
Pedro Bay Emissions Inventory Results

Presented by:

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Welcome to Pedro Bay, Alaska!



Pedro Bay Introduction

- Community Location: Lake Iliamna, Southcentral Alaska
- Lake Iliamna: largest lake in AK, 3rd largest fresh-water lake in USA.
- Community Size: 42 year-round residents, 40 additional seasonal residents
- Two commercial fishing lodges
- Two Air Cargo providers
- Three regional Air Passenger providers
- One small electrical generating unit



Typical Rural Alaska Village

- No roads access- access by boat or air *only*
- Dirt roads, trails, and unpaved airport
- No requirement for vehicle registration
- Few vehicles – mostly ATVs and snow machines
- Trucks used for government operations, hauling trash, wood collection, loading boats.
- Subsistence and Recreation are primary activities
- Home heating - wood and diesel (monitors)
- Landfills - cold climate and slow decomposition, some incineration.
- No public utilities: septic fields, sewage lagoon , and well water.
No electric grid – diesel generator – minor on no permits

Project Background

- Pedro Bay committed in 2018 IGAP Plan to conduct a Greenhouse Gas (GHG) and Criteria Air Pollutant (CAP) inventory.
- Inventories will be used to support decisions made by tribal council, and in community forums, to develop a Climate Action Plan.
- DEC was asked for support – had completed residential inventories in the past to support NEI efforts.
- DEC agreed as it could use the emissions inventory to supplement available data for the 2017 Triennial NEI, test the EPA GHG Toolkit for tribal governments (free online), and understand emissions from remote recreation facilities and subsistence activities.
- First time that EPA Tribal GHG toolkit has been used in any capacity in AK

Study Structure

Study Sectors

1. Household
2. Government
3. Commercial

Data Collection Process

- DEC developed “Source Lists” to identify information to be collected
- Survey forms were developed from source lists.
- Met with community contacts to ensure adequate collection



EPA Tribal GHG Toolkit

<https://www.epa.gov/statelocalenergy/tribal-greenhouse-gas-inventory-tool>

EPA GHG Toolkit

- Released in last three years
- Excel-based spreadsheet
- Automatically tabulates emissions
- **Free!**

ICLEI GHG tool – Requires membership, \$\$ and reduction targets.

- Majority of participants are urban communities
- AK wanted to try the tool. Lots of small community interest in emissions footprint.

Tribal Greenhouse Gas Inventory Tool

EPA's Tribal Greenhouse Gas Inventory Tool was developed to help tribes across the United States to evaluate their greenhouse gas emissions. Use this tool to compile a greenhouse gas (GHG) inventory for your entire tribe or for tribal government operations in particular.

[Download the Tribal Greenhouse Gas Inventory Tool and sign up for updates.](#)

What is the Tribal Greenhouse Gas Inventory Tool?

This free, interactive spreadsheet tool calculates GHG emissions for many sectors, including residential, commercial, transportation, and waste and water management. The tool is comprised of two separate modules: one for community-wide inventories, the other for inventories of tribal government operations only. You may choose to use one or both modules.

The tool is pre-programmed with default emission factors and system assumptions needed to calculate emissions or you may enter community-specific information. The tool is scalable to accommodate different levels of activity data to meet the needs and constraints of different tribal governments.

Who should use the Tribal Greenhouse Gas Inventory Tool?

The tool is designed for tribal governments interested in compiling a relatively quick and simple GHG inventory. People interested in emissions from specific facilities should consult [EPA data on greenhouse gas emissions from large facilities](#). The data set includes public information from facilities



Household Emissions Calculations

- Household emissions were broken into three main categories:
 - Transportation
 - Home heating
 - Other: total fuel use, motorized equipment, outdoor burning, etc.
- Information gathered for both summer and winter usage
- First time that ADEC has been able to quantify core cultural and subsistence activities.



Residential – Cultural & Subsistence Activities

- Represent an underreported segment of rural AK emissions.
- These emissions include:
 - Subsistence Gathering (Fishing, hunting, etc.)
 - Subsistence Preparation (Smoking/drying)
 - Cultural Practices (Sauna/steam bath, camps)
- Collected fuel use, estimated hours of use for CAP and GHG calculations
- Recreation overlaps cultural and subsistence practices



Government Emissions Calculations

Government calculations include community support operations and infrastructure:

- Transportation
- Electrical generation
- Port and fuel operations
- Waste management
- Infrastructure and housing
- Small government emissions sources (Under 100 KW emergency generators, etc.)
- No local private industry to offer services such as fuel sales, housing, etc.



