

Virtual Bioethanol Workshop

Capacity Building Workshop – Introduction to Bioethanol for Clean Cooking

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A LITTLE ABOUT ME

- BS Chemistry
- MS Management and Leadership
- Laboratory Work
 - Air quality monitoring
 - Catalyst research
- Quality Manager POET Biorefining
 - 2008 during startup



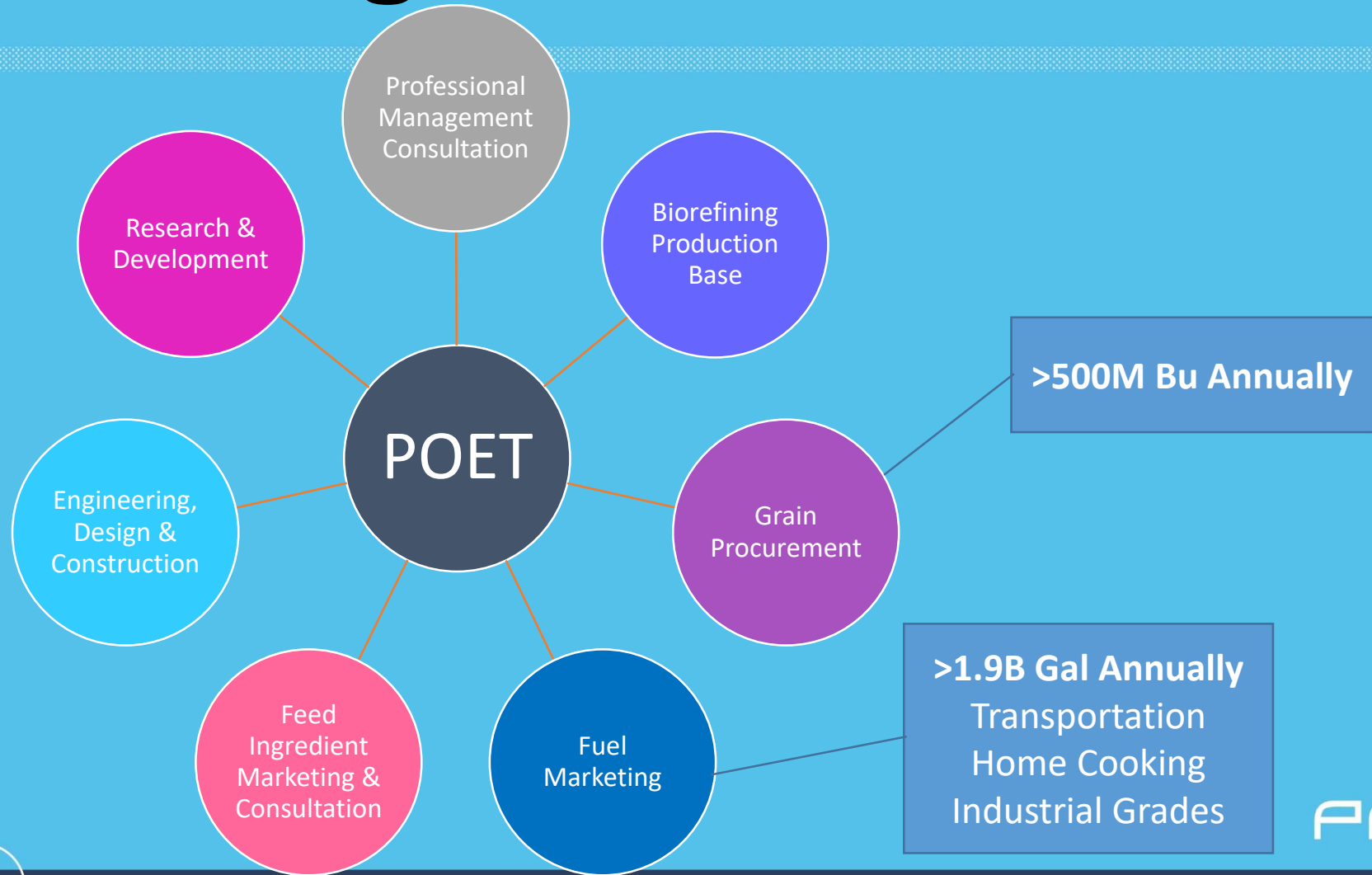
POET

- In the last 30+ years, grown from a single, humble refinery to the **world's largest** producer of ethanol and other biorefined products.
 - 27 Corn processing plants
- Products Produced:
 - Biofuel
 - Feed Solutions
 - Asphalt Rejuvenator
 - Carbon Dioxide
 - Clean Cooking

Our vision is to live in a world with natural balance. Where we no longer take from the Earth, but rather use its enormous ability to regenerate. Where we are no longer dependent on fossil fuels, but rather rely on the power of nature and the genius of the human spirit. Where farmers are the creators, and innovators are the heroes. Where we use the resources given to us in ways we believe God intended.



