

2011 Puget Sound Emissions Inventory Update

Task B: Methodology and Data Collection *Process Document*

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SECTION 1: INTRODUCTION

Task B of the 2011 Puget Sound Emission Inventory (PSEI) Update is to provide an overview of the 2011 PSEI emission calculation methodology and provide data collection procedures that include the data requirements for each source category. This is a living document and is subject to change during the course of data collection in 2011.

1.1 Source Categories and Geographical Extent

The 2011 PSEI Update covers activities within delineated geographical areas depending on the source category. The mobile source categories included in the 2011 PSEI are: 1) Ocean-Going Vessels (OGV), 2) Harbor Vessels, 3) Cargo Handling Equipment (CHE), 4) Rail Locomotives (RL), 5) Heavy-Duty Vehicles (HDV) and 6) Fleet Vehicles/Light-Duty Vehicles (LDV). The geographical boundaries for each source category are defined below:

OGV and Harbor Vessels – The geographical extent and the border conditions on which ships are included in the update will be consistent with the 2005 PSEI (see Section 3.2).

CHE and LDV- The CHE and LDV geographical extent is the same as the 2005 PSEI and is confined within the terminal that the equipment operates. The terminal types include: container; dry bulk; break bulk; liquid bulk; auto; and cruise ship. In addition, equipment from rail yard facilities associated with port-related terminals will be included.

RL – The Rail geographical extent is the same as the 2005 PSEI and covers port-related intermodal cargo transportation within Port boundaries, directly to or from port-owned properties (such as terminals and on-port rail yards), and to the edge of the study area. Rail movements of cargo that occur solely outside the port, such as switching at off-port rail yards, and movements that do not either initiate or end at a port property are not included.

HDV – The HDV geographical extent is the same as the 2005 PSEI and includes both on-terminal and on-road operations associated with Port terminals and associated rail yards. On-terminal operations include waiting for terminal entry, transiting the terminal to drop off and/or pick up cargo, and departing the terminals. On-road operations consist of travel on public roads outside the port boundaries but within the study area.

The major ports in the study area include the:

- Port of Tacoma
- Port of Seattle
- Port of Everett
- Port of Anacortes
- Port of Olympia
- Port of Port Angeles

1.2 Pollutants Covered

Exhaust emissions of the following criteria pollutants and greenhouse gases (GHGs) from port-related operational sources are included in the 2011 PSEI:

Criteria Pollutants

- Oxides of nitrogen (NO_x)
- Oxides of sulfur (SO_x)
- Particulate matter (PM) (10-micron, 2.5-micron)
- Volatile organic compounds (VOCs)
- Carbon monoxide (CO)
- Diesel particulate matter (DPM)

Greenhouse Gases (GHGs)

- Carbon dioxide (CO₂)
- Methane (CH₄)
- Nitrous oxide (N₂O)

GHG emissions are also presented in terms of CO₂ equivalent (CO₂e), a measure that weights each gas by its global warming potential (GWP) value. To estimate CO₂e, the GHG emission estimates for each gas are multiplied by the following GWP values, then the three values are summed:

- CO₂ – 1
- CH₄ – 21
- N₂O – 310

In the 2011 PSEI Update, the greenhouse gas emissions will be reported in metric tons while the criteria pollutant emissions will be reported in short tons, to be consistent with standard reporting conventions.

1.3 Overall EI Development Process

The following steps in developing the 2011 PSEI Update are described in this document for each mobile source category:

- 1) Activity Data Collection (data sources, data types, and data collection process)
- 2) Data Processing and Data Quality Control
- 3) Development of Data Defaults (where needed)
- 4) Update/Review of Methodology and Variables
- 5) Preparation and Review of Draft Emissions for Current Reporting Year

1.4 Schedule and Milestones

By 31 January 2011 – Review the data excel files with the various IDMs on an individual basis by source category so that questions may be answered

March 2011, June 2011, September 2011, December 2011 – Quarterly data collection meetings

15 March 2012 – Complete data collection and data review

April-May – Estimate emissions and write report sections

28 May 2012 – Preliminary draft report w/o appendices

1 June 2012 – Preliminary draft comments

7 June 2012 – Draft report w/o appendices

14 June 2012 – Draft comments

21 June 2012 – Final draft report with appendices

26 June 2012 – Final comments

29 June 2012 – Print version final document

1.5 2011 PSEI Report Format and Structure

Draft Table of Contents will be included in this section after it has been reviewed and agreed upon by the group.

1.6 Process Document Organization

Following this Introduction, the 2011 PSEI data requirements document is organized into the following sections:

- Section 2: Ocean-Going Vessels
- Section 3: Cargo Handling Equipment
- Section 4: Harbor Vessels
- Section 5: Rail Locomotives
- Section 6: Heavy-Duty Vehicles
- Section 7: Fleet Vehicles

SECTION 2: OCEAN-GOING VESSELS (OGV)

2.1 Data Collection and Processing

Activity data represents the specific activities of OGVs operating within the Puget Sound study area on an annual basis. As such, the activity data is unique for each year and could vary due to economic factors, regulations, and improvements in data collection, among other reasons. This subsection describes the data collection and processing steps including sources and types of raw data, quality control (QC) procedures used in reviewing the raw data, and development of data defaults for missing parameters.

2.1.1 Data Types

Ocean-going vessels are categorized by the following main vessel types:

- Auto carrier
- Bulk carrier (by woodchips, heavy-lift, and bulk)
- Containership (by 1,000 twenty-foot equivalent (TEU) groups)
- Passenger cruise vessel
- General cargo
- Ocean-going tugboat (ITB/ATB)
- Miscellaneous vessels
- Refrigerated vessel (Reefer)
- Roll-on roll-off vessel (RoRo)
- Tanker (by size and type)

2.1.2 Data Sources

The following sources of data are used to collect and compile the necessary activity data for estimating emissions from OGVs:

- Marine Exchange of Puget Sound
- HIS-Fairplay (commonly known as Lloyd's data)
- Vessel Boarding Program data
- Puget Sound Pilot Association data, if available
- Nautical charts and maps

2.1.3 Data Collected

Different types of activity data are collected from the sources listed above; examples are listed below under each data source. This is not necessarily an exhaustive list of data types.

Marine Exchange of Puget Sound (MarEx)

- Vessel Name and type
- Vessel IMO Number
- Dates and Times of Arrivals, Departures, and Shifts
- Estimated hoteling times
- Originating port and next port of call
- Vessel arrival and departure routes

Lloyd's Register of Ships (IHS Fairplay)

- Vessel Characteristics (specific to IMO Number)
- Model Year
- Propulsion Type
- Main Engine Power
- Tonnage
- Speed Rating

Puget Sound Pilot Association

- Update travel routes and average speeds since 2005.

Port Vessel Boarding Program

- Main Engine Power
- Auxiliary Engine Power
- Auxiliary Engine Load
- Boiler Fuel Consumption
- Fuel Switching
- Emission Reduction Technologies (e.g., slide valves)

Nautical Charts and Maps

- Route Distances

2.1.4 Data Collection Process

Starcrest will collect the activity data from the following sources:

Marine Exchange of Puget Sound (MarEx) – Data from MarEx is compiled for the entire reporting year covering vessel activities from January 1st to December 31st 2011.

