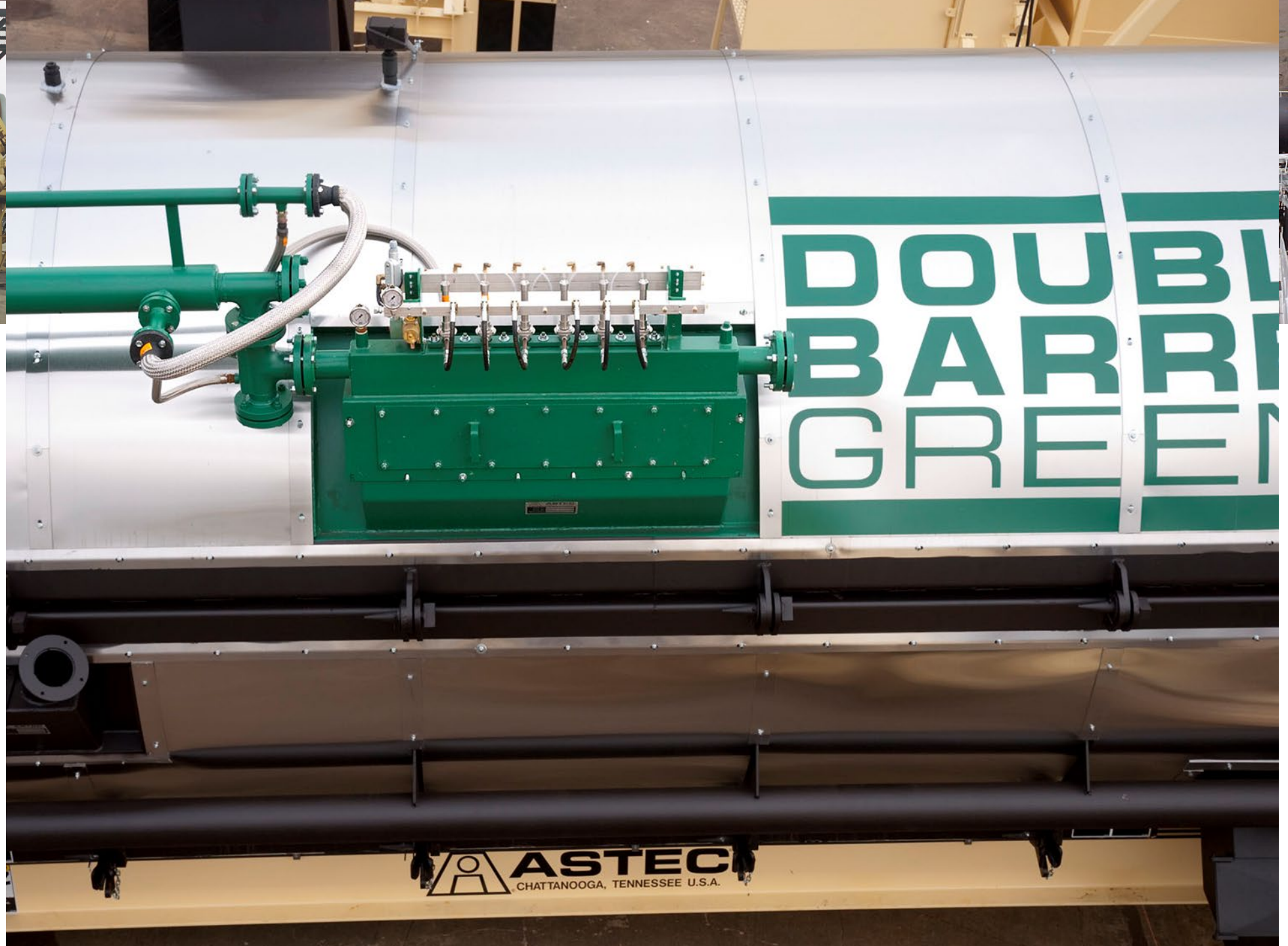
Plant History

Innovations and Future Trends


Ingersoll Rand


635

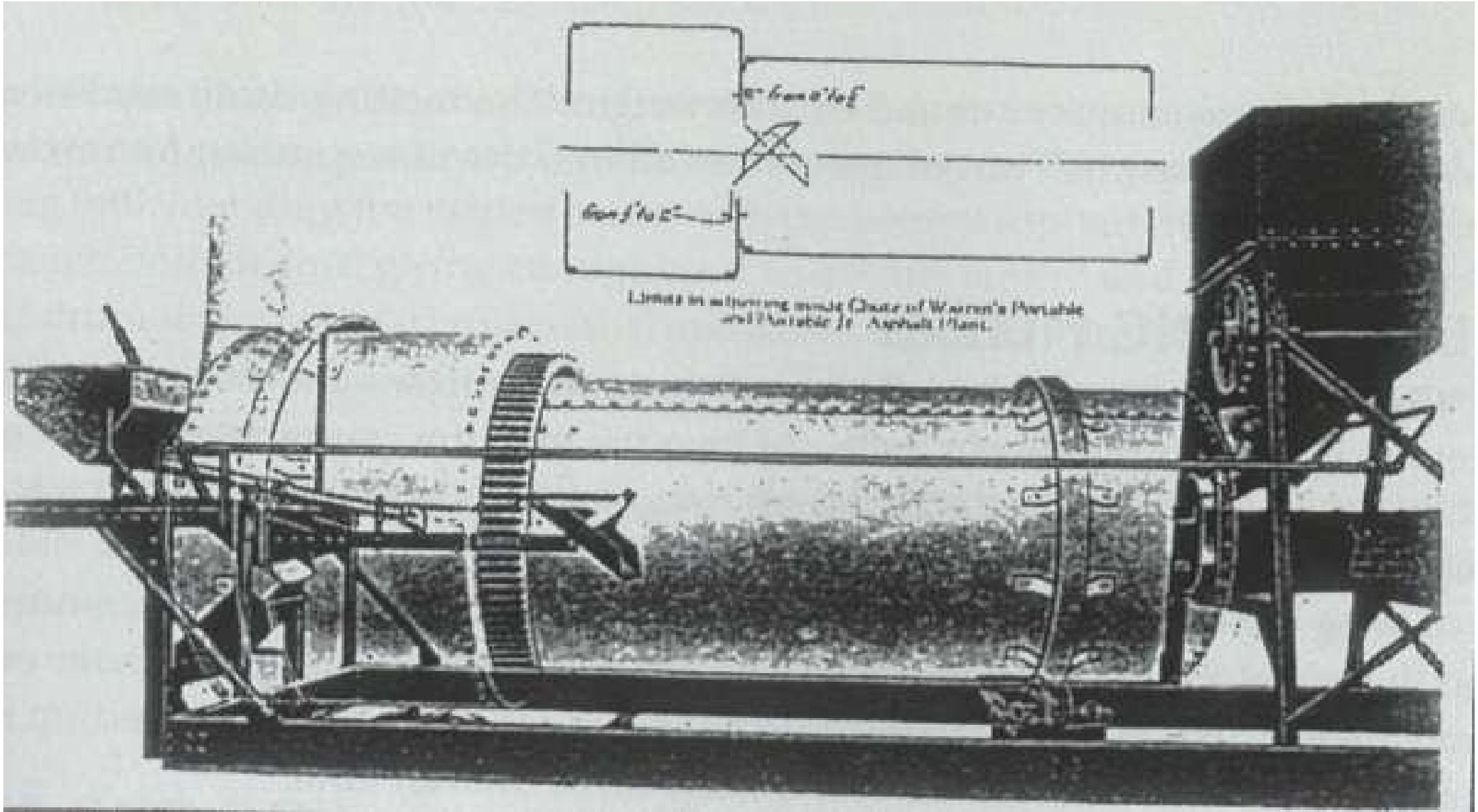

PHOTO OF BOTHELL ROAD
TAKEN MAY. 8. 1912
W B & S SEATTLE, WASH.

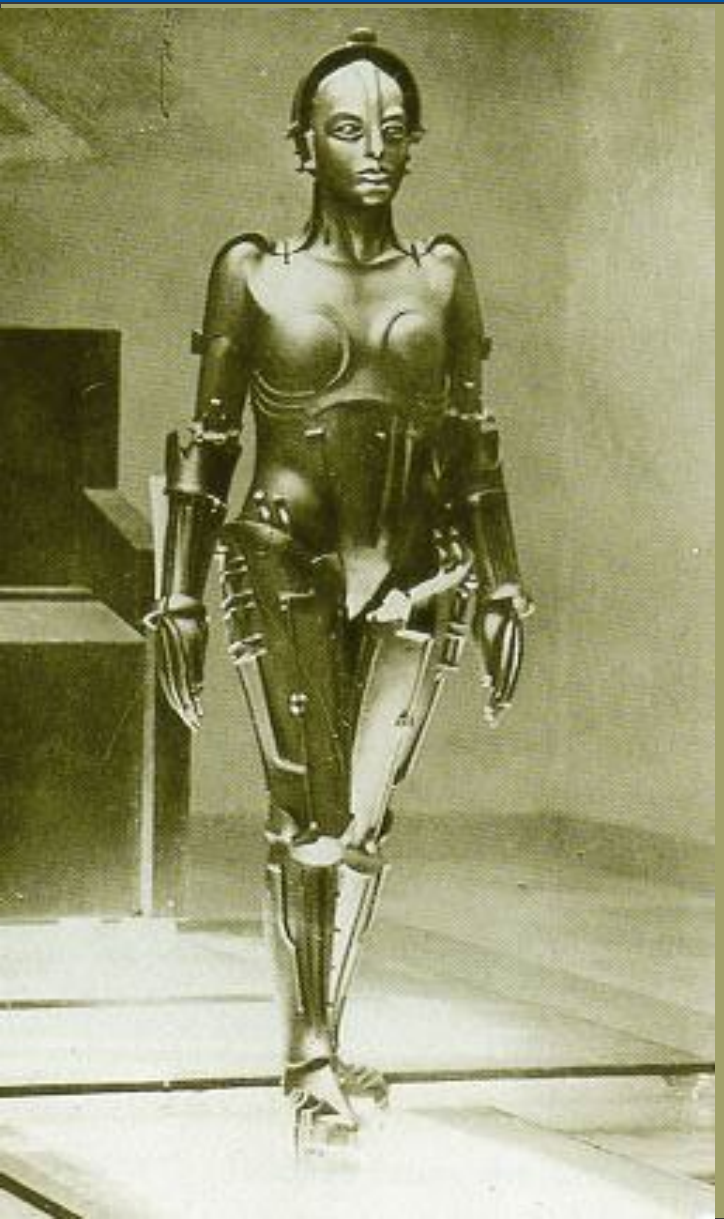

DOUBL
BARR
GREEN
ASTEC
CHATTANOOGA, TENNESSEE U.S.A.

DOUBLE BARREL XHR®

It’s not EVOLUTION.

Warren Brothers Portable





It’s INNOVATION.

Innovation Drivers

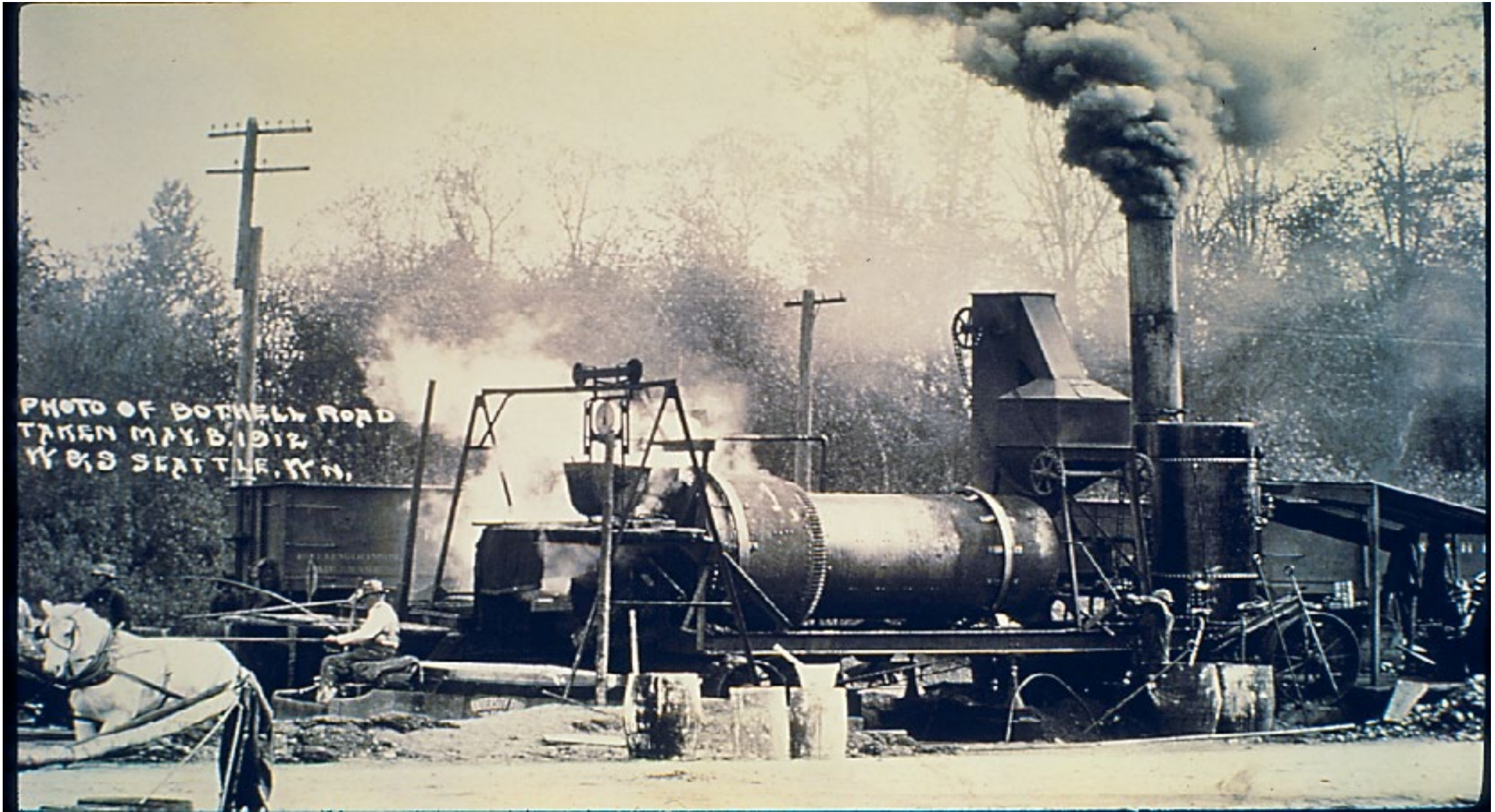
MIX DEMAND, ECONOMICS, MIX DESIGN, REGULATION, COMPETITION

CREATES NEED

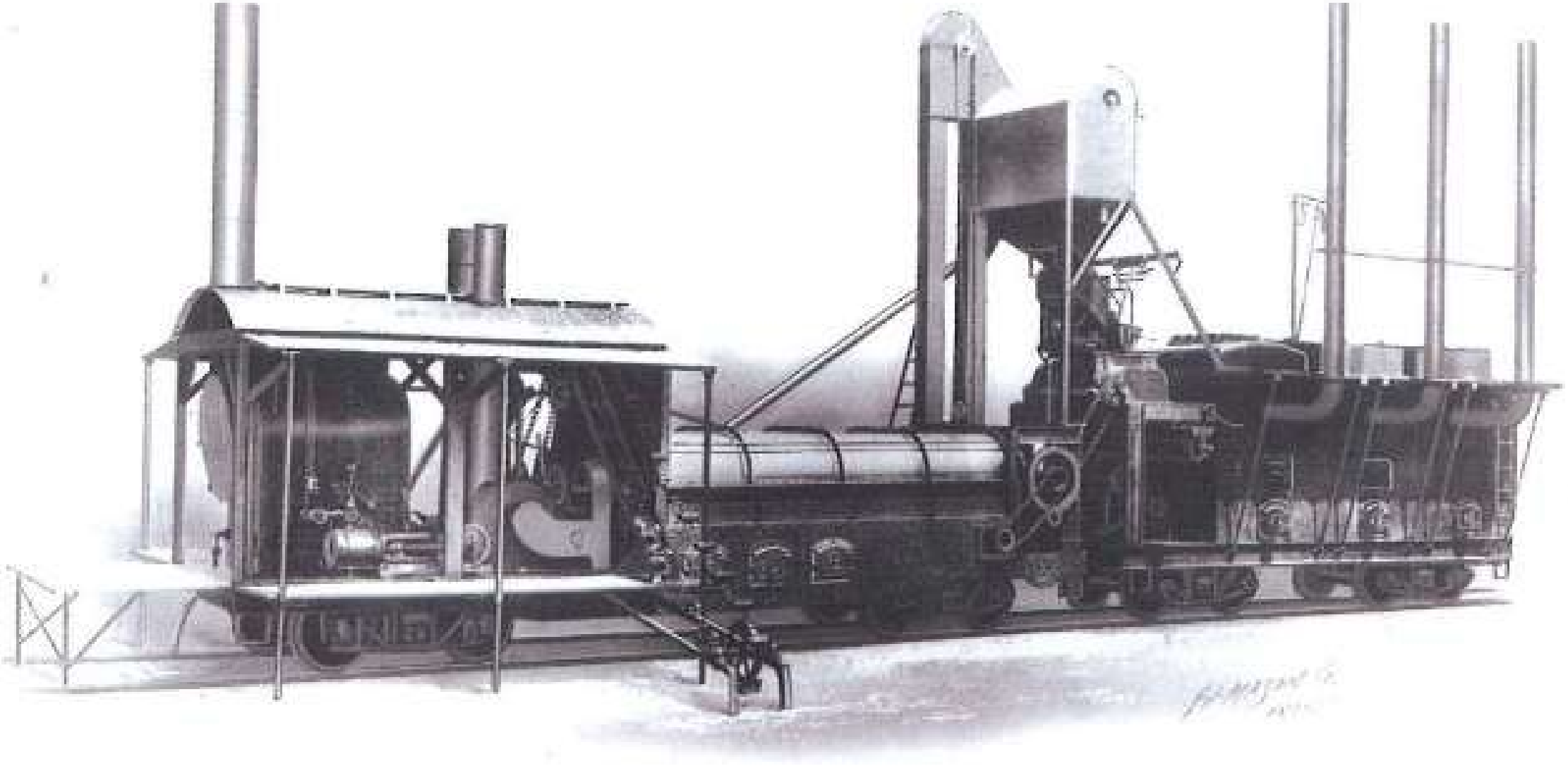
“AVAILABLE” TECHNOLOGY

ADAPT, INNOVATE

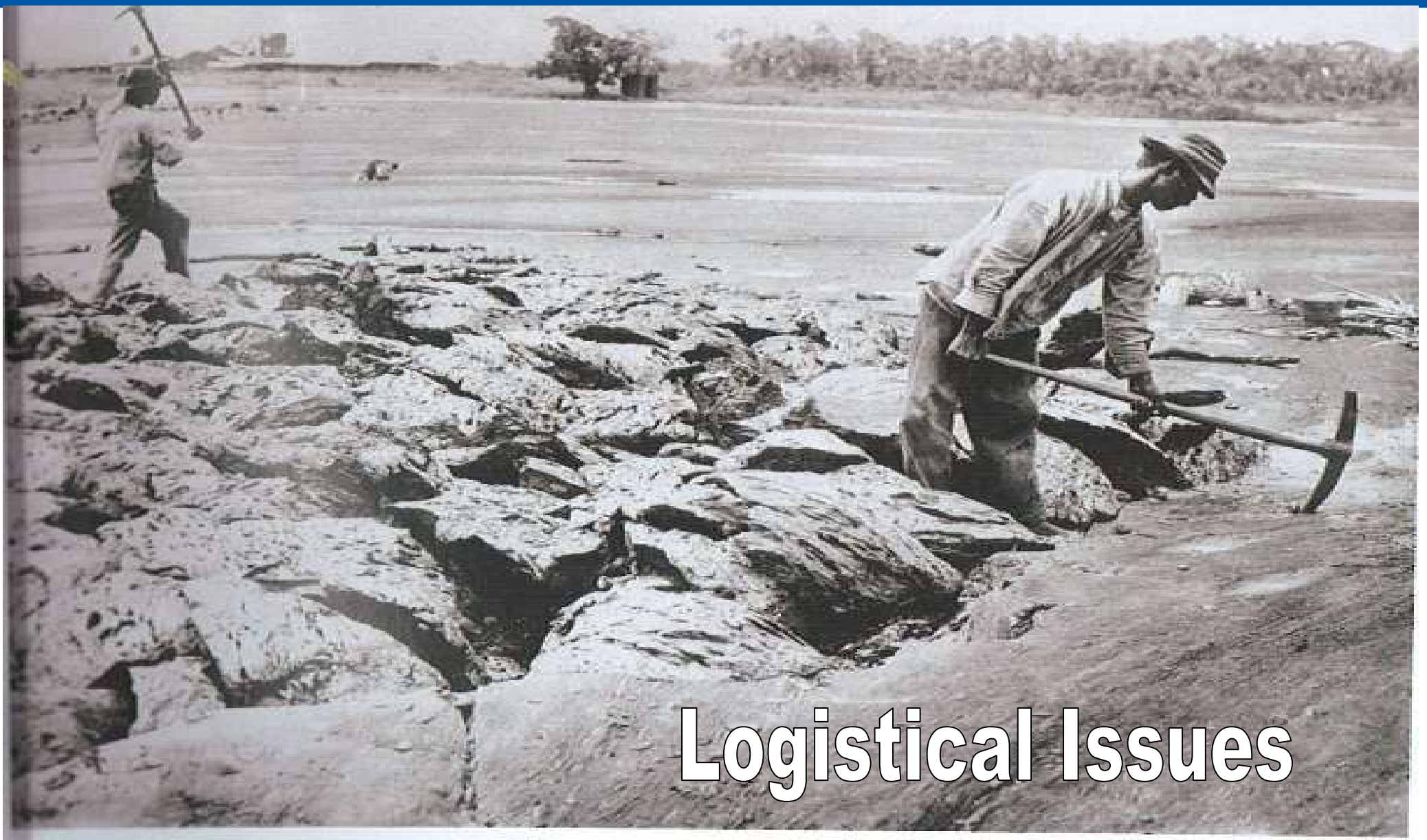
Warren Brothers Plant Operating Outside Seattle, 1912