POET – The Big Picture



POET Biorefining - Shelbyville

- Located in Indiana
- Opened in 2020
- 24/7 Operations
- ~45 Team Members
- Products Produced:
 - Biofuel
 - Denatured Ethanol, Ethanol Blended Fuels
 - Animal Food
 - DDGS, Wet Cake, Syrup, Corn Oil
 - Carbon Dioxide



Quality Manager – A day in the life

- Laboratory Operations – sampling, testing, certifications
- Fermentation – Recipe optimization
- Water Treatment – sampling and testing of boilers, cooling tower, RO
- Food Quality – compliance with state and federal regulations
- Fuel Quality – compliance with state, federal, and international regulations
 - ASTM International Standards
 - Use of standards since 2008
 - Active participation since 2014

Standardized Fuel Quality

- Consistency is imperative for customers and consumers
- ASTM International Organization for Standards
 - Consensus Organization
 - Membership
 - Producers, automotive manufacturers, regulators, users, general interest groups
- Standard Test Methods
 - The HOW TO perform the analysis
 - Ensure samples are tested the same way



Standardized Fuel Quality

- Standard Specifications
 - Provide properties' limits that producers **MUST** achieve
 - If product does not meet specification
 - Quality Issue
 - Safety Issue
 - Specs allow the blenders to know how to blend
 - Specs let the customer know what they are buying
- **Consistency is imperative for consumers!**
- **Standards help to achieve consistency in the marketplace.**



ASTM COMMITTEES

- D02: Petroleum Products, Liquid Fuels, and Lubricants
 - D4814 Automotive Spark Ignition Engine Fuel
 - D4806 Denatured Fuel Ethanol for Blending with Gasolines for Use as Automotive Spark-Ignition Engine Fuel
 - D5798 Ethanol Fuel Blends For Flexible-Fuel Automotive Spark-Ignition Engines
- E48 Bioenergy and Industrial Chemicals from Biomass
 - E3050 Home Cooking Standard
 - E3237 Undenatured Ethanol from Biomass Specification for Industrial Application Use

ASTM SUB-COMMITTEES

- Address specific segments within the general subject area of the committee
- Sub-committee Designations
 - Letter– Specifications
 - D02.A
 - Numerical – Test Methods
 - E48.05
- Common sub-committees
 - Executive
 - Strategic planning, bylaws administration
 - Terminology
 - Alignment of definitions of terms

ASTM D02 SUB-COMMITTEES

D02: Petroleum Products, Liquid Fuels, and Lubricants

- D02.A0 Gasoline and Oxygenated Fuels
 - D4814, D4806, D5798
- D02.03 Elemental Analysis – Sulfur, Sulfate/Chloride
- D02.04 Hydrocarbon Analysis – Density, Ethanol/Methanol Content
- D02.06 Analysis of Liquid Fuels and Lubricants – Acidity, Water
- D02.08 Volatility – Vapor Pressure
- D02.14 Stability and Cleanliness of Liquid Fuels – Corrosion, gums

ASTM E48 SUB-COMMITTEES

E48 Bioenergy and Industrial Chemicals from Biomass

- E48.A Product Specifications
- E48.05 Biomass Conversion
- E48.80 Sustainability of Bioenergy and Industrial Chemicals from Biomass



PRODUCTS WITH STANDARDS

- Denatured Ethanol

- Fuel Blending

- D4806

- Defines specifications for ethanol to be used in transportation fuel blending

- Cook Stoves

2016

- E3050

- Defines specifications for ethanol to be used in home cooking

- Undenatured Ethanol

- Industrial and Intermediary Applications

2019

D4806

Property	Limit	Method
Ethanol, % by volume, min	92.1	D5501
Methanol, % by volume, max	0.5	D5501
Solvent-washed gum content, mg/100 mL, max	5.0	D381
Water, % by volume (% by mass), max	1.0 (1.26)	E203, E1064, or D7923
Inorganic Chloride, mg/kg (mg/L), max	6.7 (5)	D7319 or D7328
Copper, mg/kg, max	0.1	D1688
Acidity (as acetic acid CH_3COOH) mg/kg, (% by mass) [mg/L], max	70 (0.0070) [56] (Note 2)	D7795
pHe	6.5 to 9.0	D6423
Sulfur, mg/kg, max	30.	D2622, D3120, D5453, or D7039
Existent sulfate, mg/kg, max	4	D7318, D7319, or D7328

UNDENATURED ETHANOL

- Problem:
 - No standard existed to provide specifications for undenatured ethanol
 - Product movement limited/delayed due to lack of specifications
- Solution:
 - Develop new ASTM Standard Specification



