS



Note: Freeways are identified by black lines, major arterials by gray lines, and the four project subareas (described in Chapter 5) are identified with blue, green, red, and yellow lines. Modeled receptors are the dots.

Exhibit 4-11. Annual Benzene Concentrations from On-Road and Off-Road Mobile Sources as Predicted by PATS

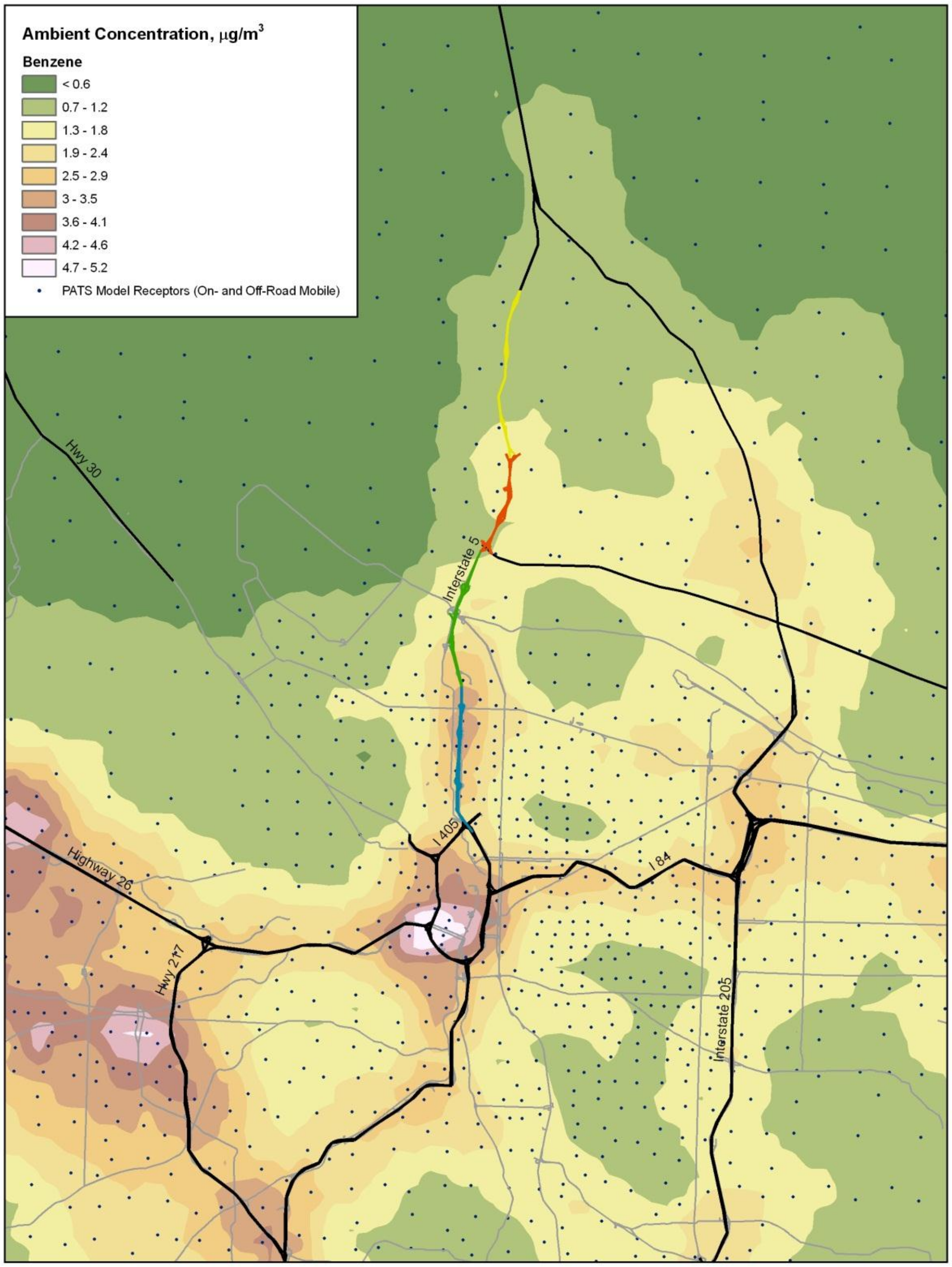


Exhibit 4-12. Annual Formaldehyde Concentrations from On-Road Mobile Sources as Predicted by PATS

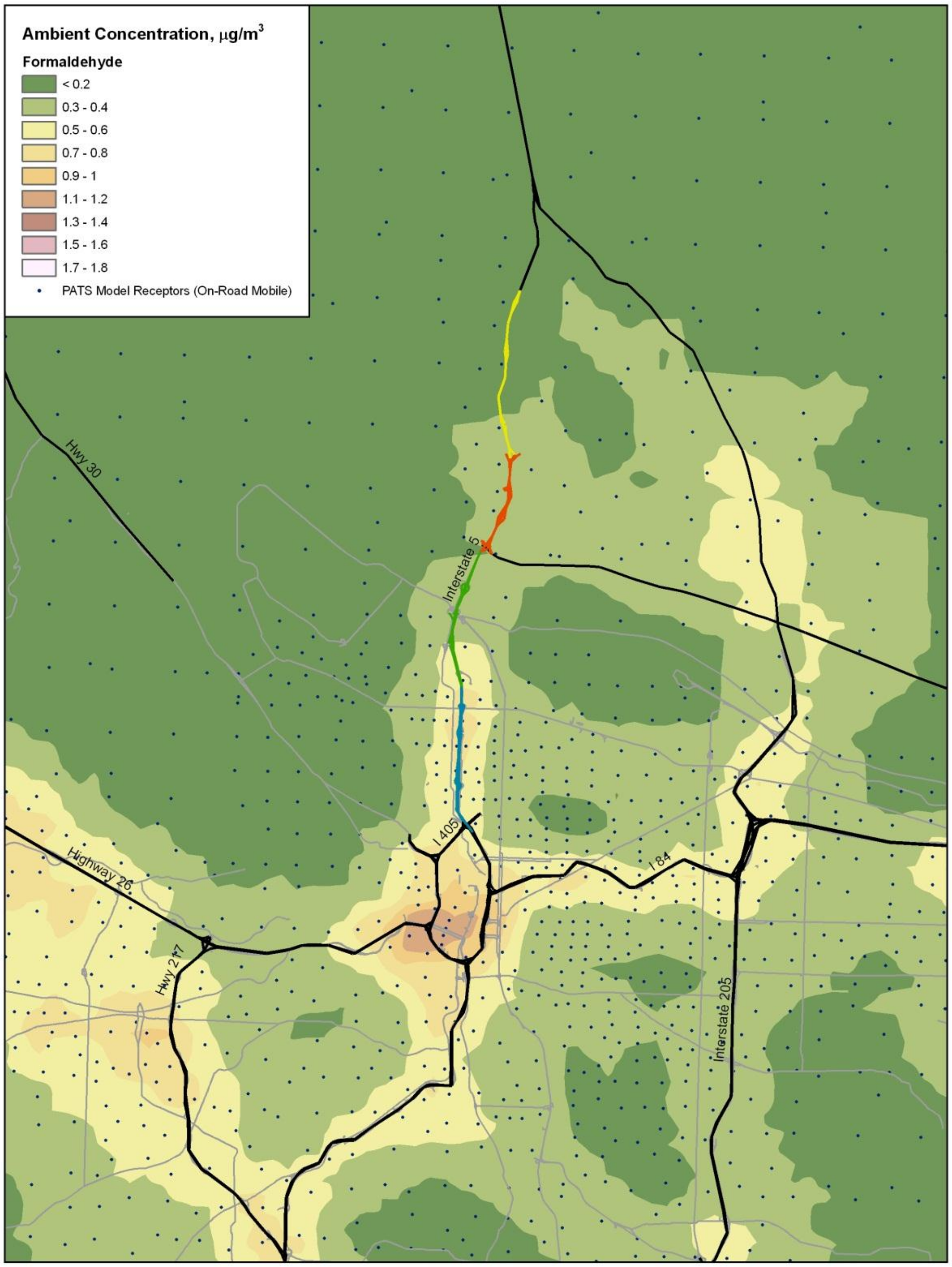


Exhibit 4-13. Annual Formaldehyde Concentrations from On-Road and Off-Road Mobile Sources as Predicted by PATS