Hetherington & Berner Railcar Portable, 1908



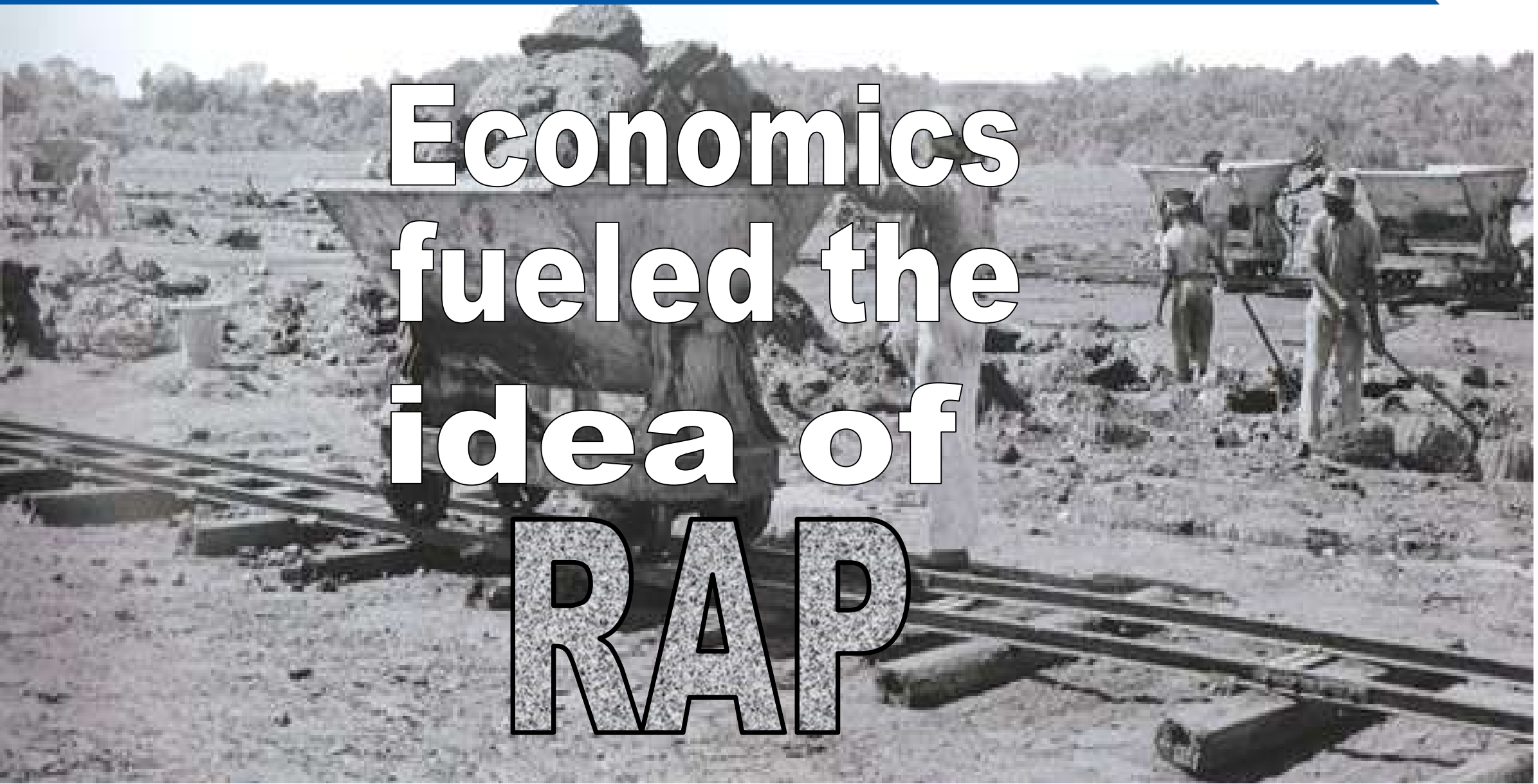
Liquid Asphalt Harvesting from Trinidad Lake



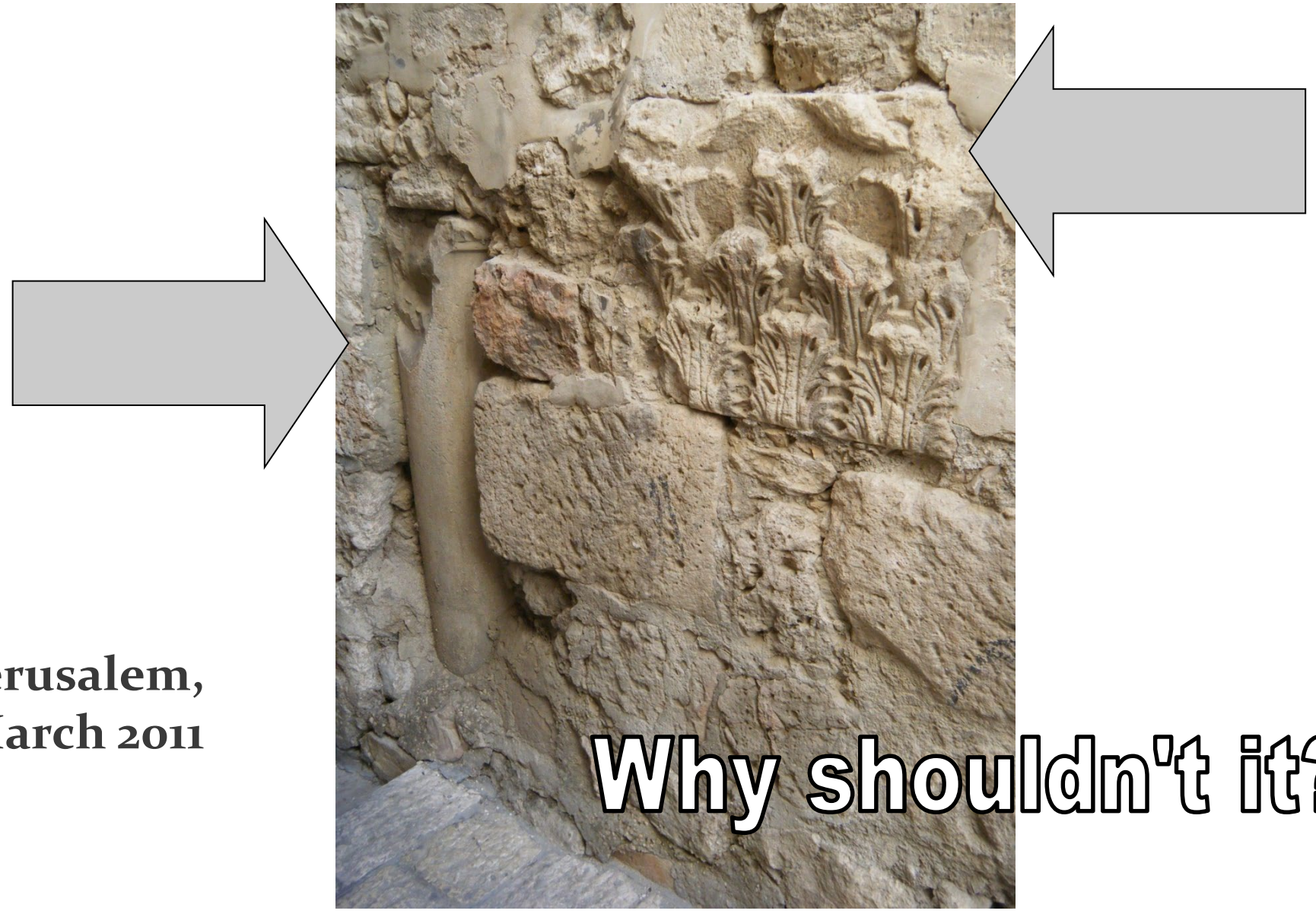
Liquid Asphalt Harvesting from Trinidad Lake

Liquid Asphalt Harvesting from Trinidad Lake

Economics a Major Driver



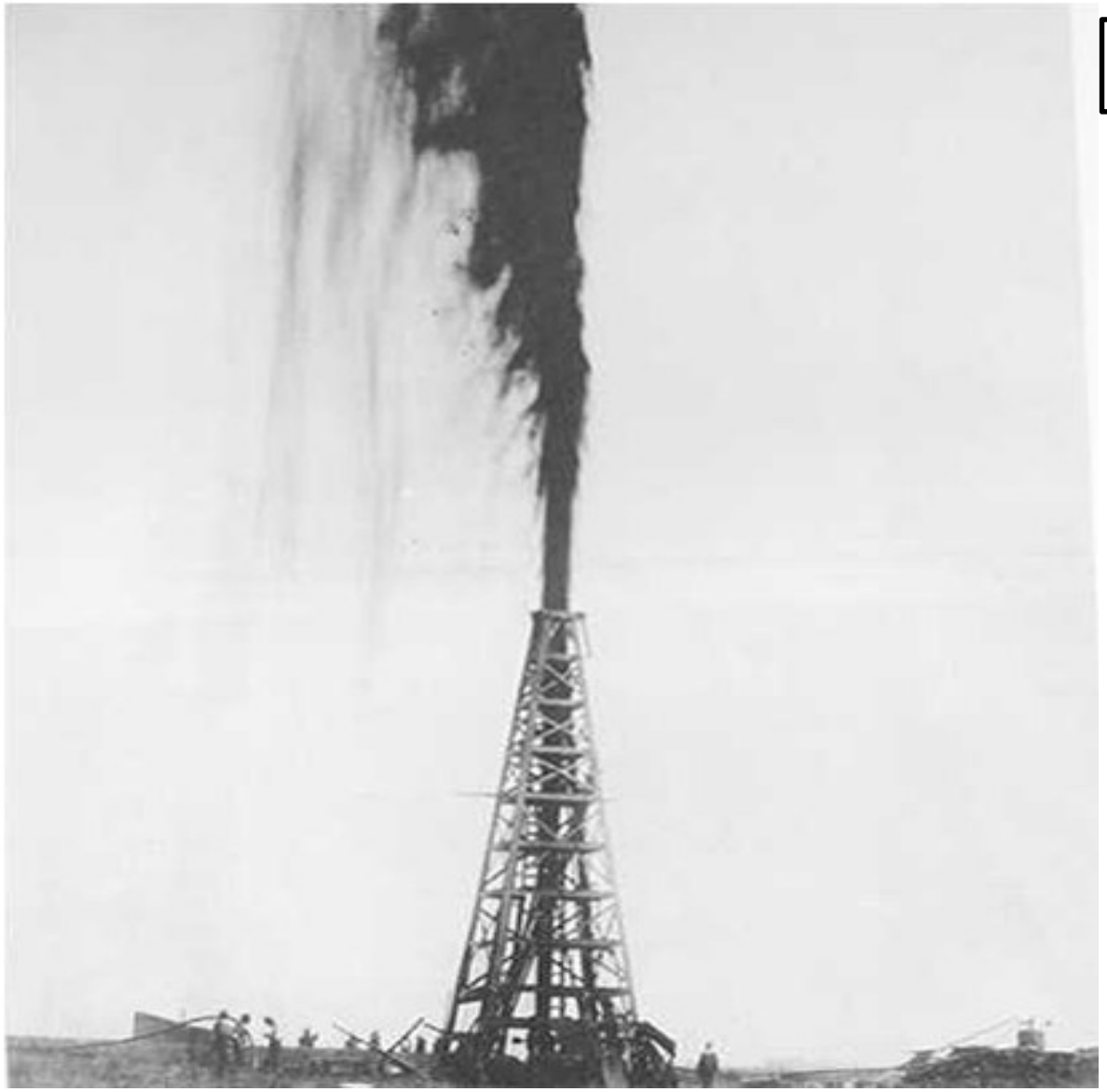
Economics is Always a Driver



Jerusalem,
March 2011

Why shouldn't it?

Supply Change Drives Economics…



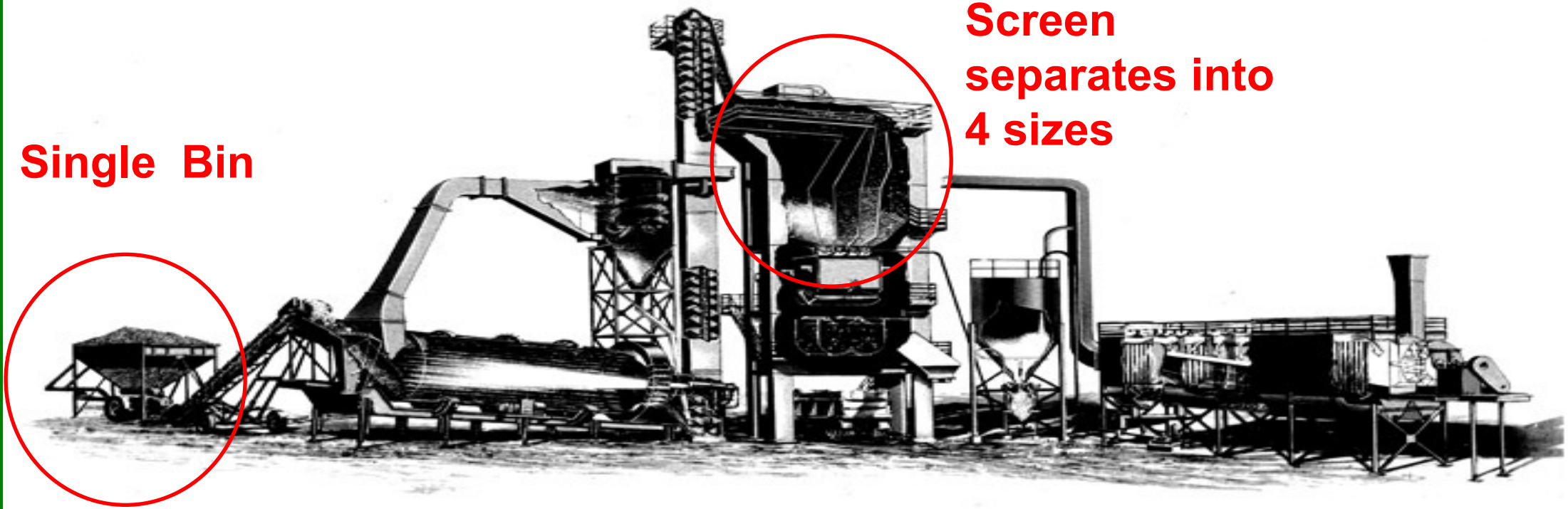
History intervenes…

- January 10, 1901 near Beaumont, Texas
- Lucas Gusher -- took 9 days to cap
- Lost 850,000 barrels
- Oil price plummeted -- $2/bbl to 3¢/bbl
- $100/bbl to $1.50/bbl

photo courtesy of the American Petroleum Institute

28 months later…

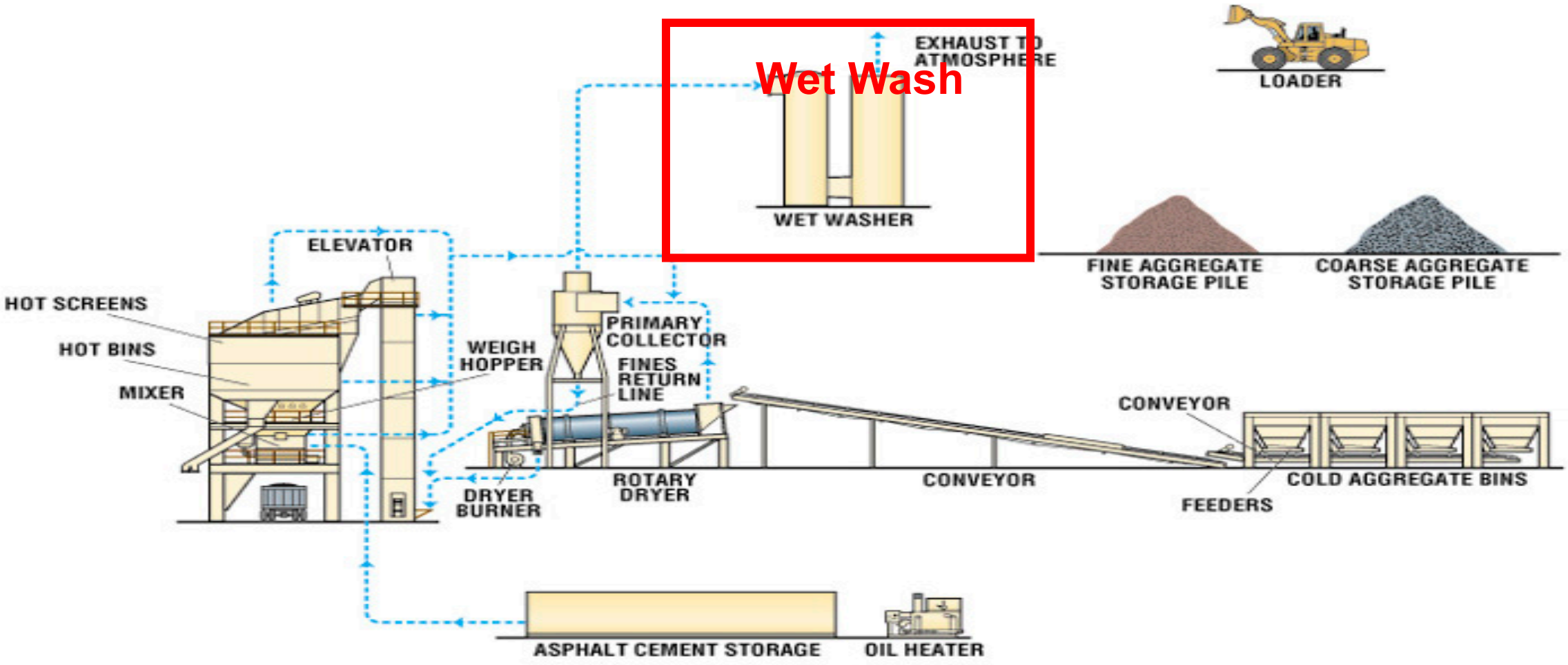
Typical Plant Design from 1920's until 1950's



