

Ethanol Production: A Safety Perspective



RENEWABLE FUELS ASSOCIATION

“THE VOICE OF THE ETHANOL INDUSTRY”

FOR OVER 25 YEARS

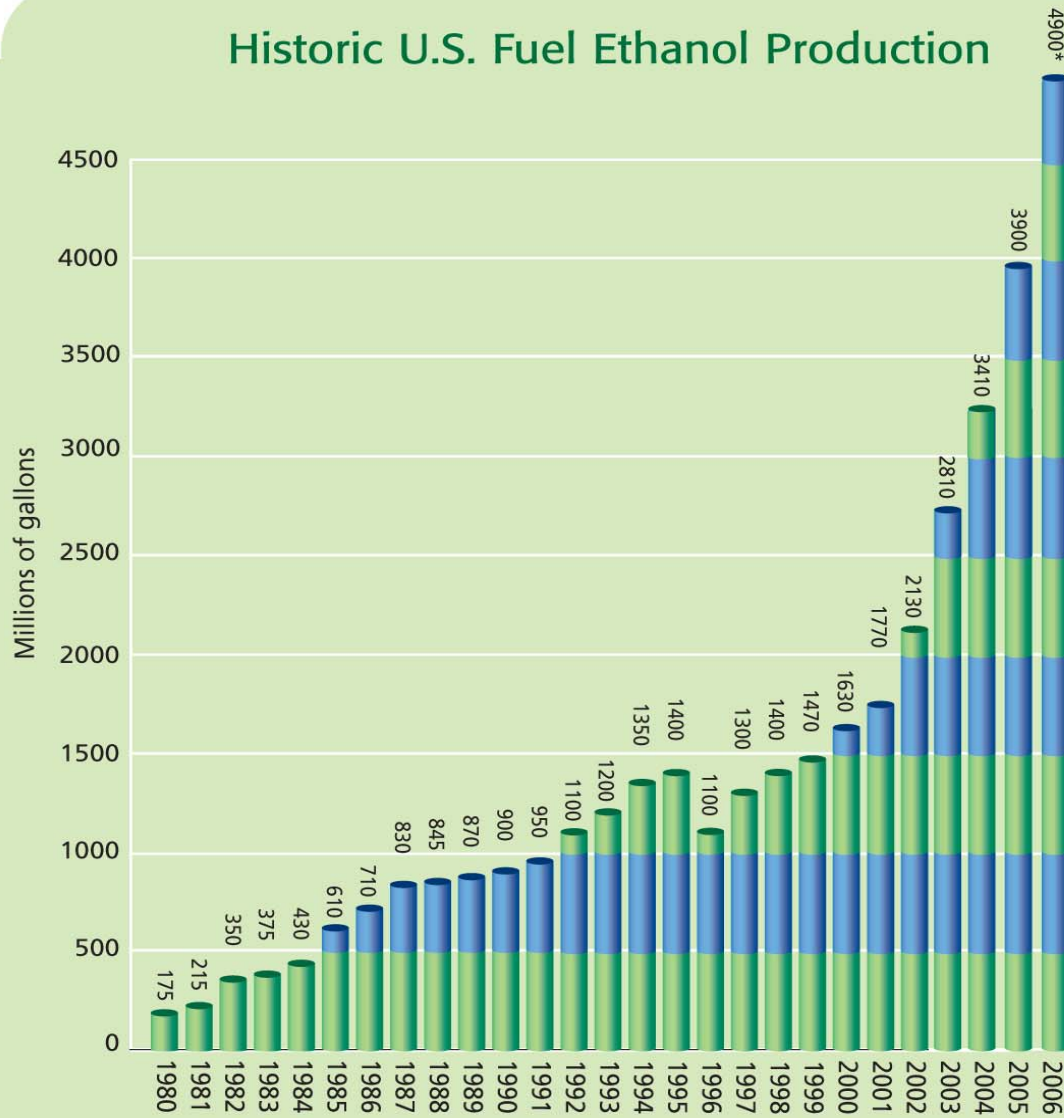
OCTOBER , 2007

United States Biofuels Projection



- **Current Ethanol domestic production 6.4 billion gallons/ year**
- **Projected 12.5 billion gallons/ year by 2009**
- **Biodiesel production projected to reach 250 million gallons/ year**

