Representative Community Emissions Inventory

May 17, 2006

Purpose

- WRAP Emissions Forum is responsible for compiling emission inventories for use in meeting regional haze requirements
- The goal of this project is to improve emission estimates for rural areas of Alaska
- Emissions in Anchorage, Fairbanks and Juneau are very well documented
- Little is known about emissions from communities in the rest of the State, including
  - 45 mid-sized (population of 2,000 – 59,332) and
  - 329 small (population of <2,000)

Approach

- Review demographic data and define common regions within the state
- Work with Alaska Native Coalition on Employment and Training (ANCET) members to identify target communities
- Recruit local ANCET staff to participate
- Send letter to tribal council explaining purpose of the study
- Establish contracts with ANCET members to cover survey expenses
- Design surveys, circulate for comment

Approach (con’t)

- Conduct residential surveys (home interviews)
- Conduct non-residential surveys
- Build data base with survey results
- Compute community specific emission estimates
- Prepare and present report of results to tribal councils
- Extrapolate results to rest of communities
- Document results

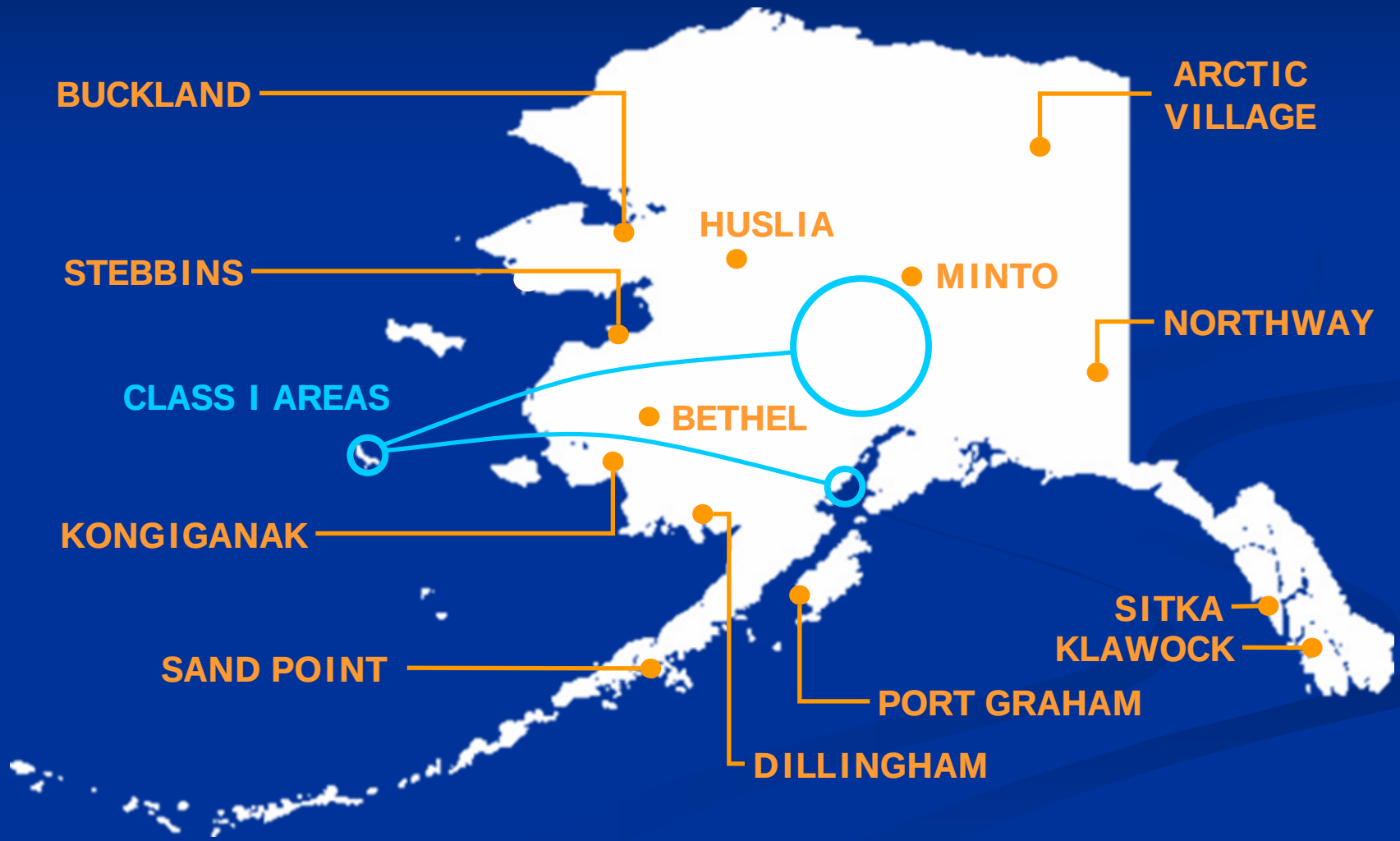
Sampling Plan

- Define common regions – A total of six selected
- Set criteria for selecting representative communities
  - Location (latitude, coast, river, highway, etc.)
  - Population
  - Proximity to Class I areas impacted by regional haze
  - Representativeness of other villages within region
  - Assess willingness to participate (iterative process)
  - Goal of selecting 2-3 communities/region
  - Total of 13 communities selected – Mixture of hubs and smaller communities

Selected Communities

Tribal Association	Community	Population
Tanana Chiefs Conference	Arctic Village	147
Assoc. of Village Council Presidents	Bethel	5,960
Kawerak	Buckland	434
Bristol Bay Native Association	Dillingham	2,370
Tanana Chiefs Conference	Huslia	265