BATCH PLANT

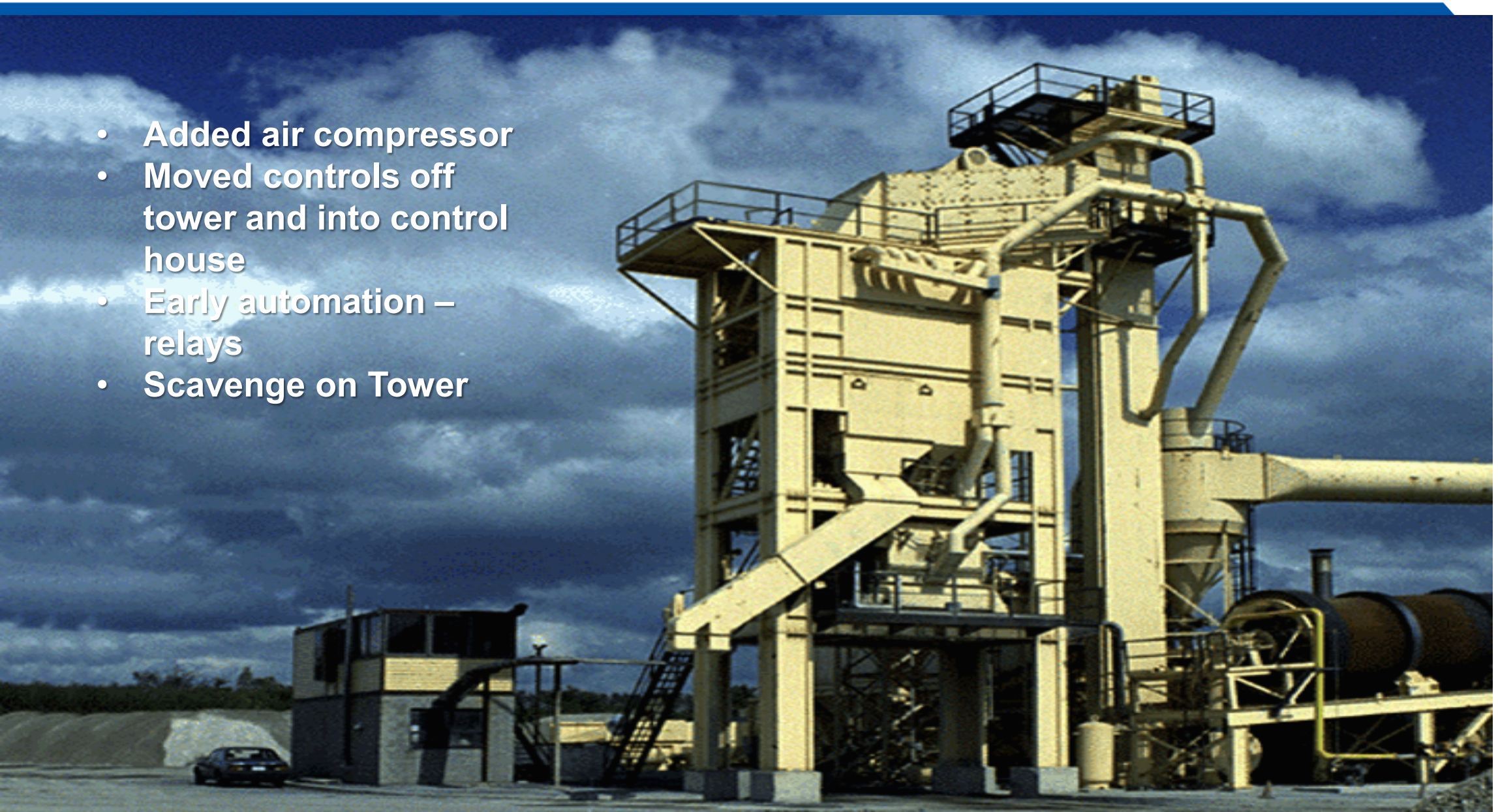
ONE BIN COLD FEED

1960’S



PROCESS FLOW DIAGRAM FOR BATCH MIX ASPHALT PAVING PLANTS

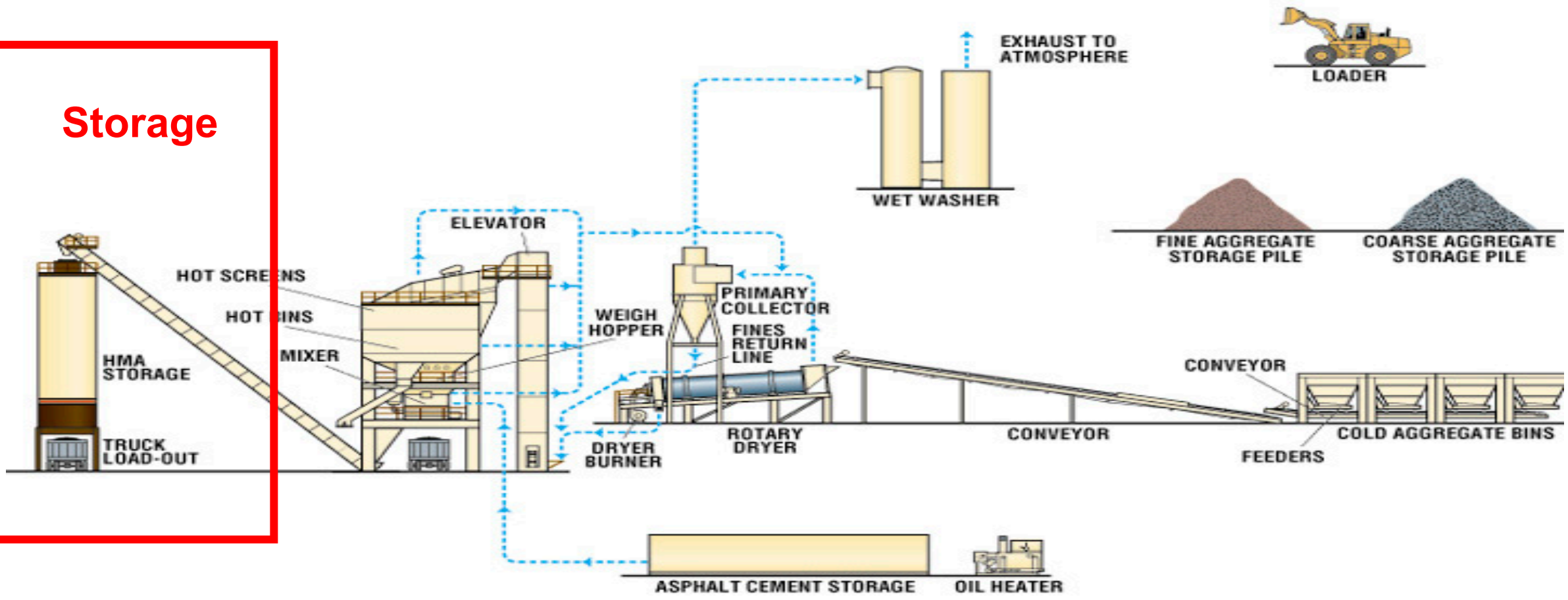
1960’S



- Added air compressor
- Moved controls off tower and into control house
- Early automation – relays
- Scavenge on Tower

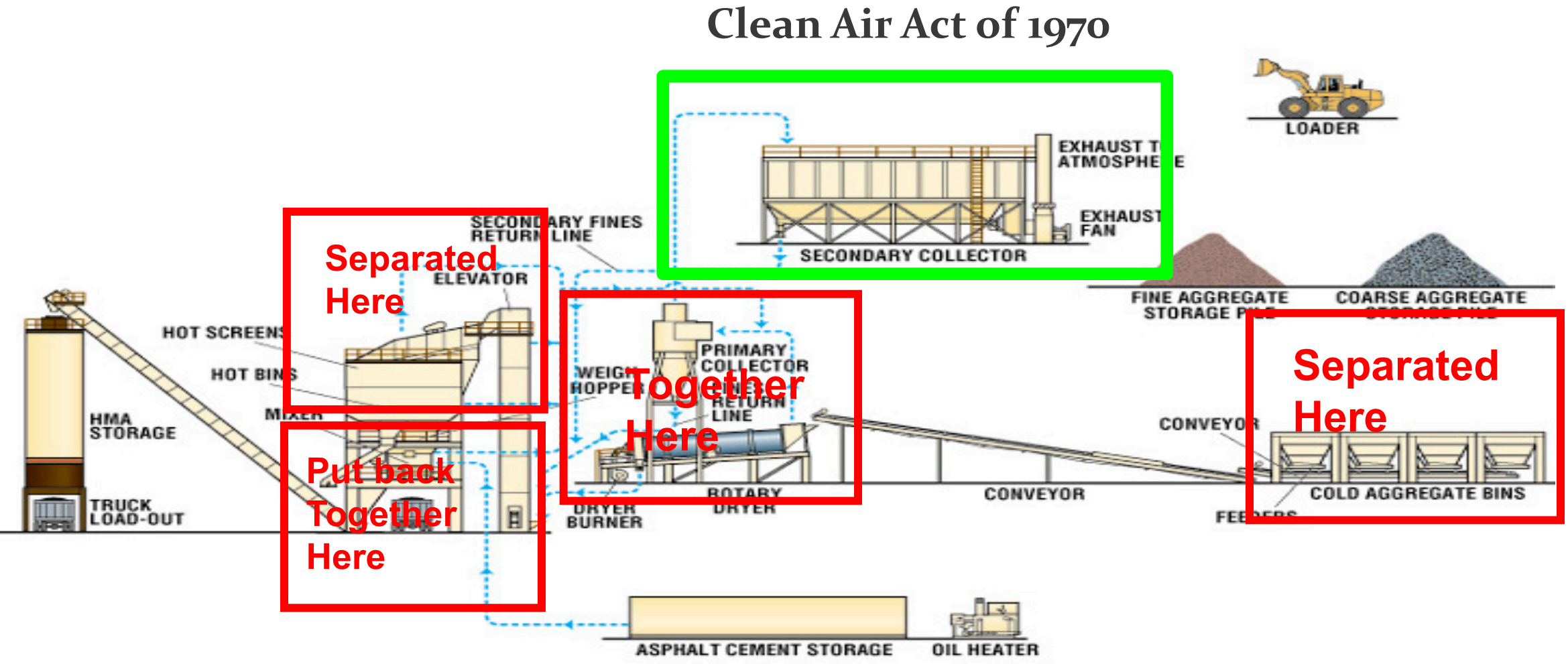
1966

Storage



PROCESS FLOW DIAGRAM FOR BATCH MIX ASPHALT PAVING PLANTS

Much Material Handling…



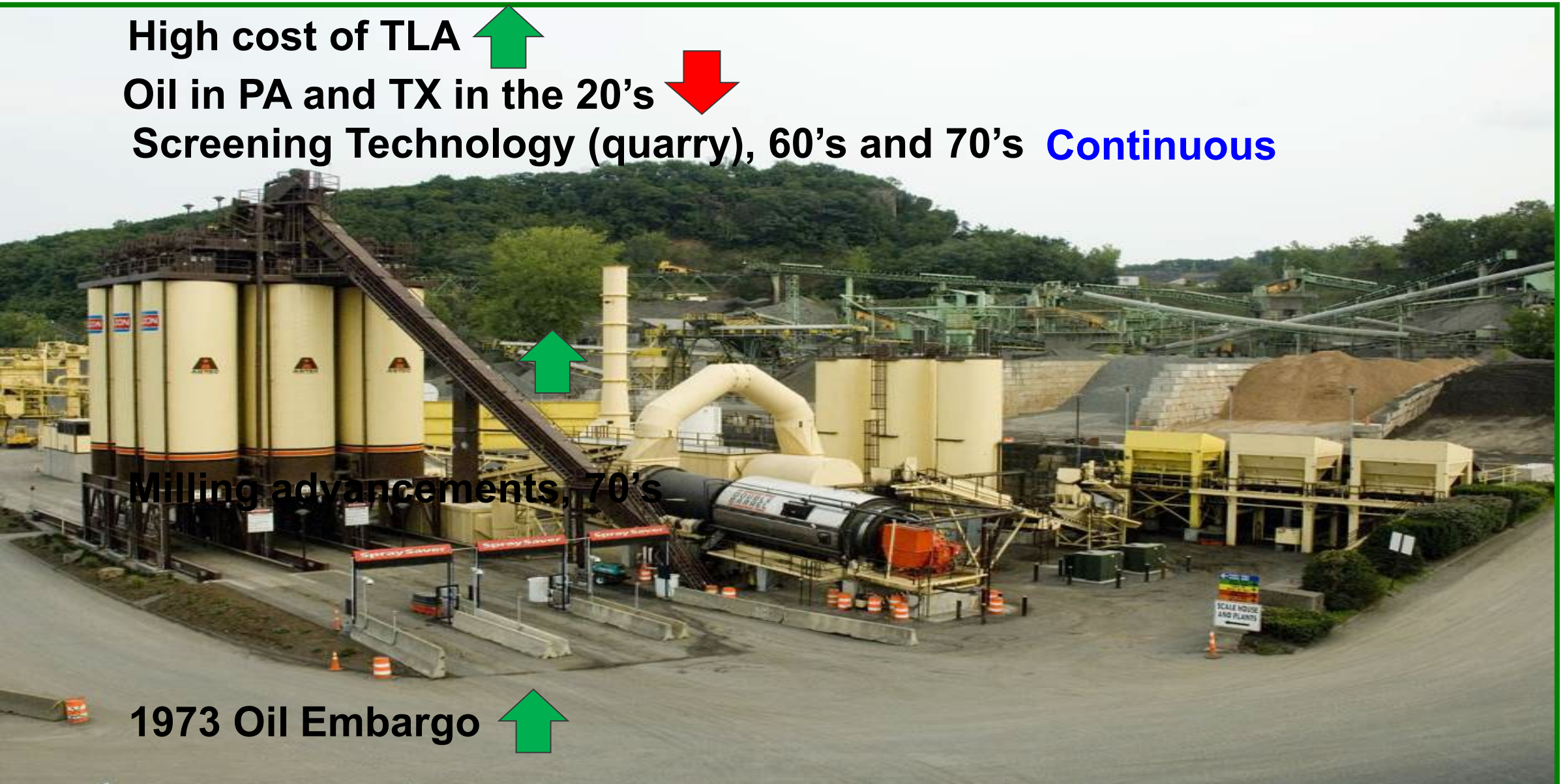
PROCESS FLOW DIAGRAM FOR BATCH MIX ASPHALT PAVING PLANTS

World Events Shape Economics…

World Events Shape Economics…

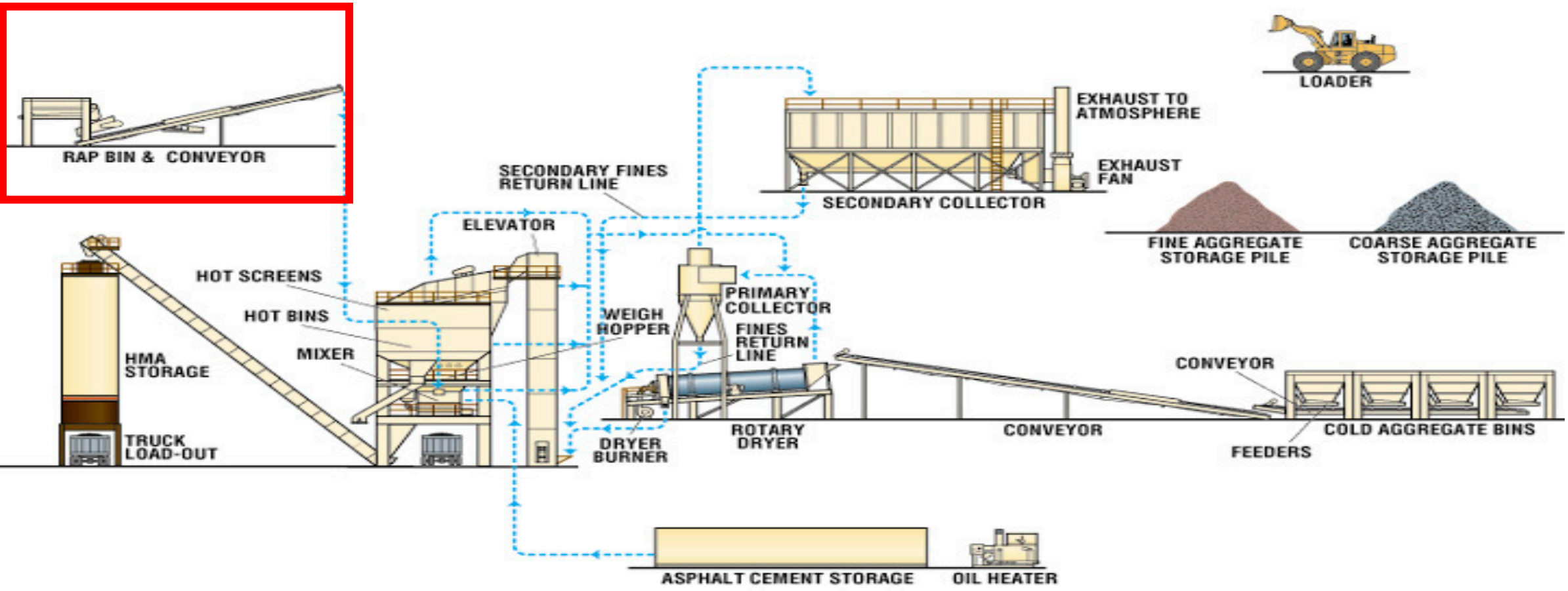
- October 1973 Embargo begins.
- Oil price jumps from $3/bbl to $12/bbl.

Many Factors Come into Play



Need to add RAP? Add a bin!

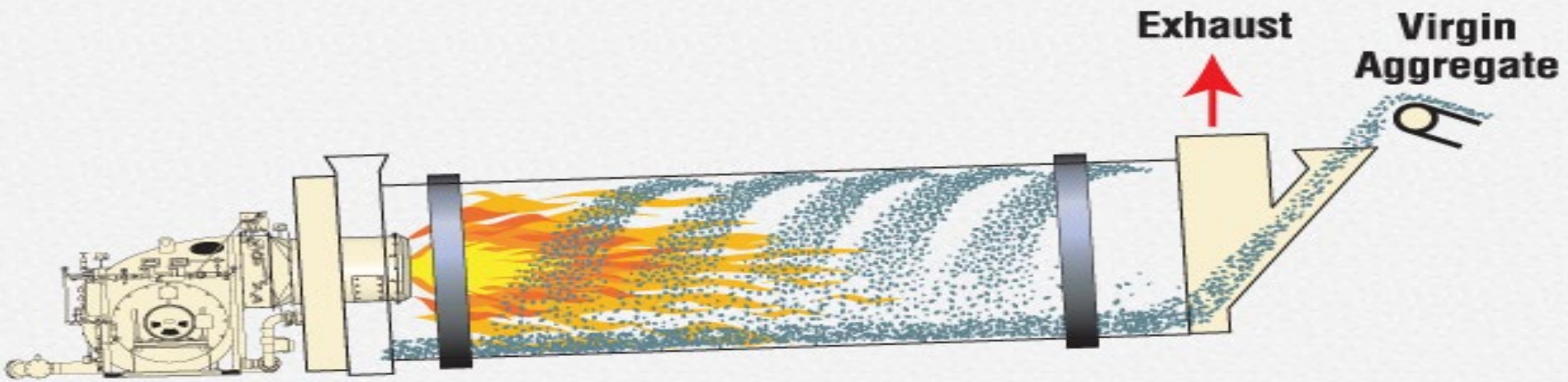
RECYCLE BINS ADDED IN LATE 1970'S EARLY 1980'S



PROCESS FLOW DIAGRAM FOR BATCH MIX ASPHALT PAVING PLANTS

F35

Batch plants use an efficient dryer, but…



Historically don't do well with high levels of recycle (indirect).

Counterflow Drying Drum

Running RAP is like…

Cold Water

RAP

(Ambient Temperature)

+

Hot Water

Virgin Aggregate

(Superheated Temperature)

=

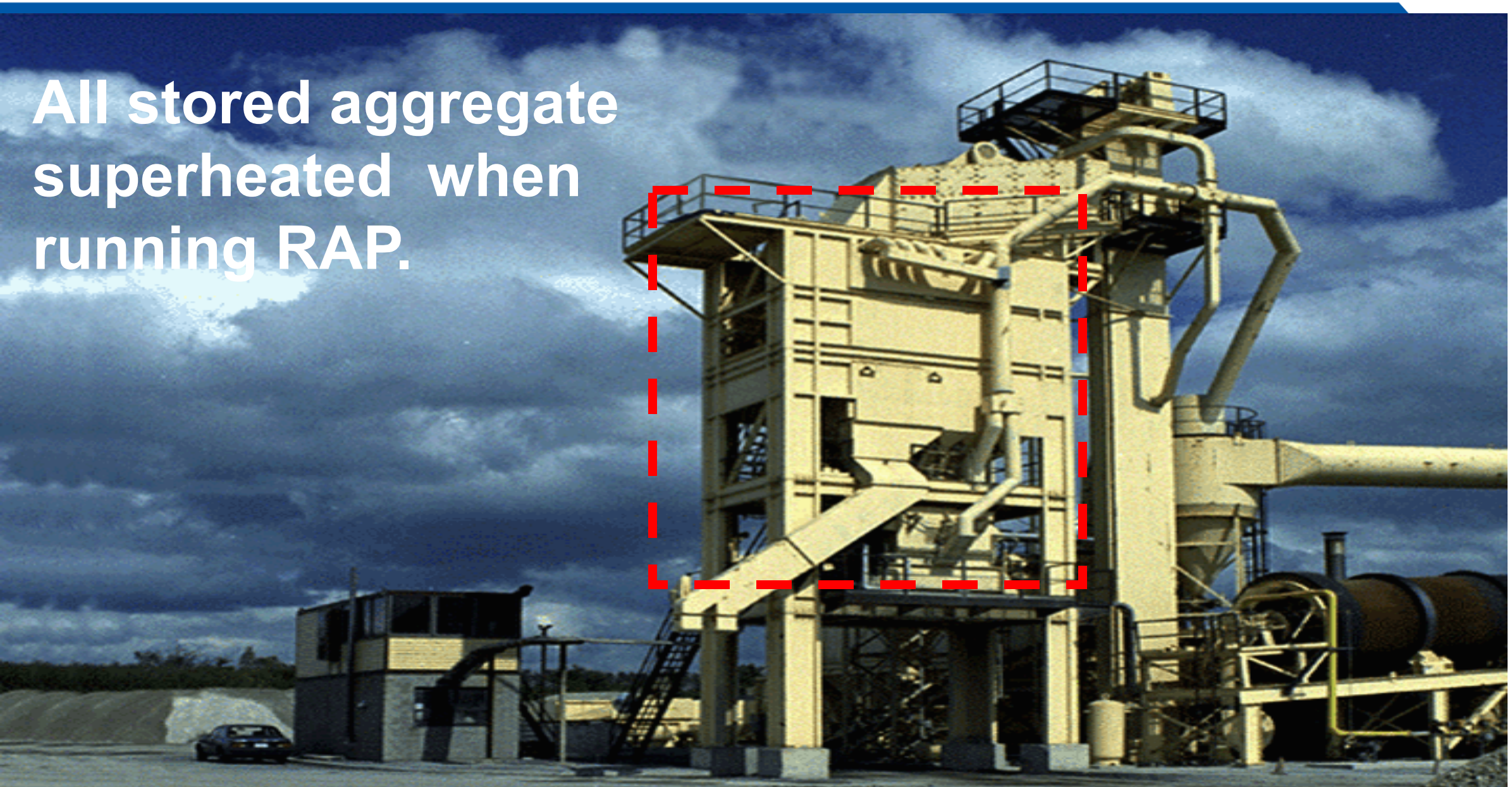
Warm Water

Mix

(Mix Temperature)

Steam “Explosion”