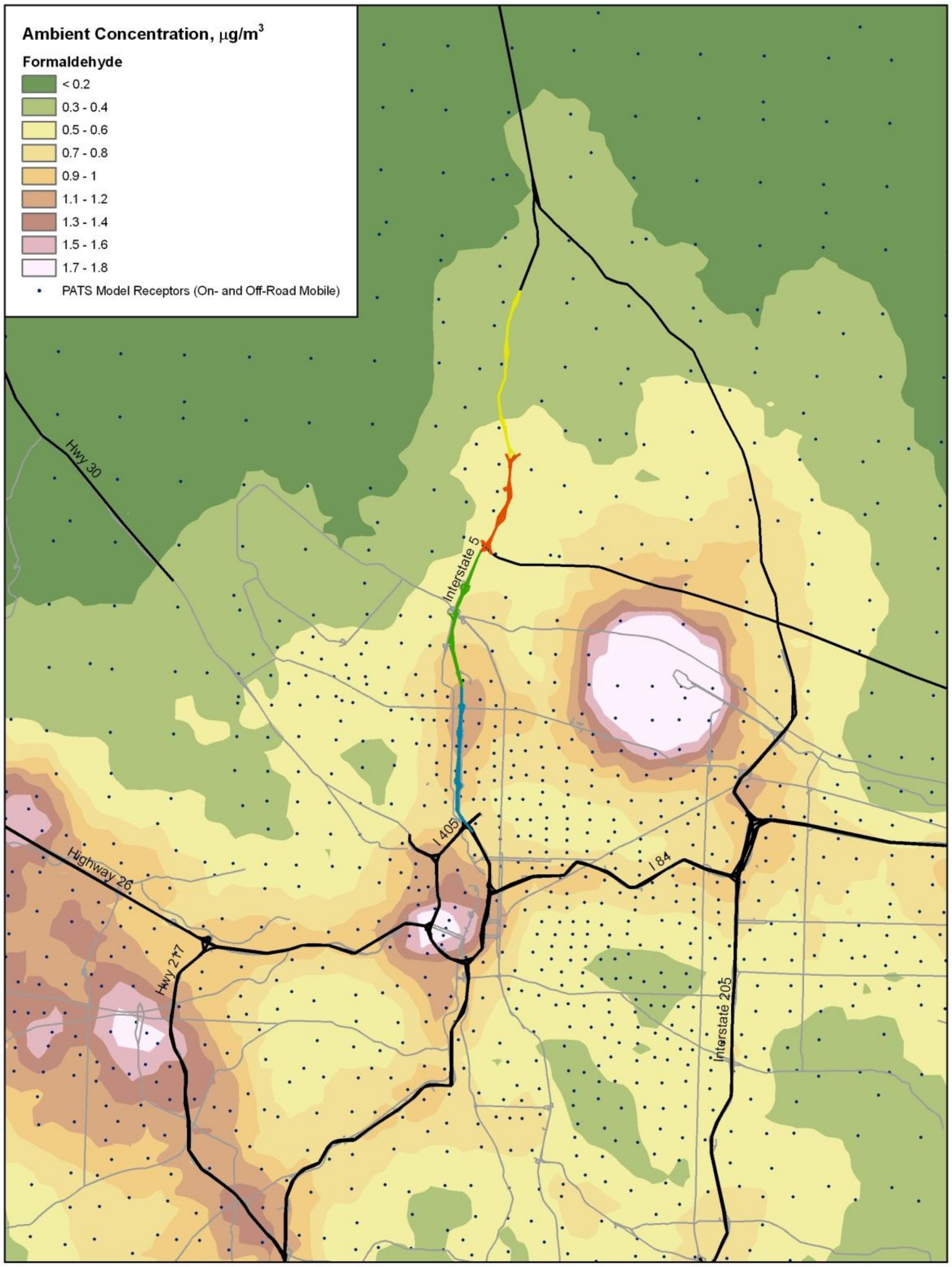


Exhibit 4-14. Annual Diesel PM Concentrations from On-Road Mobile Sources as Predicted by PATS

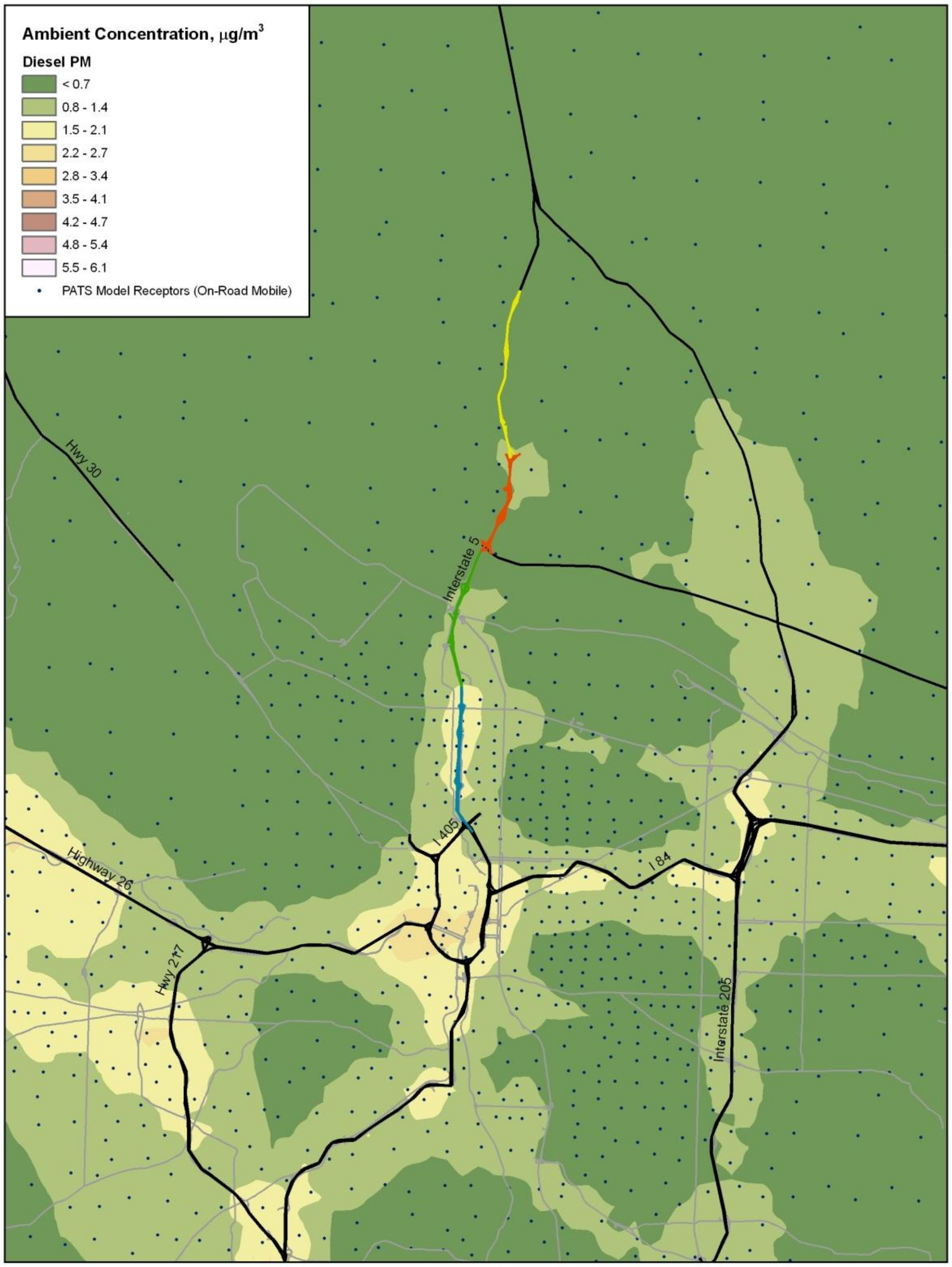
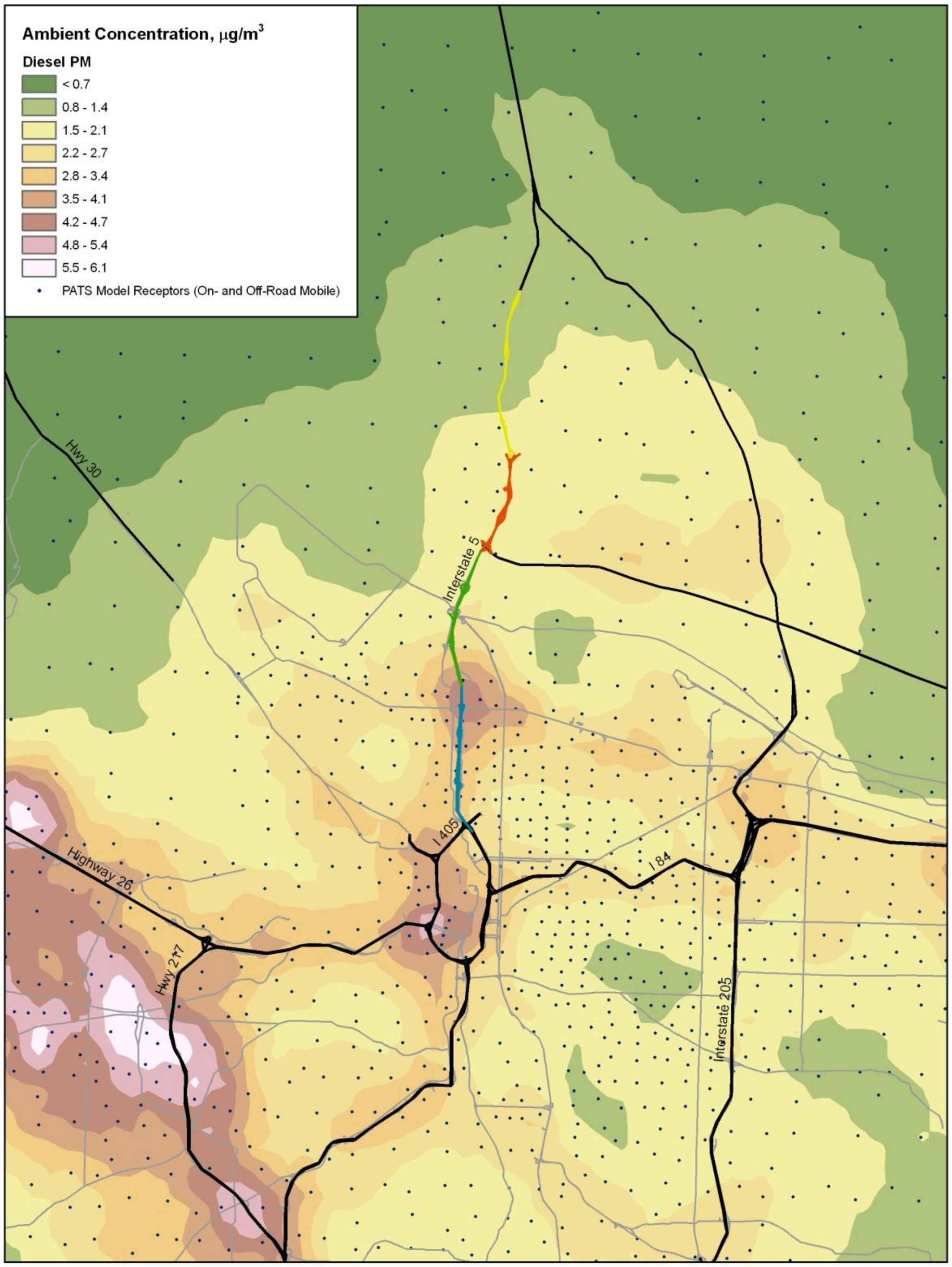