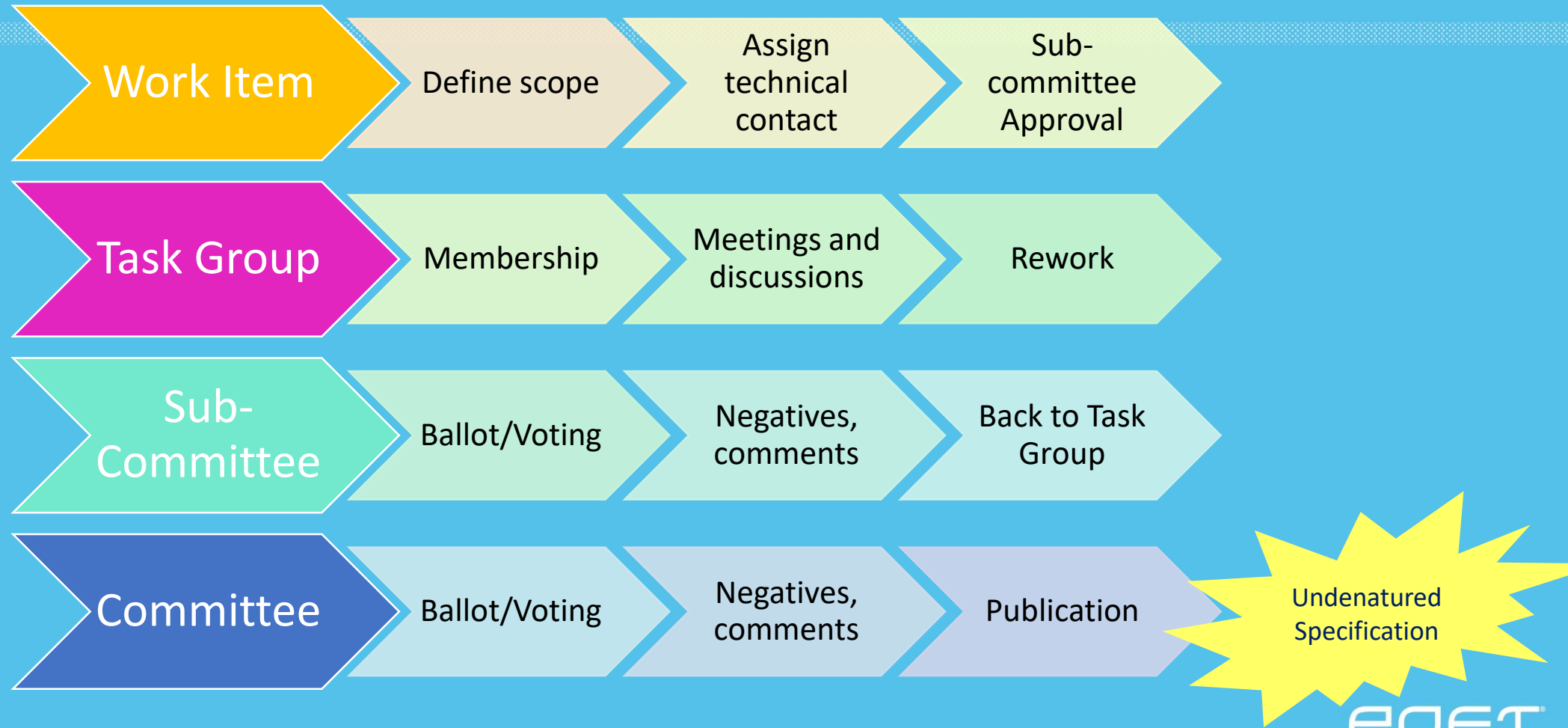
UNDENATURATED ETHANOL

- **Scope**

- This standard covers biomass derived, undenatured ethanol intended for use in industrial applications such as adhesives, detergents, inks, chemicals, plastics, paints, thinners, etc.

