



*CHN Elemental Analyzer Labs:  
Successes and Future Activities*

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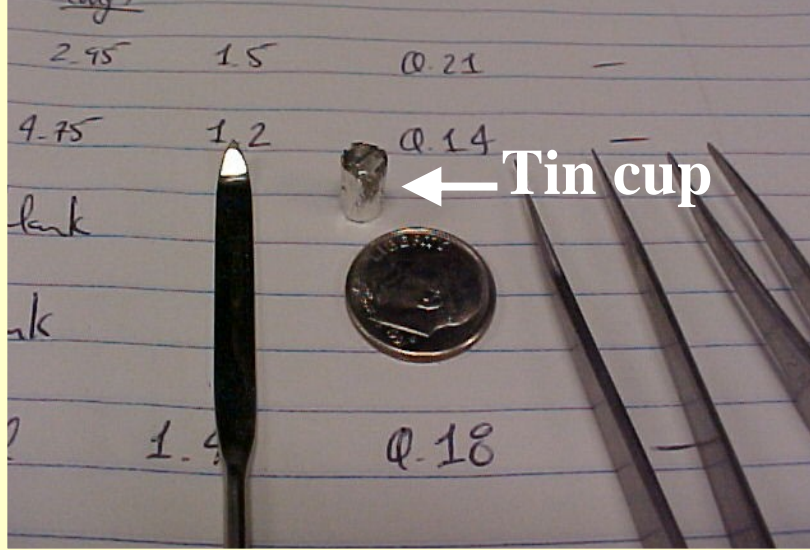
# CHN Elemental Analyzer

$O_2(g)$  not shown

$He(g)$

$N_2(g)$

1.5mg < sample mass < 3mg



Perkin Elmer 2400 Series II

# *Cellulosic Ethanol Post-Harvest Wheat Activity*



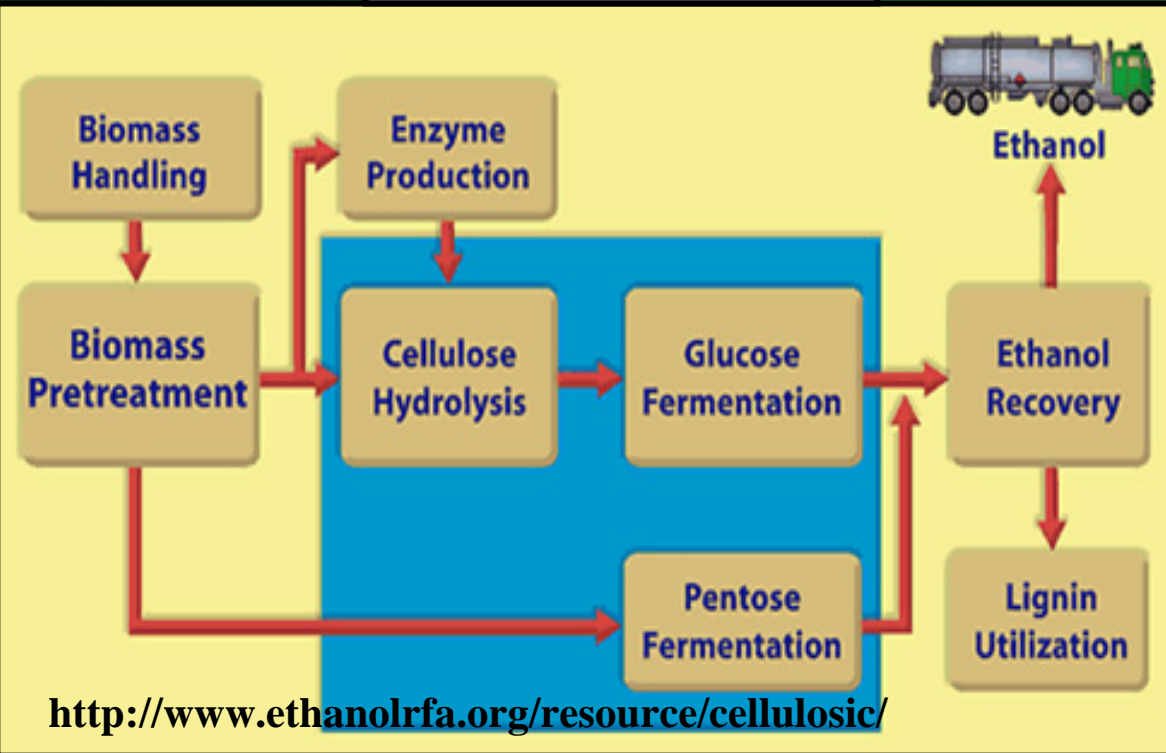
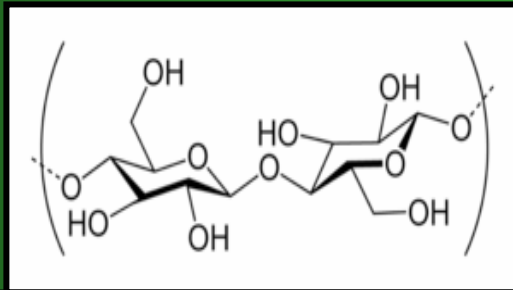
## *Fieldwork Equipment:*