Commercial Operations

Air Cargo/Passenger - DOT information, cargo operators.

Barging Operations – used in summer only

Lodge Emissions – summer only

- Lodge emissions based on assumed information. In June, DEC interviewed lodge operators and will be making final calculations.
- Lodge electricity provided by village.
- Average lodge emissions footprint as follows:



Average Lodge Emissions Footprint

- 12 guests/week
 - ~26 LTOs/week (13 rec flights)
- 2 lodge ATVs
 - 4 hrs./week total use
- Propane-fired dryers: Guest and employee use
 - ~20 hrs. use/week
- Grounds keeping equipment
 - 3 hrs. use average
- 4-6 marine craft (recreational use)
 - ~16 hrs. use/week
- Above figures averaged between both lodges over 16 weeks operation per summer



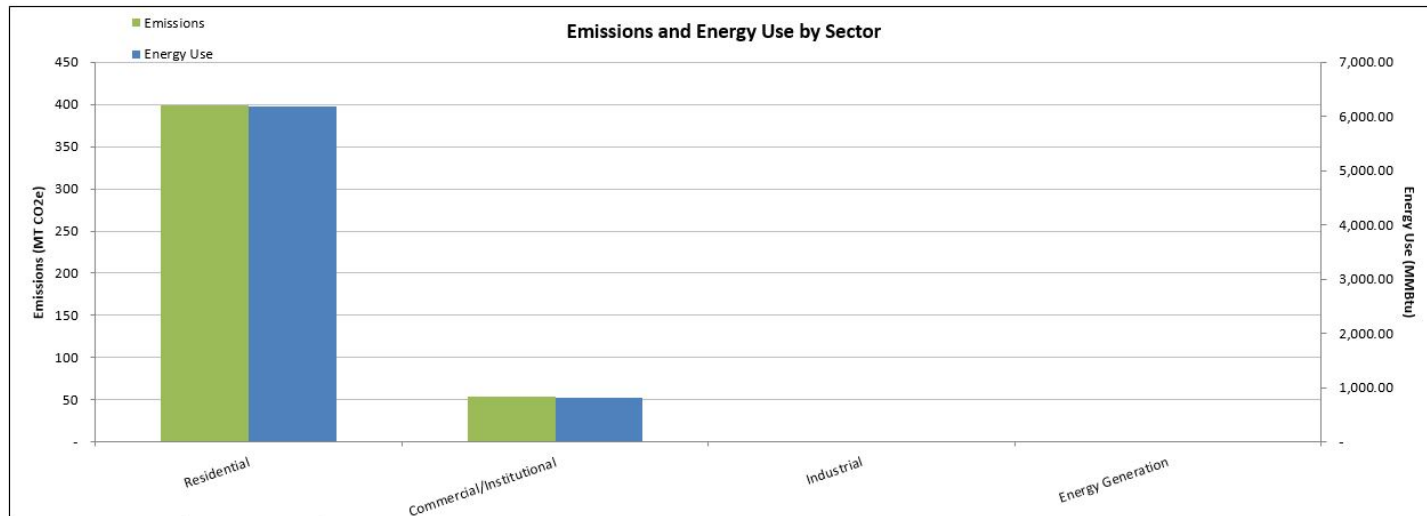
Emissions Calculations: GHGs

Sector Summary

Emissions by Sector (MT CO ₂ e)				
Sector	CO ₂	CH ₄	N ₂ O	Total
Residential	398	0	0	398
Commercial/Institutional	54	0	0	54
Industrial	-	-	-	-
Energy Generation	-	-	-	-
Total Stationary Combustion Emissions	452	0	0	453

Fuel and Energy (MMBtu) Consumption by Sector				
Sector	mcf	gal	tons	Energy Use
Residential	-	61,788	-	6,179
Commercial/Institutional	-	7,443	-	812
Industrial	-	-	-	-
Energy Generation	-	-	-	-
Total Stationary Combustion Energy Use	-	69,231	-	6,991

Check to display: Emissions Energy Use



- GHG emissions calculated by sector - EPA Toolkit based on emission source by sector, fuel-consumption, and activity data (hours/miles, etc.)
- Most inputs were the same as CAP information needed.

