

# Residential Wood Pellets: Elemental Composition, Market Analysis and Policy Implications



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# Background

- Greater push to use biomass fuels as an alternative to fossil fuels
- Limited information on components of wood pellet fuels
- Examine the efficacy of existing standards?
- Understanding composition is important
  - enhance knowledge of potential air pollution
  - public health impact
  - efficiency benefits and trade-offs
  - potential solid waste issues

# Background

- Quantify wood pellet fuel chemical composition for fuels manufactured or available in New York State
- Assess variability of composition across/within brands
- Identify policy relevant strategies to reduce or control impacts from air emissions and/or solid waste
- Provide input into pending EPA NSPS regulation Residential Wood Heater Source Performance Standard (NSPS)

# Pellet Market

- U.S. has no regulatory pellet fuel standard but expect proposed EPA regs soon
- Pellet Fuel Institute (PFI) has voluntary standards
- All pellets found in retail outlets labeled as “Premium” wood pellets
- Until 2009, demand for pellets outstripped supply but in the last two years overproduction

# Sample Collection/Prep

- 132 40# bags obtained during winter 2010-11 in 5 NE States
- ~ 100 different brands (rest: duplicates purchased independently)
- 4 categories of analysis:
  - Basic characterization (ASTM “proximate analysis”) calorific value, moisture content, ash content
  - Ions: sulfate and chlorine by IC
  - Trace metals by ICP-MS
  - Mercury - gold trap followed by CVAA analysis

# Analysis

- What is “normal” for ions and metals pellet analysis?
  - No accepted standards (ash or wood) at this time
  - No SRM or similar reference material for wood/ash analysis
- Sample Screening for “normal” values to estimate working “benchmark” concentration for ash analysis
  - Use 95th percentile of normals as preliminary “benchmark” limit
  - 85 out of 132 samples considered “normal” (64%) based on screening of all analytes
  - Remainder, 47 samples, had outlier results
  - 20 samples (15%) elements of concern (metals, mercury)

# “Normal” Pellets

- Typically, the pellets identified as normal looked like wood



# Pellet Analysis

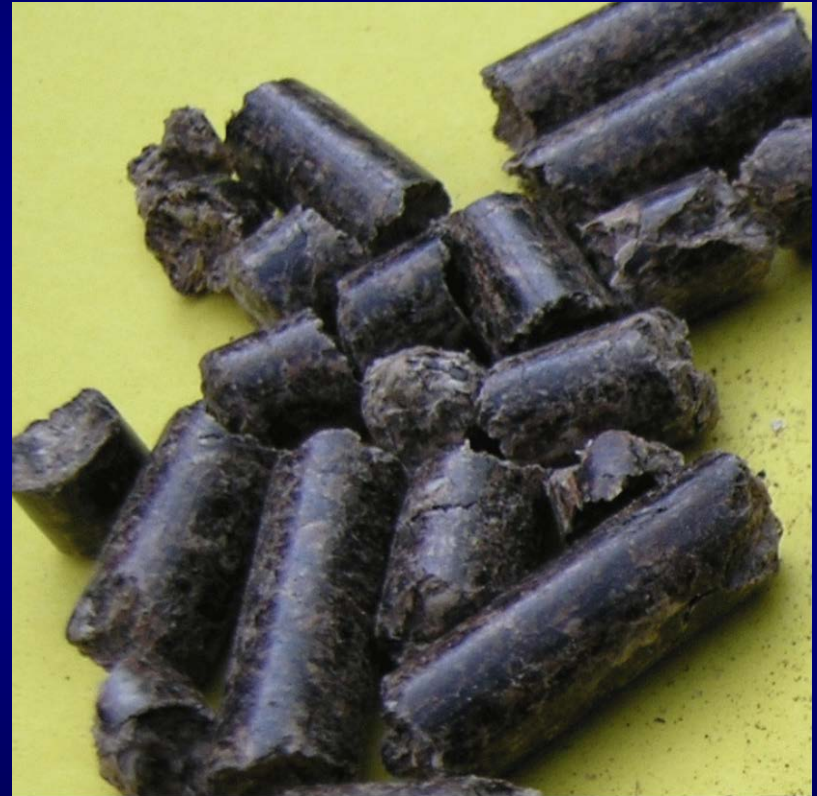
- This pellet exhibited high levels of:
  - Chromium
  - Copper
  - Arsenic
  - Lead
  - Mercury





