



Soy Excellence Center SEC Feed Manufacturing Track – Basic Level



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A  **SOY** program

Liquid applications - At mixer, Handling, and Storage

Patrick Clark, PhD

Fat Handling and Storage

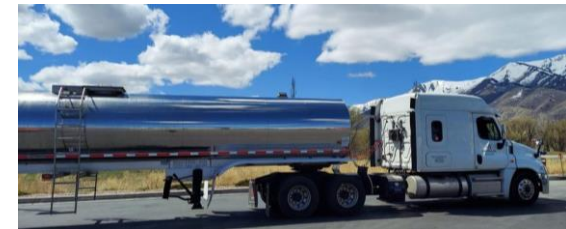
- Most fats melt at 85 to 110°F, but they are typically kept at 120°F
 - Steam is used to maintain the correct temperature
 - A temperature control valve can be used in the steam inlet to maintain the correct temperature and conserve steam
- Received by truck
 - Fat arrives hot enough to be pumped without adding extra heat
 - Truck can have their own pumping equipment
- First few gallons should be discharged in a different container to eliminate any contamination that might have settled in the bottom of the truck

Fat Handling and Storage

- Fat tanks should be vented
 - Avoid excessive condensation
 - Prevent a vacuum from being drawn on the tank when fat is pumped out and cause a collapse of the tank
 - Storage tank should be closed to the boiler room to prevent condensation from temperature changes
 - Tanks should be heated to maintain the same temperature
 - Fat tanks should be cleaned twice a year

Fat Handling and Storage

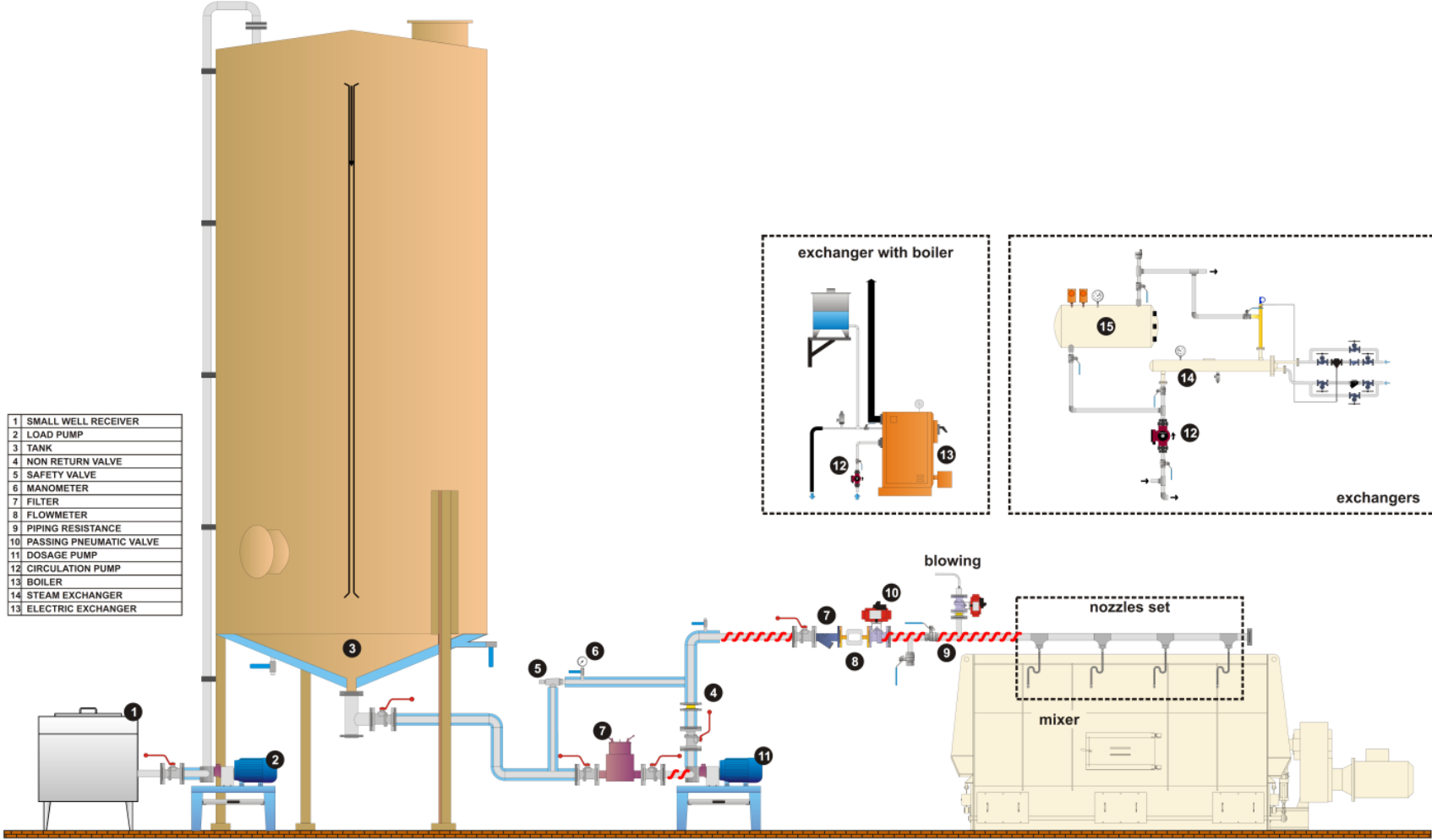
- Liquid storage systems should have a spill containment (dike)
 - Spills can occur during fat receiving
- A platform can help to unload the fat more efficiently
- Some truck can have their own pumping system of fat
- Strainer can be used to remove solids before fat storage
 - Strainer can be used to remove solids as fat is pumped out
- Agitators
 - Keep moisture and sediment suspended
 - However, it can moisture and oxygen and speed up the chemical reactions and lead to fat rancidity