Emissions Calculations: GHGs

- The GHG tool requires external research.
- For several emissions sources, specialized MPG data had to be researched for fuel consumption inputs. These included:
 - Aircraft
 - ATVs
 - Heavy Machinery
 - Trucks/SUVs
- Landfill Operations – based on CARB tool



Emissions Calculations: CAPs

- Previous DEC residential surveys - CAP emissions required additional updates for new EF's.
- Updated EF's, or updated fuel consumption figures:
 - Wood stoves (Catalytic)
 - Propane stoves/dryers, etc.
 - ATVs
 - Aircraft
 - Snowmobiles
 - Residential Campfire
- Updated EF to match updated NEI SCC codes



Wood Stove CAP Calculations

- Wood - Most widely used stationary fuel source in area
- Community wood stove change-out driven by cost savings. All old stoves replaced with new EPA-certified catalytic stoves
- Previous EF's and SCC codes did not represent catalytic stove emissions
- Utilized CARB EF's for catalytic stoves.



Aircraft CAP Calculations

- DEC 2005 study on emissions for aircraft typically used in rural AK
- Contacted commercial operators for types of aircraft used
- Generated updated EF's for both the landing and take-off cycle, as well as cruise emissions
- Researched number of LTOs and commercial lodge operations
- EF's had never been applied to residential inventories
- Two privately owned planes in village.



Photos courtesy of Alaska Department of Environmental Conservation, Everts Air Cargo, and Desert Air Cargo Websites

ATV CAP Calculations

- ATVs - Most commonly used vehicle in Pedro Bay
- Necessary to have updated EF's for newer ATVs - previous studies used AP-42 based EF's going back to 1980s.
- Utilized CARB EF's for ATVs
- Newer ATVs had a much smaller emissions footprint than older ATVs (few older ATVs in Pedro Bay)



Emissions Inventory Results: Wood Fuel Combustion (GHG and CAP)

Wood Stoves

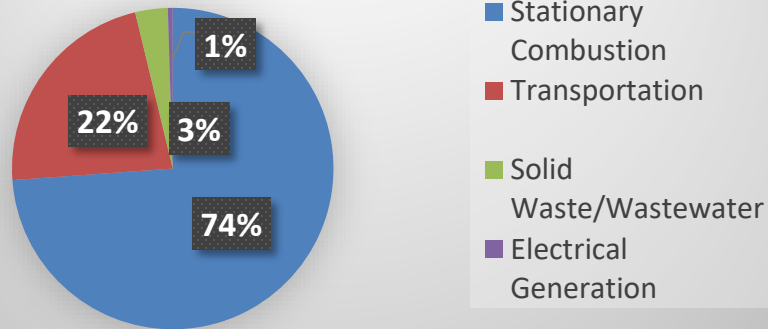
- A typical household burned 1.75 cords of wood in their wood stoves.
- Woodstoves released 284 Metric Tons carbon dioxide (CO₂), 1 ton methane (CH₄) and 2 tons Nitrogen Dioxide (N₂O)
- Woodstoves released 4 tons of Carbon Monoxide (CO), 154 lbs. Nitrogen oxides (NOX), and 0.75 tons of Particulate Matter (PM) 10 and PM2.5 each.

Saunas and Smokehouses (calculated for CAPS only)

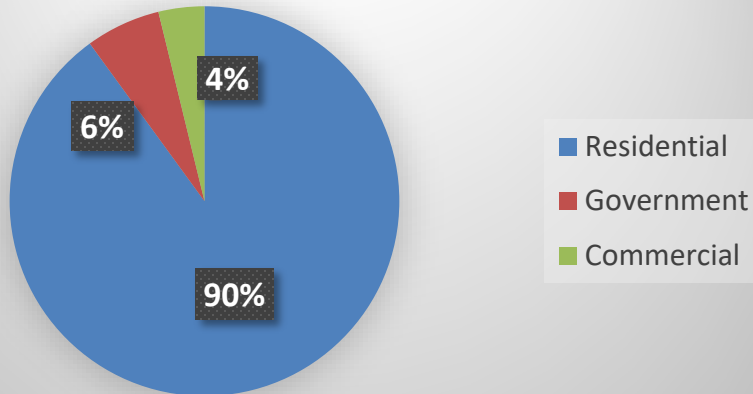
- Sauna Emissions: 2 tons CO, 760 lbs. PM10, 732 lbs. PM2.5, 65 lbs. NOX
- Smokehouse Emissions: 3.25 tons CO, 861 lbs. PM10, 830 lbs. PM2.5, and 73 lbs. NOX.
- **Propane use for refrigerators, dryers, wood stand-in**