- 300' tape to measure an acre
- One meter length rulers
- Portable quantum meters
- CHN elemental analyzer



*Durham wheat*

# *What theoretical volume of ethanol could be produced from the post-harvest cellulosic biomass?*



[http://www1.eere.energy.gov/biomass/biomass\\_today.html](http://www1.eere.energy.gov/biomass/biomass_today.html)

*Typical Student Data:*  
*Elemental analysis: 45.7%C*  
*80-100 wheat stalks/ft<sup>2</sup>*  
*13.2g/five stalks (dry)*

**Area = one acre (43,560 ft<sup>2</sup>)**



# *Student Calculations:*

**Cellulosic biomass (dry): ~20,000lbs**

**Available carbon\*: ~9,150 lbs**

**Mass Ethanol: ~17,520 lbs\*\***

**Volume Ethanol: ~2,650 gallons\*\***

\*: CHN analysis for cellulosic biomass = 45.7%C

\*\* : Assuming, for simplicity, 100% conversion efficiency

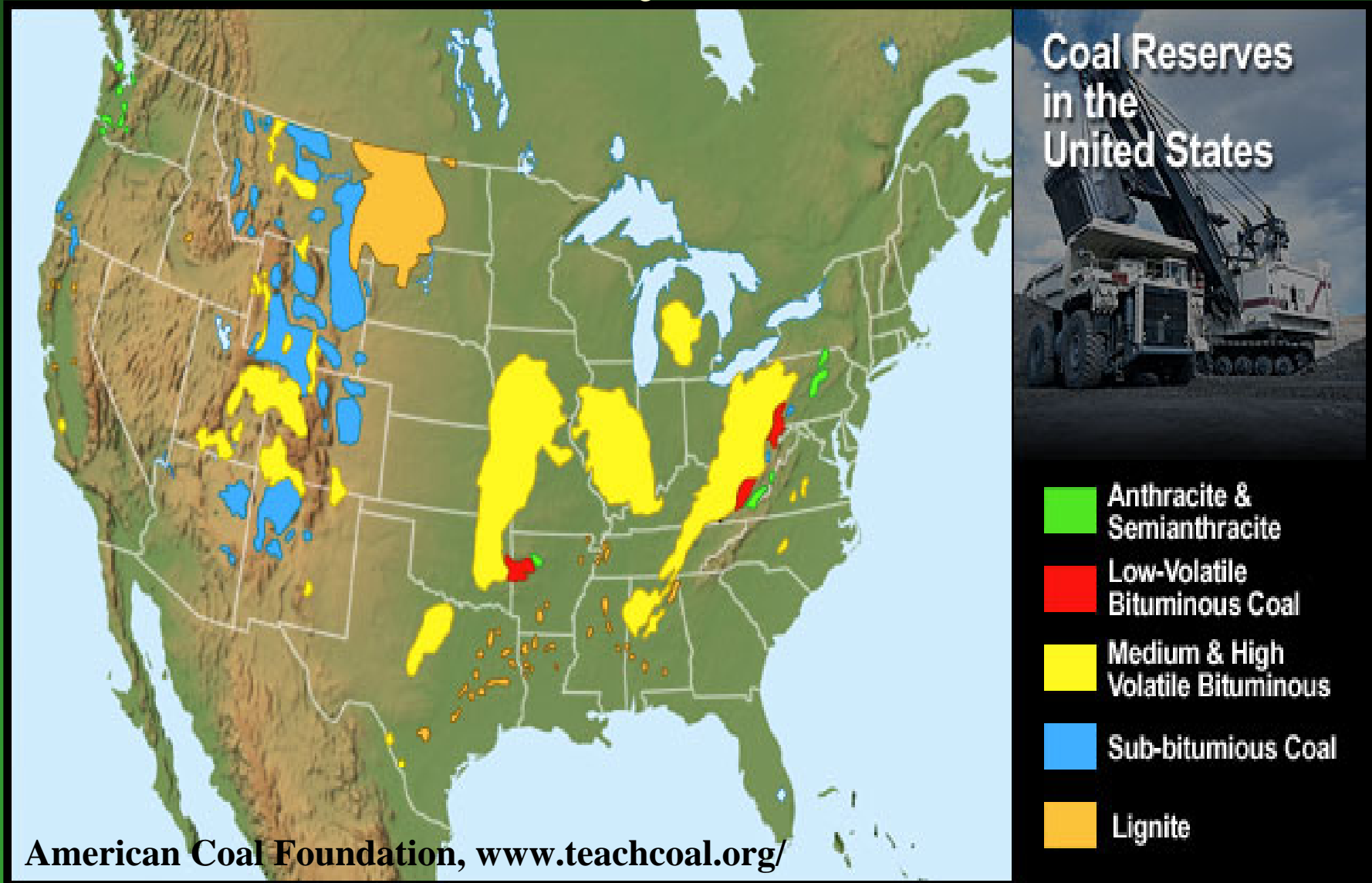


Image: [e85fuel.com/index.php](http://e85fuel.com/index.php)

**~2,650gal Ethanol =  
~1,770gal Octane 87 gasoline\***