Mixer Application

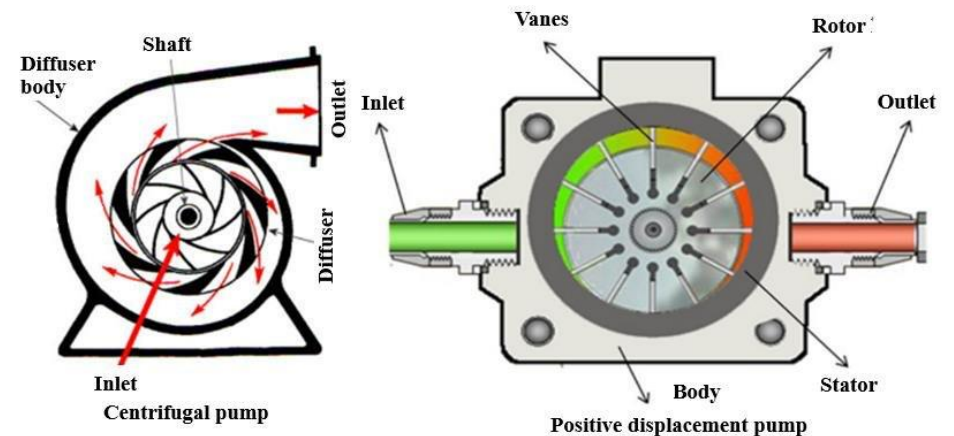
- Liquids can be added in the mixer, after the pellet die, or down stream after cooling
- Adding fat in the mixer is the easiest and cheapest way
 - More mixer added fat
 - Increase production rate
 - Reduce pellet quality

Mixer Application



Pumps

- Positive displacement pumps move a specific amount of liquid each time the pump turns from the liquid tank to the application system
 - Mixer
 - Post pellet liquid application
- Changes in density due to viscosity and temperature can influence how much liquid is applied to the dry feed



Liquid Application Systems

- **At the die:**
 - Done immediately after the pellet mill
 - Spray nozzles in the discharge chute
 - **Advantages**
 - Liquid sprayed onto a hot pellet
 - Inexpensive and can be installed on existing equipment

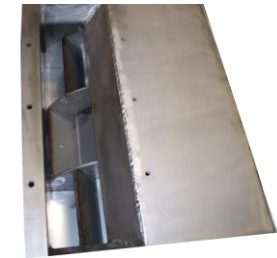
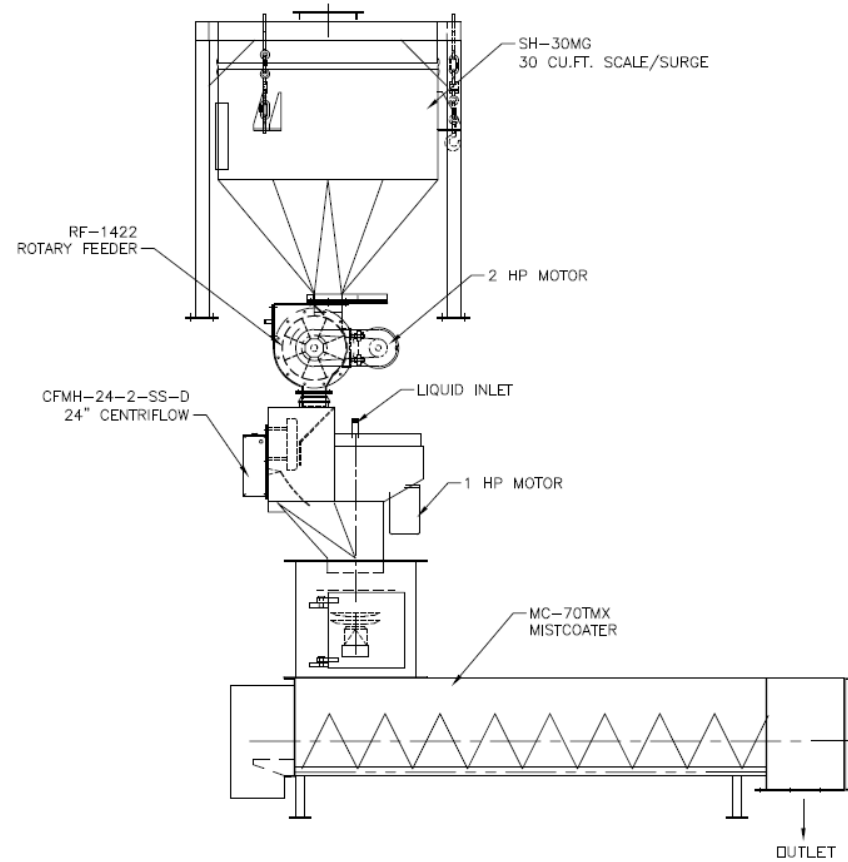
Liquid Application Systems