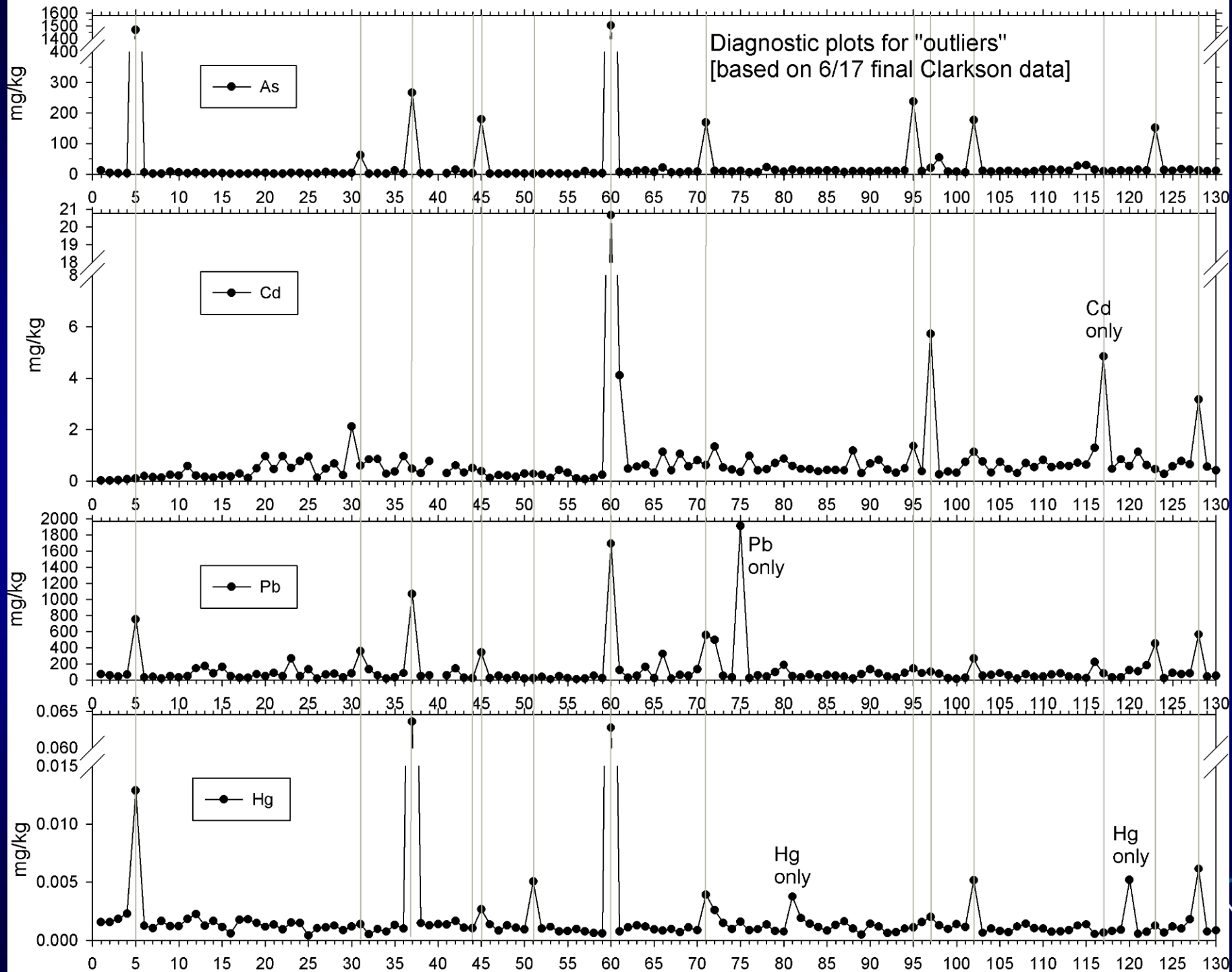
# Pellet Analysis

- This pellet almost black
  - Color could be a result of processing or of addition of black liquor
- 8% ash - PFI ash limit: 1% for “premium grade” pellets.