Exhibit 4-15. Annual Diesel PM Concentrations from On-Road and Off-Road Mobile Sources as Predicted by PATS



5. Long-term Effects

5.1 How is This Chapter Organized?

This chapter describes the long-term impacts that would be expected from the I-5 CRC project alternatives and options. This section compares the impacts between the No-Build and LPA scenarios. Differences between LPA Full Build Option A and Option B, and LPA with highway phasing scenarios are small and thus, not evaluated. This discussion focuses on how the LPA or No-Build alternatives would affect corridor and regional impacts. The traffic data used in the analysis are based on regional models for land use and employment and includes traffic from all sources and potential induced growth as a result of the project alternatives. Consequently, the results analyzed and discussed in this section include both direct and indirect effects.

MSAT emissions were provided by Metro, with the exception of naphthalene, which was estimated using a composite area-wide emission rate and the VMT. MSAT emissions from the PATS study are listed for comparison to the existing conditions and the project alternatives. Although the same general methods were used to estimate MSAT emissions for the project and the PATS study, there were differences in some underlying inputs and assumptions to accommodate the need of the specific application. For example, in PATS, emissions from local roads were allocated to modeling zones instead of roadway links. Thus, the PATS emissions and project emissions are similar but not identical.

5.2 Impacts from No-Build and LPA Alternatives

This section describes the impacts from the No-Build Alternative and LPA. These are combinations of highway, river crossing, transit, and pedestrian/bicycle alternatives and options covering all of the CRC segments. They represent the range of system-level choices that most affect overall performance, impacts, and costs. The No-Build and LPA alternatives are most useful for understanding the regional impacts, performance, and total costs associated with the I-5 CRC project. The following sections summarize the major design elements associated with project alternatives.

5.2.1 Regional Effects

Estimated emissions of CO, NO_X, VOCs, PM_{10}, and $PM_{2.5}$ for the four-county region are listed in Exhibit 5-1. Other than CO, summertime emission rates are shown. For CO, the wintertime emission rates are presented, because summertime CO emissions are two-thirds to one half of winter emissions. For PM, the difference in summer to winter emissions is small (about 4 percent), so a wintertime adjustment was not made. Estimated regional emissions of the seven MSATs are shown in Exhibit 5-2. Because naphthalene makes up 80 to 90 percent of the POM emissions for mobile sources, POM emissions were not presented.

The results of the emissions analysis showed that for future conditions (No-Build or LPA), criteria pollutant emissions are expected to be substantially lower than existing emissions for the region for all pollutants. The expected emissions reductions are in the range of 30 percent for CO, 70 percent for NO_x, 50 percent for VOCs, and 90 percent for both PM_{10} and $PM_{2.5}$. Emissions reductions for MSATs track those for VOCs and PM with approximately 50 percent reductions in the volatile MSATs benzene, 1,3-butadiene, formaldehyde, naphthalene and acrolein, and a 95 percent reduction in diesel particulate emissions. On a regional basis, differences between the future 2030 emissions for project alternatives, including the No-Build Alternative, are 1 percent or less, which is not a meaningful difference.

Exhibit 5-1. Regional NAAQS Emissions

Alternative	VMT	Units	CO (winter)	NO_X	VOC	PM_{10}	$PM_{2.5}$
Existing	37,241,099	(tons/day)	869.5	88.7	52.2	1.2	1.1
		(pounds/day)	1,730,000	177,400	104,400	2,380	2,220
No-Build (2030)	52,485,308	(tons/day)	650.9	23	23.4	0.1	0.1
		(pounds/day)	1,302,000	46,00	46,900	181	167
LPA (2030)	52,078,456	(tons/day)	646.1	22.8	23.2	0.1	0.1
		(pound/day)	1,292,000	45,600	46,300	180	166

Exhibit 5-2. Regional MSAT Emissions (pounds per summer day)

Alternative	Benzene	1,3-Buta-diene	Formalde-hyde	Acrolein	Diesel PM	Naph-thalene
PATS (2005)[a]	3,658	390	1,042	57	2,210	42.4
Existing (2005)	3,787	426	1,049	52	2,380	69.8
No-Build (2030)	1,637	201	554	25	167	44.5
LPA (2030)	1,620	199	547	25	166	44.1

a Direct comparison between PATS results and CRC emissions should not be made.

5.3 Subarea Effects

To give an indication of whether emissions are expected to affect neighborhoods directly adjacent to I-5 along the project alignment, emissions were analyzed separately in four subareas, consisting of only the I-5 mainline and ramps. The emissions are listed in pounds per day as the model results reported them so that the differences in project alternatives and the level of emissions can be seen. However, please note that the emissions estimates are not accurate to the nearest pound.

The subareas analyzed are shown in Exhibit 5-3.

Exhibits 5-4 and 5-5 list NAAQS and MSAT emissions for the I-5 mainline and ramps in Subarea 1. Emissions in Subarea 1 are substantially reduced in the future LPA and No-Build scenarios relative to existing conditions. Between the LPA and No-Build alternatives, the LPA scenario has lower emissions, as traffic flow is estimated to be better if the project is built.