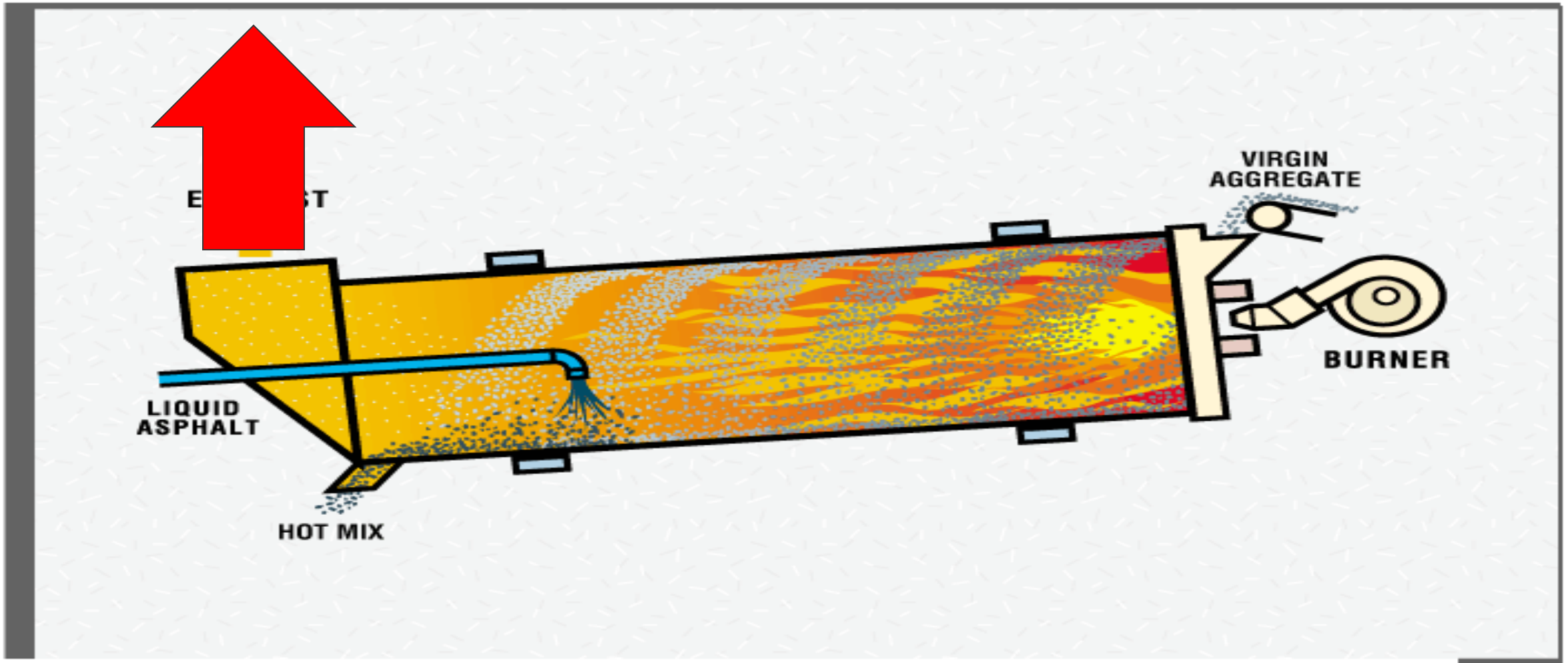
Aggregate Temperature



Answer: Continuous Production

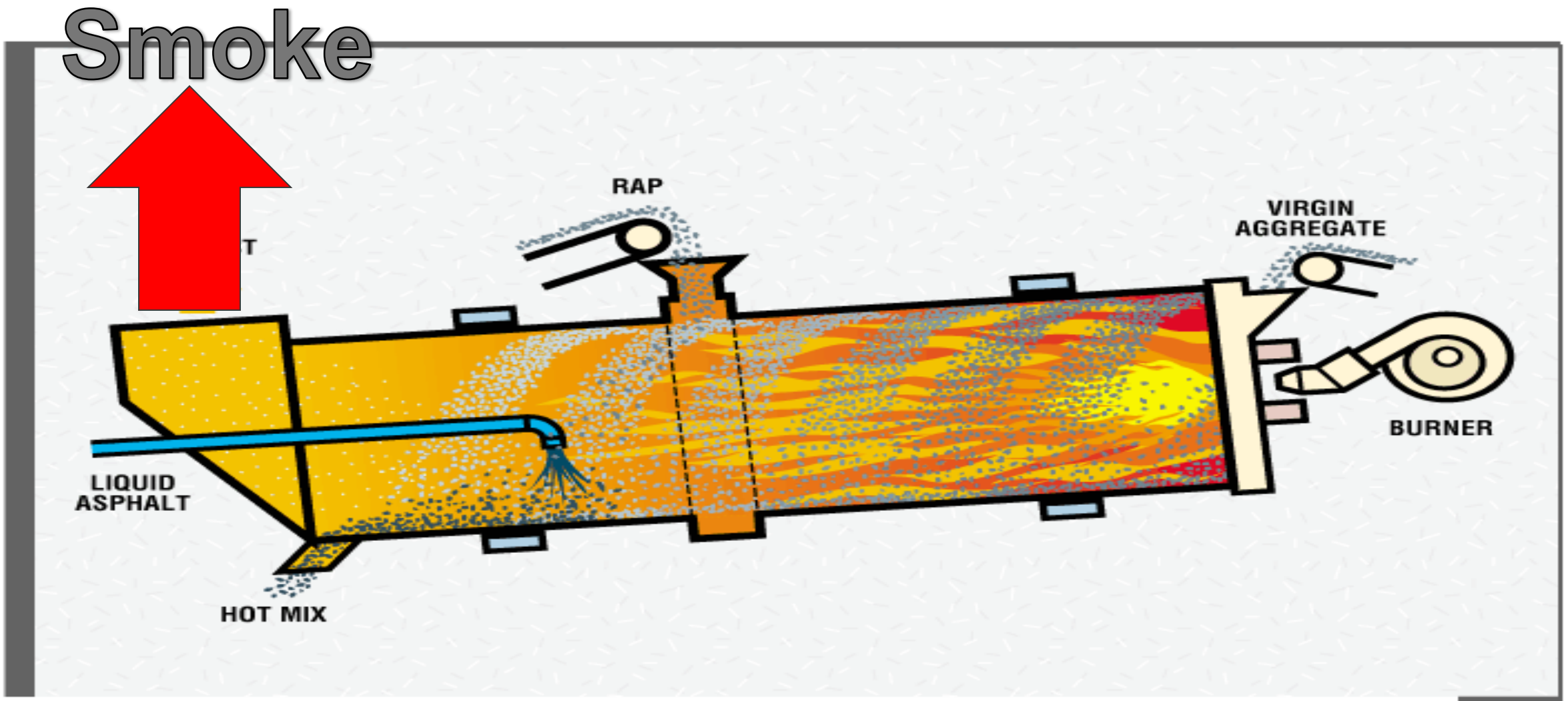
- Ability to change (RAP-Virgin-RAP) quickly
- No more steam explosion.
- Solves stored “super hot rock”
- Gradation control in coldfeed bins

Parallel Flow Continuous HMA Plant



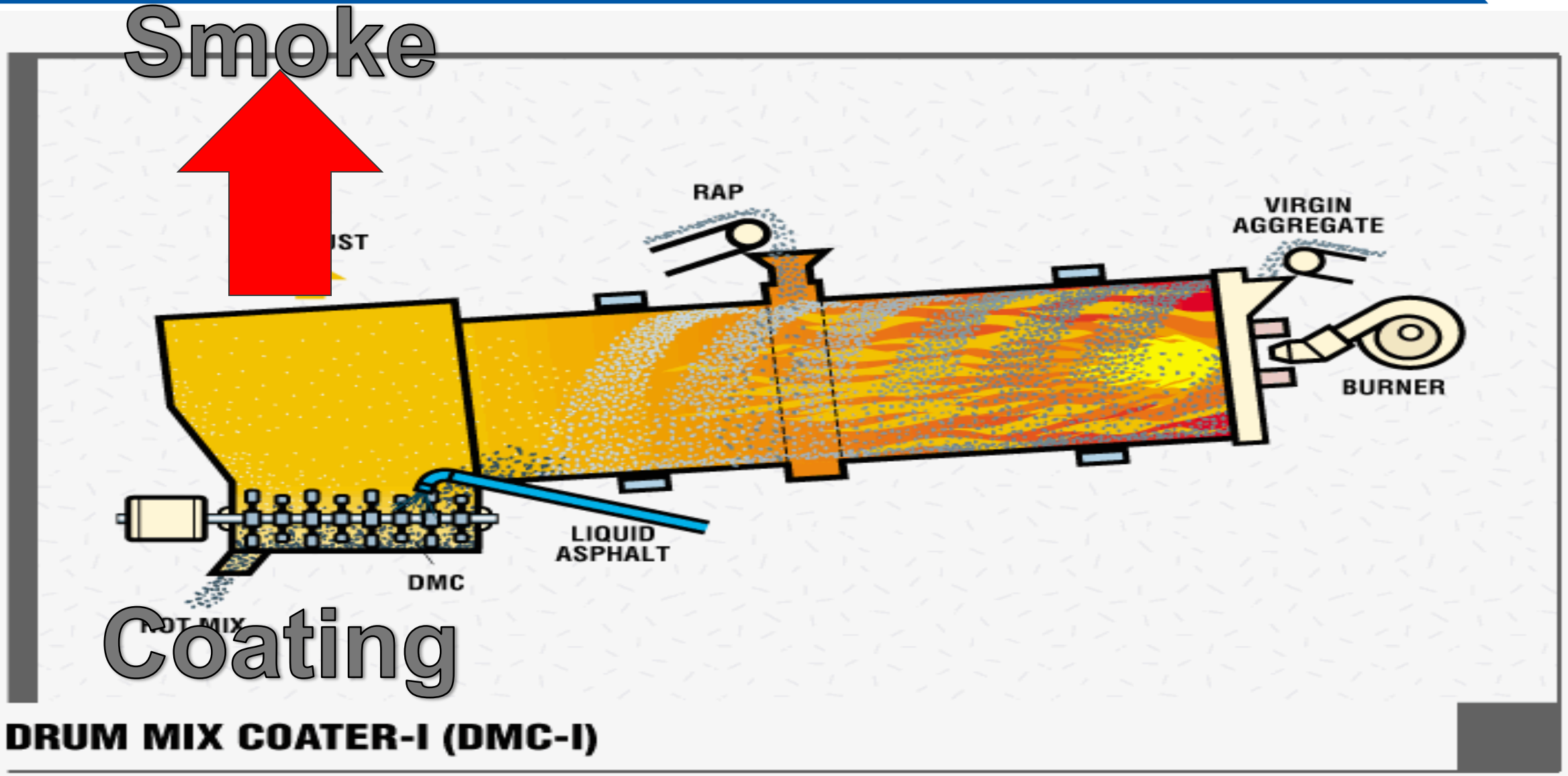
ORIGINAL PARALLEL-FLOW DRUM MIXER

Parallel Flow Continuous HMA Plant with RAP

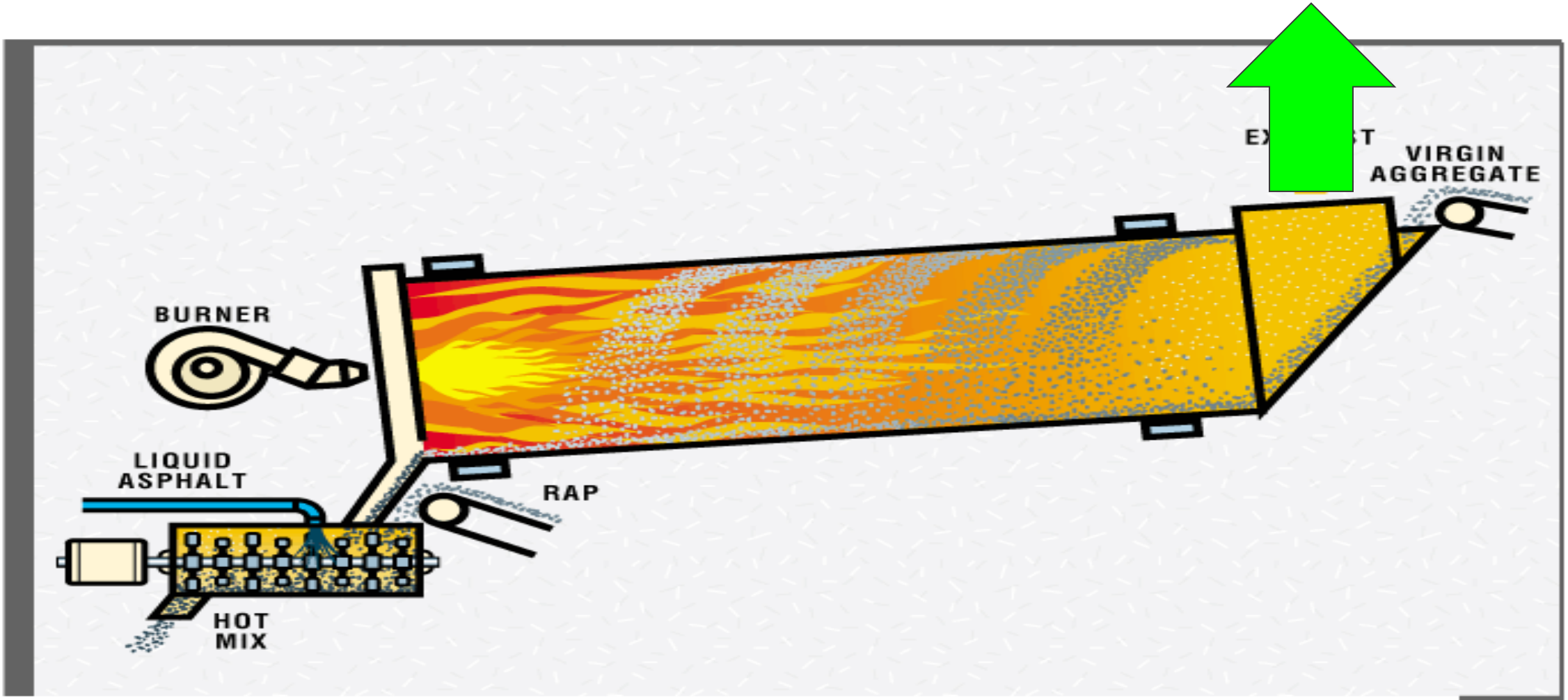


DRUM MIXER WITH CENTER INLET

Parallel Flow Drum Mix Coater I

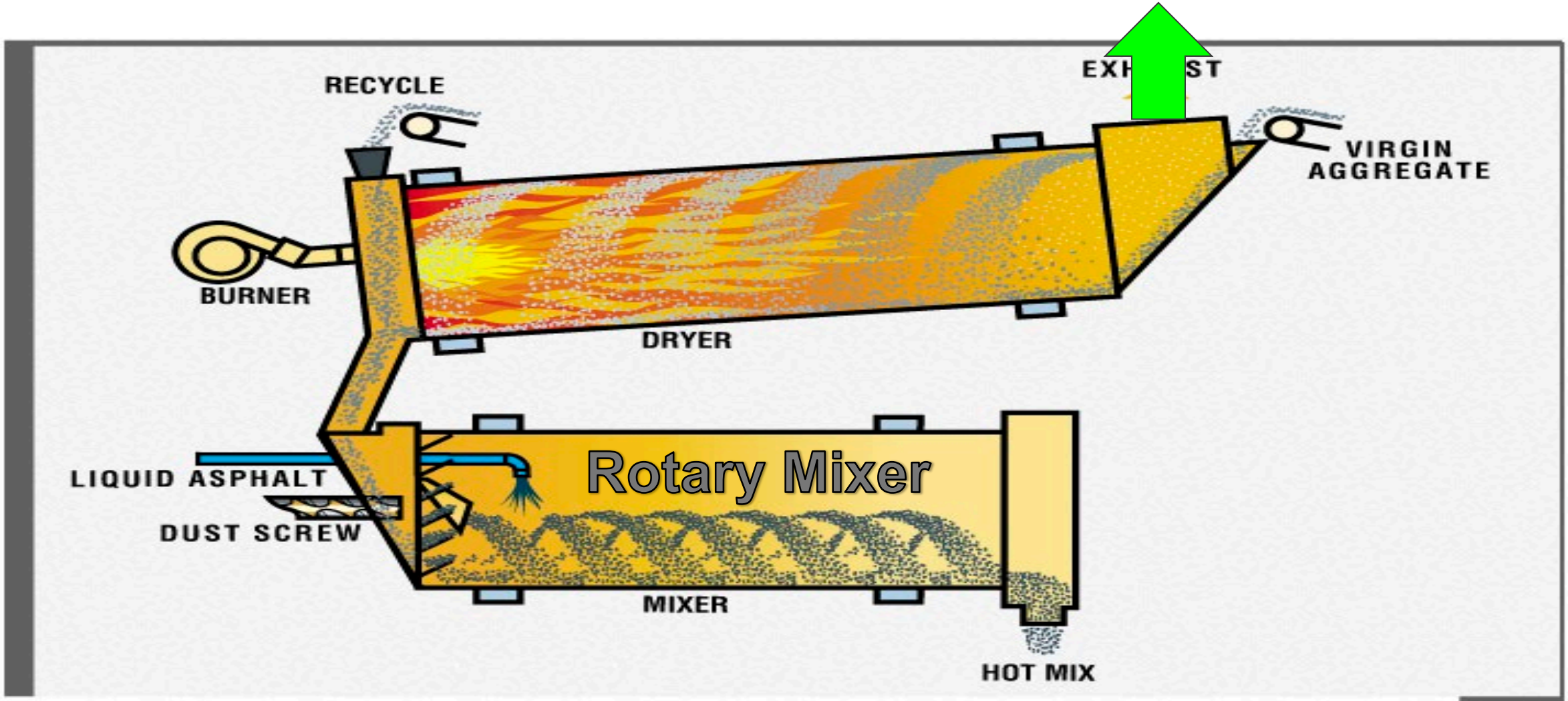


Counterflow Drum Mix Coater II



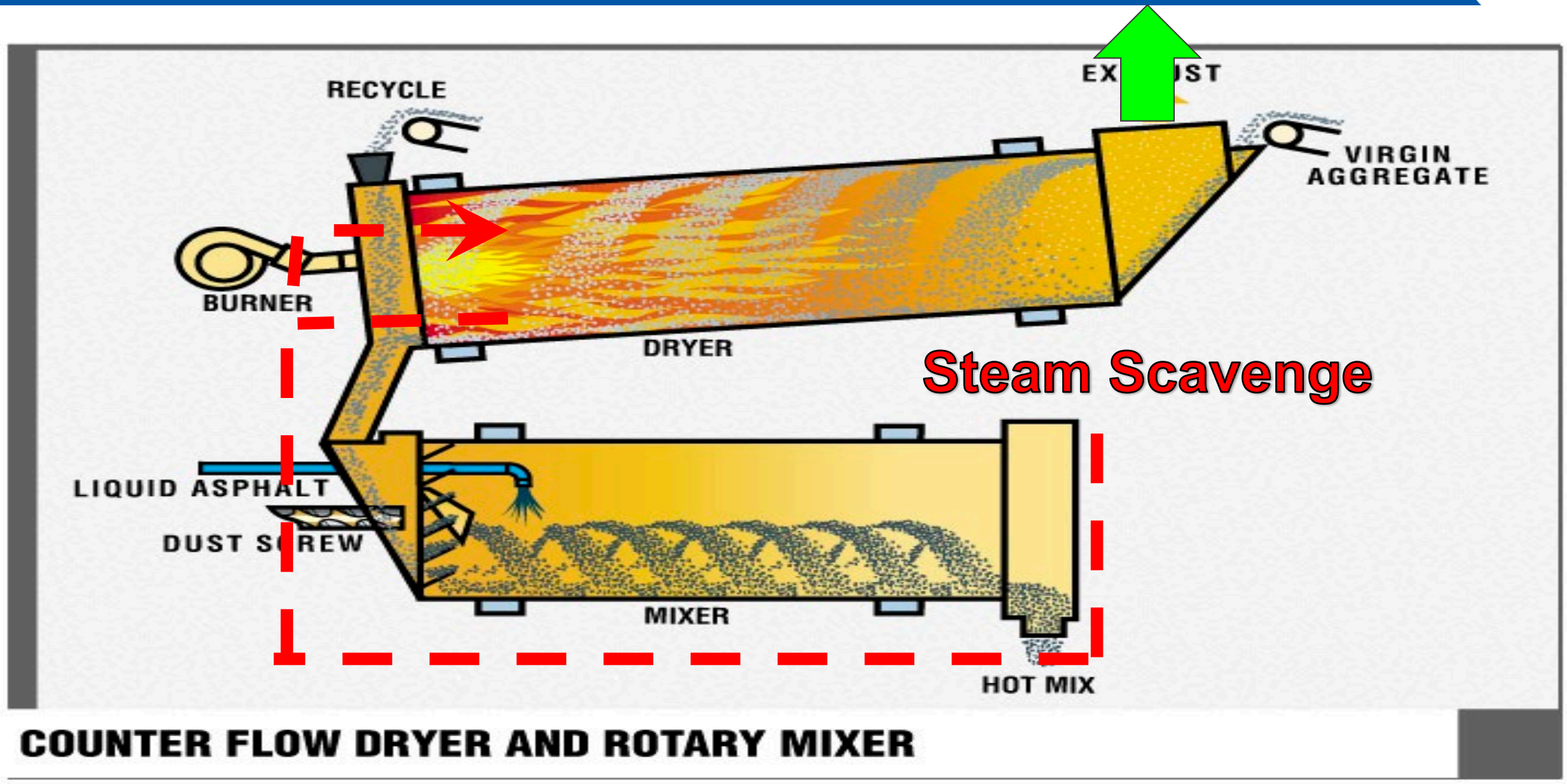
DRUM MIX COATER-II (DMC-II)