Historic U.S. Fuel Ethanol Production



*Estimated

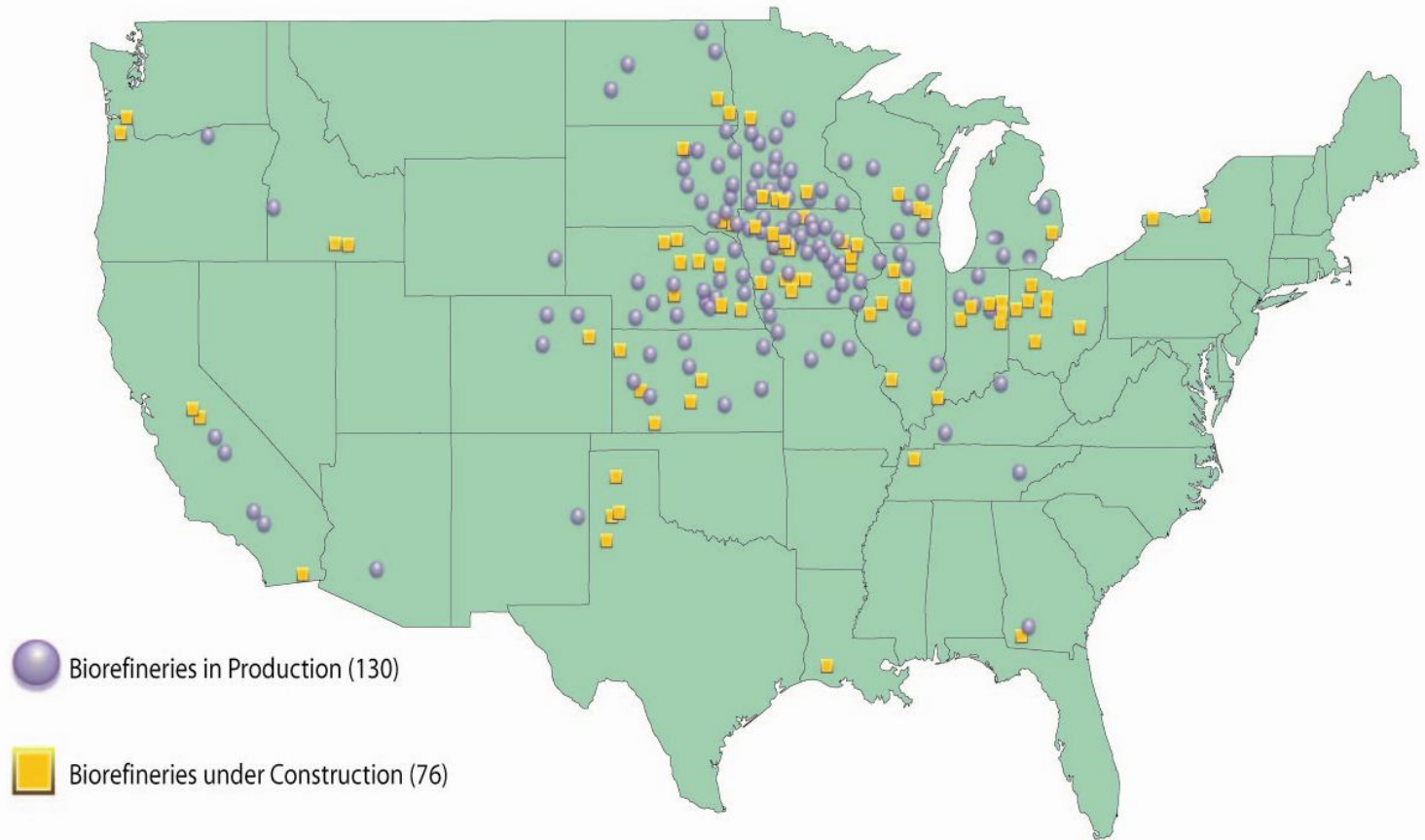
Source: U.S. Energy Information Administration / Renewable Fuels Association

Ethanol Industry Expanding



- **1980's**
 - Measurable Ethanol Production: 200 million gallons per year
 - Midwest States: Illinois, Iowa, Minnesota, Nebraska
- **1990's**
 - Ethanol Production Process efficiencies
 - Molecular Sieves replace Benzene systems
- **2000's**
 - Expanding past Midwest
 - Average plant size up from 40 to 100 million gal/year
- **Today**