Exhibit 5-3. Subarea Road Links

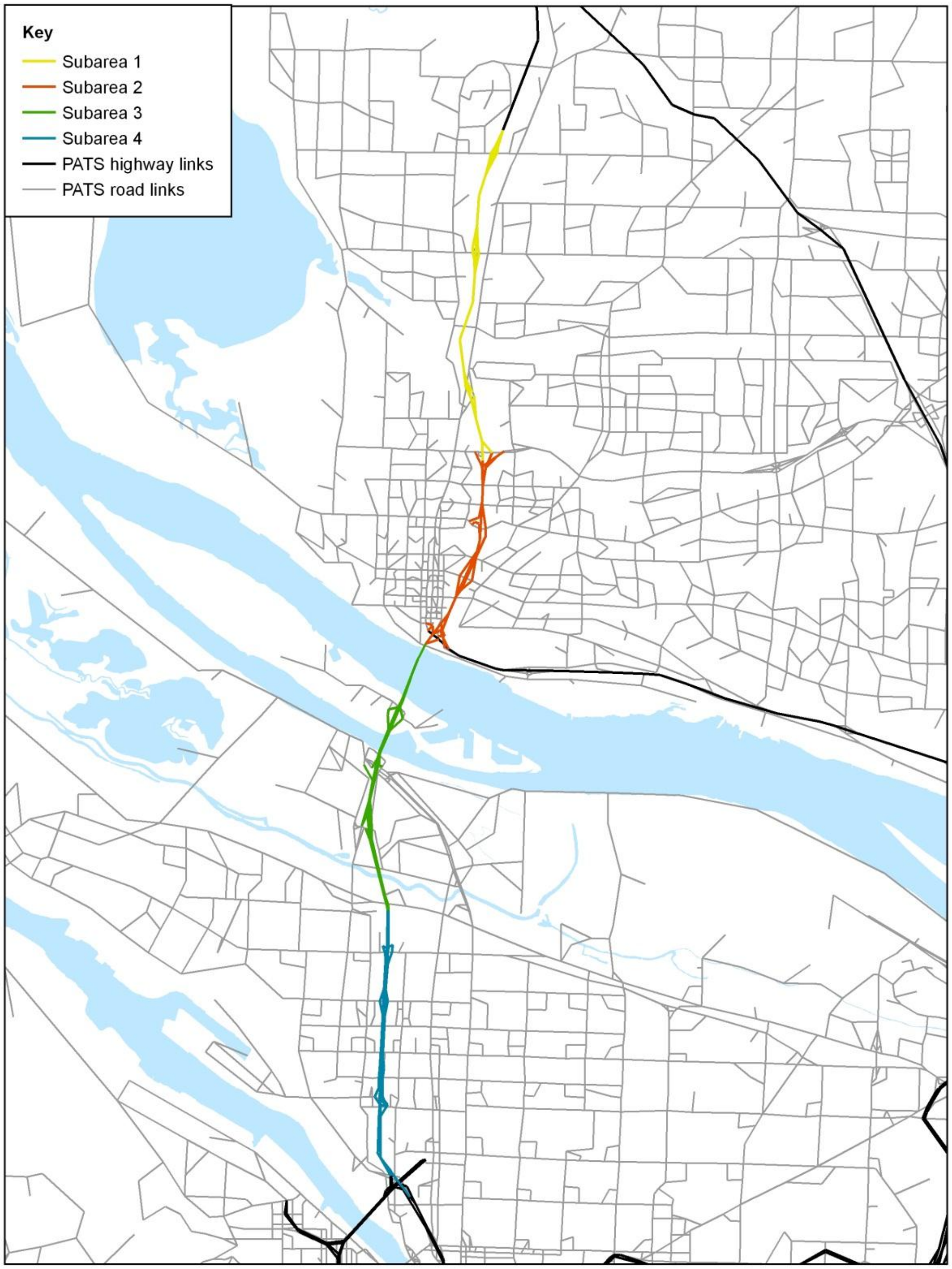


Exhibit 5-4. Subarea 1 NAAQS Emissions (pounds per summer day)

Alternative	VMT	CO (winter)	NO_X	VOC	PM_{10}	$PM_{2.5}$
Existing (2005)	273,600	14,840	1,530	886	19.3	18.1
No-Build (2030)	446,861	12,540	462	439	2.0	2.0
LPA (2030)	424,724	11,970	442	419	1.9	1.9

Exhibit 5-5. Subarea 1 MSAT Emissions (pounds per summer day)

Alternative	Benzene	1,3-Buta-diene	Formalde-hyde	Acrolein	Diesel PM	Naph-thalene
PATS (2005)[a]	28.4	1.0	7.7	0.4	17.5	0.52
Existing (2005)	31.8	3.6	8.5	0.4	19.3	0.51
No-Build (2030)	15.2	1.9	4.7	0.2	2.0	0.38
LPA (2030)	14.5	1.8	4.5	0.2	1.9	0.36

a Direct comparison between PATS results and CRC emissions should not be made.

Exhibits 5-6 and 5-7 list NAAQS and MSAT emissions for the I-5 mainline and ramps in Subarea 2. Emissions in Subarea 2 show a substantial reduction in the future relative to existing conditions. The reductions are similar to the regional reductions. In this subregion, the estimated vehicle miles traveled (VMT) for the build scenario is larger than the No-Build. This results in higher CO and NOx emissions for the build scenario compared the No-Build scenario, although the difference is small (less than 5 percent). For VOC, PM, and MSATs, the build scenario tends to be slightly lower or comparable to the No-Build. The difference in results can be explained by the variation in how the pollutant emission rates vary with speed and the difference in VMT between the build and No-Build scenario.

Exhibit 5-6. Subarea 2 NAAQS Emissions (pounds per summer day)

Alternative	VMT	CO (winter)	NO_X	VOC	PM_{10}	$PM_{2.5}$
Existing (2005)	298,504	16,160	1,591	985	21.1	19.2
No-Build (2030)	428,970	12,000	437	443	1.9	1.9
LPA (2030)	435,569	12,510	456	420	1.9	1.9

Exhibit 5-7. Subarea 2 MSAT Emissions (pounds per summer day)

Alternative	Benzene	1,3-Buta-diene	Formalde-hyde	Acrolein	Diesel PM	Naph-thalene
PATS (2005)[a]	24.5	0.9	6.7	0.4	14.3	0.44
Existing (2005)	35.5	4.0	9.6	0.5	21.1	0.56
No-Build (2030)	15.1	1.9	4.9	0.2	1.9	0.36
LPA (2030)	14.7	1.8	4.5	0.2	1.9	0.37

a Direct comparison between PATS results and CRC emissions should not be made.

Exhibits 5-8 and 5-9 list NAAQS and MSAT emissions for the I-5 mainline and ramps in Subarea 3. Emissions in Subarea 3 show a substantial reduction in the future relative to existing conditions. The reductions are similar to the regional reductions. For this subarea, the LPA emissions are lower than the No-Build for all pollutants.

Exhibit 5-8. Subarea 3 NAAQS Emissions (pounds per summer day)

Alternative	VMT	CO (winter)	NO_X	VOC	PM_{10}	$PM_{2.5}$
Existing (2005)	391,696	20,040	2,045	1,244	26.7	25.0
No-Build (2030)	528,264	14,410	518	557	2.3	2.3
LPA (2030)	472,325	12,800	461	435	2.1	2.0

Exhibit 5-9. Subarea 3 MSAT Emissions (pounds per summer day)

Alternative	Benzene	1,3-Buta-diene	Formalde-hyde	Acrolein	Diesel PM	Naph-thalene
PATs (2005)[a]	33.8	1.4	9.6	0.5	19.7	0.62
Existing (2005)	44.5	5.0	12.2	0.6	26.7	0.73
No-Build (2030)	18.6	2.3	6.2	0.3	2.3	0.45
LPA (2030)	15.3	1.9	4.8	0.2	2.1	0.40

a Direct comparison between PATS results and CRC emissions should not be made.

Exhibits 5-10 and 5-11 list NAAQS and MSAT emissions for the I-5 mainline and ramps in Subarea 4. Emissions in Subarea 4 show a substantial reduction in the future relative to existing conditions. For this subarea, the build emissions are lower than the No-Build for all pollutants.

Exhibit 5-10. Subarea 4 NAAQS Emissions (pounds per summer day)

Alternative	VMT	CO (winter)	NO_X	VOC	PM_{10}	$PM_{2.5}$
Existing (2005)	366,309	17,740	1,835	1,038	24.1	22.5
No-Build (2030)	423,473	10,700	377	368	1.9	0.9
LPA (2030)	391,636	9,912	349	339	1.7	0.9

Exhibit 5-11. Subarea 4 MSAT Emissions (pounds per summer day)

Alternative	Benzene	1,3-Buta-diene	Formalde-hyde	Acrolein	Diesel PM	Naph-thalene
PATS (2005)[a]	35.0	1.4	9.8	0.5	22.6	0.68
Existing (2005)	37.7	4.2	10.1	0.5	24.1	0.69
No-Build (2030)	13.0	1.6	4.2	0.2	1.9	0.36
LPA (2030)	12.0	1.5	3.9	0.2	1.7	0.33

a Direct comparison between PATS results and CRC emissions should not be made.

In general, future emissions in the subareas are expected to be substantially lower than existing emissions for all project alternatives. For most subareas, the emissions for the LPA configuration are less than for the No-Build.