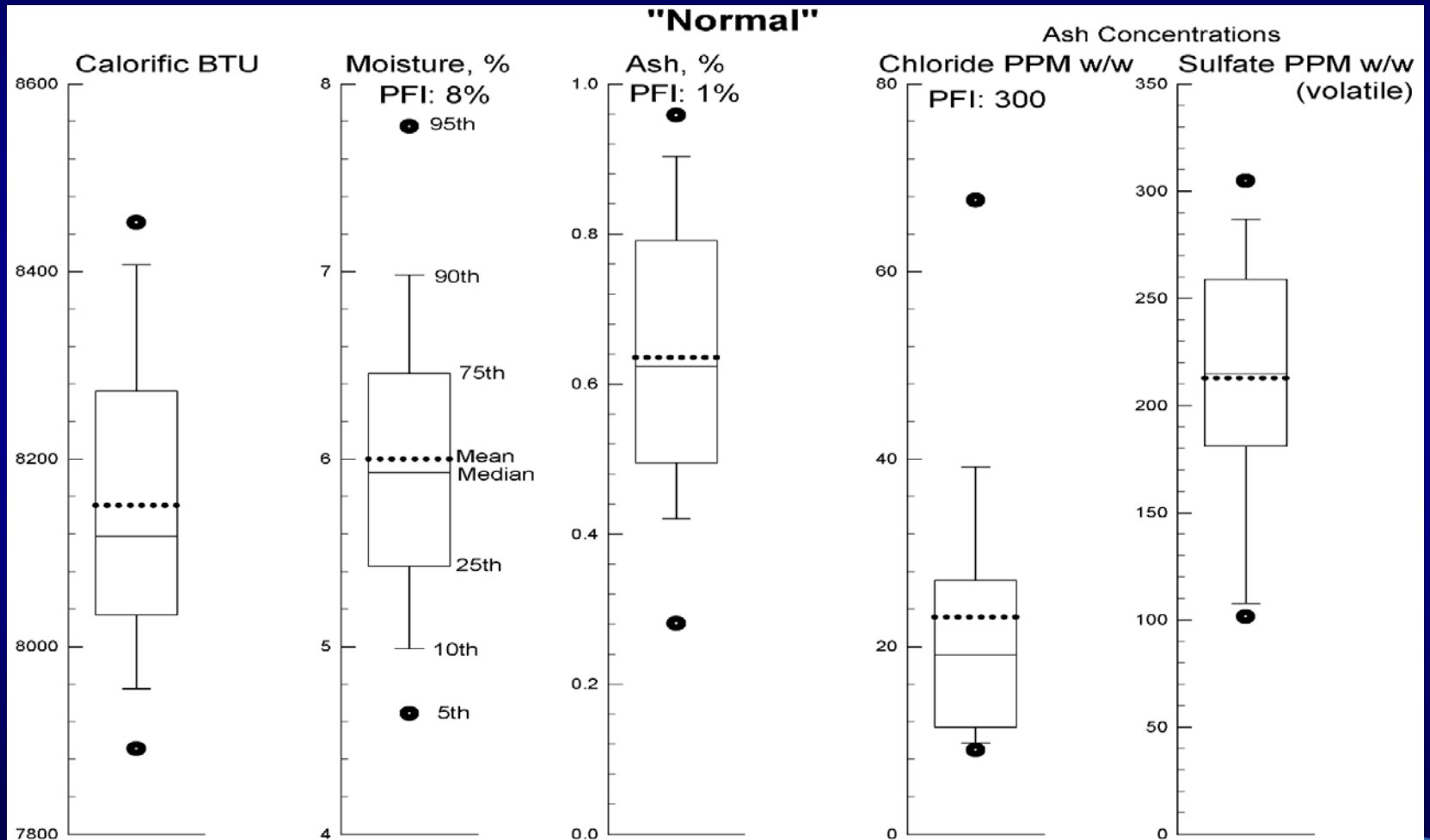


# PFI Standard

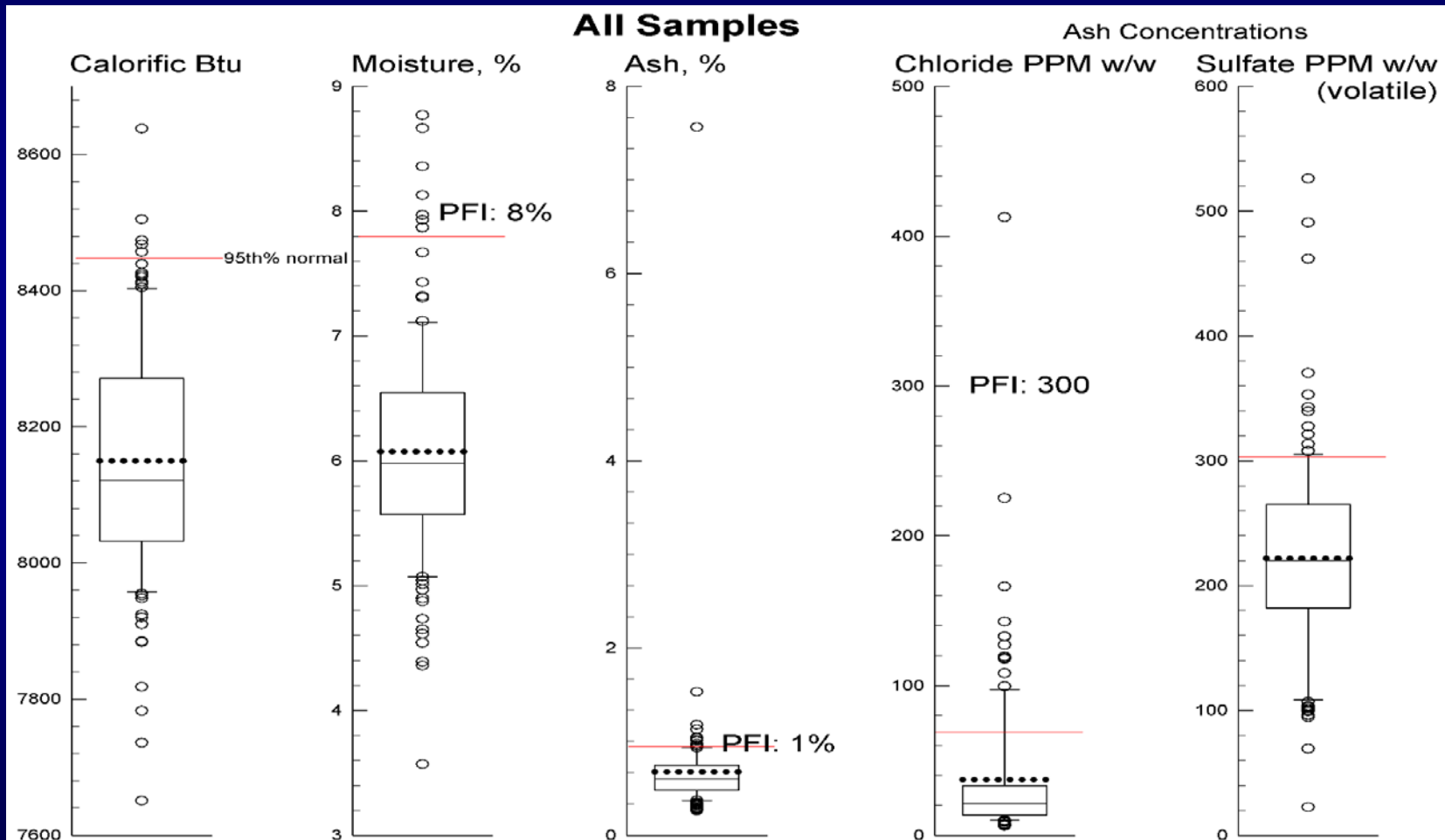
Fuel Property	PFI Premium
Normative Information - Mandatory	
Bulk Density, lb./cubic foot	40.0 - 46.0
Diameter, inches	0.230 - 0.285
Diameter, mm	5.84 - 7.25
Pellet Durability Index	$\geq 96.5$
Fines, % (at the mill gate)	$\leq 0.50$
Inorganic Ash, %	$\leq 1.0$
Length, % greater than 1.50 inches	$\leq 1.0$
Moisture, %	$\leq 8.0$
Chloride, ppm	$\leq 300$