- **At the die:**
 - **Disadvantages**
 - Little to none time for liquid absorption
 - Coated product travels through the rest of the system, which can create problems with cross contamination
 - Possible fat build up in the cooler and fugitive fat can be drawn off into the air system
 - Relies on the volumetric feed rate of the feeder, but diet density is influenced by the density of feed ingredients
 - Fat can trap water inside the pellets and dilute the nutrient concentration
 - If fines are removed and re-pelleted, fines are exposed to more liquid addition

Post-Pellet Liquid Applications

- Standard method to apply fat and other liquids to the surface of pellets
 - Fat addition post-pellet reduces mixer fat additions and helps to improve pellet quality
 - PPLA systems can be used to apply micro ingredients such as:
 - Vitamins: most vitamins can withstand the rigorous of thermal feed processing
 - Enzymes – some enzymes are not stable to the thermal processing of conditioning and pelleting
 - Medicated feed additives - Eliminate the risk of carryover or cross contamination

Post Pellet Liquid Application



PPLA Components

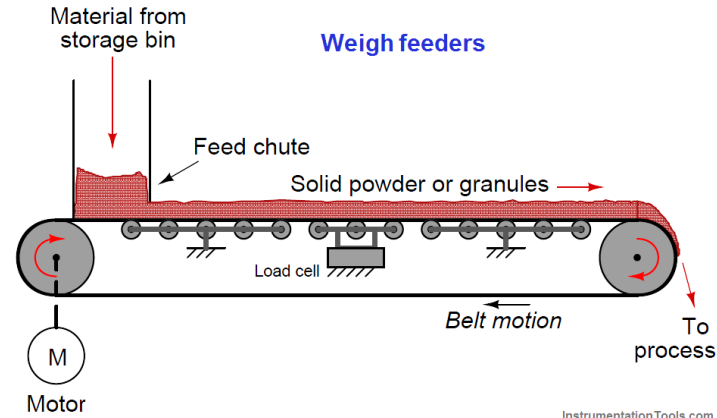
- Dry solids flow measurement
- Liquid measurement/metering
- Spraying/coating
- Mixing

Dry Solids Flow Measurement

- Critical to insuring that PPLA systems correctly dose the liquid ingredients
- Determine if the device is density dependent or independent
- In general, systems that are density dependent cost significantly less, but density of the dry solids must constantly be monitored

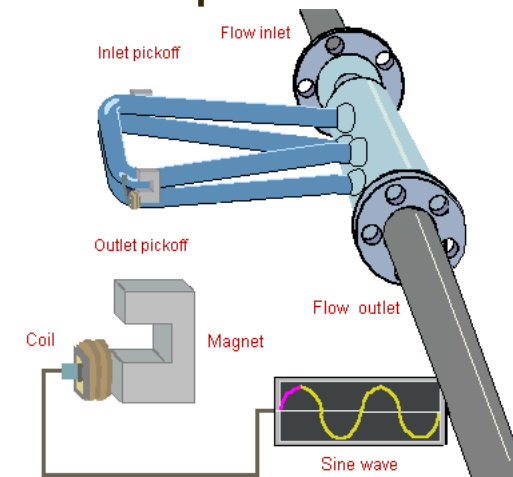
Dry Flow Measurement

- Weigh belt
- Weigh screw
- Impact scale
- CentriFlow



Liquid Measurement

- Positive displacement pumps
- Coriolis meter
- The material moves through the bent tubes which creates a vibration frequency that can be measure and calibrated back to a quantity of liquid
- Changes in viscosity, temperature, and density are accounted for within the meter which allows for a more accurate measurement of the liquid
- Loss in weight scale



Spraying/Coating

- Application methods:
 - Spray into a screw conveyor
 - Spinning disk applicator to atomize and apply the liquid
- Advantages
- Since application is prior to storage, there is less chance of contaminating downstream equipment
- Disadvantages
 - Typically on the upper levels of the mill - access



Liquid Spray Into a Screw Conveyor

- Screw conveyor with spray nozzles
- Coverage can be improved with the addition of a spray plenum
 - Increases the probability of the liquid hitting the dry product uniformly
- Disadvantages
 - Nozzles apply liquid to a limited number of particles
 - Depend on the conveyor to spread the liquid
 - Spotty coverage
 - Little mixing action with standard flighting
 - Cut & fold or ribbon & paddle flight