5.4 Local Effects

To determine if local congestion is likely to cause air quality impacts, a hot spot analysis was performed at the three worst performing intersections in both Portland and Vancouver. Existing conditions (2005 for Portland, 2009 for Vancouver) along with opening year (2018) and future year No-Build and build scenarios were evaluated. The intersection ranking tables are included in Appendix B. The rankings changed from the DEIS as changes were made in the project that altered intersection volumes. One method change was for the Mill Plain and I-5 interchange. For the DEIS, the northbound and southbound intersections were evaluated separately and thus were not identified for evaluation. For the FEIS, this interchange was reconfigured into an SPUI in which the left turn ramps were brought to a center intersection. Thus the two existing traffic signals to move vehicles through the interchange and the center intersection allow opposing left turns to and from the ramps to occur simultaneously. Since the three intersections are linked together, they were evaluated as a single intersection, thus making it the intersection with the highest entering volume. Given the complexity of this interchange, it stretches the intent of CAL3QHC and WASIST models in that the ramps do not align with the intersection itself. Since this is a non-standard configuration, a method to model the intersection with WASIST was discussed and coordinated with WSDOT. For the existing and No-Build scenarios, the northbound and southbound ramp intersections were modeled separately and the larger concentration used. For the build scenario, the center intersection was modeled but included the ramp traffic from the side intersections. Since the ramps are 200 to 300 feet from the center intersection, including the ramp volumes would raise impacts, thus providing for a conservative estimate for the intersection.

The results of the hot spot analysis are shown in Exhibits 5-12 and 5-13. Exhibit 5-14 shows the intersections analyzed for local CO impacts. The 1-hour and 8-hour CO concentrations were forecast and compared with 1-hour and 8-hour standards. No violations of the NAAQS were shown for existing conditions, the No-Build condition, or the build conditions. Therefore, long-term air quality impacts are not expected to occur as a result of the project.

Exhibit 5-12. Maximum One-Hour Carbon Monoxide Concentrations (ppm)

Intersections	Existing	Opening No-Build (2018)	Opening Build (2018)	Future No-Build (2030)	Future Build (2030)
Vancouver	(2009)				
East 39th Street at Main Street	5.6	4.6	4.5	5.2	5.1
Mill Plain Blvd at C Street	5.2	4.5	4.4	5.0	5.0
Mill Plain Blvd at I-5 Interchange	6.4	4.9	5.3	5.8	6.5
Portland	(2005)				
Lombard Street at Interstate Avenue	6.0	4.9	4.8	5.0	4.8
Fremont and MLK Jr. Blvd	6.9	5.7	5.2	5.4	5.4
Lombard and MLK Jr. Blvd	6.3	5.3	4.9	5.1	5.0

Note: The 1-hour CO standard is 35 ppm. A background concentration of 3.0 ppm is added to modeled concentrations to calculate the results shown.

Exhibit 5-13. Maximum Eight-Hour Carbon Monoxide Concentrations (ppm)

Intersections	Existing	Opening No-Build (2018)	Opening Build (2018)	Future No-Build (2030)	Future Build (2030)
Vancouver	(2009)				
East 39th Street at Main Street	4.8	4.1	4.0	4.5	4.5
Mill Plain Blvd at C Street	4.5	4.0	4.0	4.4	4.4
Mill Plain Blvd at I-5 Interchange	5.4	4.3	5.0	5.0	5.4
Portland	(2005)				
Lombard Street at Interstate Avenue	5.3	4.4	4.4	4.5	4.4

Intersections	Existing	Opening No-Build (2018)	Opening Build (2018)	Future No-Build (2030)	Future Build (2030)
Fremont at MLK Jr. Blvd	6.0	5.1	4.7	4.8	4.8
Lombard at MLK Jr. Blvd	5.5	4.7	4.4	4.6	4.5

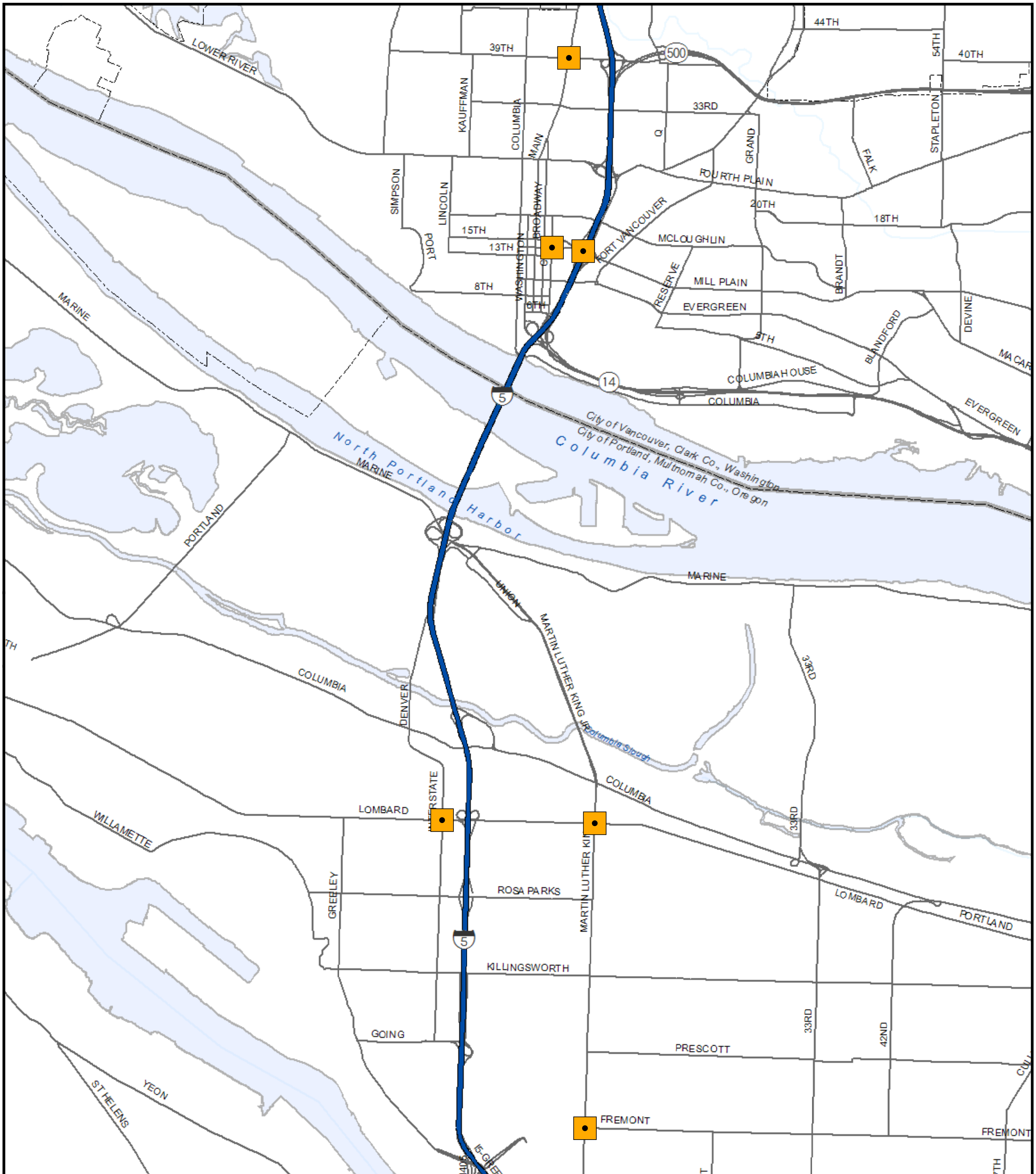
Note: The 8-hour CO standard is 9 ppm. A background concentration of 3.0 ppm is added to modeled concentrations to calculate the results shown.

Since the three Vancouver high-volume intersections (E 39th Street and Main Street, Mill Plain Boulevard and C Street, and Mill Plain Boulevard and I-5 interchange) are unaffected by the east-west light rail transit alignment option, the selection of the east-west alignment has no bearing on the CO hotspot analysis. Thus, adoption of the 17th Street alignment for the Vancouver light rail segment light does not alter the outcome of the LPA hotspots analysis.

5.5 Impacts from Other Project Elements

5.5.1 Maintenance Base Operations

Maintenance of light rail transit vehicles would require an expansion of the existing facility at Ruby Junction in Gresham, Oregon. Stationary sources such as bus and light rail maintenance facilities are subject to the permitting regulations of either DEQ or SWCAA. The existing permitting regulations are designed to protect the health of the public. Consequently, no impacts are expected as a result of maintenance base operations.



Intersections

Exhibit 5-14. Intersections for CO Analysis

0 0.25 0.5
Miles

Columbia River CROSSING

Analysis by J. Koloszar; Analysis Date: Jan. 23, 2010; File Name: Exhibit5-14_LH131.mxd

6. Temporary Effects

6.1 Introduction

Insufficient information is currently available to quantify the potential air quality effects of construction for the I-5 CRC LPA and No-Build alternatives. The following qualitative discussion gives an indication of the potential effects on air quality from project construction.

6.2 Construction Activities

A description of construction activities is provided in Section 1.2.3.

Construction-related activities would include direct construction activities such as:

- Earth moving (grading, earth removal and transport, fill transport)
- Pile driving (barge activities)
- Demolition (with barge activities)
- Concrete batch plant and transport.