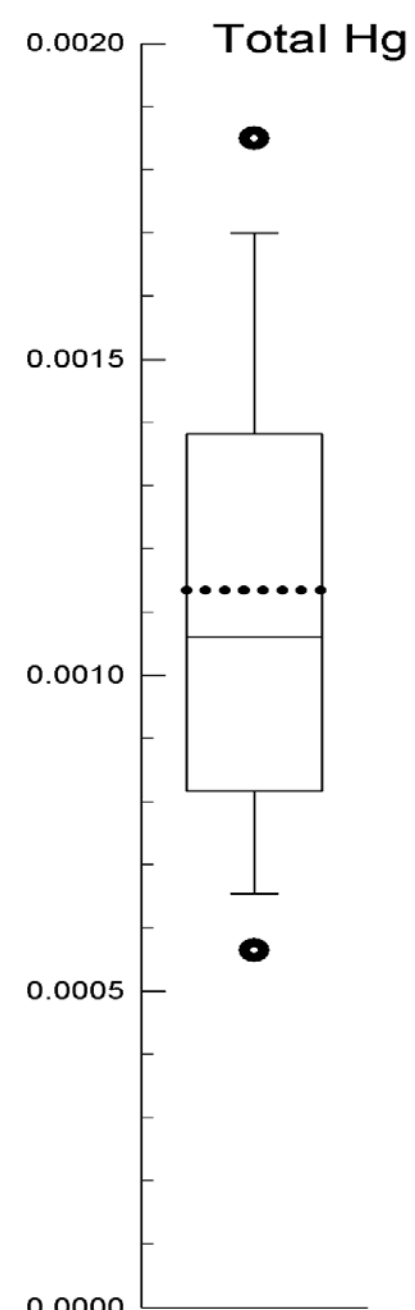
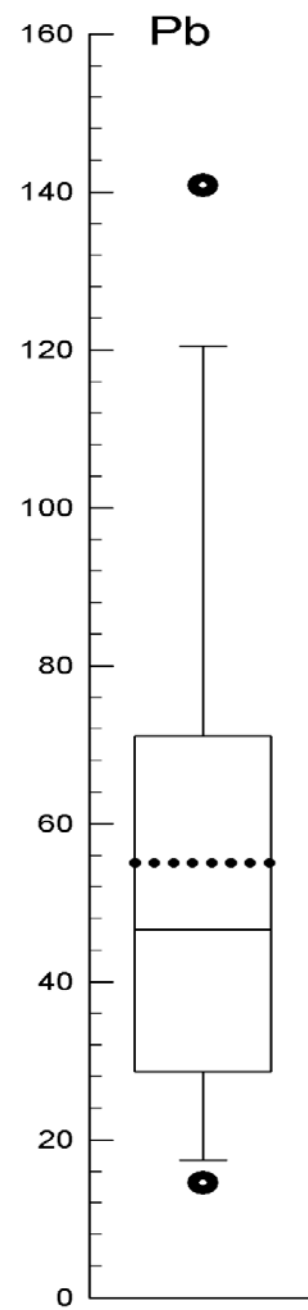
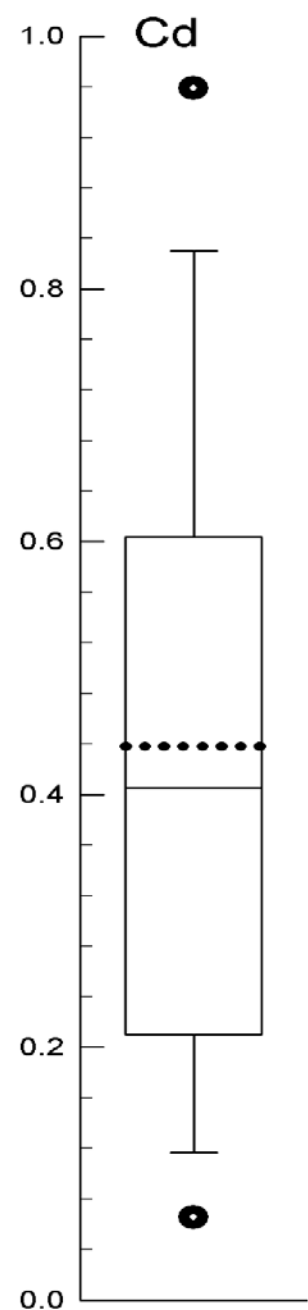
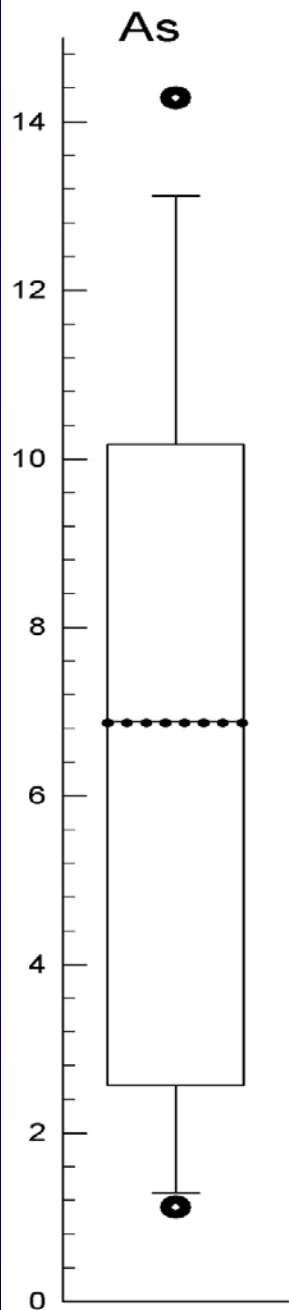
# PFI Standards Analysis – Normal Samples