Lloyd's Register of Ships – Data from Lloyds is purchased through a company called IHS Fairplay which has the rights to Lloyd's vessel data. The use and presentation of the data is subject to the Starcrest/IHS licensing agreement.

Puget Sound Pilot Association – An interview the pilots will be conducted by Starcrest to review and update the routing and average speeds for slow and fast OGVs through the Puget Sound waterway system. Changes in vessel operations and routing will be discussed. Starcrest will update the 2005 routing files based on the interview.

Port Vessel Boarding Program (VBP) – Starcrest will use its most recent VBP data (over 850 vessels surveyed) and recommend a limited number of Puget Sound vessels types that should be boarded to supplement the data set. In addition, data collected in 2005 will be sent back to vessel owner/operators for review and update.

Nautical Charts and Maps – Nautical charts and geographical information system (GIS) will be used to update new routes and changes to existing routes and segment distances. In addition, these sources will be used to update the report geographical extent figures as needed.

2.1.5 Data Processing and QC

Data collected from each data source is processed and reviewed as described below:

Marine Exchange of Puget Sound (MarEx) – The MarEx data received for the entire reporting year is compiled for processing and review. A number of validation checks are conducted in the database to identify and correct errors identified in the MarEx data. Records with validation issues are generated for review and correction. Validation checks include:

- Vessel Number not in Lloyds
- Actual speed(s) above 40 knots (most likely an erroneous value)
- Missing Engine Category
- Missing Operator
- Missing Route
- Missing Vessel Event ID
- Missing Vessel Name
- Invalid Vessel Number
- Missing Vessel Type Category

Lloyd's Data from IHS Fairplay – The latest Lloyd's data is used for review and processing. Vessels included in the MarEx data are matched by IMO number with the Lloyd's data to determine whether specific vessel characteristics are available for estimating emissions (e.g., main engine power, max speed rating). Defaults, based on vessel class averages, are used when values are not available from Lloyd's.

Port Vessel Boarding Program (VBP) – The actual vessel operating data initially collected during interviews with the vessel's engineer or Captain is reviewed on-board to make sure that data is within the reasonable range. Any questionable data is re-checked with the vessel's personnel during the boardings. At the end of each series of vessel boardings, the new survey data collected for each vessel boarding is reviewed again for any obvious data entry errors. In addition to correcting any typographical errors, data is subsequently reviewed for any questionable values in which case the shipping company may be contacted again to confirm or correct. Data from vessels boarded and from sister ships is then entered into a master file containing the previously collected data. The updated master file is subsequently used to develop default factors.

2.1.6 Data Defaults

Since OGV emissions are calculated for each vessel call, and activity parameters may not be available for each vessel call, default values are needed for certain operating parameters in cases where such data is missing or not available. A description of the process for generating default values for the following parameters is provided below.

Main Engine Power – If there is 100% match between the vessels identified in the MarEx call data and the main engine power values in the Lloyd's vessels data (which has been the case recently), there is no need to develop default values for main engines (i.e., engine power rating). However, if there are one or more vessels identified in the MarEx data for which no match is found in the Lloyd's data, default values are calculated based on the average of existing Lloyd's main engine power values for each vessel type.

Auxiliary Engine Power – Auxiliary engine load data by mode is not available from Lloyd's and the only data available is from the VBP dataset. For vessels that have been interviewed as part of the VBP, their ship specific data will be used. For vessels that have a sister vessel that has been interviewed as part of the VBP, the sister vessel data will be used. For those vessels that have not been boarded nor have a sister vessel that has been boarded, defaults by vessel class and mode (based on the latest VBP data) will be used.

Auxiliary Boiler Power – Auxiliary boiler load data by mode is not available from Lloyd's and the only data available is from the VBP dataset. Boiler power by mode is determined by using the same approach as auxiliary engines described above.

2.2 Emission Estimating Methodology

The estimating methodology will be consistent with the 2005 PSEI methodology and any agreed upon changes (none at this time) will be carefully documented to permit comparisons between inventories. Emissions are estimated for each vessel movement (i.e., inbound, outbound, shifts) in each operating mode as a function of vessel power demand (energy expressed in kW-hrs) multiplied by an emission factor, where the emission factor is expressed in terms of grams per kilowatt-hour (g/kW-hr). The energy demand is estimated by mode based on the estimated load on the engine (load or rated power x load factor) and the activity level in hours of operation by mode. For propulsion main engines, a load factor is derived using the Propeller Law, which is then multiplied by the maximum rated engine power to determine the engine load. For auxiliary engine and boiler power loads, since default values are developed from actual operating data from VBP, there is no need for estimating a load factor for these engines. The activity level is either determined directly from available records (e.g., hotelling times from MarEx data) or estimated based on vessel speed and the segment distance.

SECTION 3: HARBOR VESSELS

3.1 Data Collection and Processing

Harbor vessels include harbor craft (commercial vessels that spend the majority of the time within or near the ports and harbors, or use the Puget Sound as their home port), tank barges (not self-propelled), and recreational vessels. The activity data on which the emissions are based is unique for each year and could vary due to economic factors, regulations, and improvements in data collection, among other reasons. This subsection describes the data collection and processing steps including sources and types of raw data collected, quality control (QC) procedure used in reviewing the raw data and development of data defaults for missing parameters.

Port and Washington State Ferries Inventory Data Managers (IDMs) are only responsible for data collection. Starcrest will be responsible for data processing, emission estimates and report write-up.

3.1.1 Vessel Types

Harbor Craft are categorized by the following main vessels types:

- Assist and escort tug
- Harbor tug
- Ocean tug (does not include Articulated Tug Barges and Integrated Tug Barges (ATB/ITB))
- Commercial fishing
- Ferry
- Excursion
- Government (not including Navy)
- Pilot boat
- Workboat

In addition, the 2005 inventory included tank barges and recreational vessels at public port-owned and privately owned marinas. These sources will also be included in the 2011 PSEI.

3.1.2 Data Sources

Activity data for harbor vessels within Puget Sound will be collected by the Port and Washington State Ferries IDMs from vessel owners and operators.

Harbor Craft and Tank Barges

For harbor craft and tank barges, port IDMs for the Ports of Seattle, Everett, Tacoma, Olympia and Anacortes will collect data for vessels within the boundaries of their ports, including tugs, commercial fishing, excursion, government, pilot and work vessels. Companies whose vessels travel to multiple ports will be divided among the ports for data collection. The Washington State Ferries IDM will collect data on Washington State ferries. As budget allows, Starcrest will collect activity data for non-funding ports and private ferries within the study area.

Recreational Vessels

For recreational vessels, port IDMs for the Ports of Seattle, Everett, Tacoma, Olympia and Anacortes will collect data for vessels at the marinas which they own. As budget allows, Starcrest will collect activity data for marinas located at non-funding ports and private marinas.

Emissions for all harbor vessels for which the data is not collected in 2011 will be estimated by applying a scaling factor to the 2005 data or by another method approved by the Project Funding Committee or the Harbor Craft Subgroup. The scaling factor, if used, will be based on data collected at the funding ports for 2011. See Section 3.1.3 for the type of data that will be collected.