Tlingit & Haida Central Council	Klawock	780
Assoc. of Village Council Presidents	Kongiganak	167
Tanana Chiefs Conference	Minto	202
Tanana Chiefs Conference	Northway Village	99
Chugachmiut	Port Graham	134
Aleutian Pribilof Islands Association	Sand Point	939
Tlingit & Haida Central Council	Sitka	8,947
Kawerak	Stebbins	596

Alaska Communities Participating in WRAP Survey



Survey Approach

- Work with ANCET member or local tribe to identify someone living in each community to conduct the survey
  - Approach varied by community, ANCET not always involved
  - Frequently involved ANCET staff located in the village working with village youth to collect the data
- Negotiate contracts with ANCET members/tribe to
  - Recruit staff
  - Establish contacts with village councils
  - Cover expense of collecting data
  - Transmit results to Sierra
  - Travel to villages to present results

Survey Approach (con't)

- Send out post cards to announce the survey to homes
- Send letter to tribal councils describing purpose of the study
- Review purpose of study and content of surveys with local staff and youth prior to the start of the survey
- Respond to questions as they occur

Residential Surveys

- Minimum target of 30 responses per community per season
- Survey designed for in-home interview
- Information collected on both activity (e.g., hours, miles, etc.) and fuel use (e.g., cords, gallons, etc.)
- Goal is to be able to report both emissions and fuel use statistics back to the community
- Fuel categories include
  - Wood (cords)
  - Fuel oil (gallons)
  - Propane (gallons)
  - Other

Nonresidential Surveys

- Covers all facilities not addressed in residential surveys
- Facilities include
  - Airports
  - Schools
  - Fuel suppliers
  - Marinas and ports
  - Utilities (electricity generation, water treatment, etc.)
  - Landfills
  - Hospitals and clinics
  - Municipal offices
- Information collected on both activity (e.g., hours, miles, etc.) and fuel use (e.g., gallons, etc.)
- Surveys provided to all communities
- Limited response