Spinning Disk Applicator

- Apply single or multiple liquids through 1 inlet
- Totally closed system – no airborne mist
- Overspray falls into mixing conveyor for further blending
- Utilize high speed rotating liquid disks for atomization
- **No spray nozzles**
- If you can pump it – the spinning disk applicator can apply it
- Twin screw mixing conveyor has gentle but active mixing
- 10 ft. conveyor = approx. 45 to 60 seconds of retention and mixing



Spinning Disks

- High speed spinning disks atomize the liquid
- Multiple disks = wider spray band
- Slots in each disk allows liquid to migrate to lower disks
- Serrated disk teeth provides multiple planes of liquid discharge = wider band of spray
 - Wider spray band = more product surface area exposed for a greater amount of time
- **Advantages**
 - Closed system, no spray nozzles to clog, liquid delivered to the disks via a hollow shaft, can apply slurries
 - Twin screw mixing conveyor has gentle but active mixing
 - 10 ft. conveyor = approx. 45 to 60 seconds of retention and mixing
- **Disadvantages**
 - Requires further mixing in a drum or mixing conveyor, requires more headroom than a standard screw conveyor, higher cost

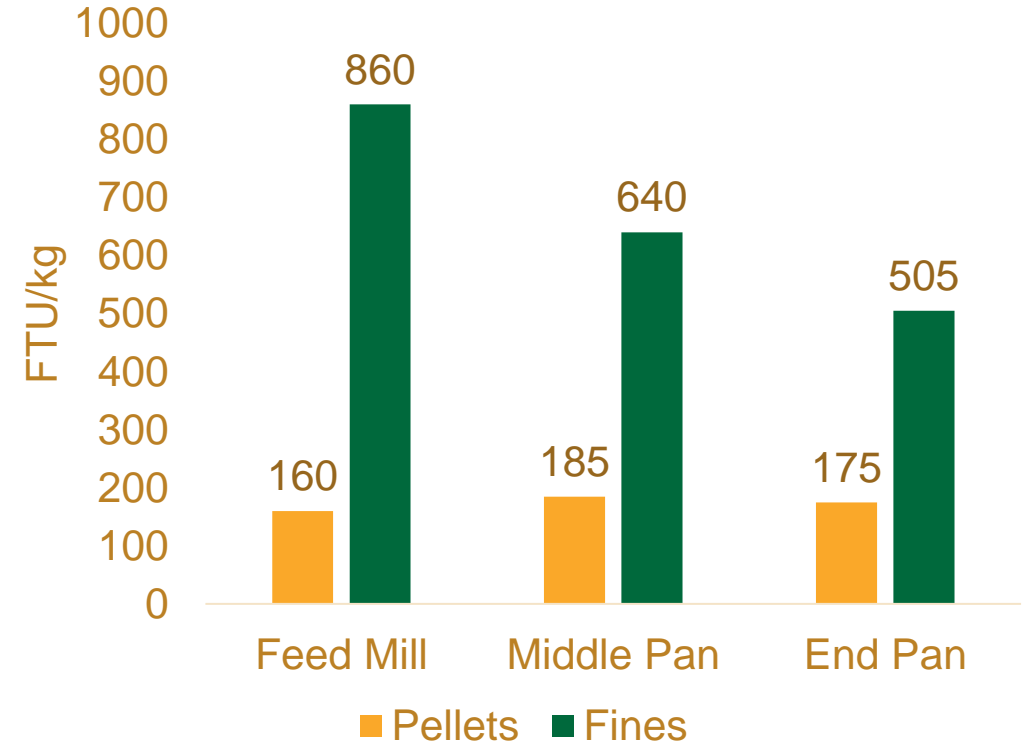
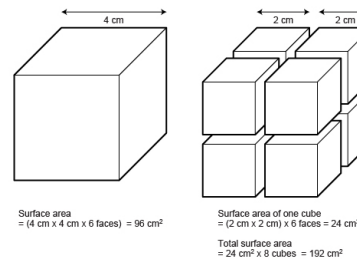