Sector Results

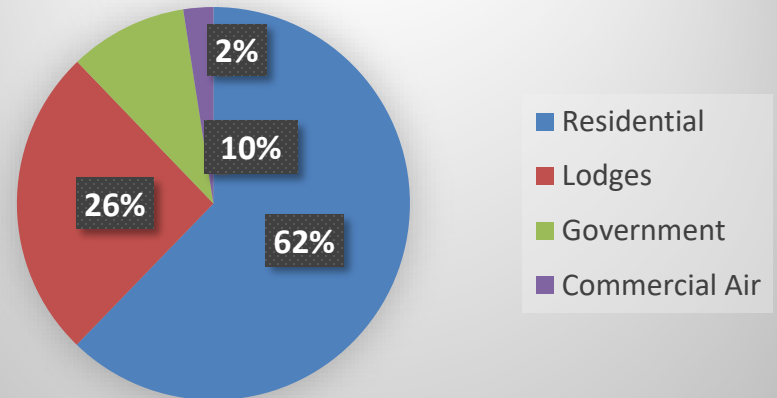
Greenhouse Gas Emissions Total



Hydrocarbon Emissions



Carbon Monoxide Emissions

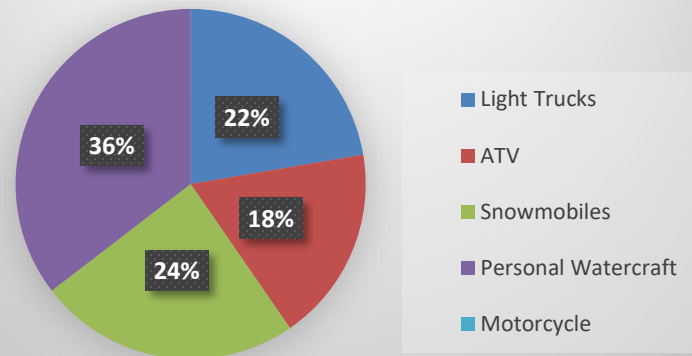


Results: Residential Transportation (GHG and CAP)

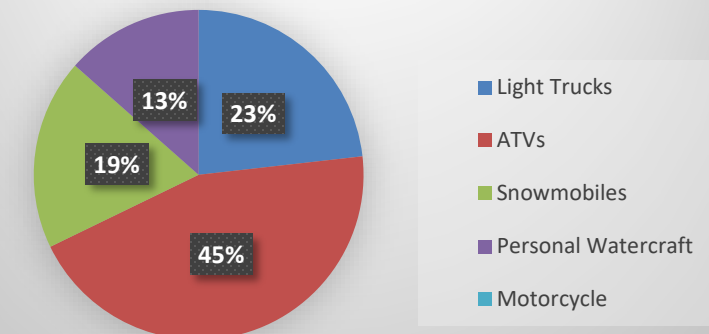
Mobile Emissions

- Includes seasonal use. ATV vs. snow machines
- **Largest source of CAP emissions:** Boats, followed by ATVs, Snowmachines, and Light Trucks/SUVs.
- **GHG Emissions:** Residential gasoline consumption (including SUVs, ATVs, Snowmachines, and Boats)=5289 gallons of gasoline, producing 48 Metric Tons of CO₂.