Counterflow Drum Mix Coater II Alternative – “Double Drum”



COUNTER FLOW DRYER AND ROTARY MIXER

Managing RAP Steam: Problematic



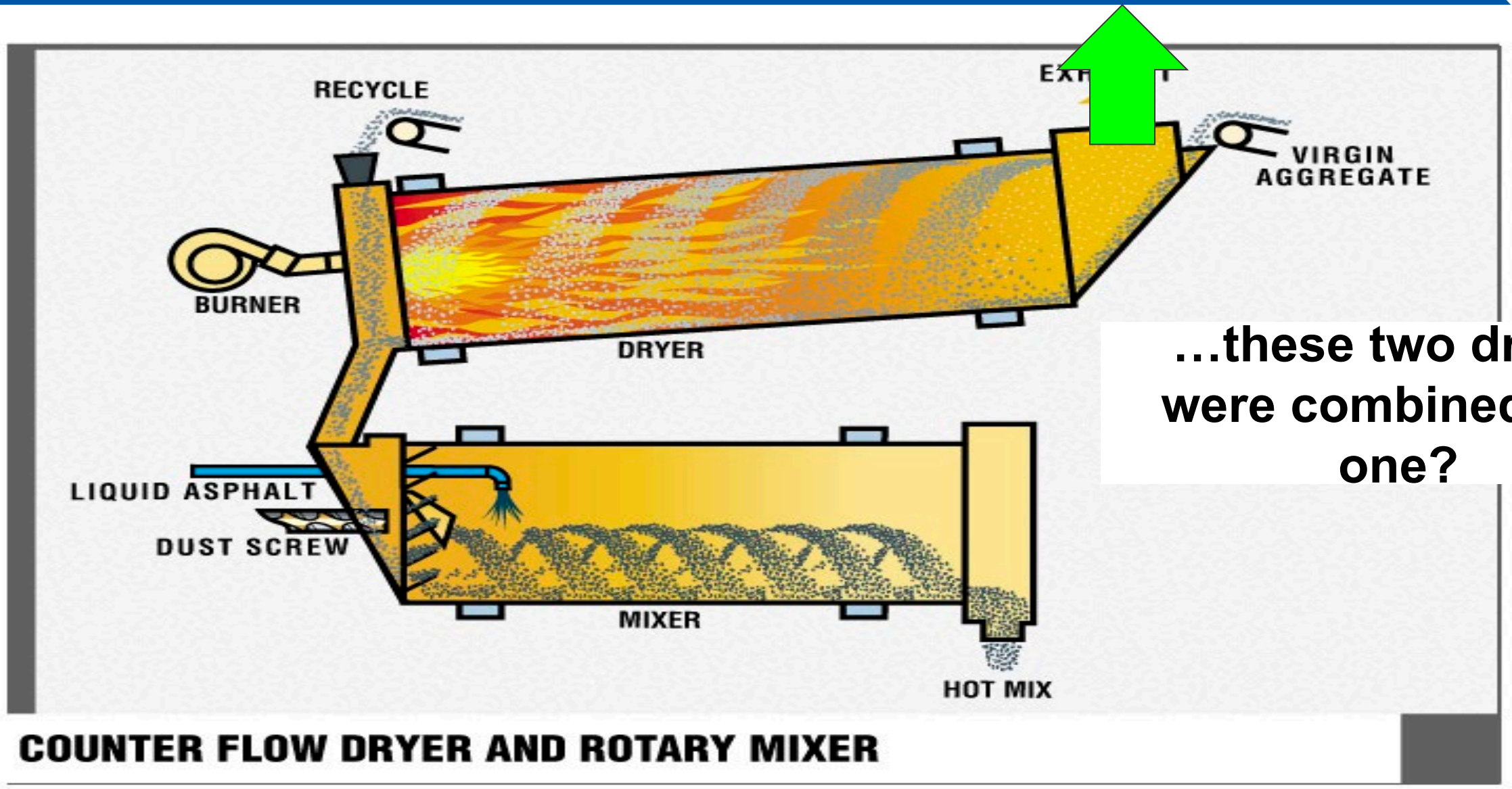
Managing RAP Steam: Examples

Non-Astec Double Drum, North Carolina, 2013;
Steam Scavenge Retrofit (Before)

Managing RAP Steam: Examples

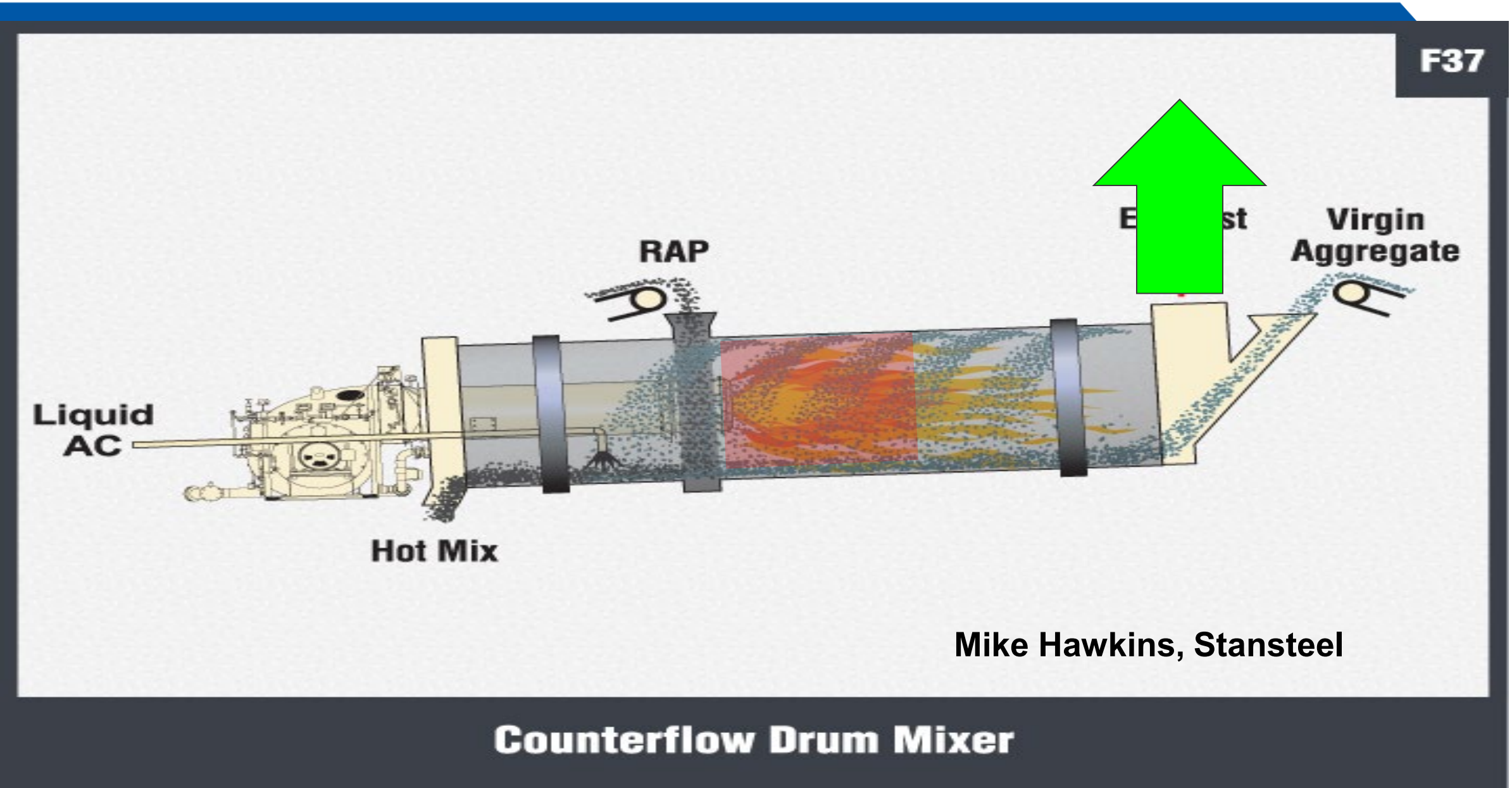
Non-Astec Double Drum, North Carolina, 2013;
Steam Scavenge Retrofit (After)

Going back to this diagram…. What if…

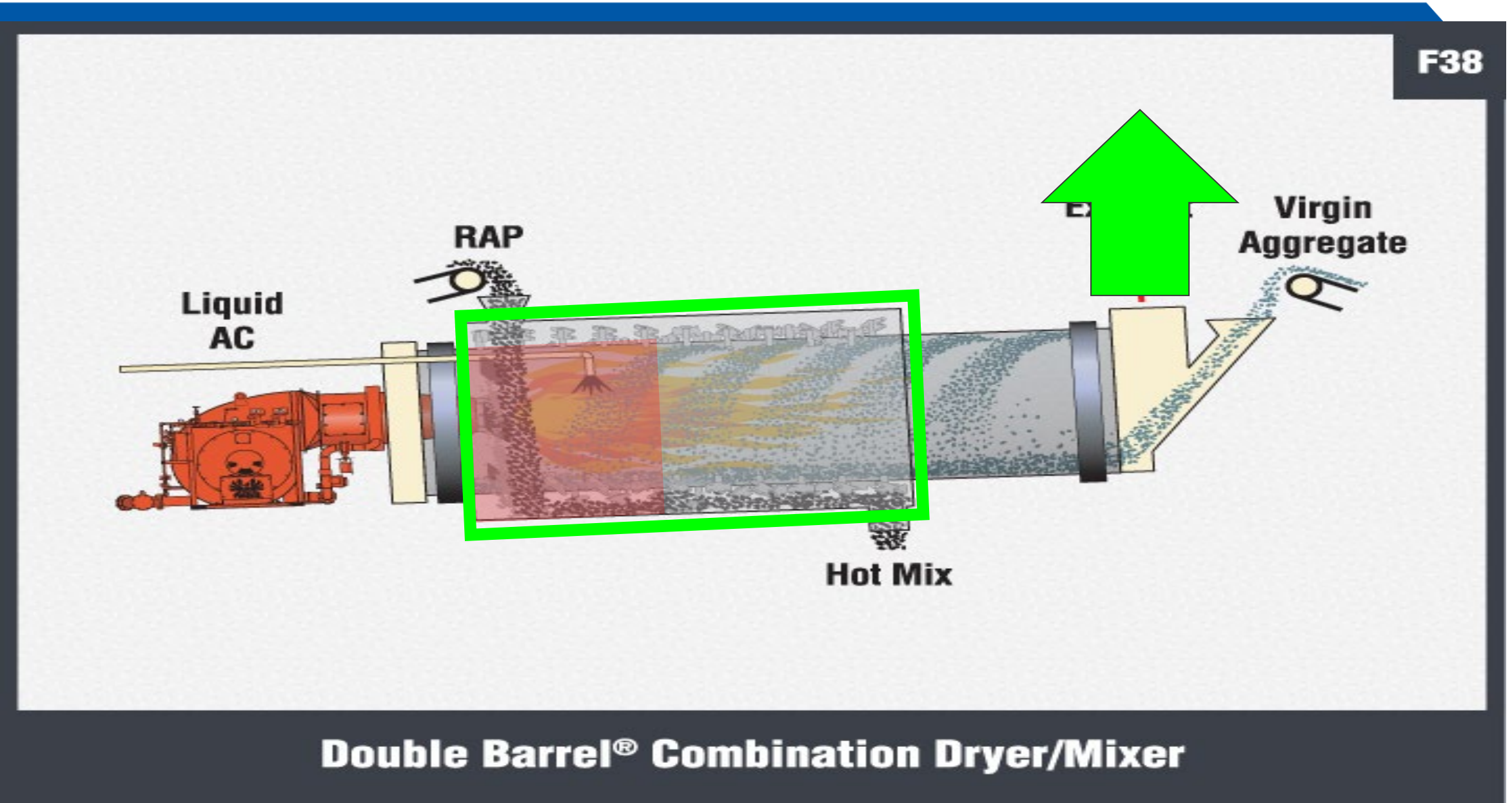


…these two drums were combined into one?

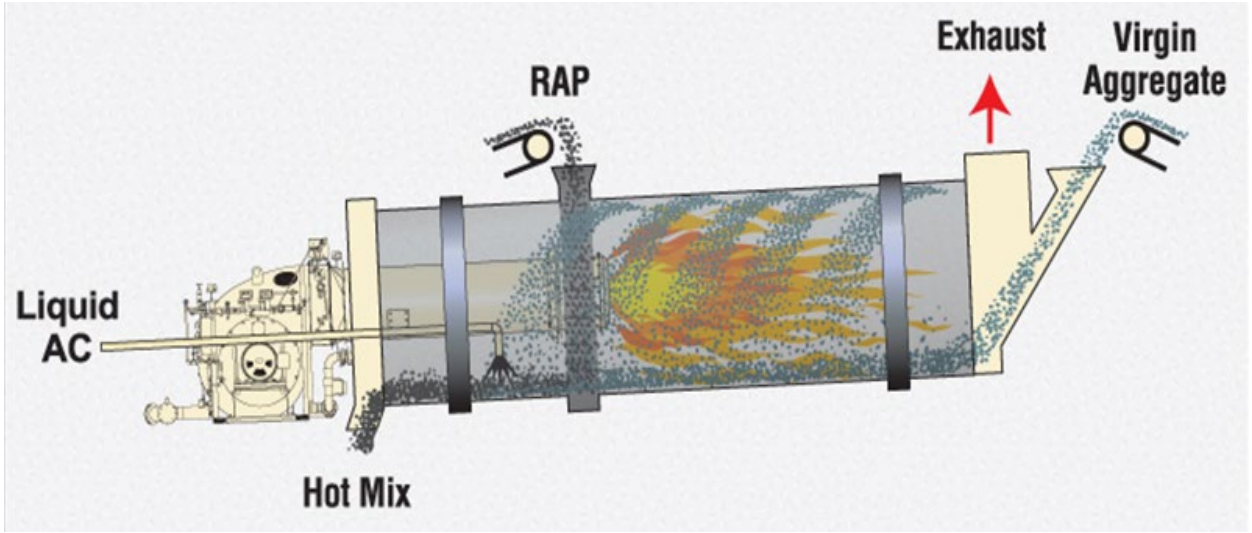
The “Unified” Drum: Counterflow Drum Mixer



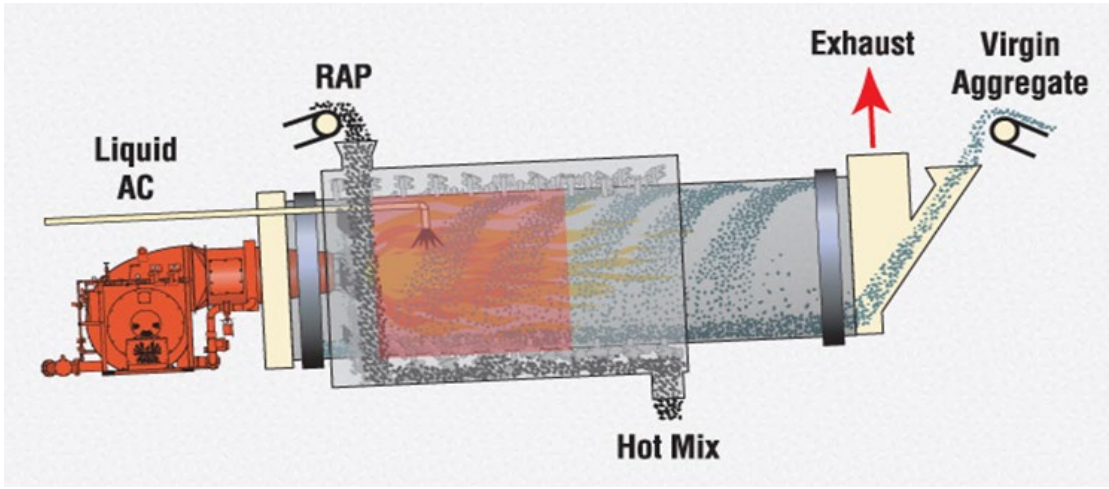
Astec Double Barrel



Computer Analogy

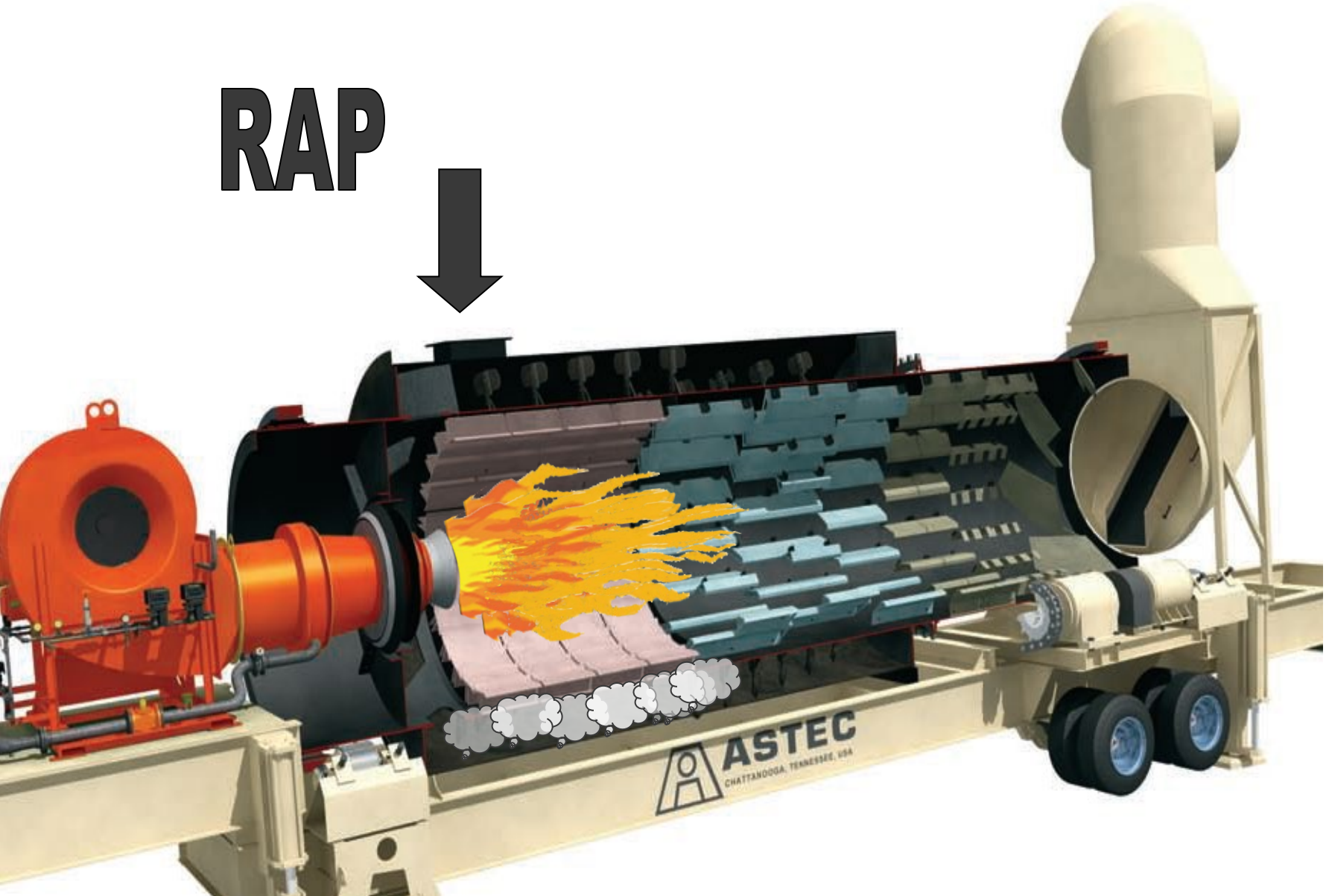


PC

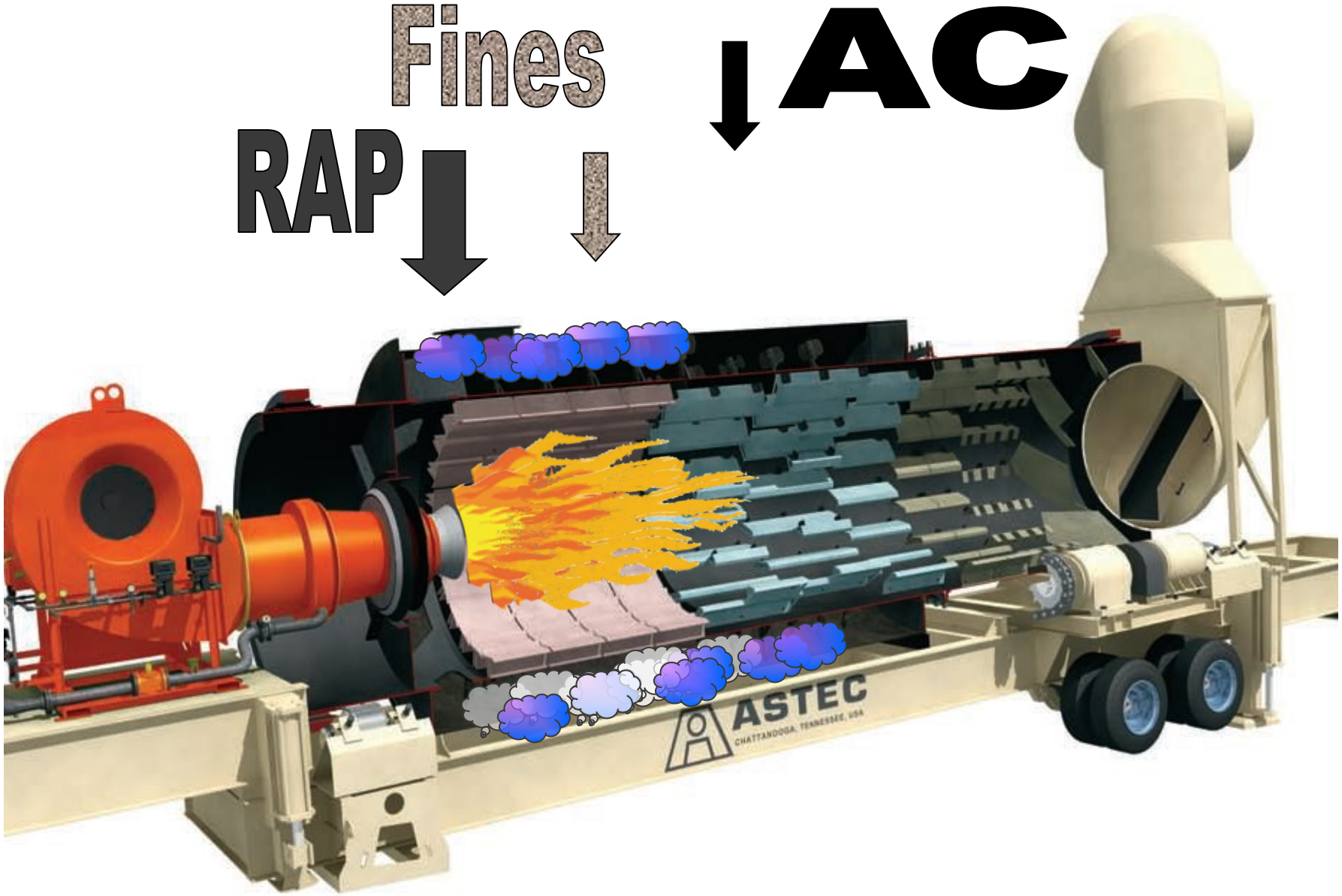


Apple™

Advantage of Continuous Production: RAP Processing



Advantage of Continuous Production: Emissions Mitigation



Rebranded a few years ago…

DBX

Double Barrel®

External Mixer

Astec Double Barrel XHR (2014)

Astec Double Barrel XHR (2015)

Remember the Innovation Drivers?

