Greenhouse Gas Emissions
Methodology and Findings

Introduction

The South Kitsap Industrial Area (SKIA) Planned Action Environmental Impact Statement (EIS) includes a detailed analysis of estimated greenhouse gas (GHG) emissions under three industrial development scenarios of differing intensities. The analysis provides a baseline estimate of existing GHG emissions for comparison against future (2030) development scenarios. The analysis also provides a menu of possible actions that could reduce lifetime GHG emissions by about 30% of the total estimate.

This Overview is intended to provide the reader with a summary of the EIS GHG analysis and contains an overview of the GHG analysis methodology, key findings and recommended mitigation.

Methodology

Existing greenhouse gas emissions within the SKIA subarea were calculated using the *SEPA Greenhouse Gas Emissions Worksheet* developed by King County[1]. Findings from the Worksheet were then tailored to recognize unique conditions of SKIA through (1) an area-specific analysis of vehicle miles travelled and (2) an analysis of GHG emissions resulting from aircraft operations at the Bremerton National Airport. Each step of this approach is described below, followed by key findings.

King County SEPA Greenhouse Gas Emissions Worksheet

The King County worksheet is a comprehensive spreadsheet tool that estimates GHG emissions related to the building materials, energy consumption, and transportation, as described below.

- *Building materials and processes (embodied emissions)*, which considers both the "upstream" (i.e., mining, harvest, manufacturing, and transport) and the "downstream" (operational use and maintenance) of building materials. The worksheet assumes a 62.5 year lifespan for industrial buildings.
- *Post-development energy usage*, which includes energy consumption such as heating and electrical usage. No consideration was made to whether or not the buildings would incorporate Built Green or Energy Star ratings, or LEED® ratings.
- *Transportation*, which includes vehicle travel of residences and employees. The King County default calculation includes statewide per capita annual vehicle miles assumptions for residents and employees.

Other uses that do not generate a substantial amount of traffic, such as forest land, were not included in the GHG emissions estimate. Using available information on existing development, the *King County SEPA GHG Emissions Worksheet* calculated that SKIA currently generates roughly 841,761 $MTCO_2e$ GHG emissions.[2]

[1] http://www.kingcounty.gov/property/permits/info/SiteSpecific/ClimateChange.aspx

[2] $MTCO_2e$, defined as Metric Ton Carbon Dioxide Equivalent; equates to 2204.62 pounds of CO_2. MCO_2e is commonly used in GHG analyses since it simplifies the reporting of GHG emissions to a single number.

Vehicle Miles Traveled (VMT) GHG Tool

To provide a more accurate estimate of the transportation related GHG emissions specific to SKIA, a more detailed transportation tool developed by Fehr & Peers was used. In this tool, land use information, such as the number of residents, employees, and square footage of building space is entered to estimate the number of vehicle trips generated by the study area. This trip generation estimate is then adjusted to account for factors like short vehicle and non-motorized trips that remain internal to the study area, trips made by other modes, and "pass-by" retail trips[3]. The tool also accounts for the location of the SKIA site, which is at the edge of the Bremerton urban area, and therefore has unique travel patterns associated with it.

Using this trip generation estimate, the tool calculates the total amount of vehicle-miles traveled (VMT) based on trip length survey results from the Puget Sound Regional Council and the US Census Bureau. The trip length data account for different distances that employees and residents travel for commute, shopping, and other types of travel. A separate trip length factor is also included to account for delivery and shipment of goods to and from industrial areas.

Trip length factors and existing/proposed land use data was entered into the VMT-GHG analysis tool. While the VMT-GHG tool is based on trip generation rates from the Institute of Transportation Engineers (ITE) Trip Generation document, traffic counts collected at SKIA indicate that the actual trip generation of the industrial and airport uses in SKIA is about half of the observed ITE rate. The locally observed trip generation information was used for the industrial and airport portions of SKIA.

The VMT-GHG tool estimates average weekday and annual GHG emissions. To develop lifetime (62.5 years) GHG emissions estimates consistent the King County Worksheets, annual GHG emissions estimates were factored up to 62.5 years. Based on this analysis, SKIA existing conditions transportation GHG emissions was estimated as follows: 32.5 $MTCO_2e$ weekly, 11,443 $MTCO_2e$ annually, and 715,182 $MTCO_2e$ lifetime.

When the King County SEPA GHG Emissions Worksheet is modified to include SKIA-specific lifetime transportation GHG emission estimates, existing development in SKIA is estimated to generate roughly 1,416,576 $MTCO_2e$ lifetime GHG emissions. It should be noted that this estimate is approximately 574,800 $MTCO_2e$ higher than the more generalized King County worksheets estimate without the VMT modification.

In-Air Transportation GHG Emissions

According to the Airport Cooperative Research Program (ACRP) Report 11: Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories (Transportation Research Board, 2009), GHG emissions from aircraft operations (take off, taxi, landing, travel to the airport) typically far exceed the GHG emissions of all other transportation sources (travel to the airport by cars, trucks, and busses, and tarmac vehicle activities like airplane tugs, baggage vehicles, and fuel tankers).