Residential Transportation CAP Emissions - Particulate Matter



Residential Transportation CAP Emissions - Carbon Monoxide



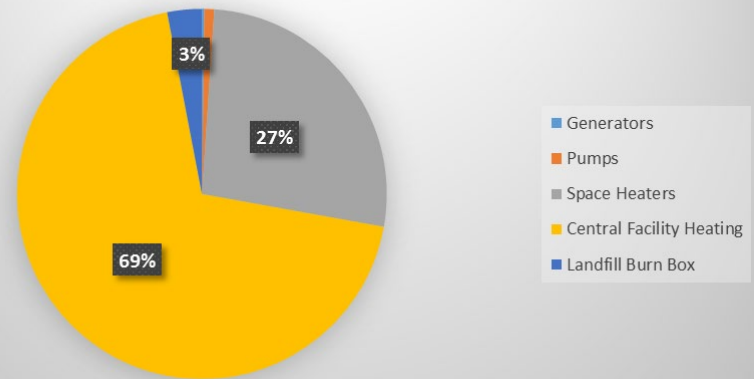
CAP Results: Government Stationary Sources

Sources

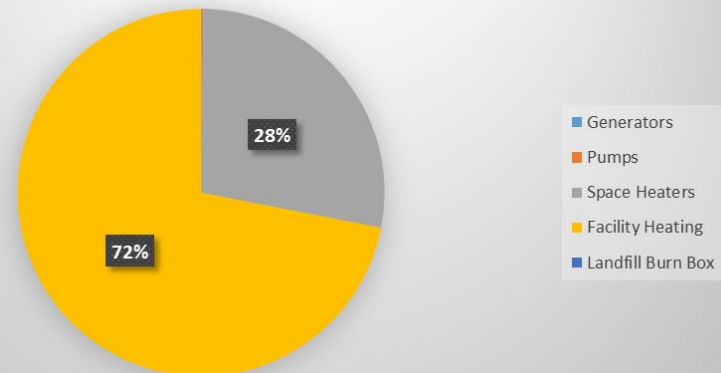
Stationary Emissions

- *Facility heaters:* 10,644 lbs. (5.322 tons) CO, 851 lbs. PM10, 825 lbs. PM2.5, 5307.1 (2.65 tons) Hydrocarbons.
- *Space Heaters:* 4121.90 lbs. (2.06 tons) CO, 329 lbs. PM10, 319 lbs. PM2.5, and 2033.30 lbs. (1.01 tons) Hydrocarbons

Government Stationary Sources Carbon Monoxide



Government Stationary Sources - Particulate Matter

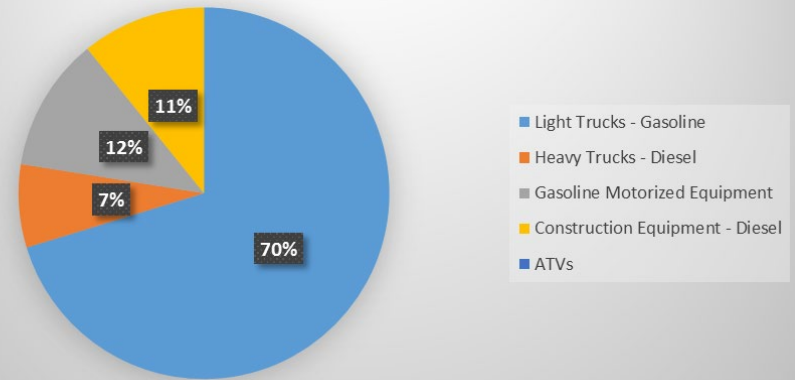


CAP Results: Government Transportation

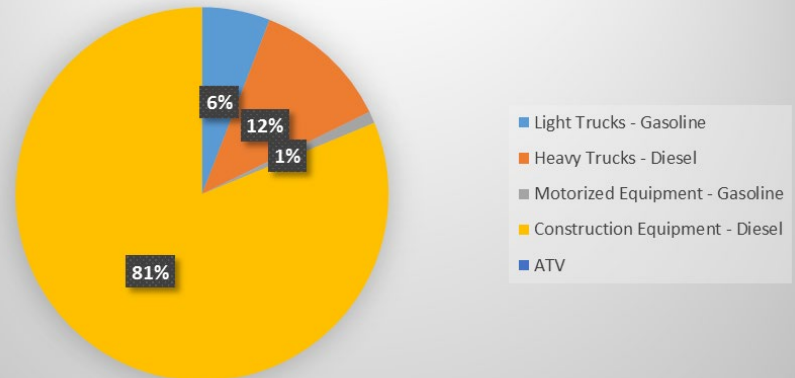
Mobile Emissions

- *Light Trucks/SUVs*: 1576.85 lbs. (0.78 tons) CO, 4 lbs. PM10, 2.7 lbs. Pm2.5, and 304 lbs. Hydrocarbons.
- *Light and Heavy Motorized Equipment*: 1 ton CO, 1 lb. PM10, 0.78 lbs. PM2.5, and 50 lbs. Hydrocarbons.
- *Heavy Diesel Machinery*: 212 lbs. CO, 557 lbs. NOX, 34 lbs. PM10, 60 lbs. PM2.5, and 46 lbs. Hydrocarbons.