Mixing Conveyor



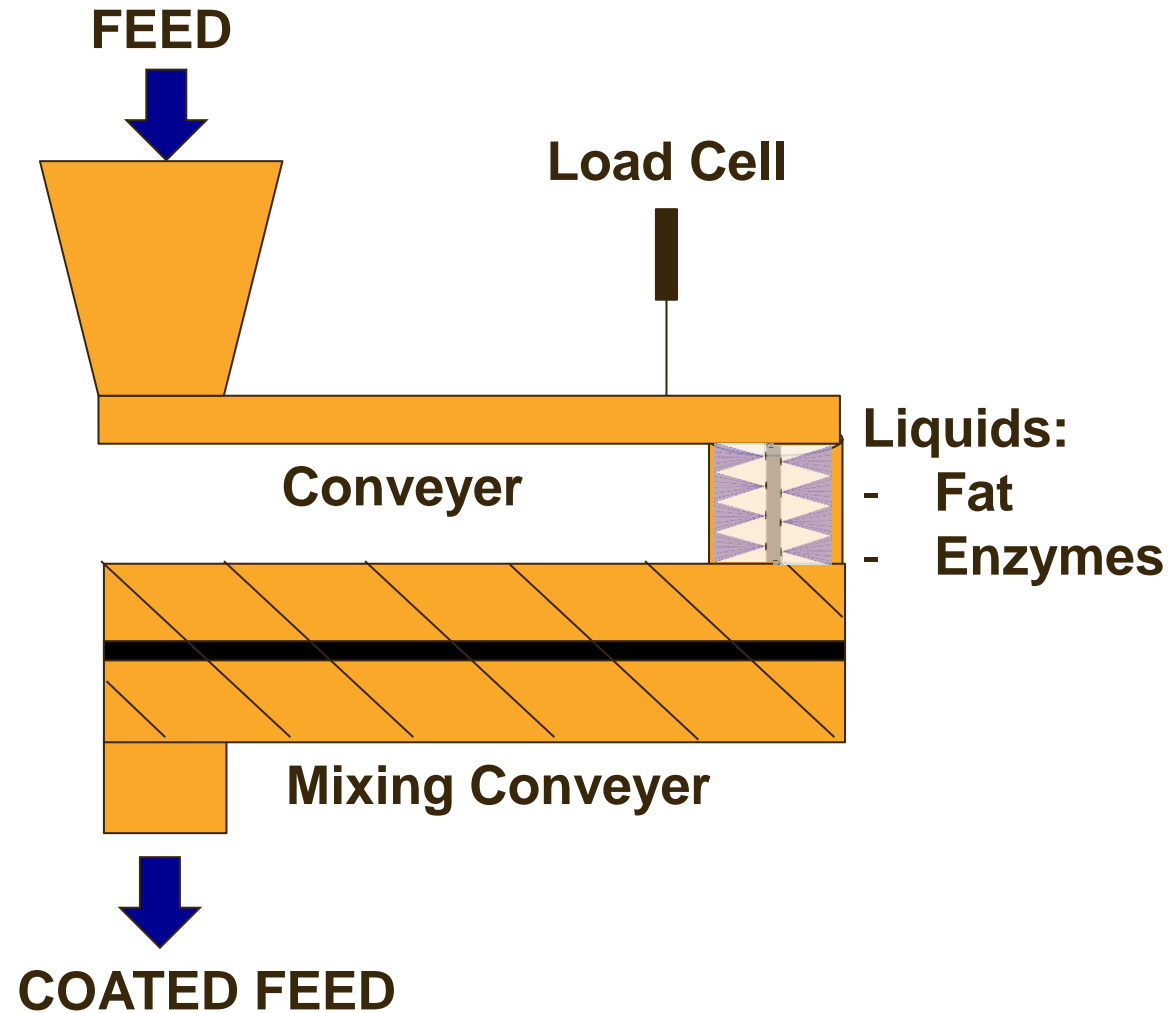
Factors Influencing Accuracy

- Type of PPLA equipment
 - Application rates
 - Quantity of pellet fines
 - Feed processing rates