Following is the list of vessel owners/operators and databases included in the 2005 PSEI with updates for 2011. Some, but not all, will be contacted for the 2011 PSEI due to lack of funding.

Assist and Escort

Crowley
Foss

Commercial Fishing

North Pacific Fishing Vessel Owners Association
Vessel Traffic Service
Alaska Commercial Fisheries Entry Commission Database
American Seafood
Trident Seafood

Excursion

Argosy Cruises
POS Pier 56
Aggergaard
Anchor Bay Charters
Aqua Express
Averna
Ballard Diving & Salvage
Bandito Charters
Browns Point Charters
Cristal Charters
DB Holdings LLC
Drayton Harbor Maritime
Evans Maritime Co.
Hat Island Community
Heeter
Herron Maintenance
Island Adventures
Island Express Charters
Jamal Charters
Lake Union Charters

Lake Union Crew
Mt Rainier Council Boy Scouts
Myers
Mystic Sea
New Dimension Cruises
Orca Song
Orcas Isle Eclipse
Pacific Cruises Northwest
Pelagic Charters
Port Madison Charters
R W Miller Enterprises
Salish Sea Charters
San Juan Charters
Seattle Ferry Service
Seattle Harbor Tours
Sebring Marine Services
The Steamer Virginia V Foundation
The Undersea Co
Victoria Rapid Transit
Viking Cruises
Washington State
Waterways Boat Com
Western Prince Cruises

Ferries

Black Ball Transport
County of Pierce
Horluck Transportation
Island Commuter Service
Kitsap Transit
McNeil Island Corrections Center
Puget Sound Express
Skagit County Public Works
Victoria Clipper
Washington State Department of Corrections
Washington State Ferries
Whatcom County Public Works Department

Government

NOAA
Seattle Fire Department
Seattle Police Department
State of Washington Department of Natural Resources
USCG
Washington State Department of Corrections

Harbor Tug

Brusco Tug and Barge
Campbell Maritime
Dunlap Towing Co
Foss
Fremont Tugboat Co.
Harley Marine Services
Island Tug & Barge
Manson Construction
Sea Coast Transportation
Western Towboat

Ocean Tug

Crowley
Dunlap Towing Co
Foss
Sea Coast Transportation
Western Towboat

Pilot Boat

Puget Sound Pilot Association

Tank Barge

Harley Marine Services
Sea Coast Transportation

Workboat

Arrow Launch
Manson Construction
Port of Seattle

Port Owned Marinas for Ports Providing Funds

Marina	County	Associated Port
Fishermen's Terminal	King	Port of Seattle
Harbor Island	King	Port of Seattle
Shilshole Bay Marina	King	Port of Seattle
Bell Harbor Marina	King	Port of Seattle
City Marina	Pierce	Port of Tacoma
Cap Sante Boat Haven	Skagit	Port of Anacortes
Everett Marina	Snohomish	Port Everett
12th Street Yacht Basin	Snohomish	Port Everett
Swantown	Thurston	Port of Olympia

Port Owned Marinas for Ports Not Providing Funds

Marina	County	Associated Port
Coupeville Wharf	Island	Port of Coupeville
Point Hudson	Jefferson	Port of Port Townsend
Boat Haven	Jefferson	Port of Port Townsend
Herb Beck Marina	Jefferson	Port of Port Townsend
Bremerton	Kitsap	Port of Bremerton
Port Orchard	Kitsap	Port of Bremerton
Port of Brownsville	Kitsap	Port of Brownsville
Keyport Marina	Kitsap	Port of Keyport
Cove Marina	Kitsap	Port of Kingston
Poulsbo Marina	Kitsap	Port of Poulsbo
Shelton Marina	Mason	Port of Shelton
Friday Harbor	San Juan	Port of Friday Harbor
La Conner Marina	Skagit	Port of Skagit County
Edmonds Marina	Snohomish	Port of Edmonds
John Wayne Marina	Clallam	Port Angeles
Port Angeles Boat Haven	Clallam	Port Angeles
Blaine Harbor	Whatcom	Port of Bellingham
Squalicum	Whatcom	Port of Bellingham

Private Marinas Located in Counties with Funding Ports

Marina	Location	County
City of des Moines Marina	Des Moines	King
Elliott Bay Marina	Seattle	King
Fairview Marina	Seattle	King
Harbour Village Marina	Kenmore	King
Sagstad Marina	Seattle	King
Salmon Bay Marina	Seattle	King
Arabella's Landing	Gig Harbor	Pierce
Breakwater Marina	Tacoma	Pierce
Chinook Landing Marina	Tacoma	Pierce
Crow's Nest Marina	Tacoma	Pierce
Fair Harbor Marina	Grapeview	Pierce
Foss Waterway Marina	Tacoma	Pierce
Longbranch Marina	Longbranch	Pierce
Murphy's Landing	Gig Harbor	Pierce
Narrows Marina	Tacoma	Pierce
Peninsula Yacht Basin	Gig Harbor	Pierce
Point Defiance Boathouse Marina	Tacoma	Pierce
Totem Marina	Tacoma	Pierce
Anchor Cove Marina	Anacortes	Skagit
Fidalgo Marina	Fidalgo Bay	Skagit
LaConner City Floats	LaConner	Skagit
Lovric's Landing	Anacortes	Skagit
Skyline Marina	Anacortes	Skagit
Shelter Bay Marina	LaConner	Skagit
Boston Harbor Marina	Olympia	Thurston
Zittles Marina	Olympia	Thurston

Private Marinas Located in Counties Outside Funding Ports

Marina	Location	County
La Push Marina	La Push	Clallam
Port of Neah Bay	Neah Bay	Clallam
City of Langley Boat Harbor	Langley	Island
Deception Pass Marina	Oak Harbor	Island
Oak Harbor Marina	Oak Harbor	Island
Pleasant Harbor Marina	Brinnon	Jefferson
Port Hadlock Marina	Port Hadlock	Jefferson
Bainbridge Island Marina	Bainbridge Island	Kitsap
Harbour Marina	Bainbridge Island	Kitsap
Eagle Harbor Marina	Bainbridge Island	Kitsap
Liberty Bay Marina	Poulsbo	Kitsap
Point Hudson Marina	Port Townsend	Kitsap
Port Ludlow Marina	Port Ludlow	Kitsap
Port Orchard Yacht Club	Port Orchard	Kitsap
Port Washington Marina	Bremerton	Kitsap
Seabeck Marina	Seabeck	Kitsap
Winslow Wharf Marina	Bainbridge Island	Kitsap
Hood Canal Marina	Union	Mason
Jarrell's Cove Marina	Shelton	Mason
Port of Allyn	Allyn	Mason
Blakely Island Marina	Blakely Island	San Juan
Cayou Quay Marina	Deer Harbor	San Juan
Deer Harbor Marina	Deer Harbor	San Juan
Islands Marina Center	Lopez Island	San Juan
Lopez Islander Resort & Marina	Lopez Island	San Juan
Quartermaster Yacht Club	Burton	San Juan
Roche Harbor Resort & Marina	Roche Harbor	San Juan
Rosario Resort Marina	Eastbound	San Juan
Snug Harbor Marina Resort	Friday Harbor	San Juan
Stuart Island	Stuart Island	San Juan
Sucia Island	Sucia Island	San Juan
West Beach Resort & Marina	Eastbound	San Juan
West Sound Marina	Orcas Island	San Juan
Fisherman's Cove Marina	Bellingham	Whatcom
Point Roberts Marina	Point Roberts	Whatcom
Semiahmoo Marina	Blaine	Whatcom