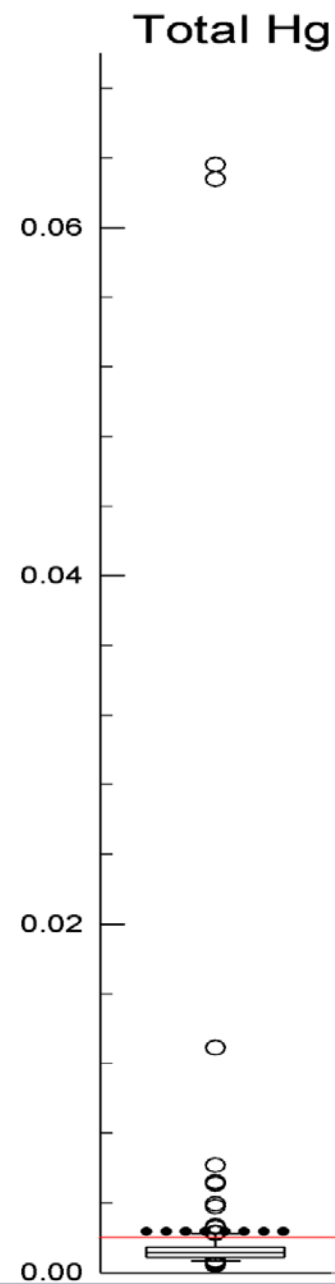
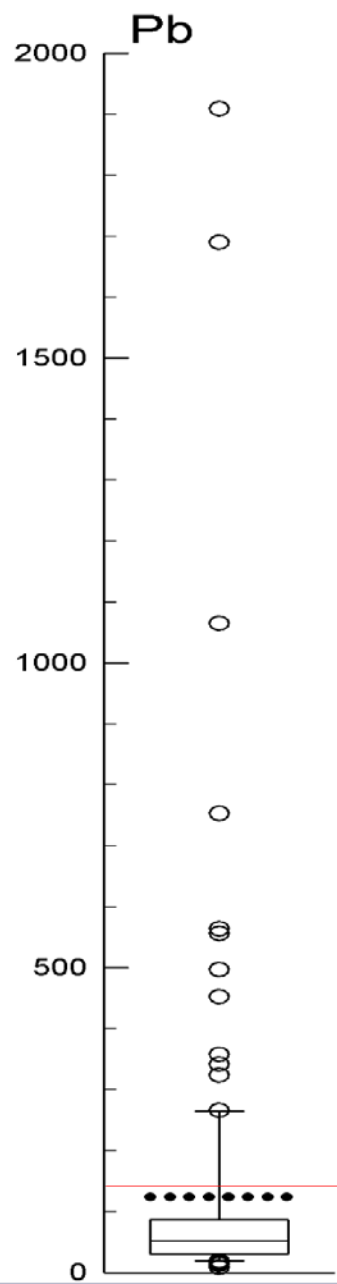
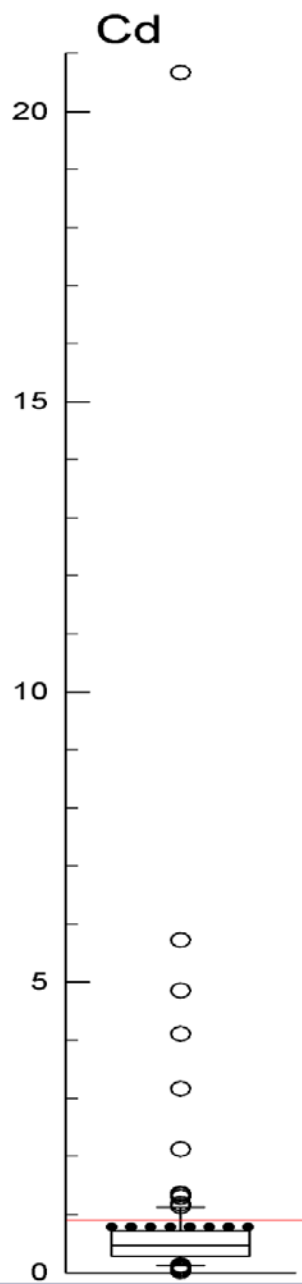
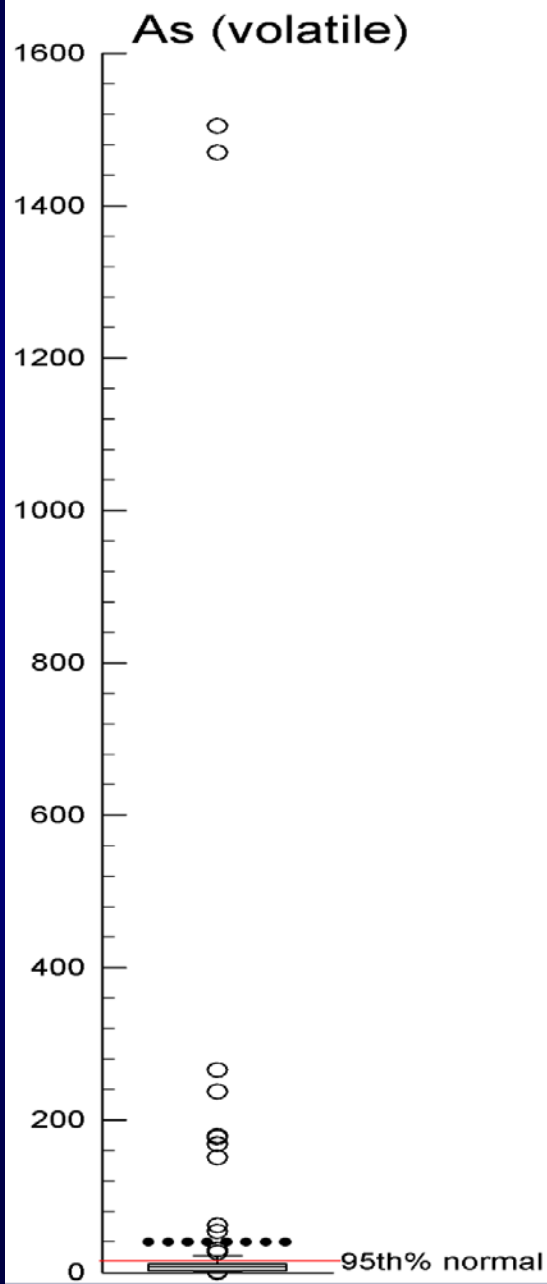
# PFI Standards Analysis – All Samples