For the purposes of this analysis, the GHG emissions of aircraft operations were calculated consistent with the methodologies suggested by the ACRP Report. However, the emissions of tarmac vehicle operations were not calculated since there is not sufficient data about these types of vehicles and because these activities do not substantially contribute to the emissions of the airport.

[3] Pass-by trips are defined by ITE as vehicle trips that visit a land use solely because it is already on the traveler's primary route. In other words, the driver will make the trip along the road even if the land use was not there, but a trip to the land use is made because it is in the way to the primary destination. Pass-by trips are only valid for retail uses and constitute a substantial portion of trips to uses like gas stations, fast food restaurants, and supermarkets.

The ACRP Report recommends that in-air GHG emissions associated with an airport be calculated for departure flights only. This is to avoid double-counting GHG emissions between departure and arrival airports. This methodology is widely recognized and has been adopted by other airports in the region, including the Seattle-Tacoma International Airport and King County International Airport/Boeing Field. Since it can be difficult to determine the exact flight patterns (destination, route, speed, etc.) of all departing aircraft, the ACRP Report suggests that fuel consumption at the airport be used to estimate GHG emissions.

Average annual GHG emissions were calculated by using average annual fuel sales at the Bremerton National Airport, CO_2 emissions factors from the US Department of Energy, and a CO_2e conversion factor from the US EPA. Lastly, to report GHG emissions consistent with other land uses in the King County spreadsheet, a lifetime GHG emissions estimate was calculated. This lifespan GHG calculation may be less meaningful than the other lifespan GHG estimates in the King County spreadsheet since it assumes no increase or decrease in aircraft operations over the long-term. Consistent with other industrial and service uses, the lifespan of the Bremerton National Airport was assumed at 62.5 years. GHG emissions in metric tons of carbon dioxide are estimated at 2,443 annually and 152,658 lifetime (62.5 years).

Key Findings

The table below summarizes greenhouse gas emissions estimates from the existing development within SKIA based on the methodologies discussed above. The completed SEPA Greenhouse Gas Emissions Worksheets, as well as an explanation of the methodology employed to create the formulas, are included in the SKIA Planned Action Final EIS, Appendix 3.

Estimated Greenhouse Gas Emissions

Development Scenarios	Estimated GHG Emissions in $MTC0_2e$		
	King County Worksheet		
	No Modifications	Modified by SKIA-specific VMT GHG Tool	Modified by SKIA-Specific VMT GHG Tool and ACRP Report
Existing Conditions	841,761	1,416,576	1,569,234
EIS Alternatives			
Alternative 1 (No Action)			2,113,862
Alternative 2 (Preferred Alternative)			10,219,963
Alternative 3			14,252,847

Factoring in SKIA-specific modifications for VMT and aircraft operations to the King County Worksheet, total existing SKIA lifetime GHG emissions are estimated at 1,569,234 $MTC0_2e$. This same approach was used to estimate future GHG emissions under the alternatives considered in the SKIA Draft Planned Action EIS. Total estimated lifetime GHG emissions with full development of the Preferred Alternative (Alternative 2 in the EIS) are estimated at 10,219,936 MTC02e. Using this estimate as a starting point, potential site design and operations measures to reduce GHG emissions by about 30% are shown on the last page of this flyer.

Recommended Mitigation

One of the key goals of the SKIA subarea planning process is to identify strategies to reduce GHG emissions by about 30% over the baseline condition. The menu of strategies identified below is provided in the EIS as a range of actions that could achieve this goal.

GHG Reduction Strategy	Estimated Emissions Reductions ($MTC0_2e$)[1]
Green Building Standards	912,695
Renewable Electricity	305,570
Energy Efficient Outdoor Lighting Standards	73,016
Compact Development Standards (with forest retention)	1,887,000
Mandatory Commute Trip Reduction Program	78,078
Expanded Vanpool/Transit	60,060
Additional Housing Near SKIA	249,849
Support Retail and Services	39,039
Efficient Transportation Design Standards	3,000
Encourage Locally Serving Industries	19,519
Total (% reduction)	**3,624,826 (35%)**

1. *Assumes the Preferred Alternative defined in the Final EIS.*

As shown, the most effective potential strategies include compact development standards (with forest retention), green building standards, and on-site renewable electricity generation. It should be noted that the results in this table show the cumulative GHG emissions reduction benefit from enacting each strategy. However, if several strategies are implemented as part of the reduction package, the resulting GHG emissions could be less than the sum of the total package of strategies. For example, the adoption of green building standards could include components that overlap with energy efficient outdoor lighting. However, since not all the GHG emissions strategies overlap and since the total potential reductions exceed 30%, a comprehensive package to meet the goals of the project can be developed. As SKIA develops, efforts will be made to monitor and track actual GHG emissions to ensure that they are consistent with the intent of the Subarea Plan.