3.1.3 Data Collected

Harbor Craft and Tank Barges

The information collected for each vessel will be for calendar year 2011 and includes, but is not limited to, the following:

- Vessel type
- Number, type, model year, and horsepower (or kilowatts) of main engine(s)
- Number, type, model year and horsepower (or kilowatts) of auxiliary engines
- Activity hours for main and auxiliary engines
- Replaced/ Repowered engines information and date installed
- Annual fuel type and amount consumed
- Qualitative information regarding how the vessels are used in service in order to classify it into a vessel type and the percentage of time it is used in the various regions set forth for this inventory for spatial allocation. For 2011, it will mainly entail reviewing what was used in 2005 and getting confirmation that the type of work and spatial allocation is the same for that vessel in 2011.
- Emission reduction strategies such as: alternative fuels, retrofits with after-treatment, and shore power

Note: Fuel consumed is not used for the actual emission estimates and is not as important as the other items that need to be collected. It is requested from companies as clients may be interested in knowing the fuel consumed, but most operators will only be able to provide with an estimate per vessel, not on a per engine basis. It is more important to ask what type of fuel was used as this will have a direct effect on the emission estimates.

Commercial Fishing Vessels

Data to be collected by the IDMs includes:

- Times per year in the Puget Sound area
- Frequency of transits out to sea
- Number of hours engines were used while in Puget Sound
- List of vessels that called at their ports along with the length of stay and whether they used shore power while at berth.

For the 2005 inventory, some of the companies also provided specific engine information for their fleets which aided in developing defaults or averages for the commercial fishing category. If possible, the port IDMs will confirm this data and it will be used for the 2011 update.

Recreational Vessels

For recreational vessels, the information collected will be for calendar year 2011 and includes:

- Permanent Slip Count for port-owned and private marinas
- Transient Slip Count for port-owned and private marinas that have transient vessels
- Transient Dock Space Side Slippage (ft) for port-owned and private marinas that have transient vessels

3.1.4 Data Collection Process

The deliverables for this task are the completed data spreadsheets ready for emissions estimating and updated data collection milestone matrix sheets on a quarterly basis (as determined by the PTPM). All data sets need to be completed and approved by 15 Mar 2012 in order to meet the report schedule. The PTPM will be responsible for determining if the report will be delayed if any of the IDM data is missing or to publish the report without those impacted sources.

Harbor Craft and Tank Barges

The IDMs from the Ports of Anacortes, Olympia, Tacoma, Seattle and Everett, and Washington State Ferries will be responsible for collecting the data for all harbor craft and tank barges that are within their boundaries or under their ownership, including the marinas. Since some harbor craft and tank barges work within the boundaries of multiple ports within Puget Sound, data collection for these will be divided among the IDMs. Starcrest will answer questions the Inventory Data Managers may have during the data collection period and be involved in quarterly meetings to discuss progress.

For all harbor craft and tank barges outside the boundaries of the Ports of Anacortes, Olympia, Tacoma, Seattle and Everett and the Washington State Ferry system, Starcrest will collect needed data if budget allows. If the budget does not allow for collection of all required data by Starcrest, they will recommend a methodology for using the 2005 data to estimate activity level for 2011. This methodology would be approved by the Project Funding Committee or the Harbor Craft Subgroup.

The 2005 data for all tank barges and harbor craft, with the exception of commercial fishing vessels, will be provided to the IDMs to use to collect the 2011 data. At the time of initial contact for data collection, IDMs and, as budget allows, Starcrest, will ask the existing harbor craft companies if there are other harbor craft companies operating in the area that are not on the 2005 list of harbor craft companies. Each IDM and Starcrest will add new companies to the list and data will be collected for the new companies' fleet by IDMs and Starcrest. If data is not collected by an IDM, then the Project Funding Committee will decide if that portion of the PSEI will be excluded from the update. If budget does not allow for Starcrest to collect names and data for new companies, these will not be included in the emission inventory.

The 2005 data provided to the IDMs will be in the form of a Microsoft Excel file and divided by company name or vessel type. For those companies that own many vessels, individual files will be provided that can be emailed to the company and followed up by phone call. Most of these companies will need to be called and possibly visited as they will not update a file that has been submitted by email without a proper explanation of the project at hand and some face to face time. Five years have gone by since the last inventory and the company contacts may no longer be there or they may have forgotten about the study. The annual total hours of operation and quantity of fuel used in 2011 will not be collected until the beginning of 2012, but the inventory list of vessels and whether an engine has been replaced since 2005 can be updated during 2011. The type of fuel may have changed too from 2005 to 2011.

Commercial Fishing Vessels

For commercial fishing vessels, the port IDMs will interview fishing companies and fishing associations. Starcrest and the North Pacific Fishing Vessel Owners Association will provide contact information for fishing companies and fishing vessel associations, who will then be contacted directly by the port IDMs. In addition, activity data from the Marine Exchange will be collected by Starcrest as budget allows.

Recreational Vessels

For recreational vessels, Starcrest will provide the IDMs with the list of marinas and data will be collected by the IDMs and, as budget allows, Starcrest. A methodology similar to that used in the 2005 inventory will be used. This method entailed determining the number of recreational craft from the number of slips in public and private marinas. One slip was assumed to equal one boat and slips for transient boats were not included in the inventory. If dock space is provided for transient boats by the foot, instead of by the slip, then the equivalent slip count will be determined by using an average boat length or other information available to determine slip count. The average boat length will be determined when the slip count data is collected. For marinas for which data is not collected, the 2005 data will be scaled based on what is collected for Seattle, Tacoma, Everett and Anacortes or by using another method approved by the Project Funding Committee. The exact scaling procedure will be determined after the data for these four ports has been collected.

3.1.5 Data Processing and QC

Review of harbor vessel data includes reviewing the data received from vessel operators. These files will be initially reviewed by port IDMs and Starcrest to identify any missing information or obvious reporting errors or anomalies (e.g., negative values, values out of reasonable range). New data submitted will be reviewed by Starcrest to identify new equipment added, equipment no longer owned by the company, control devices installed (or removed), or alternative fuels used. For missing or erroneous data, the operators will be contacted by the Port IDMs for any subsequent corrections. However, if the operator does not provide the data in a timely manner, default values (discussed in the next subsection) will be used for these parameters.

Starcrest will review the datasets provided by the IDMs for completeness and to ensure that the data is within anticipated ranges. Data that is questionable will be sent back to the PTPM and IDMs for clarification. Once a dataset is deemed valid and complete, the Starcrest will notify the PTPM and IDMs and that dataset will be logged as complete in the data collection matrix.