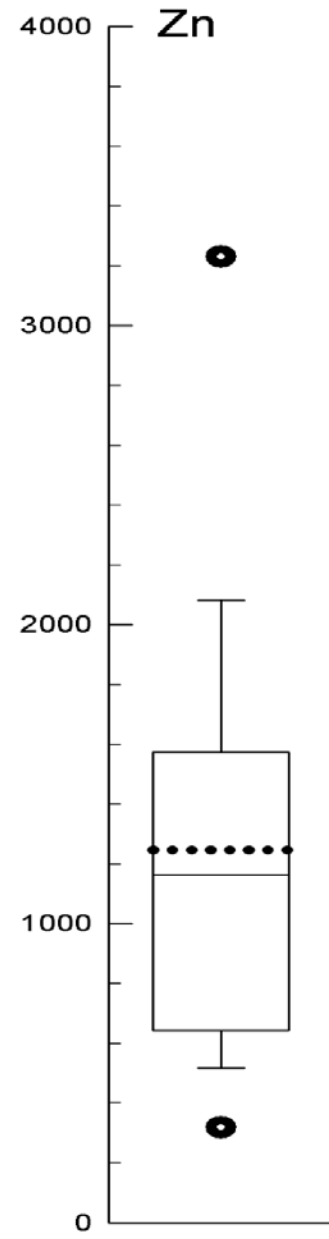
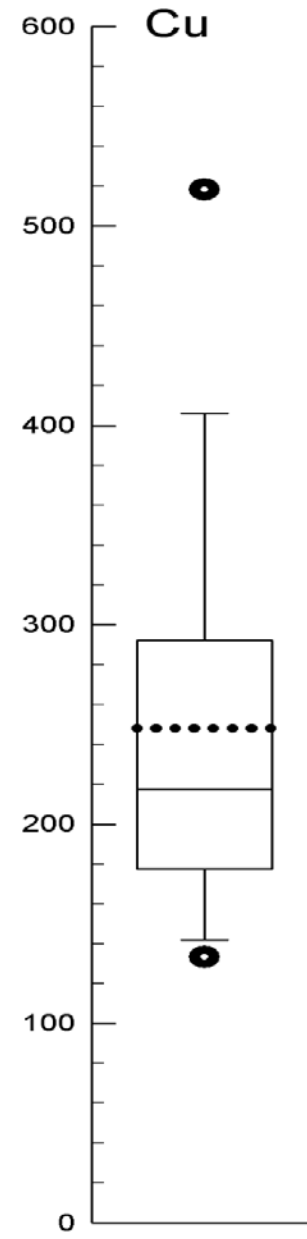
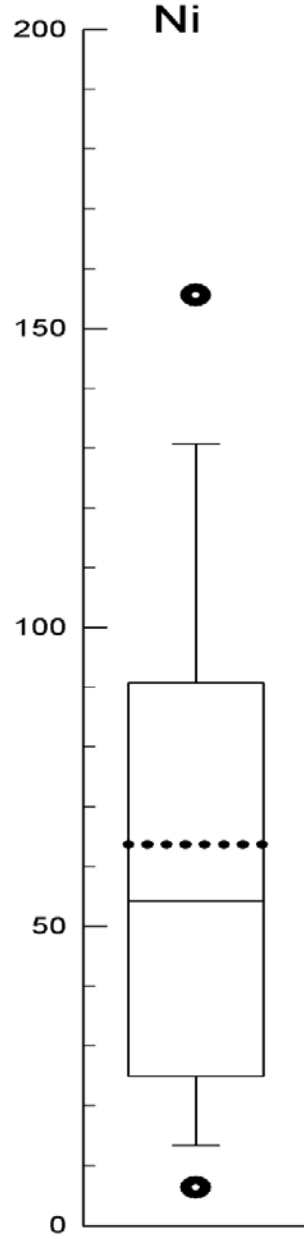
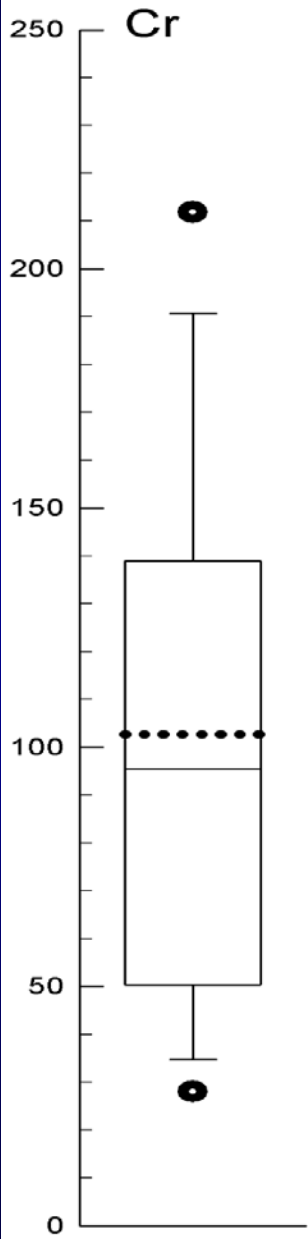
# "Normal", mg/kg, Ash Concentrations