Government Transportation Sources - Carbon Monoxide



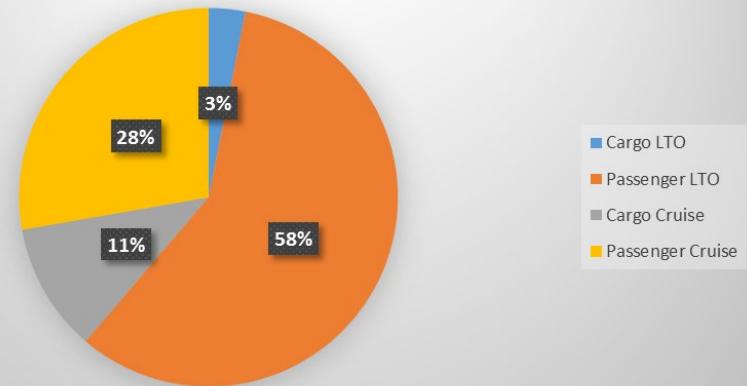
Government Transportation Sources - Particulate Matter



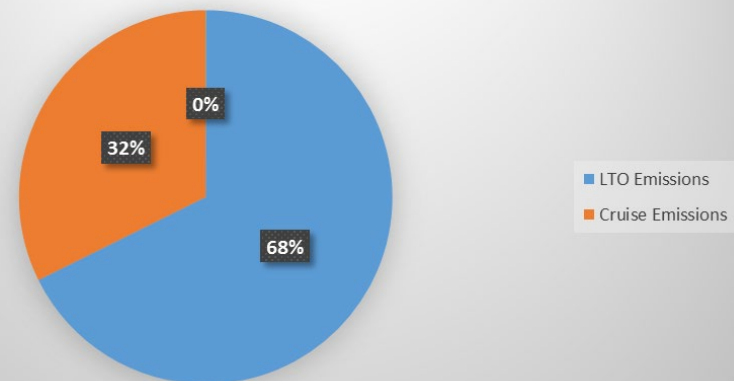
CAP Results: Commercial Passenger/Cargo Air Carriers

- **Passenger Flights:** 13164 lbs. (6.582 tons) CO, 1293 lbs. Hydrocarbons, 413 lbs. PM10, and 340 lbs. PM2.5.
- **Cargo Flights:** 2168 lbs. (1 ton) CO, 156.42 lbs. Hydrocarbons, 21.2 lbs. PM2.5, and 18.4 lbs. PM10.
- **Passenger and Cargo GHG Emissions:** 81 tons CO₂ total, created by burning 9795 gallons of Aviation Gasoline
- **Does not include commercial fishing flights**

Commercial Aircraft Emissions: Cargo and Passenger Carbon Monoxide (LTO vs. Cruise)