Summary of Responses

Community	Residential		Non-Residential	
	Summer	Winter	Summer	Winter
Arctic Village	30	31	▪Fuel Supplier ▪Health Clinic ▪Electric Company ▪Landfill	
Bethel	62	63	None	None
Buckland	30	30	▪General	▪General
Dillingham	35	29	▪City Operations ▪Refuse ▪Wastewater Treatment Facility	None
Huslia	26	30	▪Landfill ▪City Operations ▪Wastewater Treatment Facility ▪Health Clinic ▪Jimmy Huntington School	

Summary of Responses (con't)

Community	Residential		Non-Residential	
	Summer	Winter	Summer	Winter
Klawock	50	51	▪Klawock Island Fuels ▪Klawock Heenya Corporation ▪Alicia Roberts Medical Center ▪Klawock City School ▪Klawock Boat Harbor Operations ▪Wastewater Treatment Facility ▪Klawock Landfill ▪Klawock Village Council Operations ▪Viking Lumber Company ▪Electric Utility	
Kongiganak	29	28	▪General	
Minto	27	29	▪Minto Health Clinic ▪Minto School	
Northway Village	30	30	▪Airport	

Summary of Responses (con't)

Community	Residential		Non-Residential	
	Summer	Winter	Summer	Winter
Port Graham	29	32	▪Corporate Operations ▪Clinic ▪Wastewater Treatment Facility ▪Village Council Operations ▪Marine Operations ▪Landfill ▪Airport ▪Fuel Supplier ▪School ▪Homer Electric Association	▪Corporate Operations ▪Clinic ▪Wastewater Treatment Facility ▪Village Council Operations ▪Marine Operations ▪Landfill ▪Airport ▪Fuel Supplier
Sand Point	18	18	▪Wastewater Treatment Facility ▪City Operations ▪City Landfill	
			▪Peter Pan Seafoods ▪TDX Power Corp ▪Fuel Supplier	None

Summary of Responses (con't)

Community	Residential		Non-Residential	
	Summer	Winter	Summer	Winter
Sitka	▪Alaska DEC (state provided) data			
Stebbins	None	53	None	None

Emission Calculations

- Review survey responses – Many follow up questions
- Enter responses into database
- Develop common community spreadsheet template
- Organize emissions and fuel use calculations
- Residential categories
  - Home heating
  - Camp heating
  - On road transportation
  - Off road transportation
  - Home motorized equipment
  - Camp motorized equipment
  - Home outdoor burning
  - Camp outdoor burning

Emission Calculations (con't)

- Nonresidential – Follows survey categories
- Establish key assumptions
  - Fuel use units reported
  - Fuel use heating rates
  - Average speeds (on and off road)
  - Percent of roads paved/unpaved
  - Silt content, etc.
- Select representative seasonal emission factors
  - MOBILE6
  - Nonroad
  - AP42
- Compute average household emission/fuel use by season
- Adjust to village population levels

Emission Calculations (con't)

- Separate approach used for commercial marine, aircraft and electricity production
- Commercial marine
  - Poor survey response
  - Activity levels highly variable
  - Disconnect between fuel use and emissions
  - Adjust ADEC estimates for selected ports
    - Modify vessel categories
    - Account for ferry schedule
    - Account for registrations
    - Account for fishing permits
    - Standardized estimates to within 25 miles of port

Emission Calculations (con’t)

- Aircraft
  - Community specific results taken from ADEC estimates
- Electricity generation
  - Fuel use values taken from Power Coast Equalization records