The deliverables for this task will be to log the dataset's status in the data collection matrix and the final datasets for emission estimates.

3.1.6 Data Defaults

For harbor craft, default values are created for three parameters: 1) annual operating hours, 2) engine horsepower, and 3) model year for both propulsion and auxiliary engines for each vessel type. Starcrest will develop default values based on the weighted average of reported values for these parameters which are then used as representative values for equipment with missing parameters.

3.2 Emission Estimating Methodology

All emissions will be calculated by Starcrest using data provided by the IDMs and collected by Starcrest. Where data is missing, 2011 emissions will be calculated by applying a scaling factor to the 2005 data or by another method approved by the project funding committee or the harbor craft subgroup. Scaling factors will be based on 2011 data that is collected for other companies and other relevant information.

Harbor Craft and Tank Barges

The estimating methodology will be consistent with the 2005 PSEI methodology summarized in section 4.6 of that report and any changes will be carefully documented to permit comparisons between inventories. The emission factors used in 2005 will be reviewed and updated if deemed necessary and agreed upon by the harbor vessel subgroup. The basic equation used to estimate harbor vessel emissions is:

$$E = kW \times Act \times LF \times EF \times FCF$$

Where:

E = Emission, g/year

kW = Kilowatts

Act = Activity, hours/year

LF = Load Factor

EF = Emission Factor, g/kW-hr

FCF = Fuel Correction Factor

The EPA emission factors are in g/kW-hr, therefore the engine horsepower was converted to kilowatts by dividing the horsepower by 1.341 (one horsepower is equal to 0.746 kilowatts). The hours represent annual hours of use within the Puget Sound. The calculated emissions are converted to tons per year by dividing the emissions by 907,200 (which is 2,000 lb/ton x 453.6 g/lb).

The engine load factors will be the same as those used in 2005 PSEI (table 4.10), which were cited from various sources including EPA NONROAD model guidance for the 43% engine load factor for the auxiliary engines, Port of Los Angeles Air Emissions Inventory for the 31% engine load factor used for assist tugboats and a 2004 California Air Resources Board Statewide Commercial Harbor Craft Survey for all other engine load factors.

Engine Load Factors for Harbor Craft

Harbor Vessel Type	Load Factor
Assist and escort tug	0.31
Harbor and ocean tug	0.68
Ferry/excursion	0.76
Crew boat	0.45
Work boat	0.45
Government	0.51
Commercial fishing	0.27
Auxiliary engines	0.43

Fuel correction factors are applied to adjust the emission rates for changes in fuel properties. Fuel correction factors may be used to take into account the use of ULSD, onroad diesel and/or biodiesel since the emission factors used for the PSEI are based on use of EPA offroad diesel fuel and thus need to be adjusted to account for other fuels.

The 2005 SO₂ emission factor was estimated based on the average sulfur content of the diesel fuel sold to the harbor vessels in Puget Sound. The majority of the harbor vessels used offroad diesel fuel in 2005. The SO₂ emission factor was estimated for offroad diesel fuel based on an average sulfur content of 3,100 parts per million. For 2011, the updated fuel sulfur content information will be used.

Recreational Vessels

The number of boats and percent of boats by vessel type will be used in conjunction with EPA's NONROAD model to determine emissions. The NONROAD model estimates recreational vessel emissions for outboard gasoline engines, inboard gasoline engines and inboard diesel engines. The same percent of population by different recreational vessels (ie outboard, inboard) and average horsepower used in the 2005 inventory based on interviews and literature on recreational vessels will be used for the 2011 update. Evaporative emissions from the gasoline engines are included in the emissions estimates for the recreational vessels.

SECTION 4: CARGO HANDLING EQUIPMENT (CHE)

4.1 Data Collection and Processing

Activity data represents the level of activities of CHE operating at the port terminals and other port facilities on an annual basis. As such, the activity data is unique for each year and could vary due to economic factors, regulations, and improvements in data collection, among other reasons. This subsection describes the data collection and processing steps including sources and types of raw data collected every year, quality control (QC) procedure used in reviewing the raw data and development of data defaults for missing parameters.

4.1.1 Data Types

Following is the list of types of CHE included in the inventory:

- Forklift
- Rubber tired gantry (RTG) crane
- Side handler
- Sweeper
- Top handler
- Yard tractor
- Other

4.1.2 Data Sources

Activity data is collected for cargo handling equipment operated at the Port terminals and other Port tenants' facilities. Following is the latest list of terminals by Port:

Port of Tacoma

Blair Terminal
Grain Terminal
Pierce County Terminal
Husky Terminal
Marshall Avenue Auto Facility
Olympic Container Terminal
Port of Tacoma
Terminal 7
TOTE
Washington United Terminals

Port of Seattle

APM
Eagle Marine (APL), Terminal 5
SSAT, Terminal 18
SSAT, Terminal 25/28/30
Northland, Terminal 115
TII, Terminal 46
Seaport Maintenance
Cruise Terminals, Pier 91 and 66
Grain Terminal Pier 86

Port of Everett

Everett South, Pacific and Hewitt Terminal
Dunlap Towing
Jones Stevedoring
SSAT

Port of Olympia

Port of Anacortes

4.1.3 Data Collected

The information collected for each piece of equipment from terminal and facility operators includes, but is not limited to, the following:

- Equipment type
- Equipment identification number
- Equipment make and model
- Engine make and model
- Rated horsepower
- Type of fuel used (diesel, ULSD, gasoline or propane)
- Alternative fuel used with a start date (examples include emulsified fuel, O2 diesel)
- Fuel consumption
- Annual hours of operation (hour meter reading are encouraged)
- Emission control devices (i.e., DOC, DPF, Vycon, BlueCat) and date installed
- On-road certified engine installed (instead of off-road certified engine)
- Any other emissions control strategies (i.e., repower, replace, retrofit)
- Equipment powered by electricity

4.1.4 Data Collection Process

For CHE data collection, the effort will focus on working with the Inventory Data Managers (IDMs) from the Ports of Tacoma, Seattle and Everett, and other participating ports who will be responsible for collecting the data that is within their boundaries or under their ownership. If data is not collected by an IDM, then the PTPM will decide if that portion of the PSEI will be excluded from the update.

The deliverables for this task are the completed data spreadsheets ready for emissions estimating and updated data collection milestone matrix sheets on a quarterly basis (as determined by the PTPM). All data sets need to be completed and approved by 15 Mar 2012 in order to meet the report schedule. The PTPM will be responsible for determining if the report will be delayed if any of the IDM data is missing or to publish the report without those impacted sources.

4.1.5 Data Processing and QC

Review of equipment data collected includes reviewing the data received from operators. These files are initially reviewed to identify any missing information or obvious reporting errors or anomalies (e.g., negative values, values out of reasonable range). New data submitted is reviewed to identify new equipment added, old equipment sold, control devices installed (or removed), or alternative fuels used. For missing or erroneous data, the operators are contacted for any subsequent corrections. However, if the operator is not responsive to provide the data in a timely manner, default values (discussed in the next subsection) are used for these parameters.