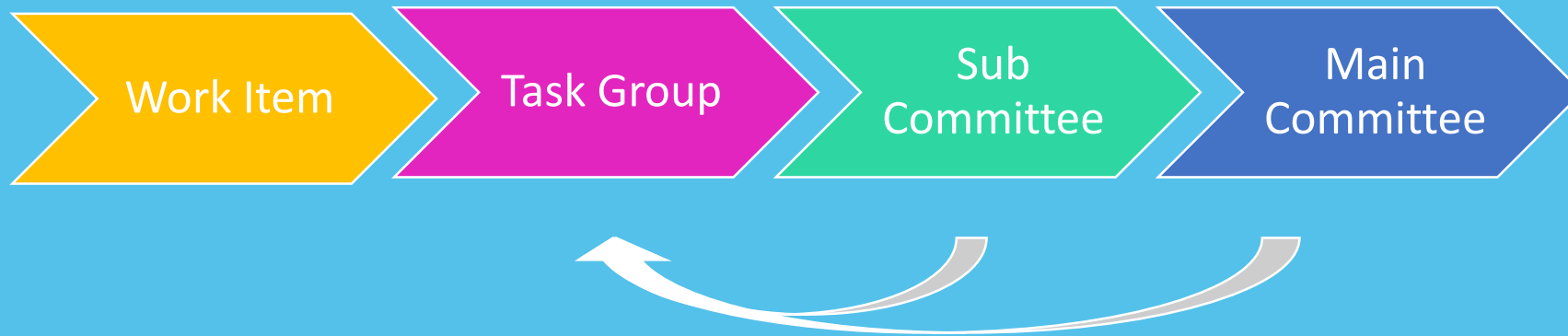
Parameter	Limit	ASTM TM
Specific Gravity, 20C	Report	D4052
Ethanol, % by volume, min.	Report	D5501
Water, % by volume, max.	Report	D7923, E1064
Acidity (as acetic acid) mg/ kg (% by mass) [mg/L]	70 (0.0070)[56] (Note 2)	D7795
Nonvolatile Residue, mg/ ml, max.	5	D1353
Odor	Typical	D1296
Color, Pt- Co, max.	10	D1209

SPECIFICATION DEVELOPMENT





ASTM BALLOT PROCESS

- Consensus Achieved through balloting process
- Voting bodies
 - Affirmative, Negative, Abstain
- Adjudication of negative votes



EXPERIENCES

- Industry goals include developing export markets.
- Globally, these shipments often require 3rd party labs that are unfamiliar with ethanol. Contract terms typically state adherence to D4806.
- D4806 allows for use of D1613 or D7795 for acidity testing
 -  D1613 Test Method for Acidity in Volatile Solvents and Chemical Intermediates Used in Paint, Varnish, Lacquer, and Related Products
 -  D7795 Test Method of Acidity in Ethanol and Ethanol Blends by Titration
 - 2 methodologies: Potentiometric and Colorimetric
 - Referee method

EXPERIENCES cont.

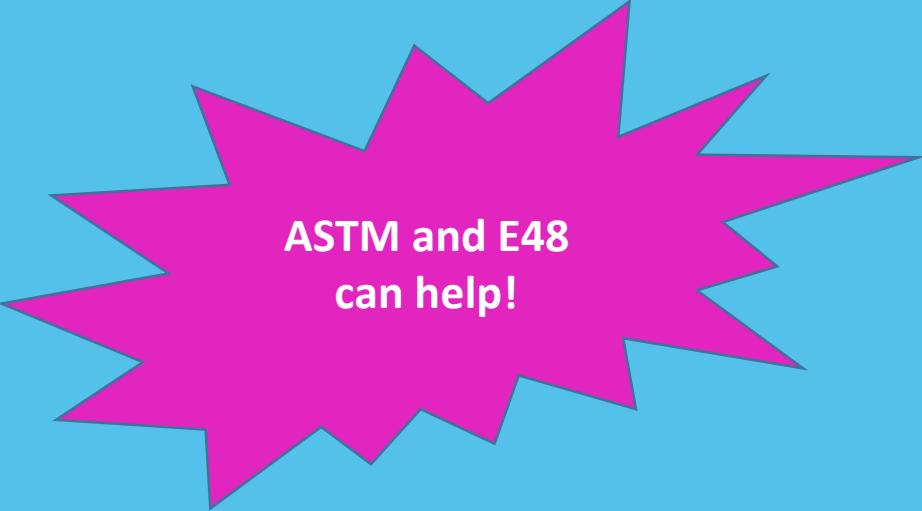
- D1613 has known interferences with dissolved CO₂, which can lead to erroneously high acidity results.
- Many erroneous results from labs using D1613, because it doesn't have all of the information that D7795 contains.
- This causes resampling/retesting cycle that stalls vessels, leading to demurrage and other financial penalties.
- Proposed removal of D1613 from D4806

EXPERIENCES cont.

- Resistance to the change
 - Select appropriate labs
 - Specify D7795 in contracts
- Mitigation of the resistance
 - Some international labs not familiar with the product and interferences
 - Contracts reference adherence to D4806
 - D1613 was originally modified to work with ethanol and ethanol blends
 - Does not include all of the information that D7795 includes
 - D7795 was created and approved over 5 years prior
 - Time consuming process
 - D7795 allows for both methods and no additional steps or equipment required

LOOKING AT

- What can you learn from the standards process?
- How can ethanol standards be useful?
- Standards that could benefit
 - Blending denatured ethanol for fuel
 - Fuel quality, consumer protection
 - Denatured ethanol for cooking
 - Consumer protection
 - Undenatured ethanol
 - International market suppliers



ASTM and E48
can help!

CONTACT INFORMATION

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THANK YOU!