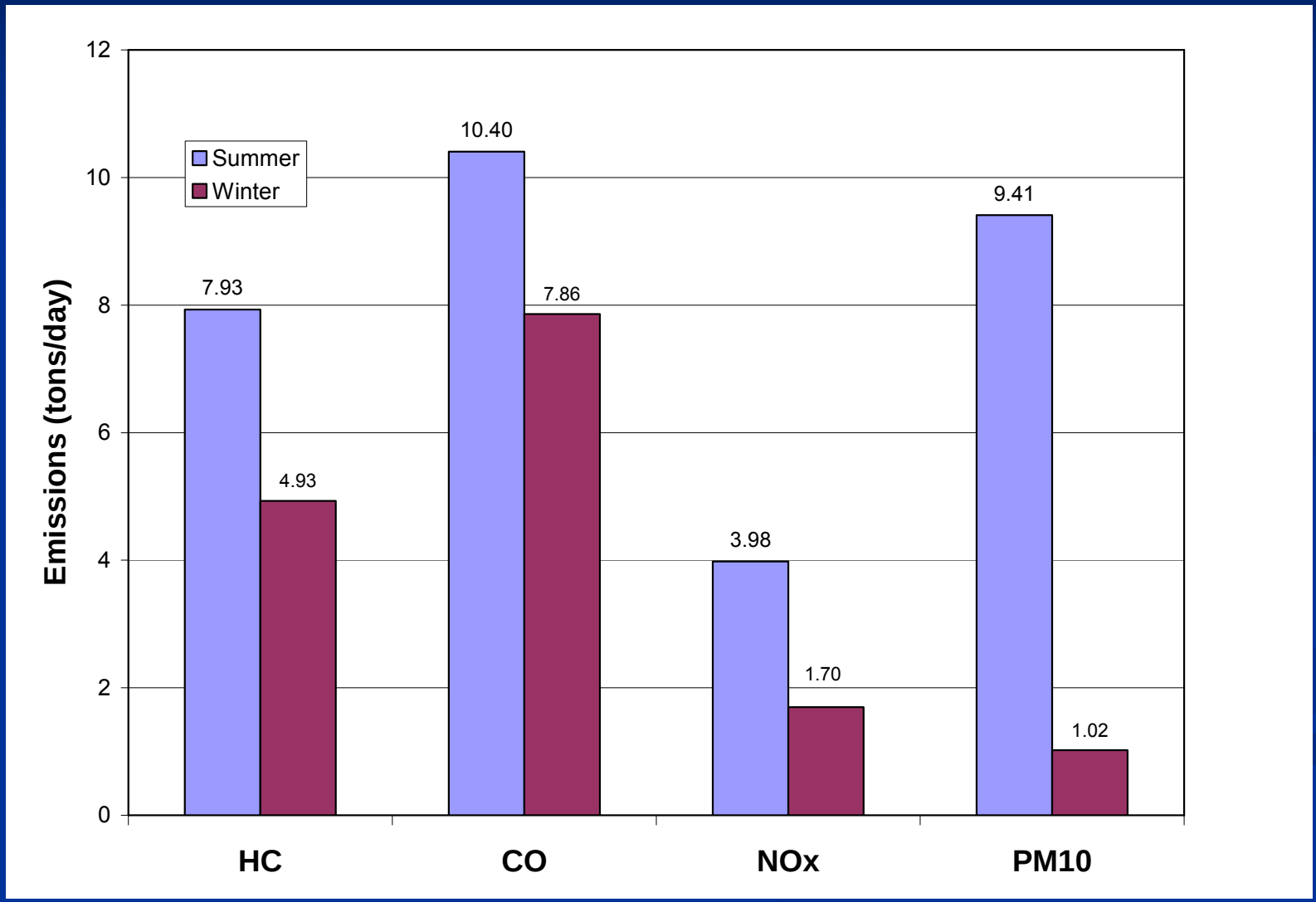
Annual Emissions By Community

Community	Total Annual Emissions (tons/day)			
	HC	CO	NOx	PM10
Arctic Village	3.97	2.78	0.08	1.45
Bethel	15.10	15.66	2.71	5.13
Buckland	1.05	1.60	0.06	0.43
Dillingham	13.35	13.01	1.83	5.10
Huslia	0.49	0.73	0.04	0.58
Klawock	2.03	2.44	0.20	1.49
Kongiganak	0.97	1.02	0.04	0.13
Minto	1.16	1.03	0.07	0.70
Northway Village	0.64	0.70	0.09	0.39
Port Graham	0.39	0.27	0.03	0.22
Sand Point	0.07	0.40	0.73	45.82
Sitka	0.98	6.99	4.27	2.38
Stebbins	2.51	2.27	0.14	1.34