# All Samples, mg/kg, Ash Concentrations

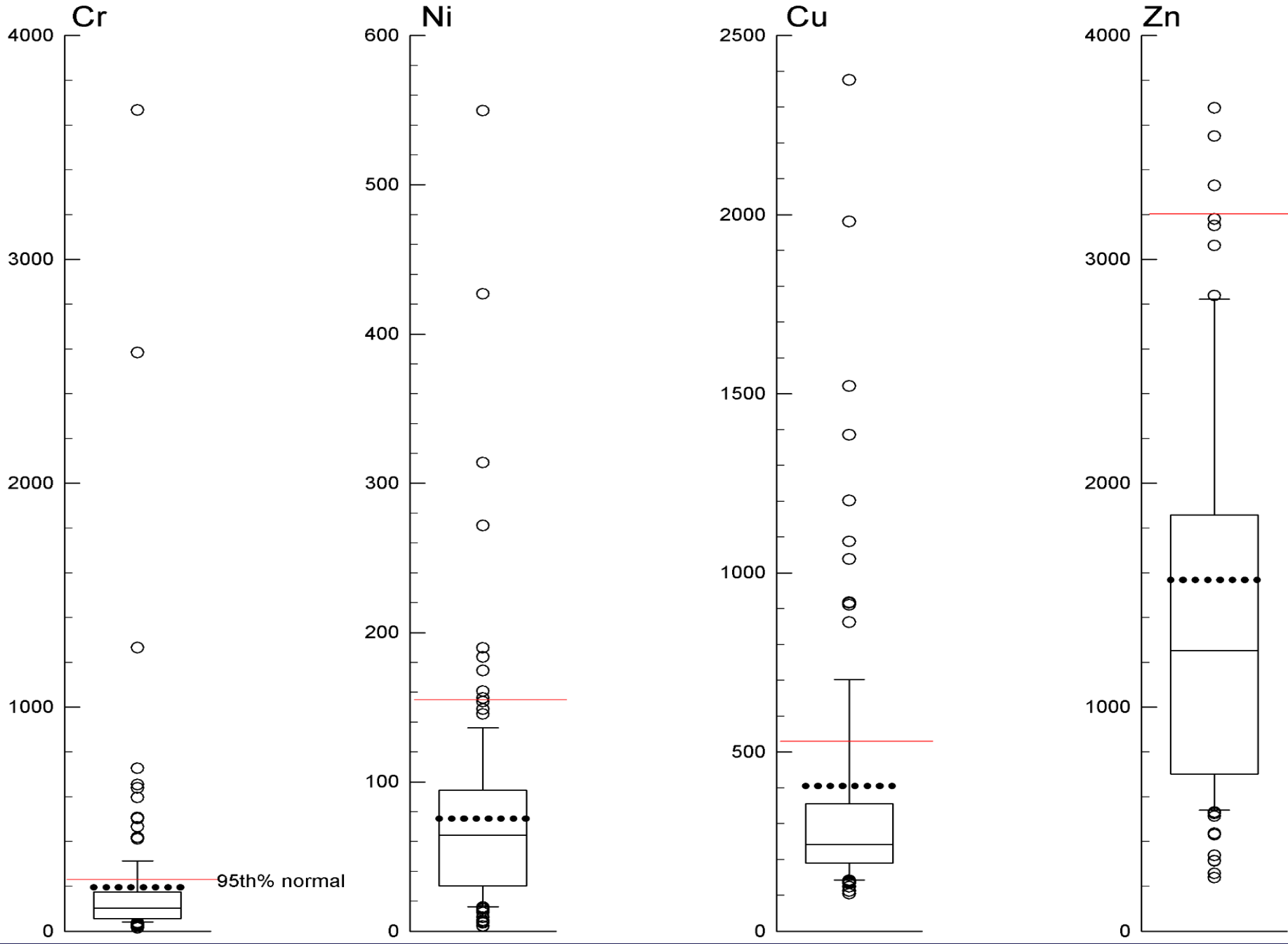


# "Normal", mg/kg, Ash Concentrations





# All Samples, mg/kg, Ash Concentrations



# Potential Sources of Elevated Elements

- Harvesting/processing practices
- Uptake from soluble sources
- Wood species
- Inclusion of bark
- Use of waste wood

# Initial Conclusions

- PFI standards are not likely to identify contamination in pellets since primary focus is on physical properties
- Appropriate methods for analysis are critical in identifying elemental constituents
- Need to gain a better understanding what contributes to variability in pellets and minimize sources of contamination
- Impact of elevated elements for local exposures
- Significant policy issues remain