MIX DEMAND, ECONOMICS, MIX DESIGN, REGULATION, COMPETITION

CREATES NEED

“AVAILABLE” TECHNOLOGY

ADAPT, INNOVATE

Here is where the challenges appear…

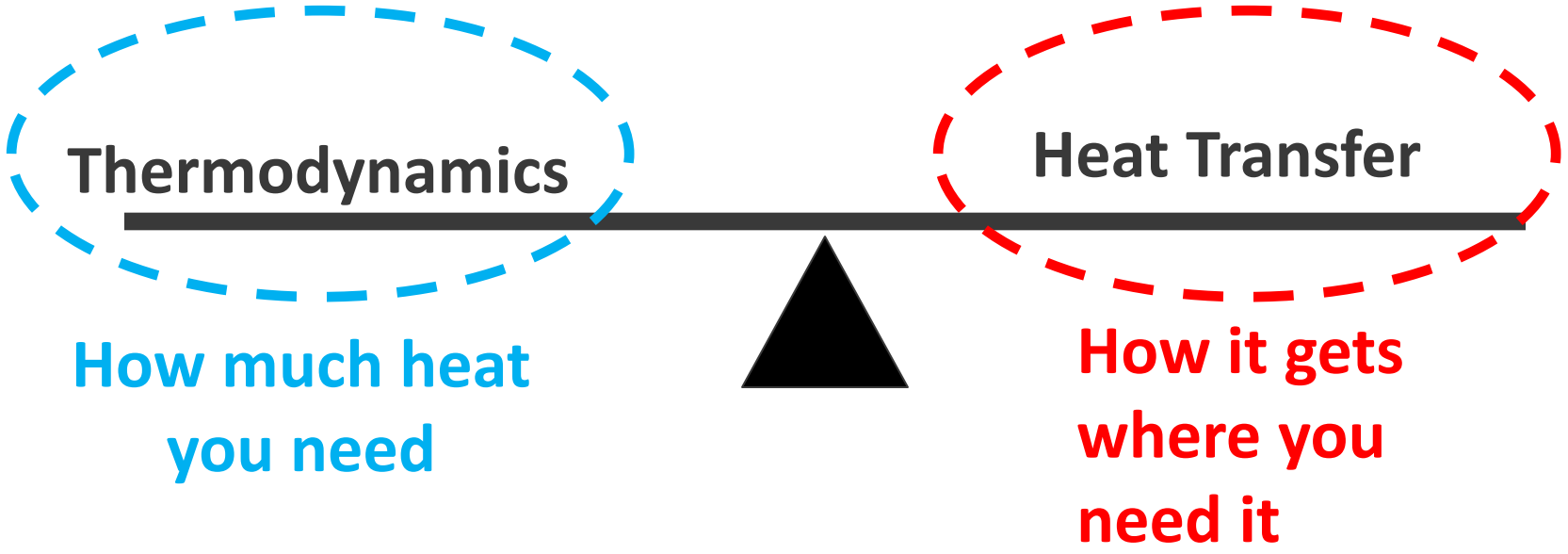
"AVAILABLE" TECHNOLOGY

CHALLENGES

ADAPT, INNOVATE

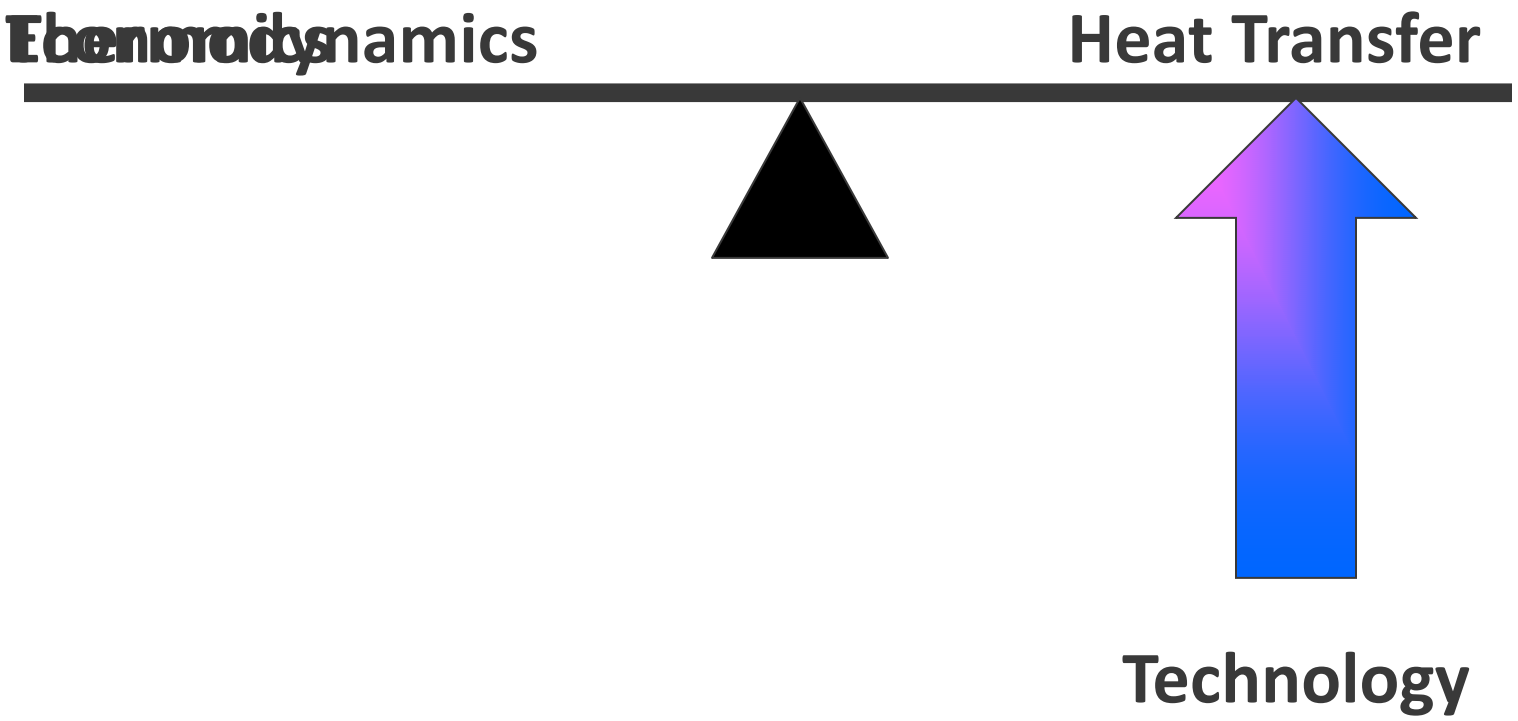
What are the challenges?

Big Challenge: Balance “Thermo” and “Heat Transfer”



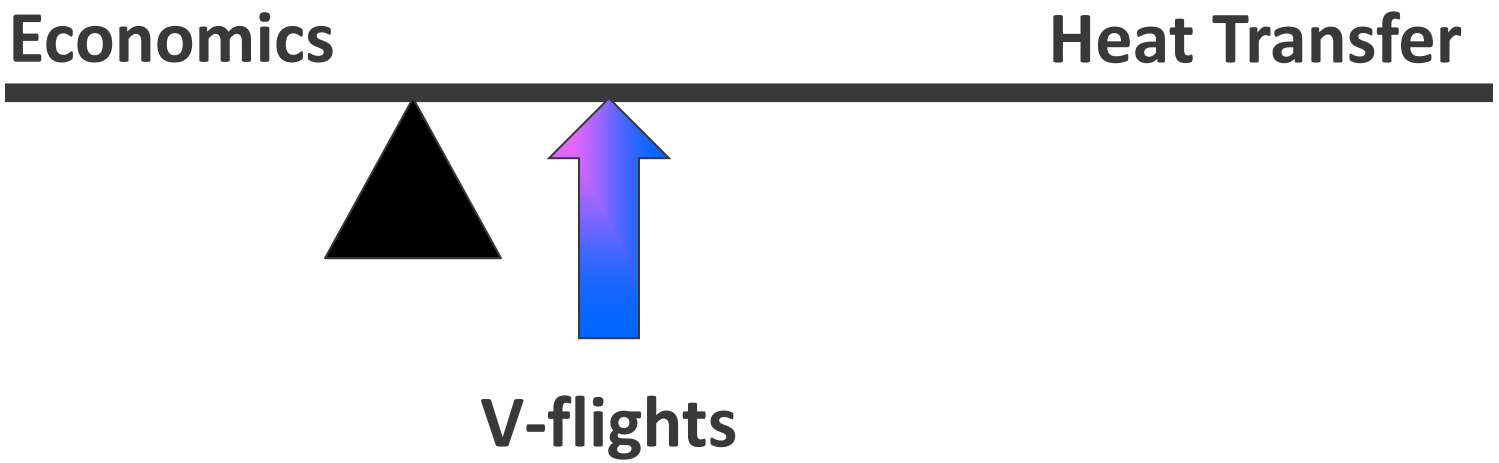
Heat transfer ALWAYS wins…
And its NOT in our favor.

Technology Drives the Balancing Effort



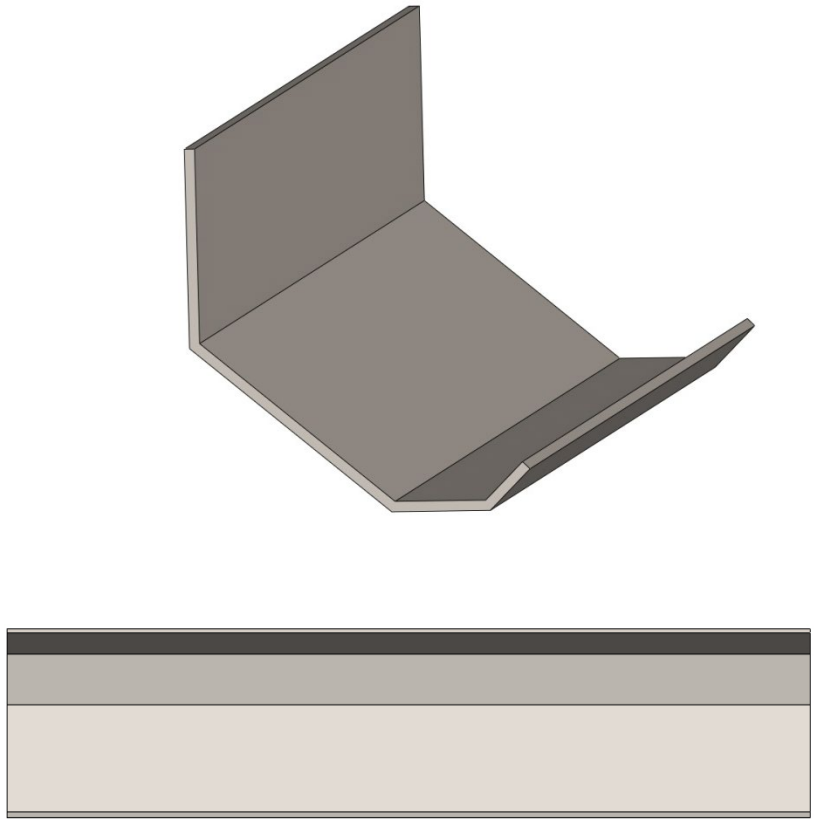
Helping heat transfer through technology

First Technology… Flighting

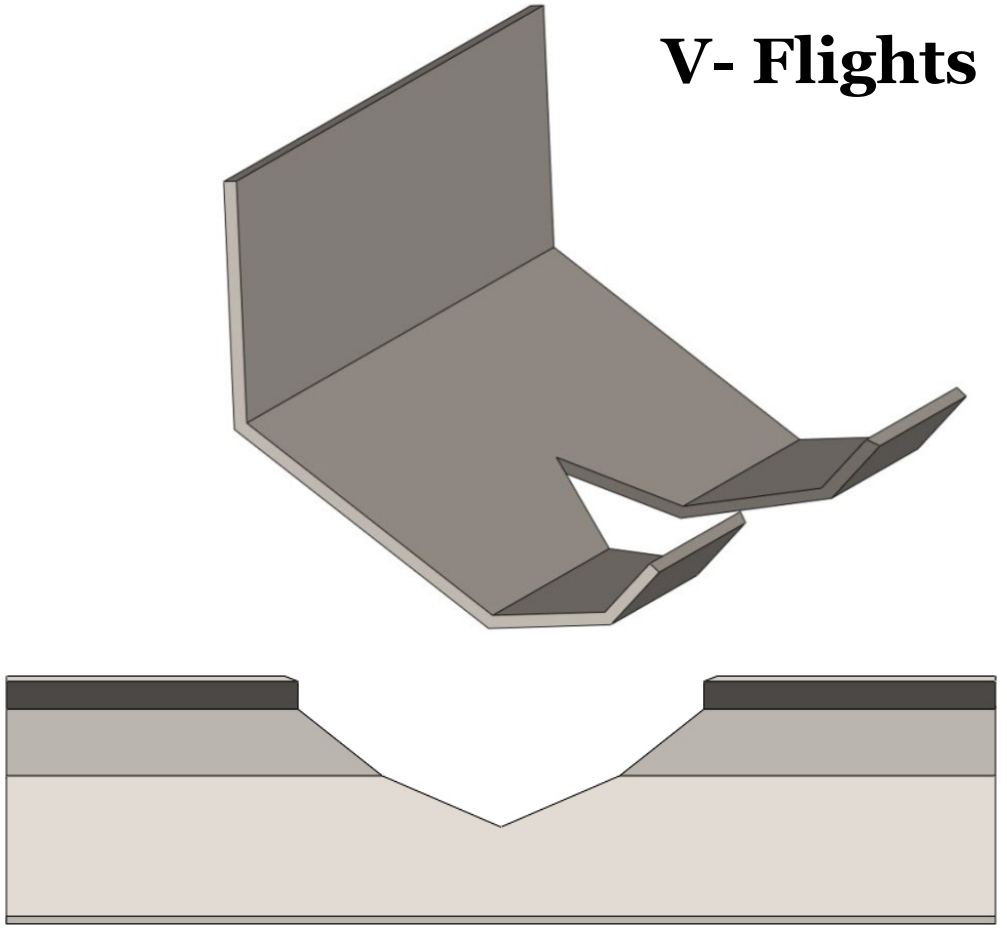


Flighting – Improving Heat Transfer in the Dryer

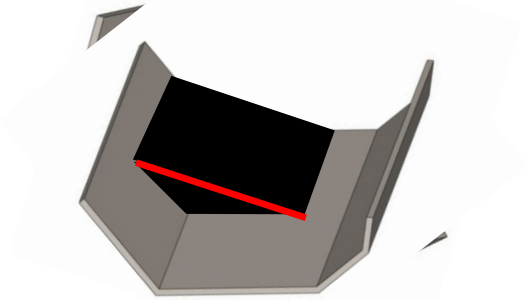
Standard Flights

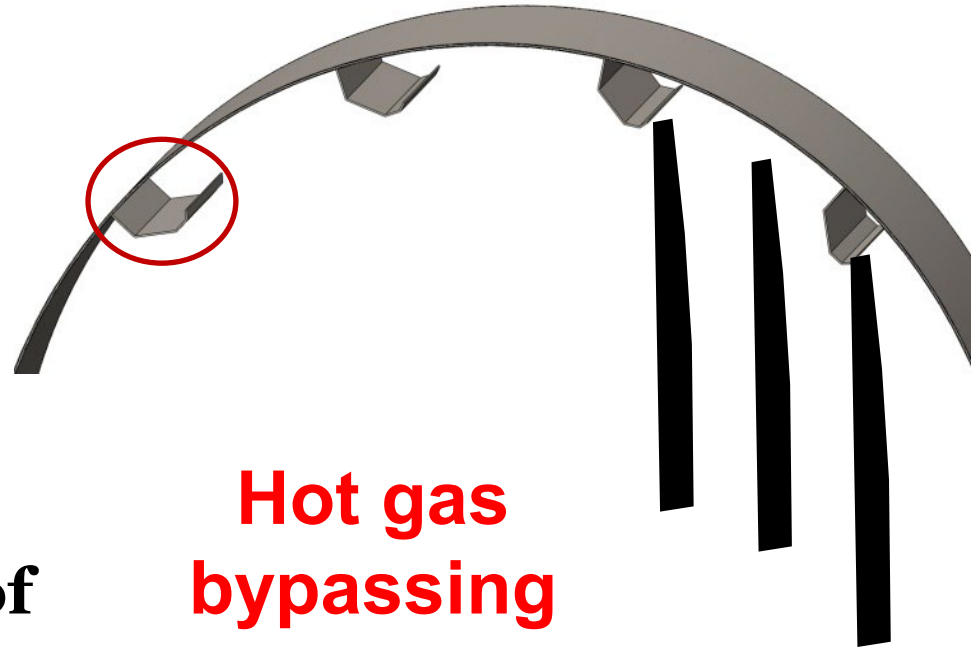


V- Flights



Flighting – Traditional Flights, Traditional Issues



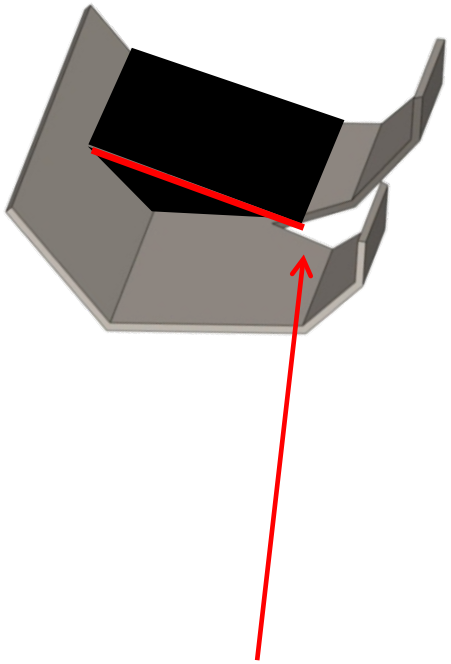


Flight must rotate further before angle of repose reaches tip of flight

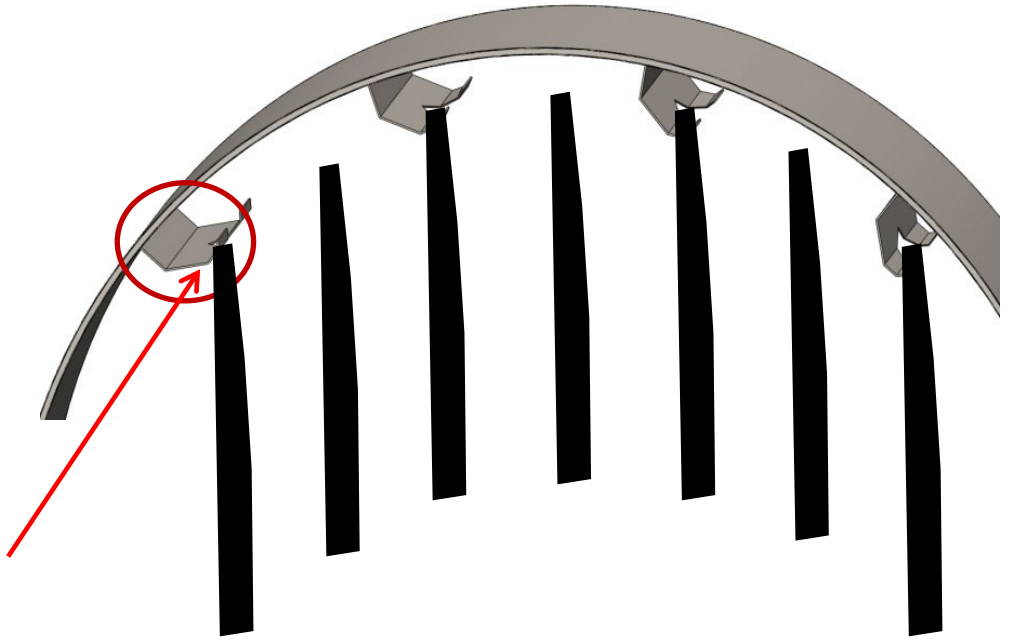
Hot gas bypassing occurs on this side of drum