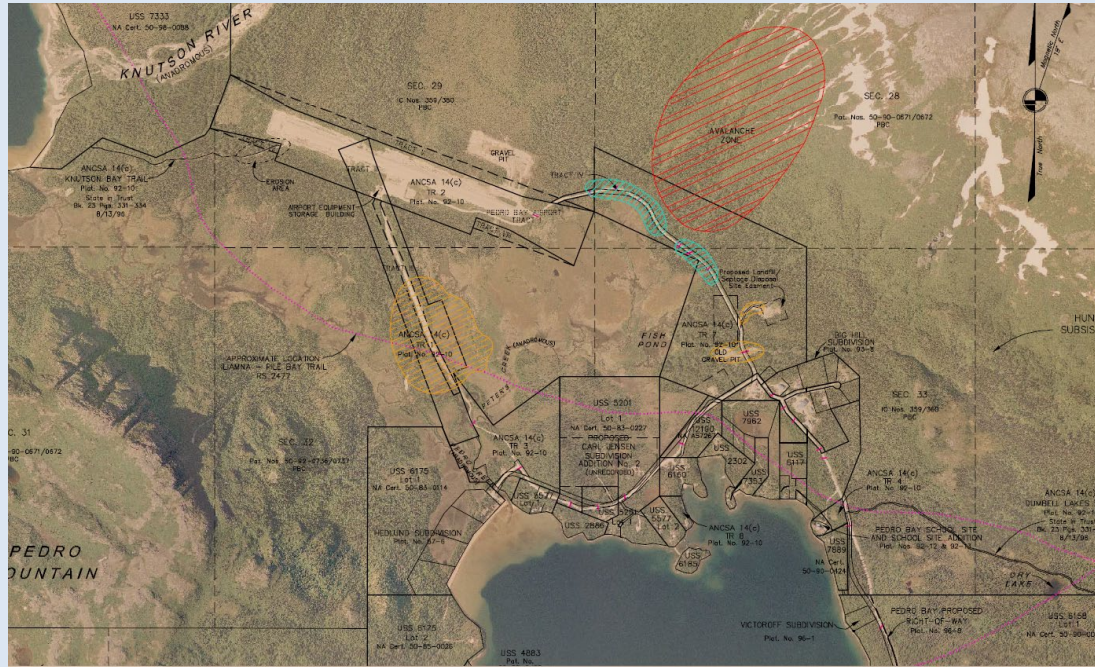
Commercial Passenger Aircraft Emissions - Carbon Monoxide (LTO vs. Cruise)



GHG Results: Landfill, Wastewater, and Electricity

- Landfill and wastewater emissions produced in GHG calculator
- Landfill produces approximately 1 Metric Ton (MT) of Methane per year. landfill emissions are calculated using British Columbia. No true geographical equivalency.
- Wastewater emissions - 8.70 MT of Methane per year based on current usage patterns in the community.
- Community currently generates 12,125 kWh electricity = 2.8 MT of CO₂ from the community's diesel power generator.
- Tool has no ability to show credits for composting, recycling, separation of biological waste, or other landfill use reduction strategies.

GHG Results: Land Use/Land Change



Calculations based on total area of community with vegetation 85%

Total gross emissions from the community top out at 603 MT CO₂e/year

Carbon Sequestration: 12,162.79 MT CO₂

All village GHGs emissions are offset by vegetation!

DEC Review of EPA GHG Toolkit

- Positives:
 - **Free!**
 - Great data graphics creation
 - EPA Customer Service:
Responsive to questions and fast assistance on spreadsheet errors.
 - Covers most emissions sources and fuel types
 - Mostly user friendly, some training required.
- Negatives:
 - No way to include emissions offset credits: Recycling program, building insulation, composting, etc.
 - **No wood fuel source**
 - Some training required for immediate use. Village reps let DEC test the tool so some components could be simplified.
 - Waste emissions not integrated into spreadsheet.
 - Landfill section was difficult to understand.
 - Didn't address AK climate regions. Alaska is huge! For large states need multiple selections

Ending Thoughts

- DEC currently working on filling in gaps with data from lodges collected during June site visit.
- Final report will be published before the end of the summer (August/September 2019)
- Goal is for the emissions inventory to serve as a model for other communities in AK to undertake their own inventories and understand their environmental footprint.
- Community used EI findings in associated Climate Action Planning meeting June 2019. Community discussions resulted in a shift to adaptation and response planning.
- Future presentations possible with EPA Region 10 and other interested tribal entities in the State of Alaska.

Project Personnel

Alaska Department of Environmental Conservation

- Molly Birnbaum: DEC - Air Quality
- Alida Bus: DEC- Air Quality
- Paul Goodfellow: DEC - Air Quality
- Stephen Price. DEC – Environmental Health (Waste Management)

EPA

- J.R. Herbst: Environmental Protection Agency, Region 10, Seattle Offices
- Michelle Davis: Environmental Protection Agency, Region 10, Anchorage Offices
- Erin McTigue: Environmental Protection Agency, Region 10, Seattle Offices
- Karl Pepple: Environmental Protection Agency, Region 10, Seattle Offices

Pedro Bay Environmental Office

- Ben Foss: Pedro Bay Environmental Office
- Wynn Knighton: Pedro Bay Environmental Office

Thank you!!

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