4.1.6 Data Defaults

Since it is almost impossible to collect all the required data for each piece of equipment, data defaults based on averages of known values are developed to represent a reasonable estimate for missing parameters. For CHE, default values are created for three parameters which are required for estimating emissions: annual operating hours, engine horsepower, and equipment model year by equipment type and terminal type. Default values are developed each year based on the weighted average of reported values for these parameters which are then used as representative values for equipment with missing parameters.

4.2 Emission Estimating Methodology

The estimating methodology will be consistent with the 2005 PSEI methodology and any changes will be carefully documented to permit comparisons between inventories. In 2005, cargo handling equipment emissions were estimated using the NONROAD model, a tool developed by EPA to estimate fleet emissions of offroad equipment. Since 2005, there has been an update to the NONROAD model and for 2011 PSEI, the latest model will be used. As an overview, the NONROAD model estimates emissions for a population of equipment as being:

$$E_{MY} = EF \times HP \times LF \times A$$

Where:

E_{MY} = emissions from a given model year of equipment

EF = emission factor

HP = maximum rated horsepower

LF = load factor

A = Activity (hours of use per year)

For the 2005 PSEI SO₂ emissions calculations, highway diesel was estimated at 310 parts per million (ppm) sulfur; off-highway diesel (also known as nonroad or offroad diesel) was estimated at 2,284 ppm sulfur. For 2011, the updated fuel sulfur content information will be used.

SECTION 5: RAIL LOCOMOTIVES (RL)

5.1 Data Collection and Processing

Activity data represents the annual level of activities of locomotives operating within the port terminals and outside the terminals to the study area boundary, used for transporting port-related intermodal cargo. Since actual activity data is not readily provided by the railroad companies, specific methodologies are used to develop surrogates and to estimate the required activity parameters for estimating emissions. The activity data is unique to each year and could vary due to economic factors, regulations, and improvements in data collection.

5.1.1 Data Types

Data is collected for two main types of locomotives:

- Switching Locomotives
- Line-Haul Locomotives

Switching and terminal rail service is provided at the Port of Tacoma by Tacoma Rail, a division of Tacoma Public Utilities, Pacific Rail Service and Temco. The Port of Olympia is served by the Tacoma Rail switching locomotives moving cargo from the Port to an off-port location for pick-up by the Class 1 railroads.

Line haul rail service is provided by two Class 1 railroads, Burlington Northern Santa Fe (BNSF) and Union Pacific (UP). Together, these railroads move cargo to and from the Port of Olympia, the Port of Seattle, the Port of Tacoma, and the Port of Everett, as well as several off-port rail yards: the Fife Yard in Tacoma (a storage and switching yard), the Seattle International Gateway (SIG) Yard, the Argo Yard in Seattle, and rail yard operations in Everett. The SIG and Argo yards are intermodal yards (where containerized cargo is transferred from or to railcars prior to or following international shipment).

5.1.2 Data Sources

The sources of data will be the various railroads that operate within the study area and the respective Ports. A preliminary list of these data sources is below:

- Tacoma Rail
- Tri-City and Olympia Railroad
- BNSF
- UP
- Port of Tacoma
- Port of Seattle
- Port of Olympia
- Port of Everett
- Louis Dreyfus
- Pac Rail

- Temco

5.1.3 Data Collected

A variety of information sources will be needed to adequately characterize locomotive operations in the emissions inventory and to estimate emissions. Because improvements in data are always sought the exact same information may not be collected for the 2011 EI as for the 2005 study, but in general the following data will be obtained from the sources noted above.

- Fuel consumption in specific areas such as counties or rail yards
- Fuel consumption factors relating fuel usage to cargo movement (e.g., gallons per ton-mile)
- Cargo throughput figures (e.g., containers per year)
- Train counts (e.g., arrival/departure counts or schedules)
- Description of locomotive fleets (e.g., percentages or numbers of Tier 2 and genset locomotives)
- Description of average or typical trains (e.g., number of locomotives, number of railcars or cargo amount, number of gross tons or revenue tons transported)

As background, a more specific list of the data obtained for the 2005 PSEI is provided below.

Switching

Port of Olympia

- Information on switching locomotive used by Tri-City & Olympia Railroad and schedule of operation

Tacoma Rail

- Details on switching locomotive fleet and operations
- Fuel consumption of fleet

Pacific Rail

- Details on switching locomotive fleet and operations
- Fuel consumption of fleet

Temco

- Details on switching locomotive fleet and operations
- Fuel consumption of fleet

BNSF

- Switching locomotive fuel consumption by county

UP

- Switching locomotive fuel consumption by county

Line Haul

Port of Tacoma

- East-bound and west-bound container throughput (total)
- Total number of rail lifts
- Number of east-bound and west-bound trains from/to Husky Terminal (served by UP)

Port of Seattle

- Total number of intermodal yard lifts
- Total number of east-bound and west-bound trains by yard

BNSF

- Information on truck and CHE activity

UP

- Ton-miles and fuel consumption by county and by subdivision/segment (line haul)
- Transit Safety Management (rail consultants): Fuel consumption estimates for specific train routes within study area, east-bound and west-bound

This information, consisting mostly of incomplete data from diverse sources, was carefully evaluated and combined to develop the emission estimates for switching and line haul activity presented in the 2005 PSEI. While this type of approach has not been uncommon in past emissions inventory work, more complete data from single sources would result in more robust emission estimates by providing more consistency and allowing more opportunities to cross-check data from different sources. The following general lists detail the information that has typically been requested of ports and railroads to support emission estimates. These lists are “wish lists” but are not exhaustive or exclusive – other types of information may also be used depending on what is actually available, given the complex nature of rail operations and the need to pull data from existing data systems. In addition, not all of the information on the list would be necessary to produce emission estimates – in some cases there is an “either/or” aspect to the list. An iterative process should be followed in which the initial lists are reviewed and amended based on discussion between members of the rail working group.

Switching Data

Description of operating area

Operating schedule (hrs/year, or hrs/day, days/year, etc.)

Characteristics of switching locomotive fleet

- Locomotive designation (unique number)
- Locomotive manufacturer and model
- Engine manufacturer and model
- Engine year of manufacture
- Year of most recent engine rebuild
- Horsepower
- Emission tier level
- Add-on emission control equipment, if any
- Fuel type and annual fuel consumption

Line Haul Data

Information on locomotives:

- Fleet distribution of locomotives by tier level [% Tier 0, % Tier 1, % Tier 1+ (rebuilt), etc.]
- Average horsepower rating
- Percent time in throttle notch (within study area and/or within port)

On-port information:

- Incoming cargo (for export):
 - How many trains per week (or per day)?
 - Average number of locomotives per train?
 - How long do they stay within the yard?
 - How often do they leave with outgoing railcars (or do they always leave light)?
- Outgoing cargo (imports):
 - How many trains per week (or per day)?
 - Average number of locomotives per train?
 - How long do they stay within the yard?

Off-port information:

- Incoming cargo (for export):
 - How many trains per week (or per day)?
 - Average number of locomotives per train?
 - Average/typical fuel consumption (per trip/per route, annual total, etc.)
- Outgoing cargo (imports):
 - How many trains per week (or per day)?
 - Average number of locomotives per train?