Indirect effects would include increased traffic and congestion due to detouring at nearby intersections. The latter would be applicable to the SR 14 interchange area when the off-ramp to downtown Vancouver is closed. However, none of these individual activities is expected to last more than 5 years at any one location.

A wide variety of construction equipment will be in use for the duration of the construction, both on land and on the river. Much of the construction equipment is likely to be diesel. The EPA promulgated the Non-road Diesel Rule in May 2004. The rule requires ultra-low sulfur levels (15 ppm) in most non-road diesel fuel starting in 2010. The ultra-low sulfur limits will become applicable to locomotive and marine diesel fuel in 2012. New construction equipment will become subject to exhaust emission standards similar to those imposed on on-road diesel engines in a phased schedule between 2008 and 2015, with most large equipment affected by the **standards between 2012 and 2015. Consequently, by the time construction is expected to start on** the I-5 CRC project, ultra-low sulfur fuel would be in use for almost all construction equipment that would potentially be used. Because the new equipment exhaust emission standards would be phased in during the expected CRC construction timing, only a portion of the equipment would likely be new and the percentage of the overall equipment fleet affected would be low in the early years of implementation and higher in later years.

Existing transportation corridors consisting of highways and arterials will be the major routes into and out of the construction areas. Most transport of goods and services associated with the project will use trucks. I-5, SR 14, SR 500, Martin Luther King Jr. Boulevard, and Marine Drive will serve as the major corridors into and out of the construction areas. Fourth Plain and Mill Plain Boulevards will serve important roles, but they are not expected to be as heavily used. The Port of Vancouver lies west of the Washington side of the project, so West Fourth Plain and West Plain (SR 501) could experience higher use depending on the potential use of Port property. Road networks in Vancouver and on Hayden Island will provide access to individual work areas and circulation for construction vehicles. Columbia Way parallels SR 14 and becomes the main access into the industrial area that could be used for various staging purposes. As such, it could become a more heavily used haul route than envisioned for the other local roads. In addition, Columbia Way could be used as a detour route, which would compound construction-related issues. Trucks used on highways would be subject to the Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirement Rules. Ultra-low sulfur fuel would be used in all highway trucks. In addition, trucks new in 2007 and later model years are subject to stringent exhaust emissions standards. The standards reduce PM and NO_x emissions by 90 and 95 percent respectively, relative to older technology.

6.3 Temporary Effects

Construction for any CRC Build Alternative will be extensive and will involve demolition, a wide variety of heavy construction equipment and operations, on-road construction vehicle activities, and potentially off-site activities such as concrete plant or borrow operations. Traffic congestion will occur in the construction area and potentially along detour or construction haul routes. Construction impacts will vary in extent and location, depending on the project alternative selected and on weather conditions (e.g., rain suppresses dust). Construction impacts in the project would logically be lowest with the No-Build Alternative and higher for the Build Alternative. Construction activities could cause short-term increases in air pollutant emissions and odors.

The primary impacts of direct construction activities will be the generation of dust from demolition, site clearing, excavating and grading activities, direct exhaust emissions from construction equipment, and impacts to traffic flow in the project area. Traffic congestion increases idling times and reduces travel speeds, resulting in increased vehicle emission levels. Demolition may involve structures containing lead or asbestos.

As described in Chapter 1, the staging and casting area are likely to have emissions associated with them. Exhibit 6-2 shows the proposed locations for the staging and casting areas. Construction of concrete structures or asphalt paving activities may have associated pollutant-emitting sources, such as mixing operations. Stationary sources, such as concrete mix and asphalt plants, are generally required to obtain an Air Contaminant Discharge Permit from either DEQ or SWCAA and to comply with regulations for controlling dust and other pollutant emissions. The proposed Port of Vancouver sites and the Sundial site are sufficiently far from the project area that they would not have a direct effect on the project area. The staging areas would have localized emissions.

Under the transportation conformity rules (40 CFR 93.123 (c)(5)):

> (5) CO, PM_{10}, and $PM_{2.5}$ hot-spot analyses are not required to consider construction-related activities which cause temporary increases in emissions. Each site which is affected by construction-related activities shall be considered separately, using established “Guideline” methods. Temporary increases are defined as those which occur only during the construction phase and last five years or less at any individual site.

Since project construction activities are not expected to last more than 5 years at any given site, a CO hot-spot analysis will not be required.

To address the potential of air quality impacts from construction, a search for construction-related monitoring conducted on other transportation construction sites was made. One project, the Dan Ryan Expressway Reconstruction project in the Chicago area, conducted air quality monitoring during their project construction phase. The Dan Ryan Expressway is the busiest expressway in

Chicago and is the major transportation artery from downtown through the City's South Side, accommodating over 300,000 vehicles per day at full capacity. In comparison, the I-5 corridor carries about 150,000 vehicles per day.

In 2006 and 2007, the Illinois Department of Transportation (IDOT) reconstructed the entire length of the Dan Ryan Expressway, including the addition of a travel lane from 47th Street to 95th Street. The project was the most massive expressway reconstruction plan in Chicago's history, with a total cost of $975 million. Construction activities included:

- Complete rebuilding of 28 east-west bridges over the expressway.
- Redesigned and rebuilt interchange with the Chicago Skyway (I-90).
- The addition of a lane in each direction.
- Construction of longer exit and entrance ramps.
- Improved drainage infrastructure to reduce pavement flooding and traffic tie-ups during heavy rains.

This project had a comparable level of construction as proposed for CRC, specifically, bridge rebuilding, pile driving, earth moving, and major amounts of concrete pavement replacement.

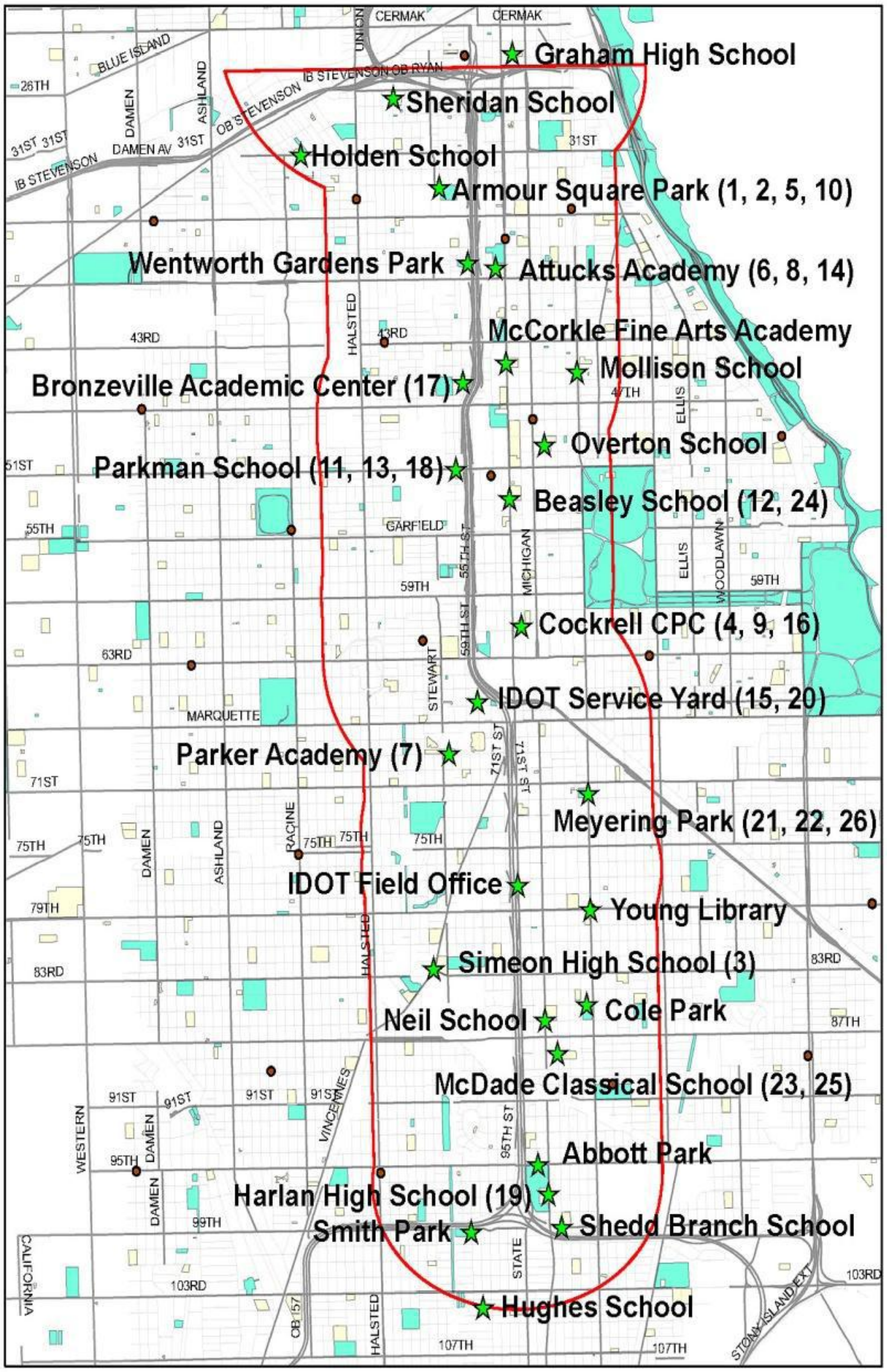
Because the Chicago area is a non-attainment area for the annual $PM_{2.5}$ standard, construction monitoring was required. The project area is in attainment for the 24-hour $PM_{2.5}$ standard. The Dan Ryan Expressway passes directly through the middle of the south side of Chicago. Air monitoring was conducted at 27 sites located at schools, parks, public housing and public facilities where the population is expected to be more sensitive to air contaminants such as those serving children and the elderly (Exhibit 6-1). The monitored pollutants included total dust, respirable silica, lead, asbestos, PAHs (as diesel components), PM_{10} and $PM_{2.5}$.