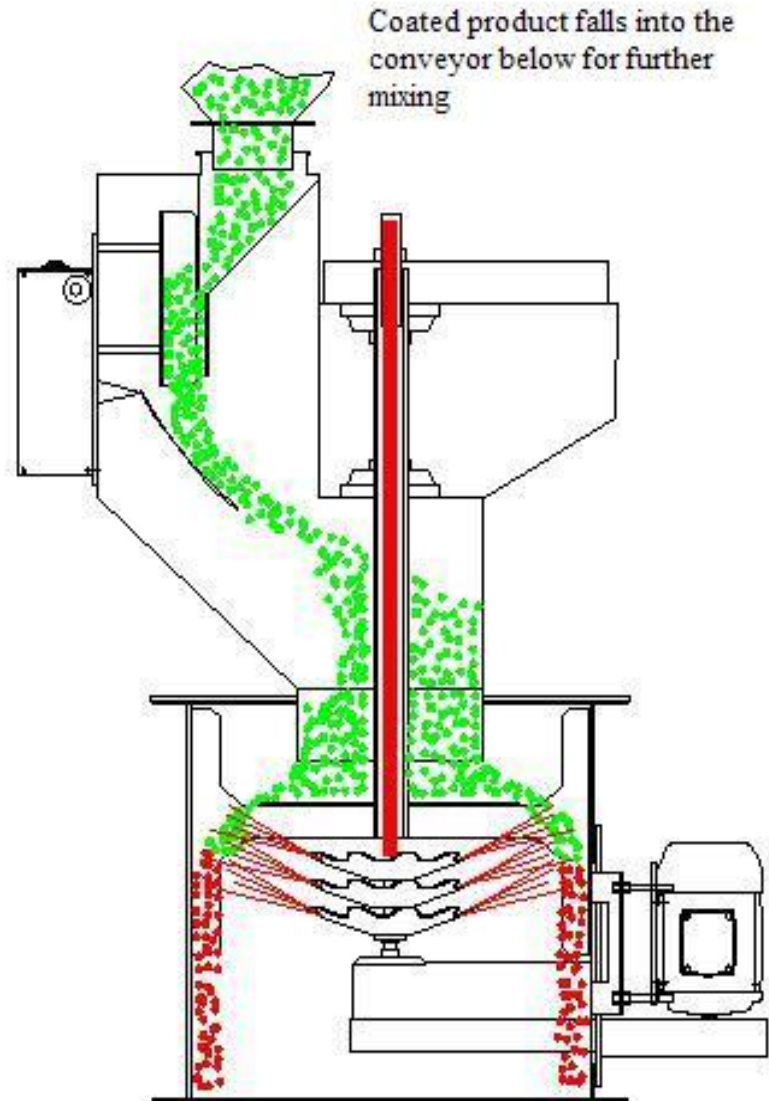


- You need to know how much liquids each system can apply accurately

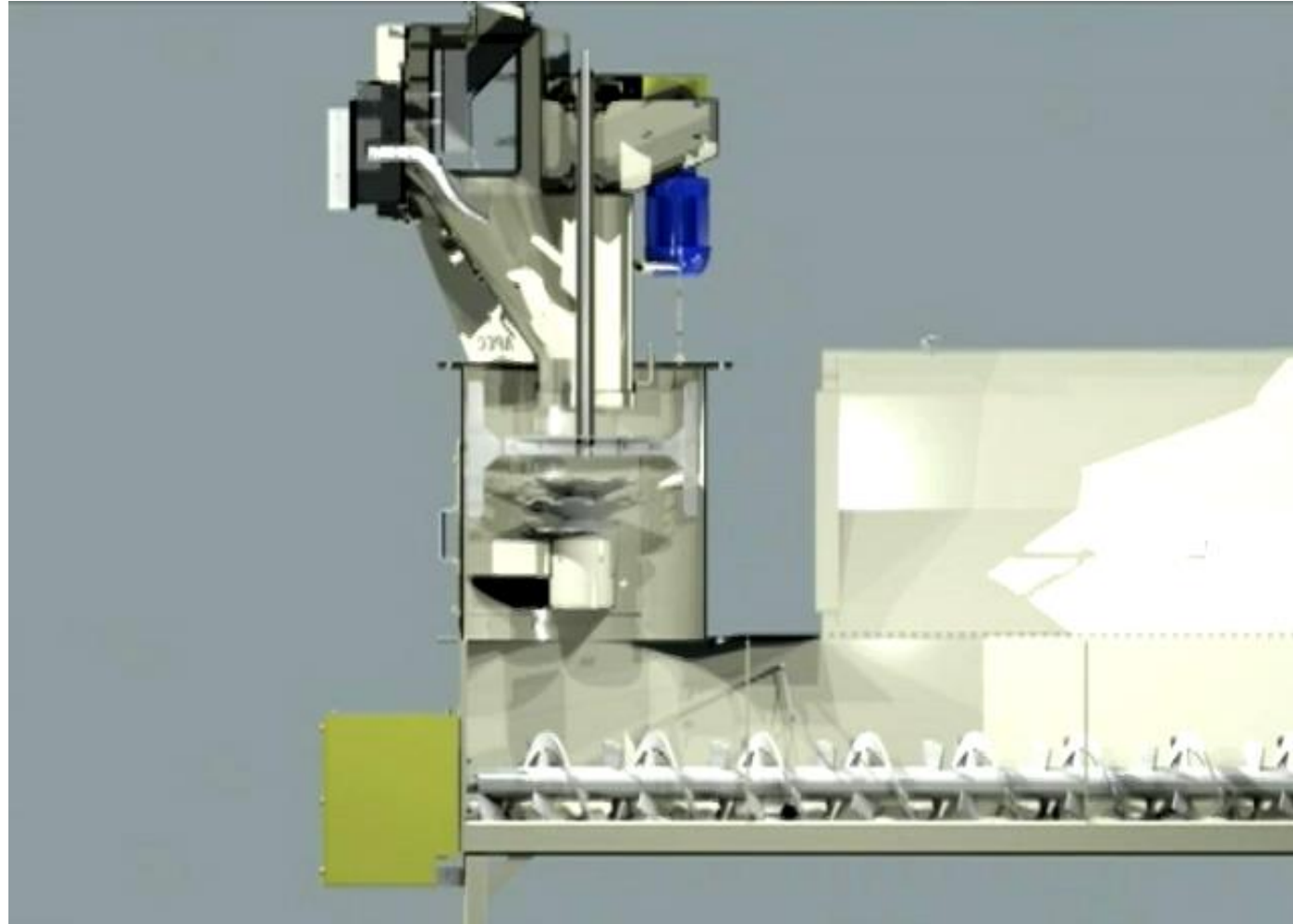
Post Pellet Liquid Application Systems – Load Cell