- Average/typical fuel consumption (per trip/per route, annual total, etc.)

Information from the Ports

The ports may be able to provide information on train activity in terms of schedules or arrival/departure records. This information can be compared with that obtained from the Class 1 railroads to provide a quality assurance check, or may be useful in the absence of this type of information from either or both railroads. The ports can also provide throughput information in terms of total cargo (e.g., containers or TEUs) and in terms of rail lifts. This information may be available directly from the Ports or from tenant terminals that have on-dock rail facilities.

These items are a starting point, there may be other information that is more readily available and that can be used to estimate activity levels and emissions, as determined by the rail working group.

5.1.4 Data Collection Process

Data collection will be coordinated through a working group composed of Port, railroad, and SCG representatives. One focus will be on obtaining more detailed and/or comprehensive data on line haul rail operations than was available for the 2005 inventory. In addition, the same data sources will be looked at for switching locomotive information (e.g., Tacoma Rail, the Port of Olympia) and for Port-specific information related to train moves and cargo throughput.

5.1.5 Data Processing and QC

Because a wide range of data sources is necessary to characterize locomotive operations and estimate emissions, data processing is a largely manual process. As much as possible, bearing in mind the aim to improve data collection where possible, the collected data will be consistent with the data collected for the 2005 PSEI, and the new data will be compared with the previous data to ensure that any differences are reasonable and can be explained by factors such as changes in throughput or changes in train makeup or locomotive characteristics.

5.1.6 Data Defaults

Depending on the specificity of the data collected, defaults will be needed for various aspects of the rail system operation. Defaults will be average or typical values representing the unknown specifics, and may include such characteristics as locomotive horsepower, the number of locomotives per train, the average or typical weight of trains, amount of time spent on-Port, etc. Proposed defaults will be vetted through the rail working group to ensure they are reasonably representative of the intended activity or characteristic.

5.2 Emission Estimating Methodology

The estimating methodology will be consistent with the 2005 PSEI methodology as much as the improved data collection will allow, and any changes will be carefully documented to permit comparisons between inventories. The methodology outlined below is that followed for the 2005 PSEI and as such may be somewhat modified, consistent with this philosophy.

5.2.1 On-Terminal

A combination of emission estimation methods was used due to the differences in type and level of detail of the data that was provided by the railroad companies. For line haul locomotives, horsepower-hour estimates were developed from operating parameters, and emission factors expressed in terms of mass of emissions per horsepower-hour were used to estimate emissions. The following terms were multiplied in the basic calculation:

- Number of trains per year
- Average number of locomotives per train
- Average locomotive rated horsepower
- Average in-use locomotive load factor
- Average on-port time per train

The equation can be summarized as:

$$\text{Activity, hp-hours/year} = \text{trains/year} \times \text{locomotives/train} \times \text{HP} \times \text{LF} \times \text{hours}$$

The result was multiplied by a pollutant-specific emission factor in grams per horsepower-hour (and divided by 453.6 g/lb x 2,000 lbs/ton) to calculate tons per year.

$$\text{Emissions, tpy} = \text{hp-hours/year} \times \text{g/hp-hr} / (453.6 \text{ g/lb} \times 2,000 \text{ lbs/ton})$$

The switching locomotive emissions were developed from fuel consumption estimates and emission factors expressed in terms of mass of emissions per gallon of fuel. This is a simpler calculation but was not used for line haul locomotives because the fuel consumption information provided by the railroads for line haul activity was not differentiated between port and non-port related rail activity. In addition, the EPA document that was the source of emission factors includes fleet average emission factors, in grams per horsepower-hour, for line haul locomotives for multiple years based on anticipated fleet turnover and the introduction of new lower-emitting locomotives. The emission factors for 2005 were used for the line haul locomotive calculations. Updated emission factors released by EPA in 2009 will be used for the 2011 PSEI.

The switching locomotive emission calculation can be summarized as:

$$\text{Emissions, tpy} = \text{gallons/year} \times \text{g/gallon} / (453.6 \text{ g/lb} \times 2,000 \text{ lbs/ton})$$

For the 2005 PSEI SO₂ emission calculation, offroad diesel was estimated to contain 3,500 ppm sulfur and ULSD was estimated to contain 50 ppm sulfur. Updated fuel sulfur content information, and information on the relative amounts of each fuel type used, will be sought by the rail working group for the 2011 PSEI

5.2.2 Off-Terminal

Off-terminal port-related locomotive emissions were estimated using emission factors provided by one of the railroads and from the EPA document containing year-by-year projections of average locomotive emission factors.

Emission estimates for overall locomotive activity and for maritime-related locomotive activity were developed using fuel consumption information and fuel-based emission factors. The railroads provided information on locomotive fuel use by county but were unable to differentiate maritime from non-maritime activity. Therefore, an attempt was made to estimate fuel usage on the basis of estimated numbers of trains and fuel consumption averages based on information provided by the Port of Tacoma and the Port of Seattle.

The Puget Sound Regional Council provided overall locomotive emission estimates for King, Pierce, and Snohomish Counties. In addition, the two Class 1 railroads provided fuel use information for Skagit and Whatcom Counties from which overall locomotive emission estimates were made. The remaining counties in the study area were assumed to have no significant locomotive activity, with the exception of Thurston County, through which trains operated by one of the Class 1 railroads travel on their way southward out of the area. No fuel information was provided for this county, but an attempt was made to estimate their port-related emissions.

The methodology for port-related emission estimates centered on estimates of the numbers of trains servicing the Ports of Tacoma and Seattle and the amount of fuel used by the trains as they traveled to or from those ports. Similar methods will be used for the 2011 PSEI but more specific information will be sought from the Class 1 railroads through the rail working group.

SECTION 6: HEAVY-DUTY VEHICLES (HDV)

6.1 Data Collection and Processing

Activity data represents the annual level of activities of heavy-duty vehicles (trucks and buses) operating within the port terminals and outside the terminals to the study area boundary, used for transporting port-related cargo and cruise terminal passengers. The on-terminal operations include waiting for terminal entry, transiting the terminal to drop off and/or pick up cargo, and departing the terminals. On-road operations consist of travel on public roads outside the terminals, both on port roads as well as outside port boundaries. Since actual activity data is not readily collected for each port-related truck trip, trip generation and travel demand models are used to estimate on-road truck volumes, distances and speeds required for estimating emissions. The activity data is unique to each year and could vary due to economic factors, regulations, and improvements in data collection.

6.1.1 Data Types

Truck activities as presented in the 2005 PSEI are represented by two primary areas of operation:

- On-Terminal Operations - within the boundaries of marine terminals or rail yards
- On-Road Operations - outside terminals, on port roads or on public roads outside the ports, within the boundaries of the U.S. portion of the Georgia Basin Puget Sound Airshed

6.1.2 Data Sources

The following sources of data provide the necessary activity and emissions data for estimating emissions from heavy-duty trucks and buses:

- The various ports taking part in the inventory process
- Puget Sound Regional Council for on-road traffic modeling
- Terminal Operators (for on-terminal operating parameters)
- Washington State Department of Ecology (for vehicle model year information and advice on choice of emission factor model)

6.1.3 Data Collected

Types of activity data collected from the above sources are listed below:

Terminals

- Number of truck trips through the terminal
- On-terminal speeds, time and distance traveled, and time spent idling
- Gate operating schedule
- Number of bus trips associated with cruise terminals

On-road estimates

- Travel estimates for roads within the study area

Model year distribution, if available from ports or other sources.