**\*: Based on enthalpic density (Btu/gal) comparison**

# Bituminous or Anthracite Coal for Electricity Production?



# *Navajo Generating Station (NGS)*



**Coal consumption:**

**A maximum of 25,000 tons per day if all three 750-MW units are running at full load.**

<http://www.srpnet.com/about/stations/navajo.aspx>

# *Elemental Analysis*

**Anthracite**

**Mass %C: >90%**



17 10:15 AM

**Bituminous**

**Mass %C: 70-80%**



17 10:14 AM



JERRY McBRIDE / Herald



Based on the CHN data which coal type releases more  $\text{CO}_2$  per ton burned? *Offer an explanation.*



**Based on CHN analysis data which coal type- anthracite or bituminous- likely has the larger specific enthalpy (Btu/ton)? *Offer an explanation.***

# *Difference in C:N Ratio?*

**Yellow Palo Verde**



**Blue Palo Verde**



## Yellow Palo Verde



**%C = 52.1**

**%N = 5.6**

**C:N = 9.3**

## Blue Palo Verde



**%C = 51.6**

**%N = 2.2**

**C:N = 24**

# *Acknowledgements*



National Science Foundation  
WHERE DISCOVERIES BEGIN

- **Course, Curriculum, & Laboratory Improvement (CCLI) grant (DUE-0310264)**
- **Organizers of this regional meeting**
- **My lovely wife and our two children**