Post Pellet Liquid Application Systems – CentriFlow

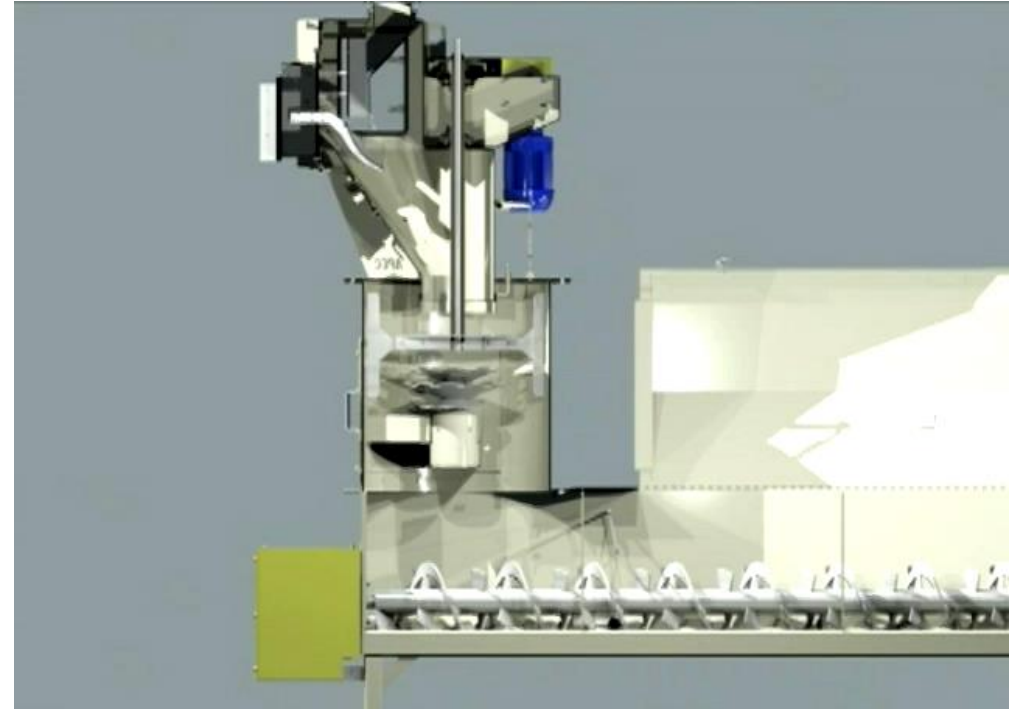


Post Pellet Liquid Application Systems



Liquid Uniformity Assessment

- The post pellet liquid application system should be checked regularly
- Liquid meters and dry flow scale should be checked every quarter
- Samples (n=10) can be obtained over a long run to validate the accuracy of the system
- Samples should be collected with and without fat in order to evaluate the system

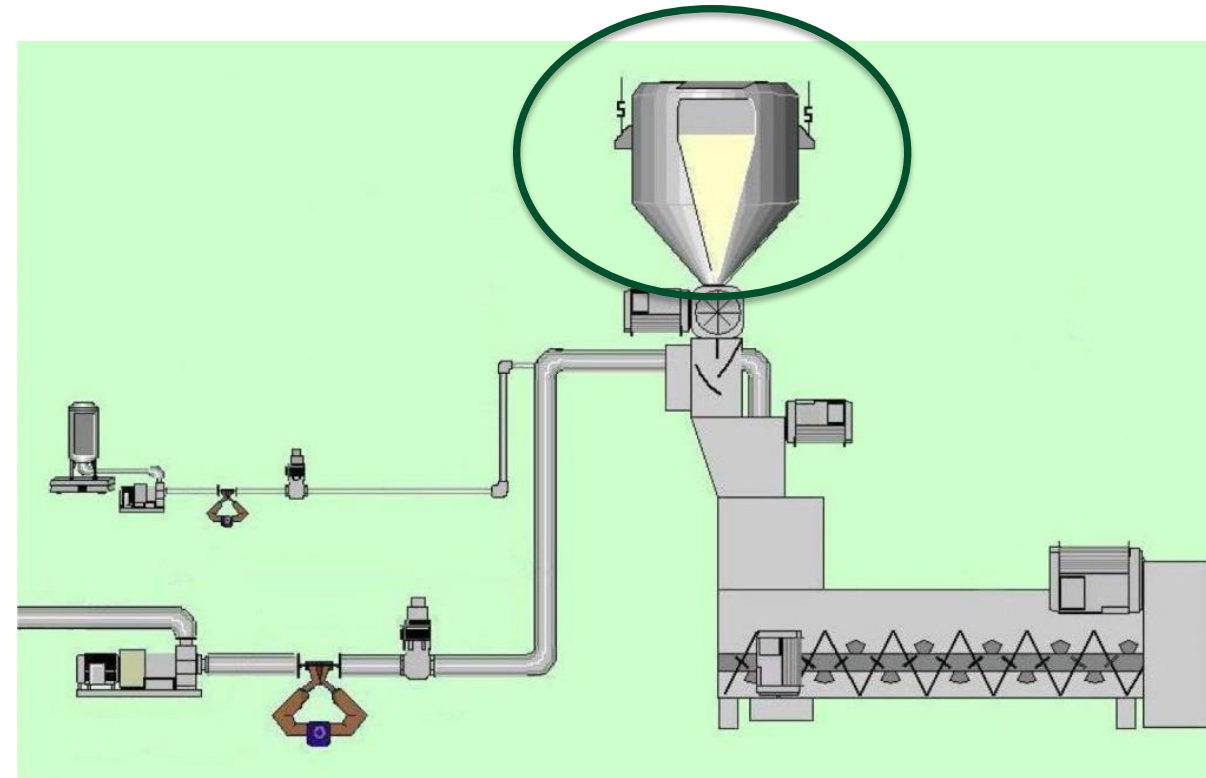


Molasses Application

- Molasses can be added:
 - At the mixer
 - Disadvantages
 - Built up in the mixer
 - Cross contamination of the feed handling and storage system
 - At loadout
 - Blending conveyer prior to bulk or bag loadout
 - Fresher product
 - Less risk of cross contamination