Annual Residential Fuel Use By Community

Community	Annual Residential Use				
	Wood (cord)	Fuel Oil (gal)	Propane (gal)	Gasoline (gal)	Diesel (gal)
Arctic Village	9,473	6,360	1,837	116,228	7,772
Bethel	20,038	2,264,564	12,774	1,920,356	63,894
Buckland	2,153	71,032	10,098	105,354	n/a
Dillingham	14,156	649,957	175,352	2,008,764	495,583
Huslia	650	59,790	0	45,862	0
Klawock	2,649	368,026	133,272	484,752	70,555
Kongiganak	1,798	56,016	n/a	55,169	4,681
Minto	1,107	79,784	2,899	76,242	2,257
Northway Village	756	69,999	56,023	48,010	10,902
Port Graham	575	48,939	28	24,972	3,877
Sand Point	n/a	524,116	0	494,958	84,845
Sitka	n/a	n/a	n/a	n/a	n/a
Stebbins	6,339	81,481	8,353	174,745	0

Seasonal Variation Community Emissions (Population Weighted Average)



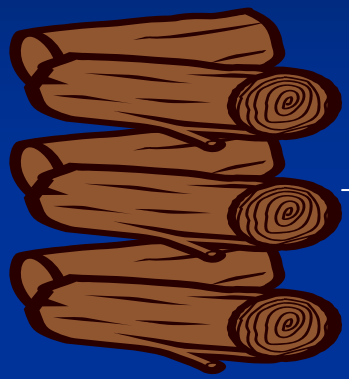
Survey Inventory Limitations

- Quality of responses inconsistent
- Difficult to obtain responses to questions
- Unit values not always clear
  - Fuel oil drum size
  - Propane tank size
  - Camp fire burn rate
  - Refuse composition/burn rate
- No representation of North Slope communities
  - Coal and natural gas available to some
  - Colder climate

Survey Inventory Limitations (con't)

- Gaps in responses filled by using data from similar size communities
  - Summer/winter activity ratios
  - Nonresidential activity proportionate to population
- Emission rates for some categories unclear
  - Fugitive dust from ATVs
  - Camp fires
  - Burn barrels