The baseline air quality monitoring was performed from September through December 2004 in areas where no reconstruction activities were occurring. Reconstruction air monitoring began in January 2005 and continued until October 2007. In March 2006, the monitoring of asbestos was discontinued due to no detections above laboratory detection limits and PAH sampling was reduced due to no detections of certain constituents above laboratory detection limits (EDI, 2008).

Project action levels were set for each pollutant. If these levels were exceeded, then the contractor attempted to identify the source and notified an IDOT project official and mitigating measures were then executed to reduce emissions. Concentrations above a project action levels did not constitute a violation, but rather were used to identify periods of elevated concentrations and implement mitigation (if deemed necessary) to reduce the projects possible effects. In general, the number of times the project action levels were exceeded was low. In many instances, the alert could be linked to instrument issues or regional scale events. In other cases, no obvious activity could be associated with the alert. For example in 2007, there were fourteen days with elevated $PM_{2.5}$ levels. All of the elevated readings appeared to be related to the regional air quality in the Chicago Metropolitan area and were not directly related to the Dan Ryan reconstruction activities (EDI, 2008). Even with some elevated concentrations, the air quality standards were maintained and not exceeded.

The results from the Dan Ryan Expressway project indicates that the CRC's construction activities should not result in any violations of the air quality standards and should not pose an undue health risk to the neighboring communities.

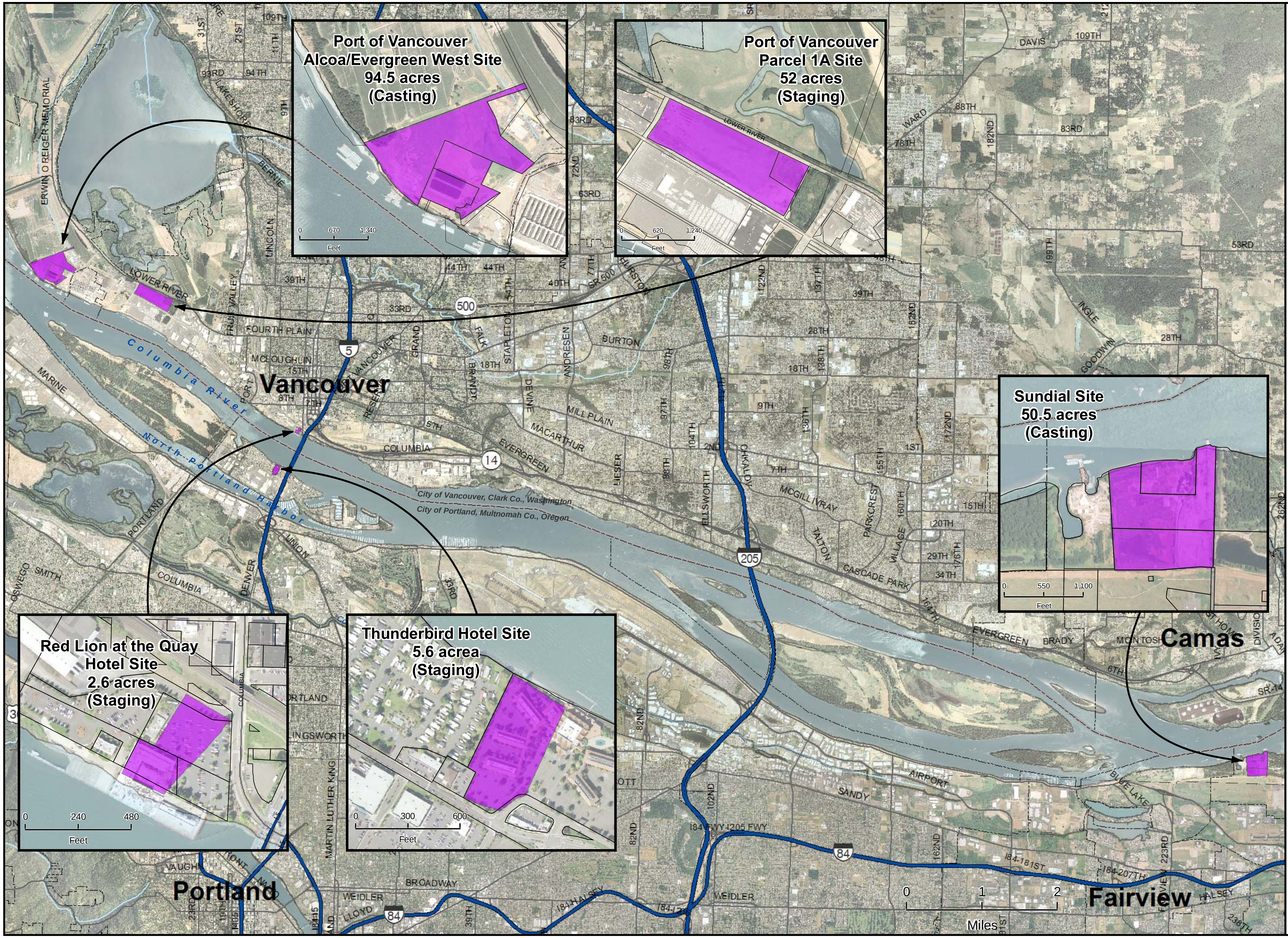
Exhibit 6-1. Locations of the Dan Ryan Expressway Air Quality Monitors



Source: EDI, 2008.

Note: Stars represent monitoring locations.

Exhibit 6-2. Potential Staging Areas and Casting Yards



Parcel Boundaries

Proposed Staging and Casting Areas

Columbia River CROSSING

Analysis by J. Koloszar; Analysis Date: Sept. - 2009; File Name: ...\AIR_Qual\Stage_Cast_DC212.mxd

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7. Mitigation

7.1 Long-term Effects

Air pollutant emissions are expected to be substantially lower in the future than under existing conditions. On a regional basis, future differences between LPA and No-Build alternatives are small enough not to be meaningful within the accuracy of the estimation methods.

For the subareas, both the LPA and No-Build scenarios have substantially lower emissions than the existing condition. For three of the subareas, the LPA is beneficial in reducing emissions relative to the No-Build Alternative. For subarea 2, the LPA CO and NO_x emissions are higher than in the No-Build scenario while the VOC, PM, and MSATs emissions are lower or comparable to the No-Build scenario. However, the variation in the LPA and No-Build scenarios is small (less than 5 percent) and likely not meaningful given the uncertainties in the emissions and modeling.

A quantitative analysis of CO concentrations for the intersections expected to yield the worst congestion conditions was performed for three intersections in Vancouver and three intersections in Portland. No violations of the NAAQS were shown for existing conditions, the No-Build condition, or the LPA Build conditions.

Long-term air quality impacts are not expected to occur as a result of the project, and mitigation for long-term impacts is not proposed.

7.2 Temporary Effects

Construction mitigation should focus on controlling dust and exhaust emissions from demolition and construction activities and on minimizing the effects of traffic congestion. For a project of this magnitude, the contractor should be required to develop a pollution control plan that includes documentation of operational measures that will be used to reduce emissions. Section 290 of the ODOT standard specifications describes requirements for environmental protection, including air pollution control measures. These control measures are designed to minimize vehicle track-out and fugitive dust and should be included in the project specifications.

Stationary sources such as concrete and asphalt mix plants are generally required to obtain air permits from DEQ or SWCAA and to comply with regulations to control dust and other pollutant emissions. As a result, their operations are typically well controlled and do not require project-specific mitigation measures. This would also be true for demolition of asbestos containing structures, as this activity is regulated.