6.1.4 Data Collection Process

On-Terminal Truck Activities - Terminal operators are asked for information regarding on-terminal truck activity. This information included the number of truck trips through the terminal, gate operating schedules, on-terminal speeds, time and distance traveled on terminal while dropping off and/or picking up loads, and time spent idling at the entry and exit gates. Most terminals are able to provide estimates of these activity parameters, although few keep detailed records of information such as gate wait times and on-terminal turn-around time. Terminals provide the truck trip data over the phone or by email.

On-Road Operations - For on-road truck operations, activity data is estimated based on the trip generation and travel demand models run by the PSRC. Estimating the trucks' distribution of model years is another critical component necessary for estimating truck emissions and provides the basis for assigning the appropriate emission factors and speed correction factors. Truck model year information was obtained from the Washington Department of Ecology for the 2005 PSEI.

6.1.5 Data Processing and QC

On-Terminal and On-Road Data – Data provided by terminals regarding the operation of trucks while on terminal, and on-road data such as traffic modeling results, will be compared with the previous data obtained for the 2005 PSEI. It will also be compared with similar data from other port inventories. Obvious anomalies or significant differences from the previous data will be followed up on with the terminal contact or other data provider and corrections made as appropriate.

6.1.6 Data Defaults

Depending on the specificity of the data collected, defaults will be needed for various aspects of the HDDV activity characterization and emission estimates. Defaults will be average or typical values representing the unknown specifics, and may include such characteristics as model year distribution of trucks, average on-terminal speed, average time spent idling, etc.

6.2 Emission Estimating Methodology

The estimating methodology will be consistent with the 2005 PSEI methodology as much as feasible, and any changes will be carefully documented to permit comparisons between inventories. The methodology outlined below is that followed for the 2005 PSEI and as such may be somewhat modified, consistent with this philosophy.

6.2.1 On-Terminal

The MOBILE6 model was used to calculate emissions for HDVs in the 2005 PSEI. The 2011 PSEI will be based on either the latest release of the MOBILE model, and/or EPA's replacement model, called MOVES. The decision will be made by the Project Funding Committee after consultation with the state and regional air agencies. If the decision is made to use the newer MOBILE model for the 2011 PSEI, a comparison will be made to the 2005 inventory results.

The general form of the equation for estimating vehicle emissions is:

$$E = EF \times A$$

Where:

E = mass of emissions per defined period

EF = emission factor (g/mile or g/hour)

A = activity (miles driven or hours of idling)

Emissions were estimated by multiplying the miles driven or hours idling by the relevant emission factor. This general methodology will be carried over to the 2011 PSEI. If MOVES is used to develop the 2011 estimates, the process of estimating idling emissions will need to be reviewed.

6.2.2 On-Road

To calculate the on-road, off-terminal port-related HDV emissions in the 2005 PSEI, data was obtained from the Washington Department of Ecology's 2005 on-road mobile source emission inventory prepared for the state of Washington except for King, Pierce, Snohomish and Kitsap Counties. For these counties, the Puget Sound Regional Council (PSRC) conducted an analysis of on-road port-related HDVs.

The PSRC used the EPA MOBILE6 model to estimate emissions from on-road port-related HDV, which is consistent with the methodology used by Starcrest for the on-terminal calculations. Because the specific make-up of the truck fleet (in terms of vehicle classifications) is not known, composite HDV emission factors were developed for each pollutant based on the MOBILE6 emission factors and VMT fraction for each HDV vehicle classification listed above. The MOBILE6 input files used the most current vehicle registration data provided by the Washington Department of Ecology for calendar year 2005. This general methodology will be carried over to the 2011 PSEI.

SECTION 7: FLEET VEHICLES

7.1 Data Collection and Processing

Activity data represents the level of activities for fleet operating at the port terminals on an annual basis. As such, the activity data is unique for each year and could vary due to economic factors, regulations, and improvements in data collection, among other reasons. This subsection describes the data collection and processing steps including sources and types of raw data collected every year, quality control (QC) procedure used in reviewing the raw data and development of data defaults for missing parameters.

7.1.1 Data Types

Fleet vehicles include on-terminal light-duty fleet vehicles, passenger-owned vehicles using cruise terminal parking areas, minivans shuttling cruise passengers, and new import and export vehicles that are driven on to or off ocean-going vessels. Employee personal vehicles were not included.

7.1.2 Data Sources

Activity data was collected for fleet vehicles at the following Ports in 2005 and are expected to be the same for 2011:

- Port of Anacortes
- Port of Everett
- Port of Seattle – includes cruise terminal with passenger-owned vehicles
- Port of Tacoma – include auto facility with new import or export vehicles

The Ports of Olympia and Port Angeles did not report any fleet vehicles in 2005.

7.1.3 Data Collected

Data will be collected by e-mail requests and during in-person and phone interviews with terminal owners and equipment operators at the same time that cargo handling equipment data is collected.

The data collected includes:

- Vehicle model year
- Gross vehicle weight rating (GVWR)
- Type of fuel used
- Vehicle miles traveled (VMT)
- Vehicle speeds

In some cases, annual hours of operation and on-terminal speed limit were used to determine VMT.

7.1.4 Data Collection Process

For fleet vehicles data collection, the effort will focus on working with the Inventory Data Managers (IDMs) from the Ports of Tacoma, Seattle, Anacortes and Everett. If data is not collected by an IDM, then the PTPM will decide if that portion of the PSEI will be excluded from the update.

The deliverables for this task are the completed data spreadsheets ready for emissions estimating and updated data collection milestone matrix sheets on a quarterly basis (as determined by the PTPM). All data sets need to be completed and approved by 15 Mar 2012 in order to meet the report schedule. The PTPM will be responsible for determining if the report will be delayed if any of the IDM data is missing or to publish the report without those impacted sources.

7.1.5 Data Processing and QC

Review of fleet vehicle data collected includes reviewing the data received from operators. These files are initially reviewed to identify any missing information or obvious reporting errors or anomalies (e.g., negative values, values out of reasonable range). New data submitted is reviewed to identify new vehicles added or alternative fuels used. For missing or erroneous data, the operators are contacted for any subsequent corrections. However, if the operator is not responsive to provide the data in a timely manner, default values (discussed in the next subsection) are used for these parameters.

7.1.6 Data Defaults

Where the GVWR is unavailable, the vehicles will be classified by size based on manufacturer, model and vehicle description data provided. In a number of cases, data for representative vehicles will be averaged and applied to vehicles for which one or more parameters is unavailable.

7.2 Emission Estimating Methodology

As with the heavy-duty vehicles, the EPA MOBILE6 model was used to calculate vehicle emissions. The 2011 PSEI light-duty vehicle emissions will be estimated consistently with the decisions made for estimating heavy-duty vehicles.