Klawock Residential Fuel Use By Season



WOOD (cords)
Summer 1,356
Winter 1,294

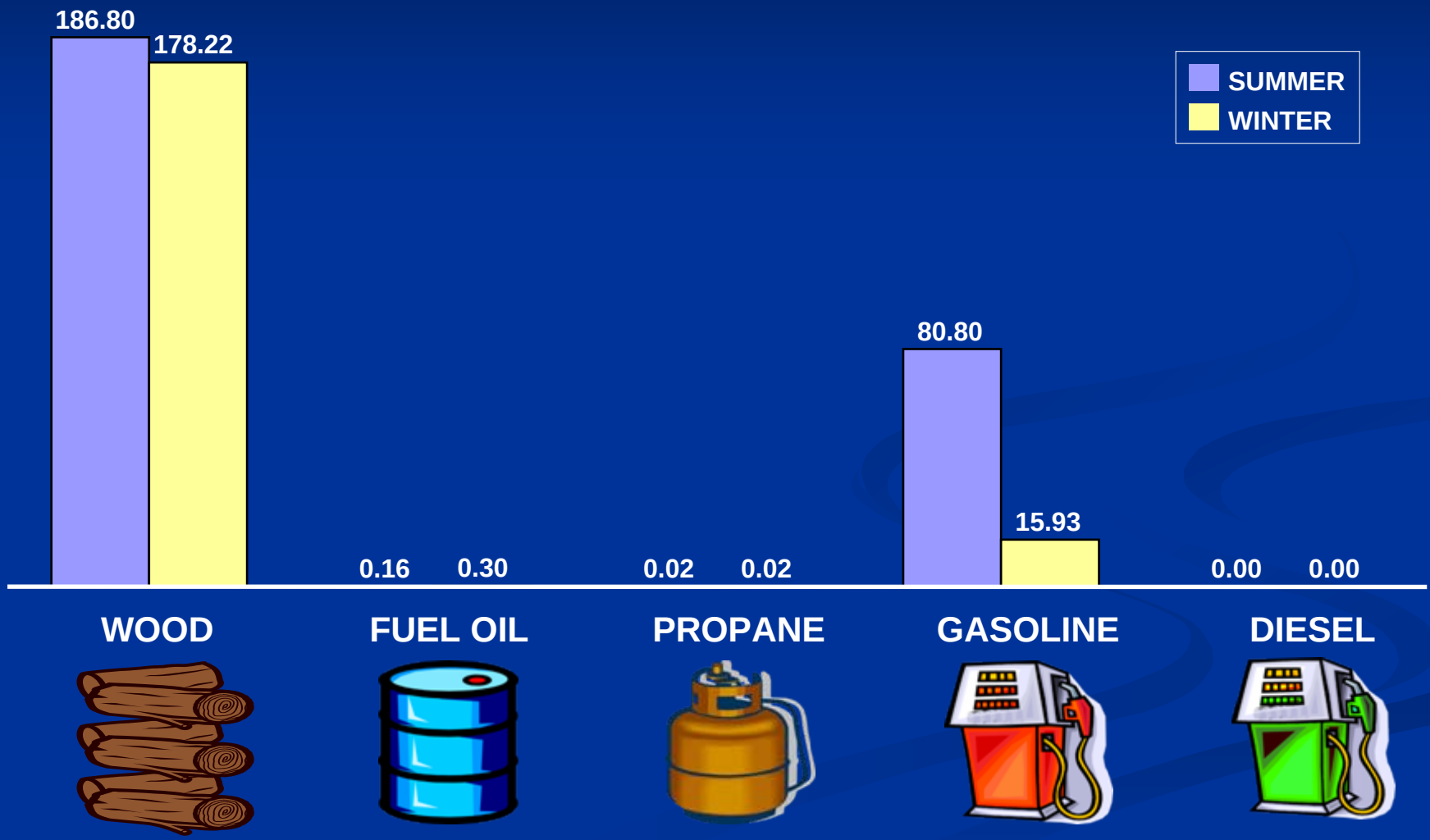
PROPANE (gal)
Summer 61,610
Winter 71,662

DIESEL (gal)
Summer 38,518
Winter 32,036

GASOLINE (gal)
Summer 264,918
Winter 219,833

FUEL OIL (gal)
Summer 126,867
Winter 241,159

Klawock Total HC Emissions By Fuel Type (tons/season)



Lessons Learned

- 75% of the effort is spent collecting data
- 25% is spent on analysis
- Surveys
  - Local data collection critical
  - Set up purchase orders to pay for work
  - Be flexible on terms (who is reimbursed)
  - Minimum lead time for responses is a year
  - Follow up with questions quickly
- Set up a emissions calculation structure that can easily be updated
  - New data activity will always be coming in
  - Need to be able to extrapolate updates to other communities

Lessons Learned (con’t)

- Identify independent data sources for use in checking results
- Provide feedback to community/help establish a long term relationship

Remaining Steps

- Present emission/fuel use summaries to participating communities
- Extrapolate results to rest of state based on population, location and other relevant data sources
- Prepare Borough summaries
- Document survey and analysis steps and findings

Conclusions

- Data collection is very labor intensive
- Plan for a multi-year effort
- Wood burning emissions are significant
- Fugitive dust emissions are significant
- Need to distribute information on control options