Contractors are required to comply with ODOT standard specifications (Section 290) for dust, diesel vehicles, and burning activities described above. Section 290 requires contractors to comply with Oregon Revised Statutes (ORS) 468, ORS 468A, Oregon Administrative Rule (OAR) 340-014, OAR 340-200 through OAR 340-268, and all other applicable laws. In order to control dust, the project should require all contractors to develop and implement a dust control plan, and to maintain air quality permits on all portable equipment. Stationary sources such as concrete and asphalt mix plants are generally required to obtain air permits from DEQ and to comply with regulations to control dust and other pollutant emissions. In Vancouver, Washington

Administrative Code (WAC) 173-400-040 places limits on fugitive dust that causes a nuisance or violates other regulations. Violations of the regulations can result in enforcement action and fines.

The OAR regulation provides a list of reasonable precautions to be taken to avoid dust emissions:

- Use of water or chemicals where possible for the control of dust in the demolition of existing buildings or structures, construction operations, the grading of roads or the clearing of land;
- Application of asphalt, water, or other suitable chemicals on unpaved roads, materials stockpiles, and other surfaces that can create airborne dusts;
- Do not use oil, waste, waste water, or other illegal materials as dust suppressants;
- Full or partial enclosure of materials stockpiles in cases where application of oil, water, or chemicals is not sufficient to prevent particulate matter from becoming airborne;
- Installation and use of hoods, fans, and fabric filters to enclose and vent the handling of dusty materials;
- Adequate containment during sandblasting or other similar operations;
- When in motion, always covering open-bodied trucks transporting materials likely to become airborne; and
- The prompt removal from paved streets of earth or other material that does or may become airborne.

In 2008, ODOT updated their standard specifications to address diesel emissions. ODOT specified that truck staging areas for diesel-powered vehicles should be located where truck emissions have a minimum impact on sensitive populations such as residences, schools, hospitals and nursing homes. Also, trucks and other diesel-powered equipment should limit idling to 5 minutes when the equipment is not in use or in motion, except as follows:

- When traffic conditions or mechanical difficulties, over which the operator has no control, force the equipment to remain motionless.
- When operating the equipment’s heating, cooling or auxiliary systems is necessary to accomplish the equipment’s intended use.
- To bring the equipment to the manufacturer’s recommended operating temperature.
  - When the outdoor temperature is below 20 °F.
  - When needing to repair equipment.
  - Under other circumstances specifically authorized by the Engineer.

Strategies to minimize the occurrence and effect of roadway congestion in the project area will be developed throughout the design phase. Alternatives will be refined, impacts to traffic analyzed, and transportation agencies and experts brought in to develop mitigation plans and solutions. Some of these strategies may consist of:

- Providing alternatives to single-occupancy vehicle (SOV) trips.
- Providing incentives to reduce automobile trips and encourage mode shifts to non-SOV types.
- Managing traffic and lane closures to avoid congestion and delay.

- Providing traveler information at key junctions to encourage traffic diversion from the I-5 corridor project area and crossing routes.
- Promoting continuous information campaigns to alert motorists of delay times within the corridor and of upcoming traffic pattern changes and detours.
- Incorporating transit priority measures where feasible.
- Working with employers whose employees must commute through the area to promote alternative work schedules.
- Instituting contractor incentives to shorten construction durations and encourage the use of lower-emitting construction equipment including retrofitting diesel engines with verified control technologies, replacing older equipment with newer, and using cleaner fuels (e.g., 20 percent biodiesel fuel).

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8. Permits and Approvals

The primary approval required for the project is a finding that the project is in conformance with the State Implementation Plan (SIP).

8.1 Air Quality Conformity Determination

The project is located in the Portland/Vancouver CO maintenance area. To conform, the project must be included in a conforming RTP and MTIP with no substantive changes in design concept or scope, and a hot spot analysis must be completed to determine that local CO impacts will not occur.

In the February 2008, Air Quality Conformity Determination for the 2035 Metropolitan Regional Transportation Plan and the 2008-2011 Metropolitan Transportation Improvement Plan, the project description is for a replacement bridge with 10,000 vehicles per hour each direction, with $2 tolls, and light rail transit with termini at the Lincoln Park and Ride lot near Main Street and I-5. The project is to be completed by 2017. On June 10, 2010, an updated conformity determination was made by Metro for the 2035 Metropolitan Regional Transportation Plan and the 2008-2011 Metropolitan Transportation Improvement Plan. FHWA followed by issuing a finding of conformity on September 20, 2010.

The project as described in this report is consistent with the conformity determination description, with exception to the Vancouver light rail termini. In this report, the terminus of light rail is located at Clark College rather than the Lincoln Park and Ride. Since the two park and rides are of similar size, any differences in the regional emissions would be minor, and thus should not influence the conformity determination.

The project will not cause an exceedance of the NAAQS. Concentrations of CO in the Portland and Vancouver areas do not currently exceed the NAAQS. The project will not delay timely implementation of Transportation Control Measures (TCMs) included in the Portland CO Maintenance Plan. The included control measures are transit service increases and bicycle and pedestrian paths.

8.2 Other Permits

Air quality permits may be required for construction sources. Both DEQ and SWCAA require permitting of stationary sources such as concrete batch plants, and notification of asbestos demolition or removal activities. SWCAA requires permitting of non-road engines that remain at “any single site at a building, structure, or installation” for more than 12 consecutive months. This regulation could affect construction equipment in Washington, and requires dispersion modeling of emissions. The regulation excludes mobile cranes and pile drivers.

Under OAR 340-254-0010, operators planning to construct or modify a parking facility or similar indirect source in the Portland AQMA must obtain an Indirect Source Permit if a facility will provide 1000 or more parking spaces (800 or more spaces if the facility is within the Portland’s Central Business District). An indirect source means a facility, building, structure, or installation, or any portion or combination thereof, which indirectly causes or may cause Mobile Source activity that results in emissions of an air contaminant for which there is a National Ambient Air Quality Standard.

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9. References

I-5 CRC Project (Interstate 5 Columbia River Crossing Project). January 2007. Air Quality Methods and Data Report.

DEQ (Oregon Department of Environmental Quality). 2006a. Oregon Air Quality Data Summaries.

DEQ. 2006b. Portland Air Toxics Assessment Study.

DEQ. 2008. 2008 Oregon Air Quality Data Summaries.

EDI (Environmental Design International, Inc.). 2008. Air, Noise, and Vibration Monitoring Final Report – September 2004 through October 2007; Project Site: Dan Ryan Expressway Reconstruction Project. Chicago, Illinois.

EPA (U.S. Environmental Protection Agency). 1995. "User's Guide to CAL3QHC Version 2.0." Office of Air Quality Planning and Standards (OAQPS). Research Triangle Park, NC. (EPA-454/R-92-006R).

EPA. 1996. Approval and Promulgation of Implementation Plans and Designations. Accessed at: http://www.epa.gov/fedrgstr/EPA-AIR/1996/July/Day-29/pr-23557.html.

EPA. 2001. Mobile Source Air Toxics. (EPA420-R-03-010) Accessed at: http://www.epa.gov/otaq/toxics.htm#March292001.

EPA. 2003. "User's Guide to MOBILE6.1 and MOBILE6.2.Mobile Source Emission Factor Model" Accessed at: http://www.epa.gov/OMS/models/mobile6/420r03010.pdf.

FHWA (Federal Highway Administration). 2009. Interim Guidance Update on Air Toxic Analysis in NEPA Documents. Accessed at: http://www.fhwa.dot.gov/environment/airtoxic/100109guidmem.htm.

George, L.A., J. Parra and P. Sitbon. 2005. Horizons - Portland Area Real-Time and Archived Air Quality and Meteorological Data. Data access via Portland State University Server Website (http://www.nextgen.pdx.edu). Portland State University - Center for Environmental Atmospheric Research (CEAR), Portland, OR.

Metro. 2002. September 26, 2002. Link-Based Calculation of Motor Vehicle Air Toxin Emissions using MOBILE 6.2.

Metro. 2009. Calculation of Motor Vehicle Emissions for Portland Air Toxics Solutions, April 9, 2009.

OAR (Oregon Administrative Rule) 340 Division 202. Oregon Department of Environmental Quality. Ambient Air Quality Standards and PSD Increments.

OAR 340 Division 252. Oregon Department of Environmental Quality. Transportation Conformity.

WAC (Washington Administrative Code) 173.420. Conformity of Transportation Activities to Air Quality Implementation Plans.

Washington Administrative Code (WAC) 173.470, 474, and 475. Ambient Air Quality Standards.

WSDOT (Washington State Department of Transportation). 2006. Environmental Procedures Manual, Chapter 425 (Air Quality).

Western Regional Climate Center. Western U.S. Climate Historical Summaries. Accessed at: http://www.wrcc.dri.edu/climsum.html.