Previous Flights – Tendency for Hot Spots

Flighting – Advanced Flights, Mitigate Issues



Veiling through notch

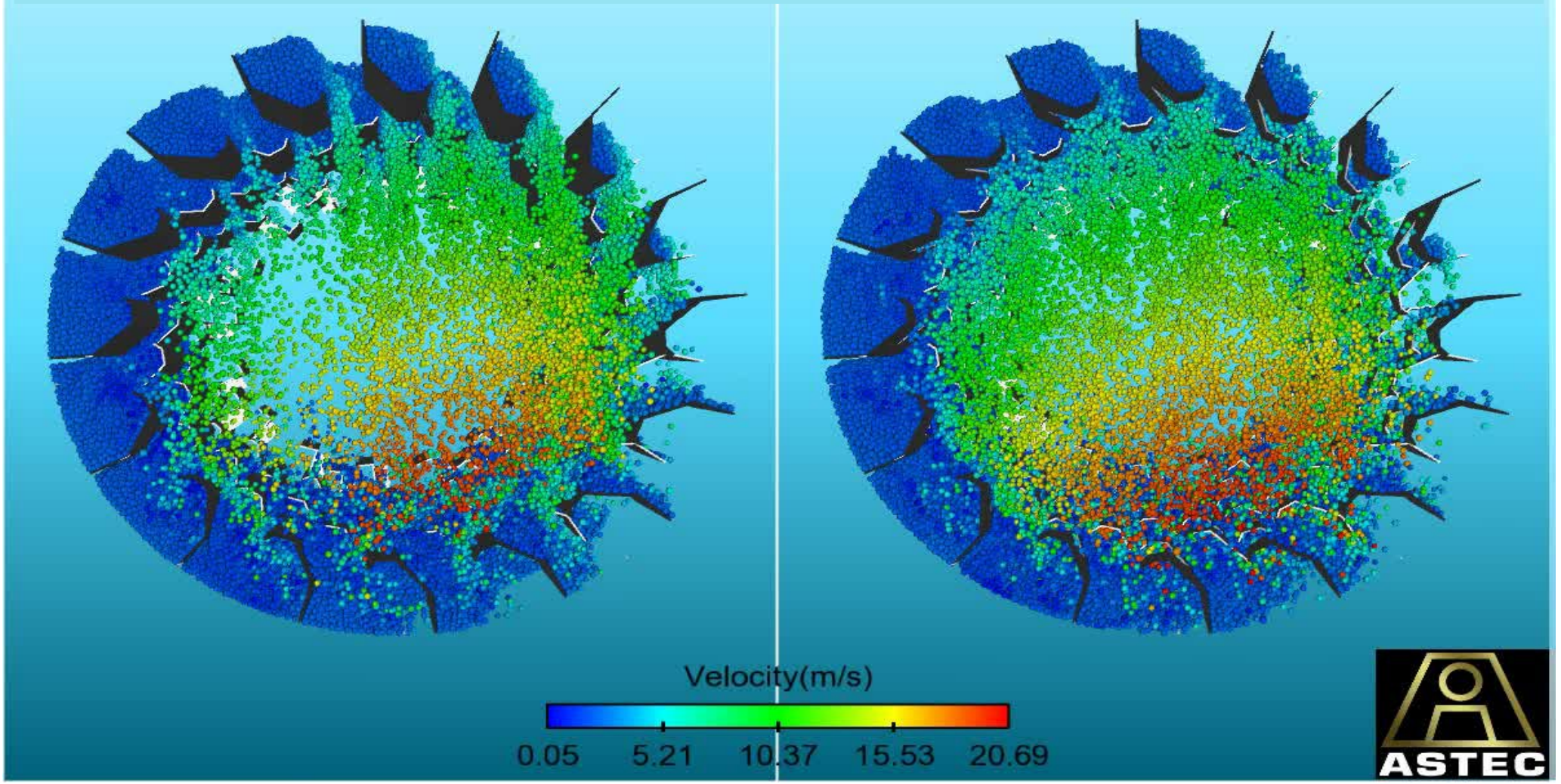


Hot gas bypassing is eliminated

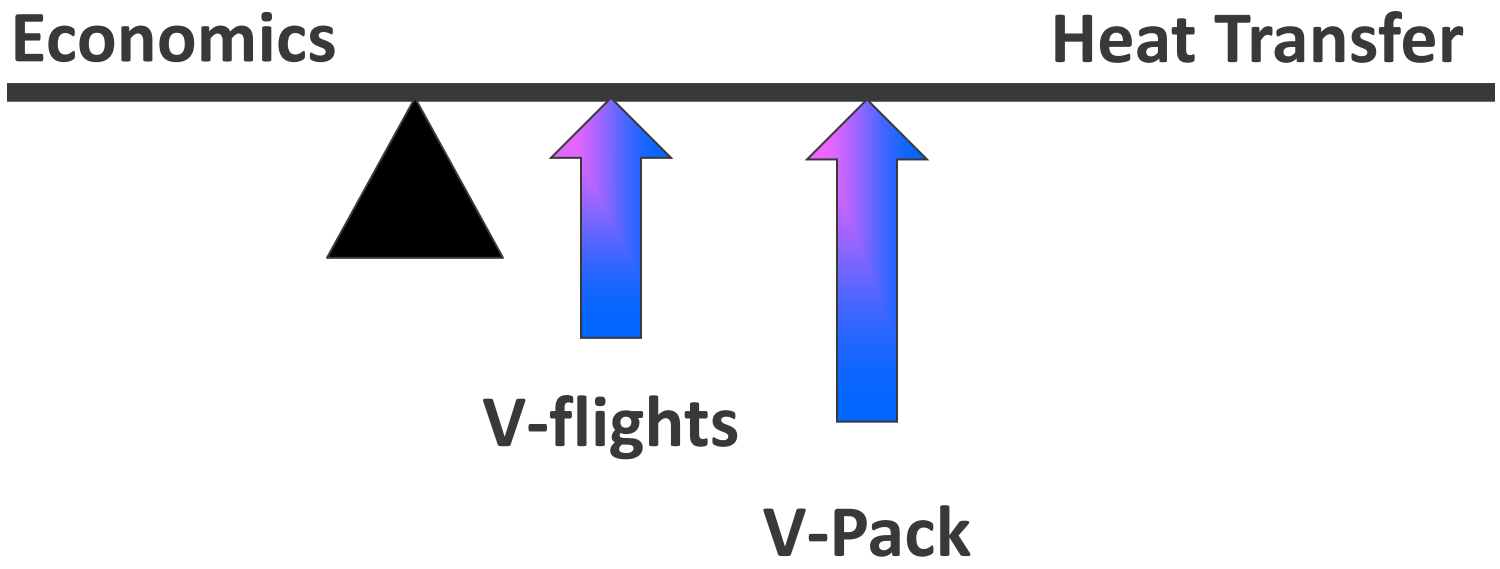
V-Flights – Minimize Hot Spots

Previous Flights

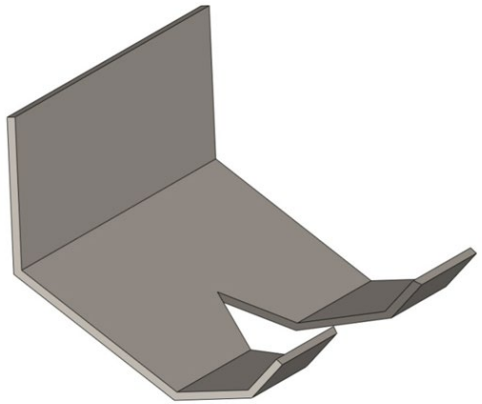
V-Flights

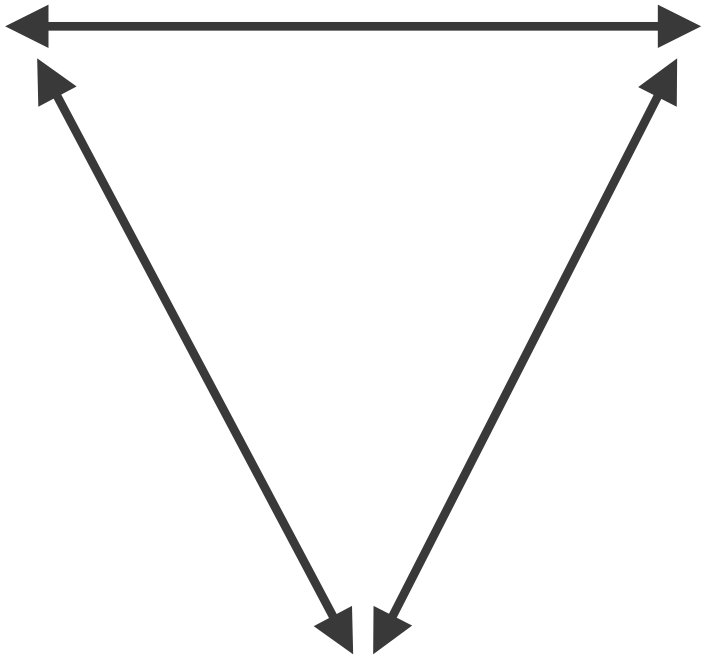


Second Technology… Drum VFD



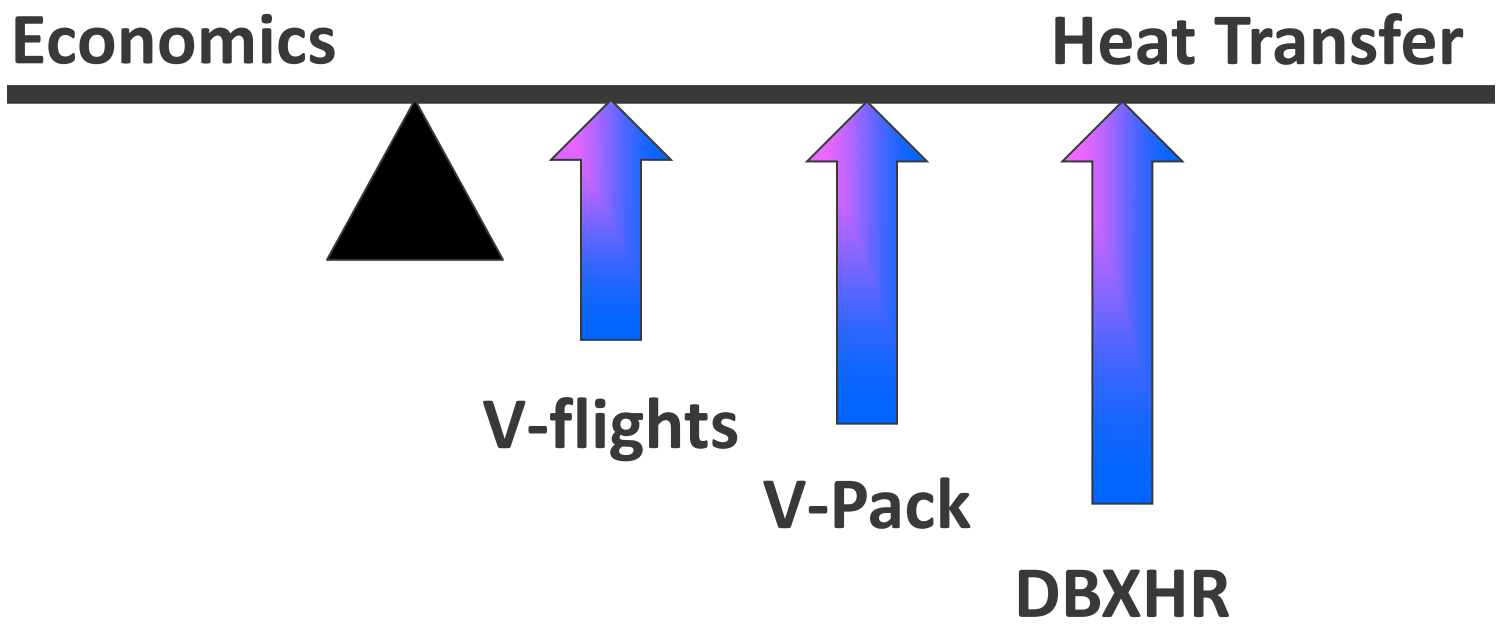
V-Pac™ Stack Temperature Control



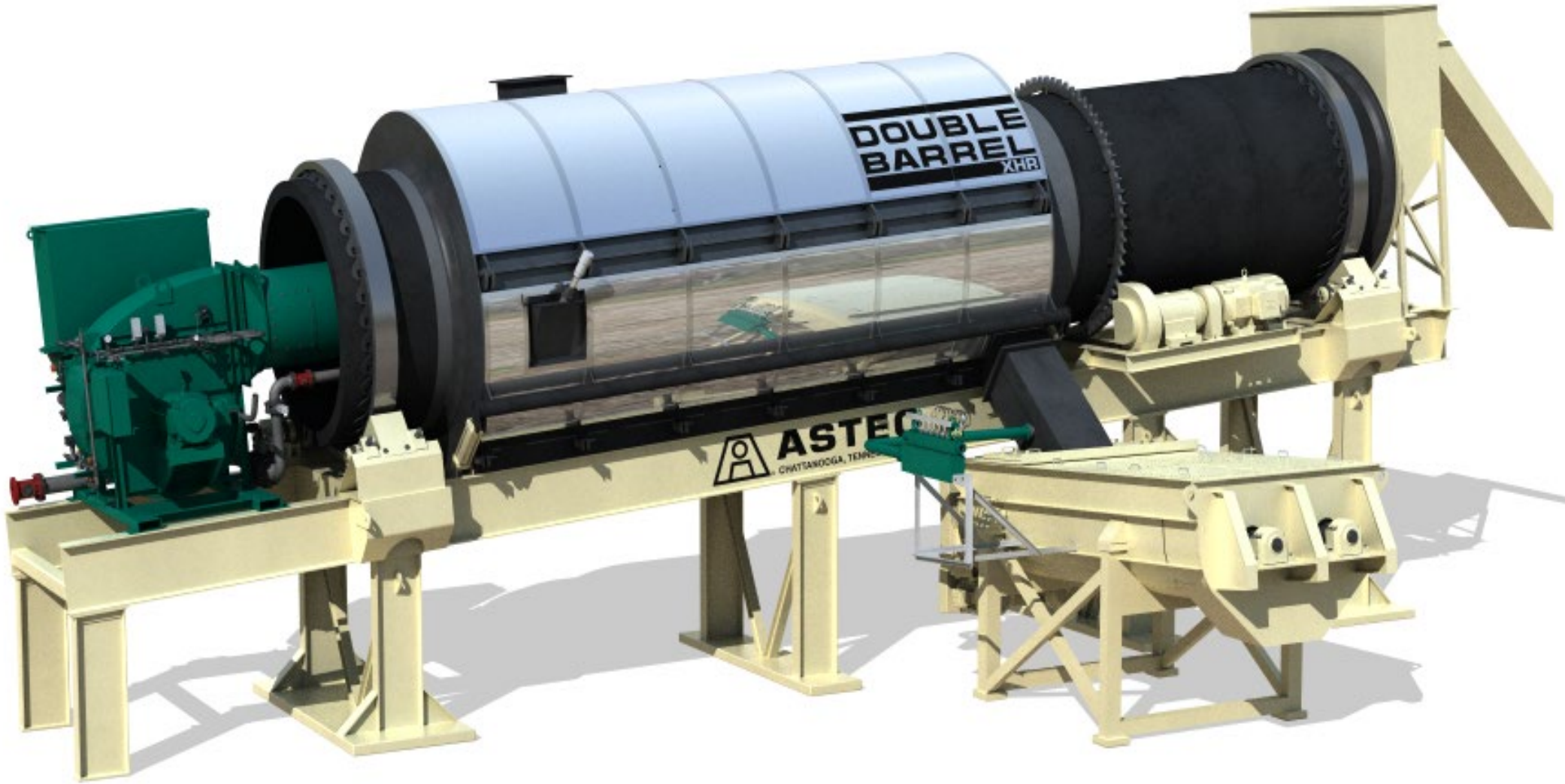


Control Logic

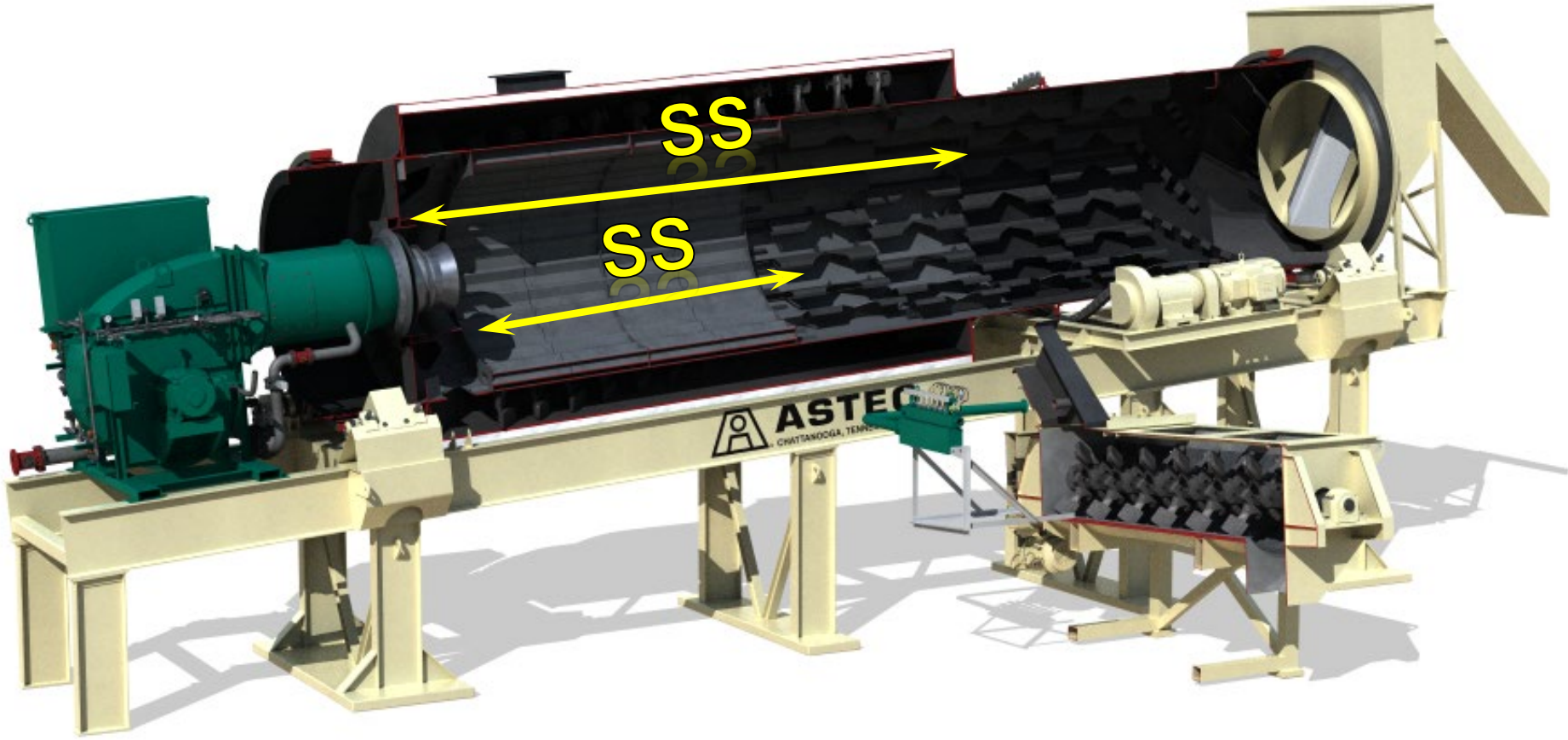
Third Technology… Double Barrel XHR



Double Barrel XHR



Double Barrel XHR Key Features



Shell and flights typically Corten, 1100°F (593°C)

Stainless, 1800°F (982°C) minimal oxidation

Predicting the Future?

What MIGHT the HMA Plant of the Future be like?

Who knows the future?

