

Management Consulting Engineering



Transportation of Grain and DDGS for Ethanol Plants and Trends in Port Development

Presented by:
Rajesh Mendiratta and Bob Klare

Outline

- Grain Receiving Requirements
- DDGS Shipping Requirements
- Logistics
- Material Handling System Design
- Port Trends



100 Million GPY Ethanol Facility

Overall Annual Material Handling

Corn Required – 37 Million Bushels

DDGS Produced – 315,000 Tons



100 Million GPY Ethanol Facility

Minimum Corn Receiving Capacity

Computational Basis: 16 hrs/day, 300 days/year

7700 Bushels per Hour

Design Capacity Should be Double

15,000 Bushels per Hour



Receiving Options for Corn

Truck, Rail, Barge

Should have at least two options

Critical aspect of site selection



Corn Receiving

- Two barges per day
- 35 rail cars per day
- 90 trucks per day



100 Million GPY Ethanol Facility

Minimum DDGS Shipping Capacity

Computational Basis: 16 hrs/day, 300 days/year

65 Tons per Hour

Design Capacity Should be 2X – 3X

130-200 Tons per Hour



Shipping Options for DDGS

Truck, Rail, Barge

- Should have at least two options
- Critical aspect of site selection
- Oriented to target market
- Flexibility to take advantage of market trends



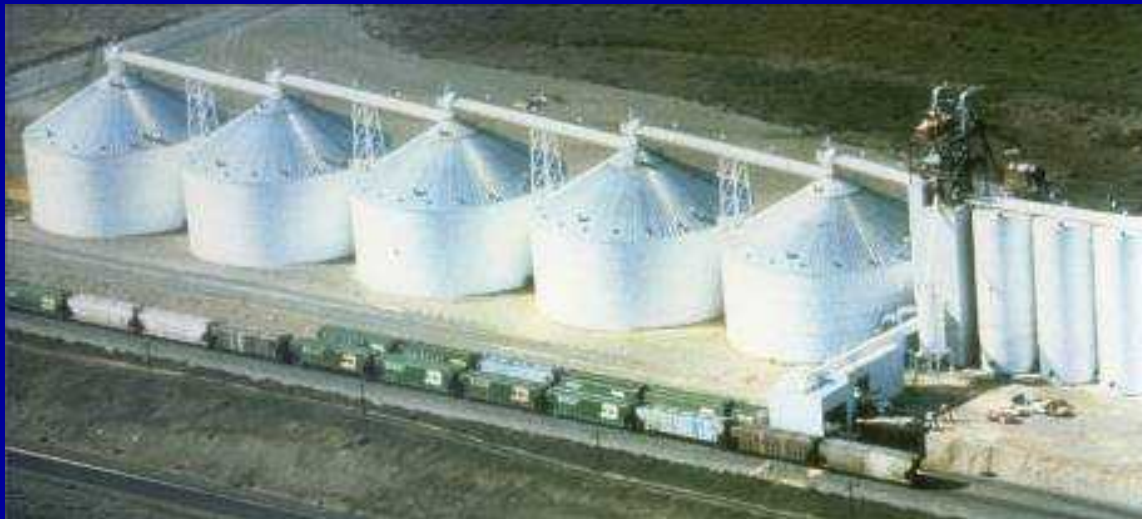
DDGS Shipping

- 2/3rd barge per day
- 10 to 12 rail cars per day
- 25 to 30 trucks per day



Logistics

- Consideration for site selection
- Transportation flexibility important
- Consider impact on Material Handling Systems
- DDGS Market relatively new and unpredictable



Material Handling System Design

Corn – Properties widely available, USDA grading standards used, extensive historical records and design standards, generally free-flowing material



Material Handling System Design

Corn

- For spout design, use 70 to 100 bushels per hour flow per square inch of spouting, depending on steepness
- Spouting angles 40 to 45 degree acceptable, can be as low as 35 degrees for clean grain if space is not available
- Ceramic tile is an excellent liner material, will polish over time with grain flow
- Wide variety of commercially available conveying equipment designed to effectively and successfully handle grains



Material Handling System Design

DDGS – Properties vary widely, largely unknown, vary with environmental conditions and ethanol process, defined as a cohesive material.



Material Handling System Design

DDGS – Flowability and material handling properties being researched by the USDA, but research is preliminary and ongoing.



Material Handling System Design

DDGS

- For spout design, use 50 bushels per hour flow per square inch of spouting maximum
- Spouting angles 60 degrees required, hard directional bends in spouting will reduce flow
- Smooth spout liners, such as UHMW, required in order to prevent material buildup
- Spouts should be designed sturdy enough to withstand vibrators



Material Handling System Design

Equipment to Handle DDGS

- Storage bins should have steep cones and if possible, live bottoms to facilitate discharge
- Bins should have capacity for vibrators and additional cleanout access included in design
- Belt conveyors are superior to drag conveyors when DDGS sit and “harden up” inside equipment



Material Handling System Design

Equipment to Handle DDGS

- Dust control baghouse may need coated bag media to resist blinding, depending on moisture content and temperature
- Vertical space should be designed into all transfer points – almost impossible to add steeper spouts as a retrofit
- Telescoping spouts will be necessary whether the DDGS are loaded into a truck, rail car, barge or ship in order to control dust



Port Trends Related to DDGS

- Approximately 10% of DDGS exported
- 2006 exports up 22% over 2005
- Export market currently 1.25 million tons/year
- Potential growth to 20 million tons/year



Port Trends Related to DDGS

The USDA does not inspect or grade DDGS or other grain byproducts (CGFP, soybean meal) for export – usually handled contractually by an independent third party inspection service.



Port Trends Related to DDGS

- Export grain facilities typically handle DDGS by direct transferring through existing elevator equipment – they will not store DDGS in silos
- Barge-mounted cranes are also used to transfer DDGS from barges to OGVs, but are less desirable because of dust emissions



Port Trends Related to DDGS

- DDGS frequently part of a shift to multiple-commodity OGV shipments. Typically four to seven grain or grain byproduct commodities on one Panamax vessel
- Currently, export elevators run near capacity six to eight months of the year. As corn usage shifts to ethanol production, corn exports are expected to decrease, which should free up capacity at the export elevators



Summary

- Transportation important in site selection
- Flexibility for future markets
- Material handling systems for corn are well established
- Special design requirements for material handling for DDGS



References

Rosentrater, Kurt A. 2006. Understanding Flowability – Part 3: Some Physical Properties of DDGS. Distillers Grain Quarterly, Fourth Quarter 2006

Collins, Keith 2006. Economic Issues Related to Biofuels. Statement to U.S. Senate Committee on Appropriations, Subcommittee on Agriculture, Rural Development, and Related Agencies. August 26, 2006

Rosentrater, Kurt 2006. Physical Properties of Distillers Dried Grains with Solubles (DDGS). Meeting proceedings from 2006 ASABE International Meeting. July 9, 2006

USDA 2004. 2004 National Distillers Grains Summary. USDA National Agricultural Statistic Service. Available online:

http://www.nass.usda.gov/ia/misc/2003dg_ethanol.pdf

USDA 2007. Outlook for U.S. Agricultural Trade. AES-54 May 31, 2007