U.S. Ethanol Biorefinery Locations



Source: Renewable Fuels Association
10.4.07

The Ethanol Production Process



Basic ingredients:

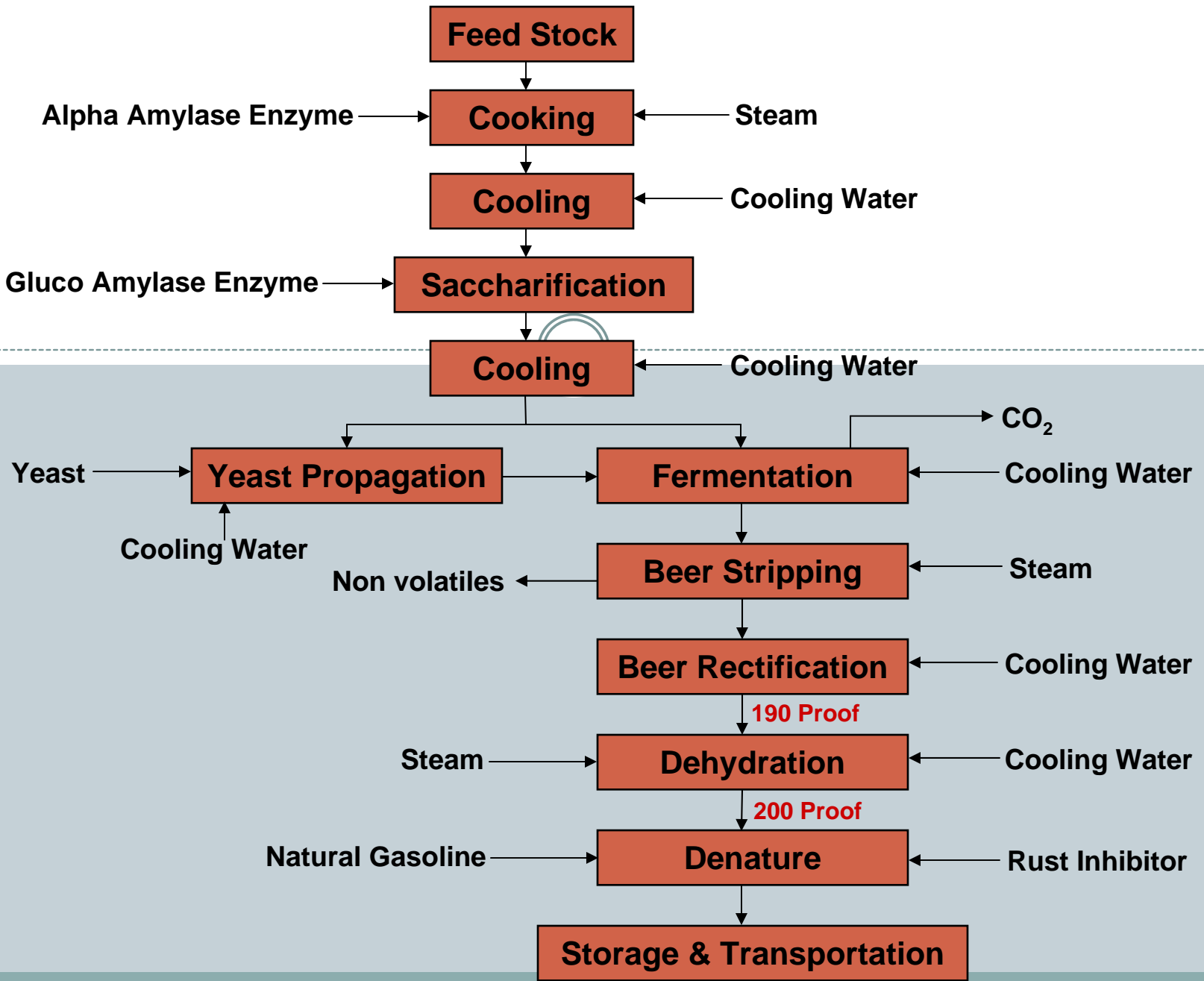
Cereal Grains + water + heat + enzymes + yeast