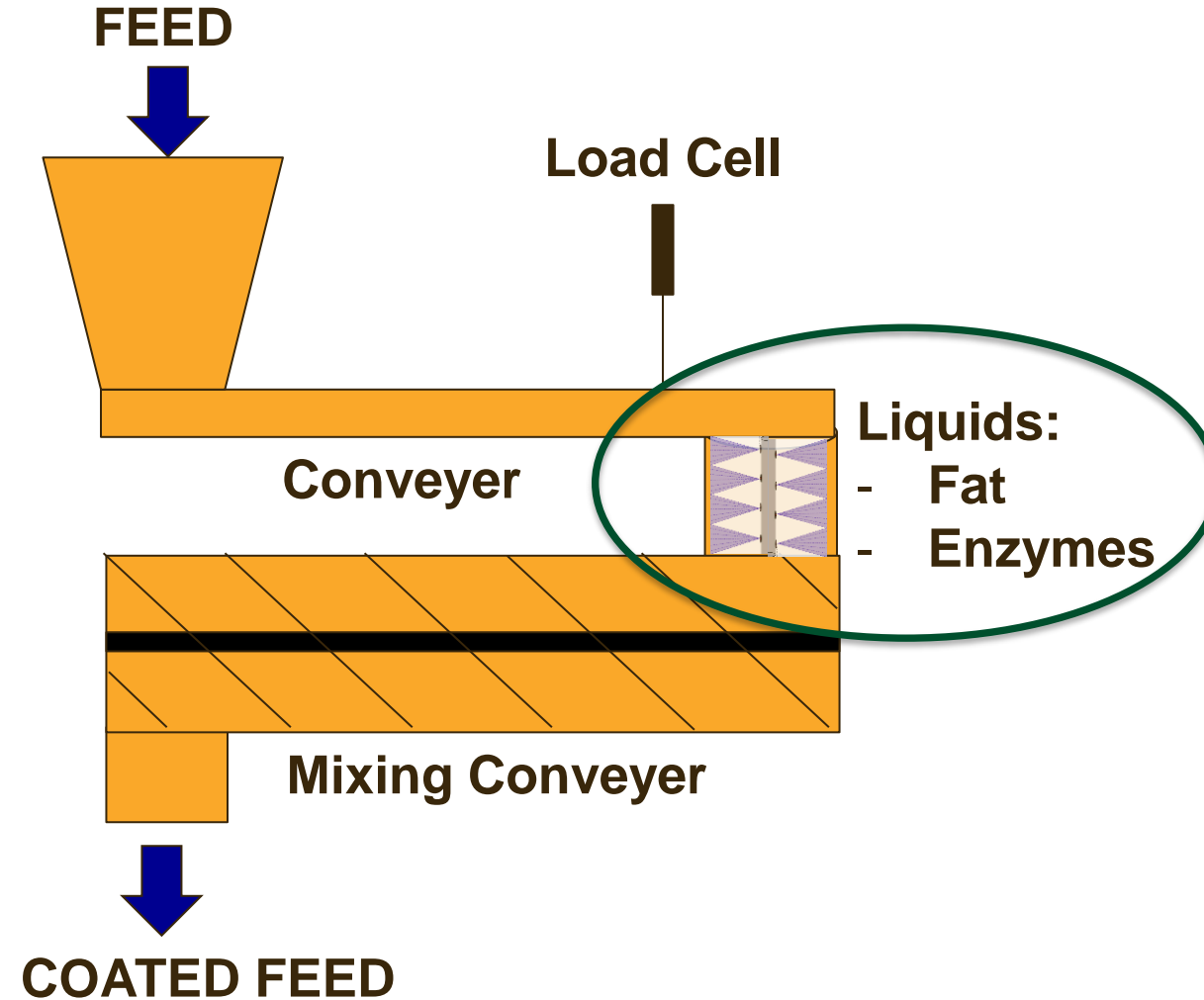
3 Keys To A Good Coating

- Keep a constant level of product in the scale/surge so the system runs continuous
 - Starting and stopping doesn't allow you to achieve a steady state
 - Harder on equipment and electronic



3 Keys To A Good Coating

- Maintain a head of product on the dry disk
 - A head of product insures a 360 degree curtain of product into the coating chamber



3 Keys To A Good Coating

- Run the mixing conveyor full
 - Allows you to take advantage of the mixing action of the screws



Thank You!



Wilmer Javier Pacheco, MSc., PhD.
Extension Specialist and Assistant Professor
Auburn University
wjp0010@auburn.edu