1 Bushel of #2 Yellow Dent Corn produces:

2.7 Gallons of 200 Proof Ethanol

17 Pounds of Distillers Dried Grains

17 Pounds of Carbon Dioxide



Hazards Identified



- **Flammable Liquids**
 - Ethanol
 - Denaturant, typically Natural Gasoline, Unleaded Gasoline
- **Grain Handling**
 - Corn
 - Dust Collection
- **Process Chemicals**
 - Acids/ Caustics/ Surfactants

Ethanol Plant Flammable Liquids



- **Distillation/ Storage Area: Class I, Division I Safety**
 - 190 Proof Ethanol present in first distillation process
 - ✦ Little if any storage, in process flow
 - 200 Proof Ethanol present in anhydrous process
 - ✦ Small day tank storage, typical <30,000 gallons on site
 - Denaturant (to make it not drinkable)
 - ✦ Small day tank storage, typical <30,000 gallons on site
 - Finished Fuel Ethanol Product
 - ✦ Large amount of storage, > 500,000 gallons on site

Fuel Ethanol Properties



- **Content: E95, 95% Ethanol, 5% Denaturant: Natural Gasoline, Unleaded, Naphtha**
- **Characteristics**
 - Boiling Point: 78°C
 - Vapor Pressure: 44@ 20°C
 - Completely miscible with water
- **MSDS**
- **Polar Solvent- must have Alcohol Resistant type of foam**
- **E85 very similar to this product, higher denaturant**

Fuel Ethanol, UN 1987 Location



- **Plant Storage Tanks**
- **Plant Loading Racks**
- **Trucks/ Railcars/ Barges in transit**
- **Petroleum Terminals**
- **Petroleum Loading Racks blend Ethanol**
 - ✦ **10% Ethanol**
 - ✦ **90% Unleaded Gasoline**
 - ✦ **Placard UN 1203**
 - ✦ **Headed to Retail Gas Stations**

Ethanol Plant Grain Handling



- **Inbound feedstock to the Plant**
 - Corn
 - Sorghum/ Milo
- **Typical storage**
 - Silo
 - Inbound Truck and Railcar
- **Dust Collection Systems**
- **Hammermill area, grain is pulverized and water added immediately thereafter**

Grain Storage and Handling



- **OSHA Grain Handling safety guidelines**
 - 29CFR1910.272
- **Housekeeping**
- **Emergency operations plan**
- **Flowing grain hazards, engulfment, dust hazards for fire**
- **Heavy machinery hazards**
 - Conveyors, pulleys, bucket elevators
- **Confined Space Entry requirements**
 - Bins, silos, tanks

Ethanol Plant Process Chemicals



- **Ethanol production process (pH adjustment, nutrients)**
 - Sulfuric Acid- Corrosive, Poison
 - Sodium Hydroxide, Caustic Soda- Corrosive
 - Ammonia Source- Anhydrous, Hydrated- Corrosive, Poison
- **Cleaning chemicals keep fermentation clean**
 - Chlorine based Solution- Corrosive, Poison
 - Caustic Soda- Corrosive
- **General water treatment chemicals**
 - Chlorine or Bromine based Solution- Corrosive, Poison
 - Ammonia related Solution- Some hazards
 - Surfactants- Some hazards, typically mild

Process Chemicals Location



- Fermentation
- Distillation
- Feed Process
- Cooling Water Treatment
- Co-Generation Water Treatment
- Warehouse

**Typical Usage is Drums, Totes,
Small Tanks <5,000 gallons**

Recognizing Fuel Ethanol on the move....



- UN 1987 used for all modes of transportation for E95
- UN 1993 used for denaturant transportation
- UN 1203 used for ethanol/ gasoline blends E10
- New Placard proposed for E85: UN 3475 coming 2008 (waiting on ruling from US DOT)

Responding to Ethanol Incidents



- Fire Safety Video produced by ethanol handlers
- Renewable Fuels Association funded
- Identifies what types of fire fighting foam is required to fire ethanol types of fires
 - Need an Alcohol Resistant (AR) type of foam

**Video is available for FREE download from
RFA website:**

www.ethanolrfa.org

Thank You



RENEWABLE FUELS ASSOCIATION

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