World Events and Trends Drive Design

Certainty: Increased Expectation of Sustainability

Certainty: Increased RAP: NORM rather than EXCEPTION

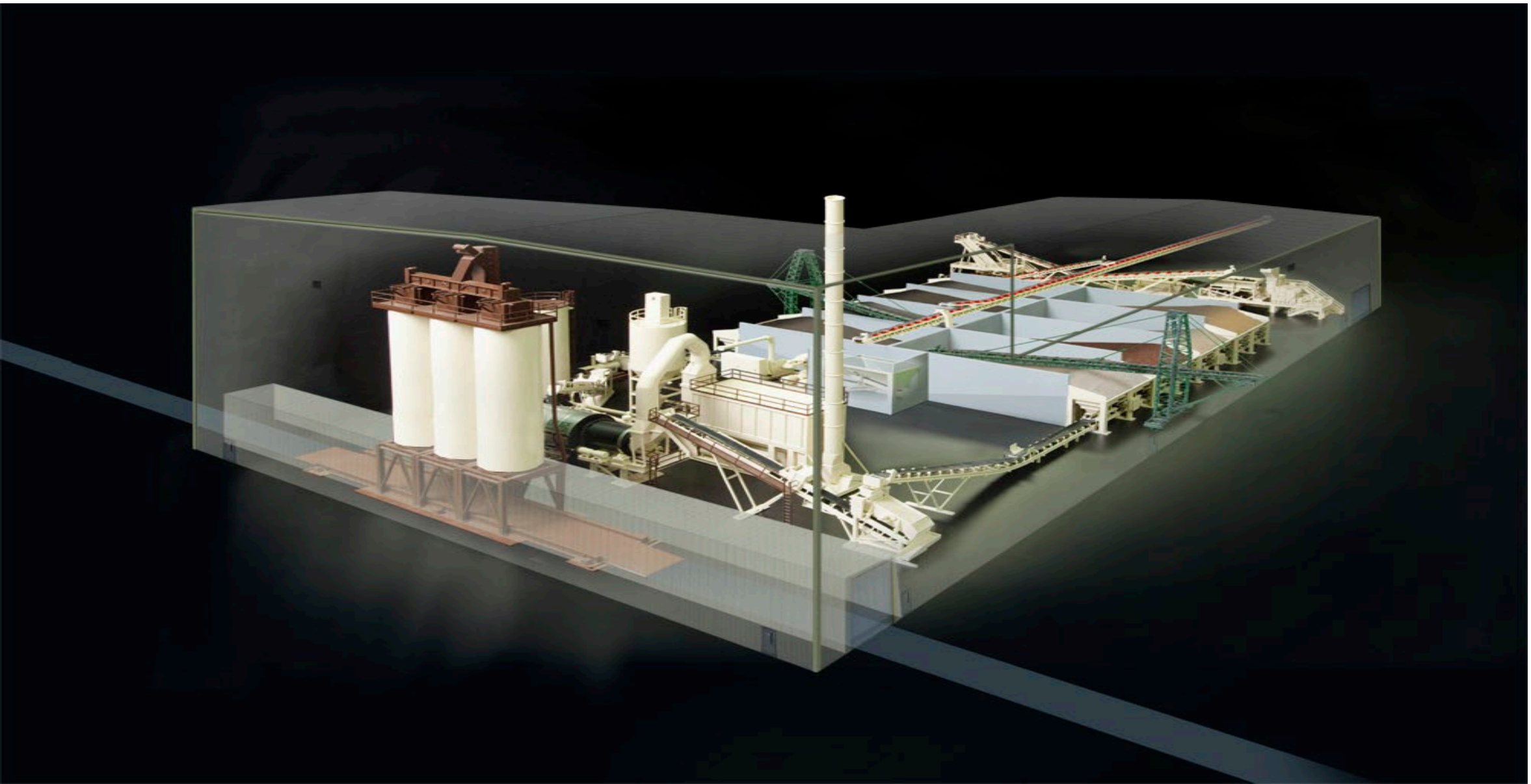
What MIGHT the HMA/WMA Plant of the Future be like?

- Well-planned and landscaped industrial facility.
- Barely audible, if at all, to neighbors (Quiet)
- Most emissions greatly reduced or eliminated...
- More fuel efficient, less effective greenhouse gas emissions.

Less impact...

Better neighbor.

Covered, Indoor Facilities?



Covered, Indoor Facility (2013)

Covered, Indoor Facility (2013)

Interface to Outdoor Storage (Feed Bins)

Interface to Outdoor Storage (Storage Bins)

What's Next?

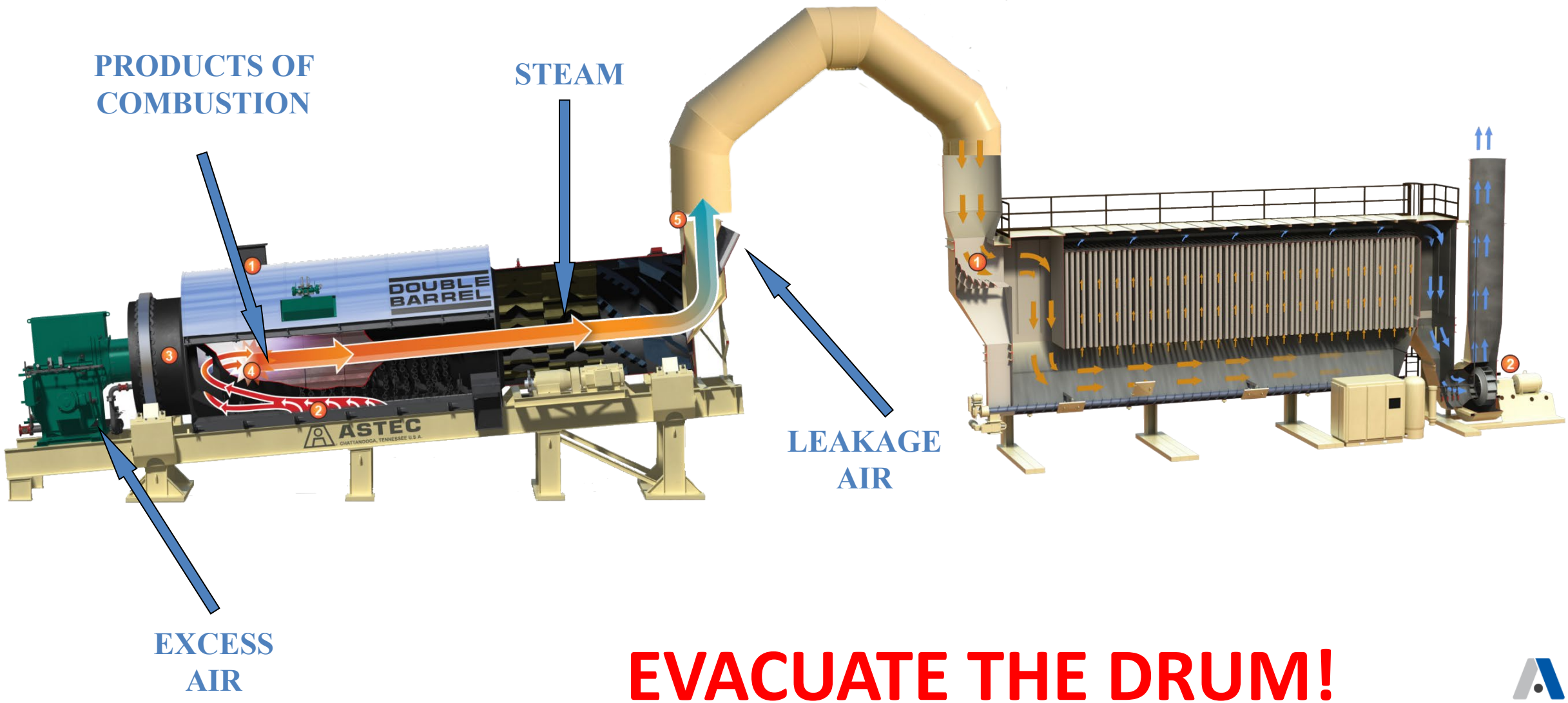
We can safely predict…

ASTEC™

PARTICULATE CONTROL & AIRFLOW

I THINK WHAT WE NEED IS A BAGHOUSE…

What is the function of the exhaust system?



EVACUATE THE DRUM!

Common Terms

AIR-TO-CLOTH RATIO: GAS VELOCITY THROUGH THE BAG FABRIC

BLINDED: CONDITION OF REDUCED BAG PERMEABILITY

CAN VELOCITY: UPWARD GAS VELOCITY IN THE HOPPER BELOW THE BAGS

DIFFERENTIAL PRESSURE: DIFFERENCE IN PRESSURE BETWEEN TWO POINTS IN SYSTEM; A.K.A. "PRESSURE DROP"; CAN BE MEASURED IN inWC OR mmHG

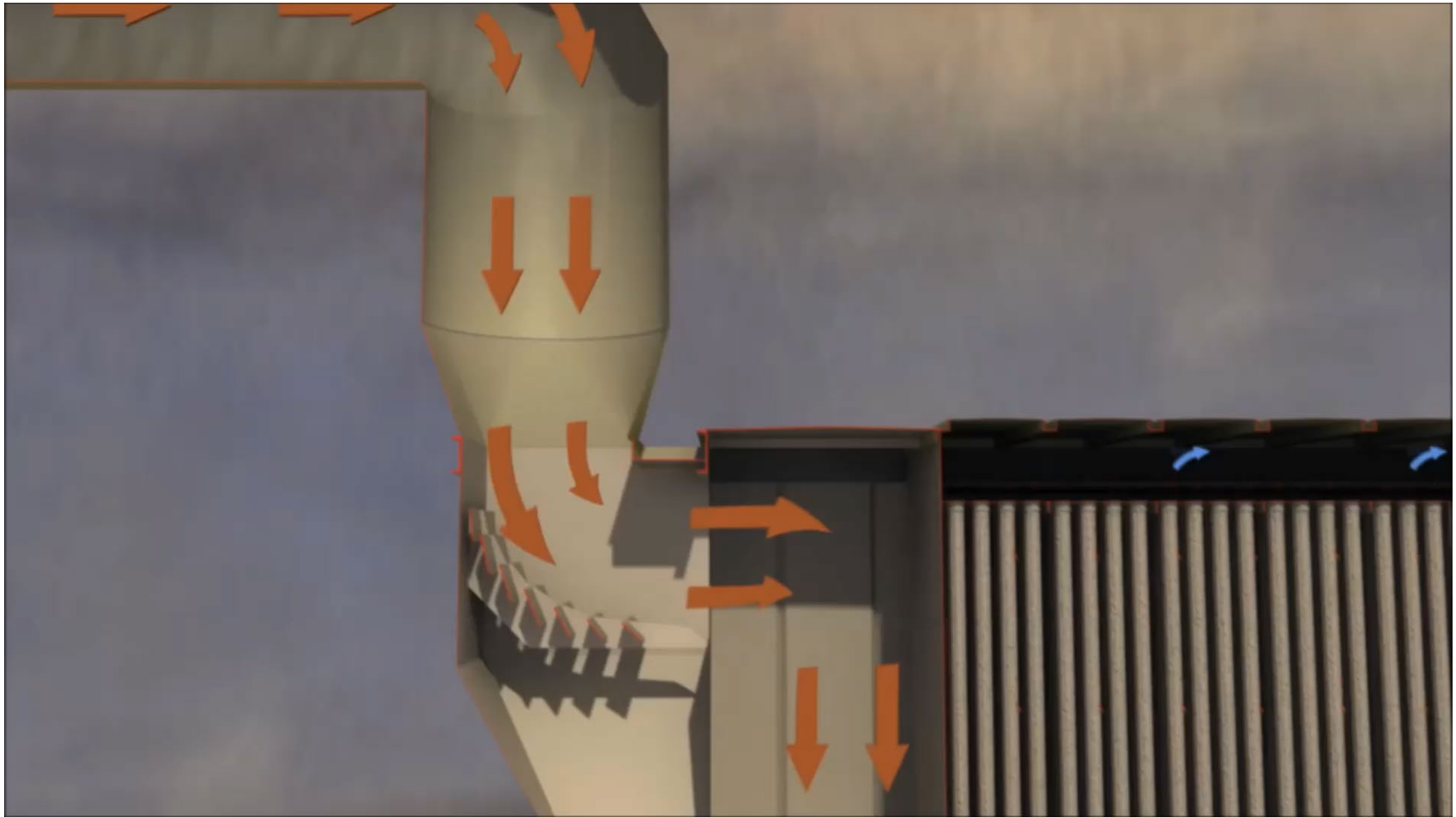
DUST CAKE: BUILDUP OF PARTICULATE MATTER ON OUTSIDE OF BAGS

GRAIN: UNIT OF WEIGHT EQUAL TO 1/7000 OF A POUND

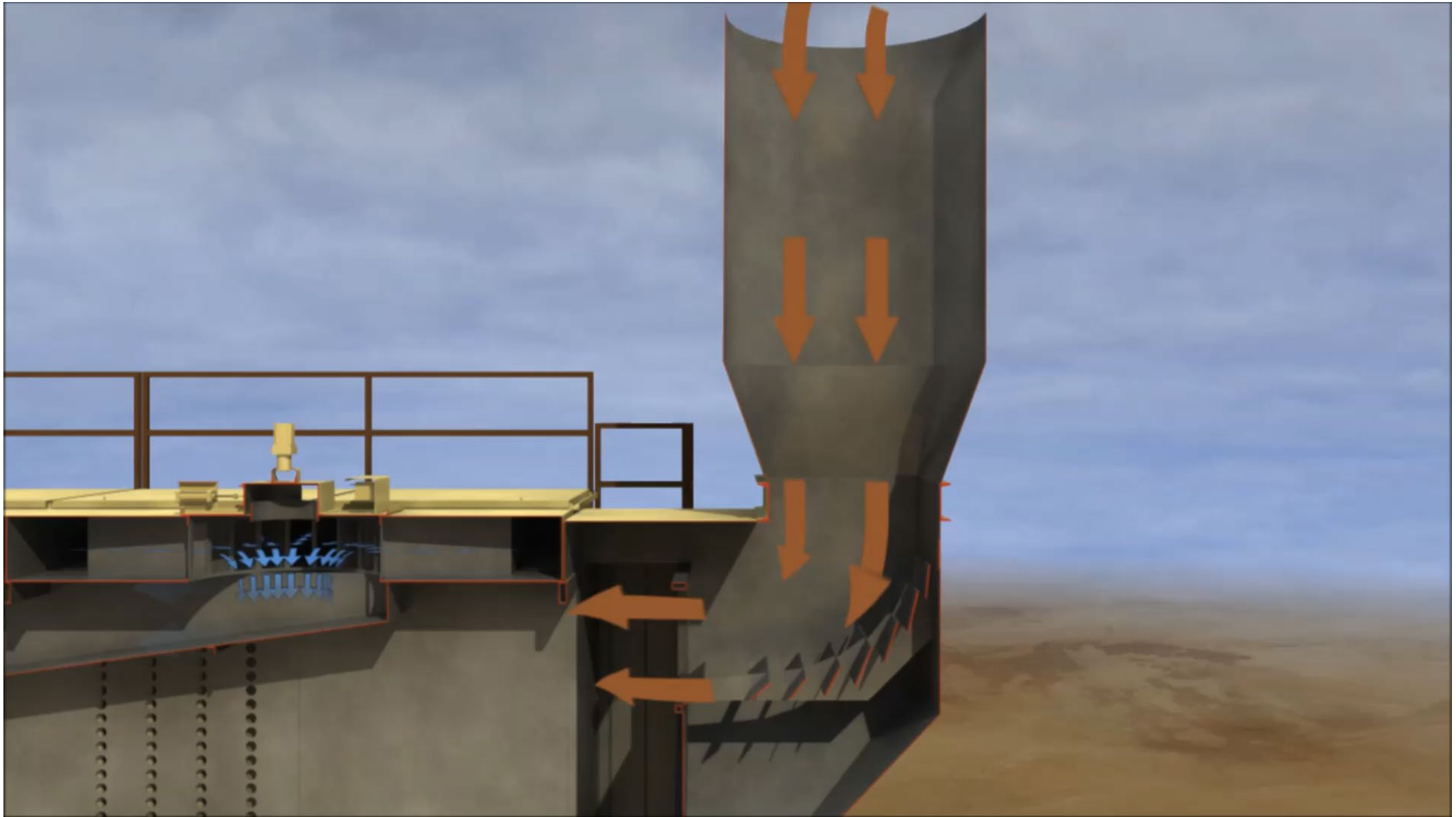
INTERSTITIAL VELOCITY: UPWARD GAS VELOCITY BETWEEN BAGS MEASURED AT BOTTOM OF BAGS

RE-ENTRAINMENT: RE-DEPOSITING OF DUST ONTO ADJACENT BAG AFTER PULSING

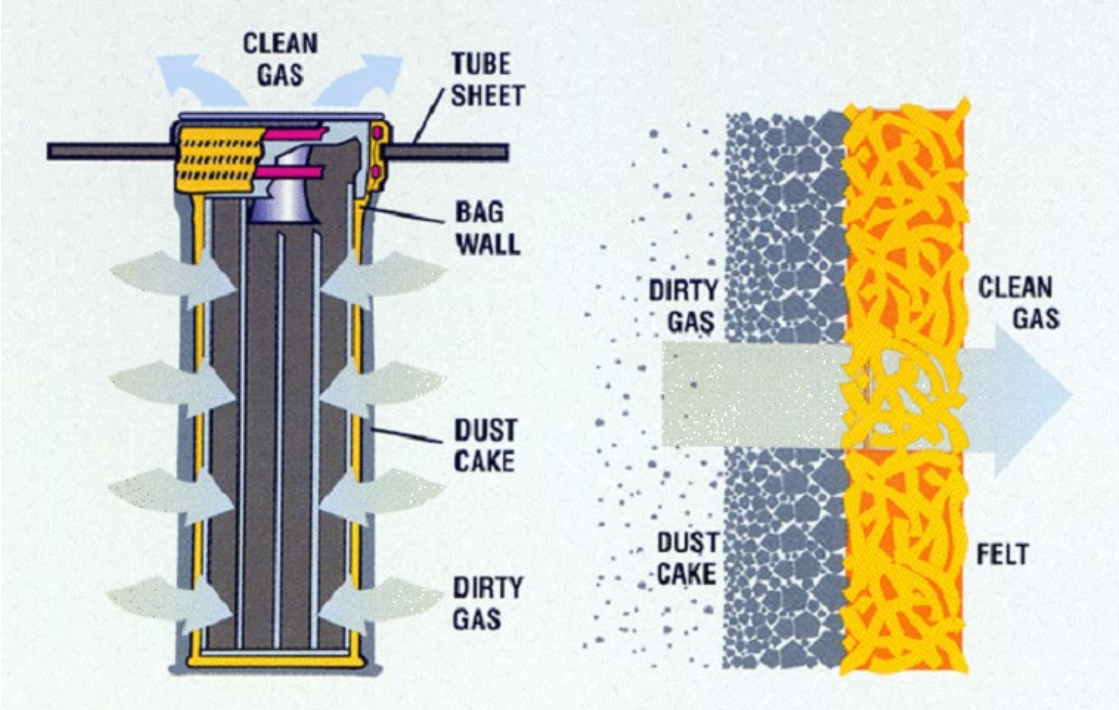
Pulse Jet Baghouse Operation

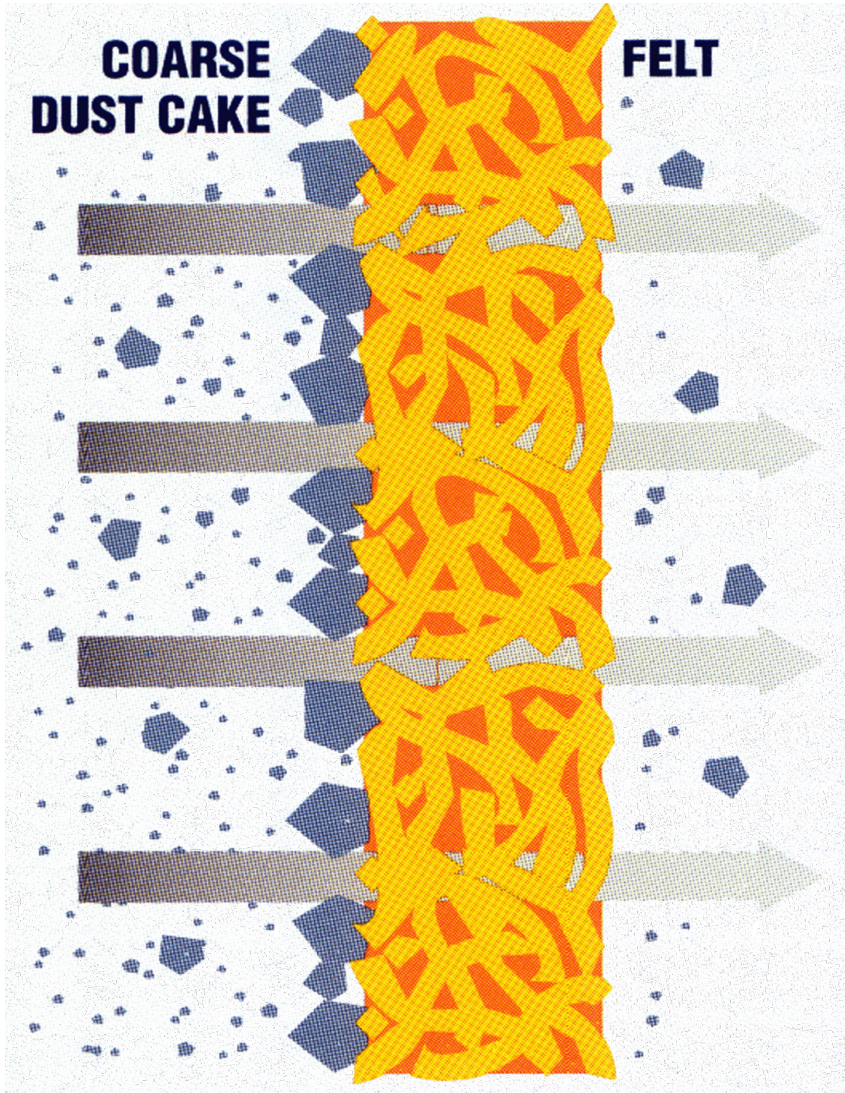


Reverse Pulse Baghouse Operation

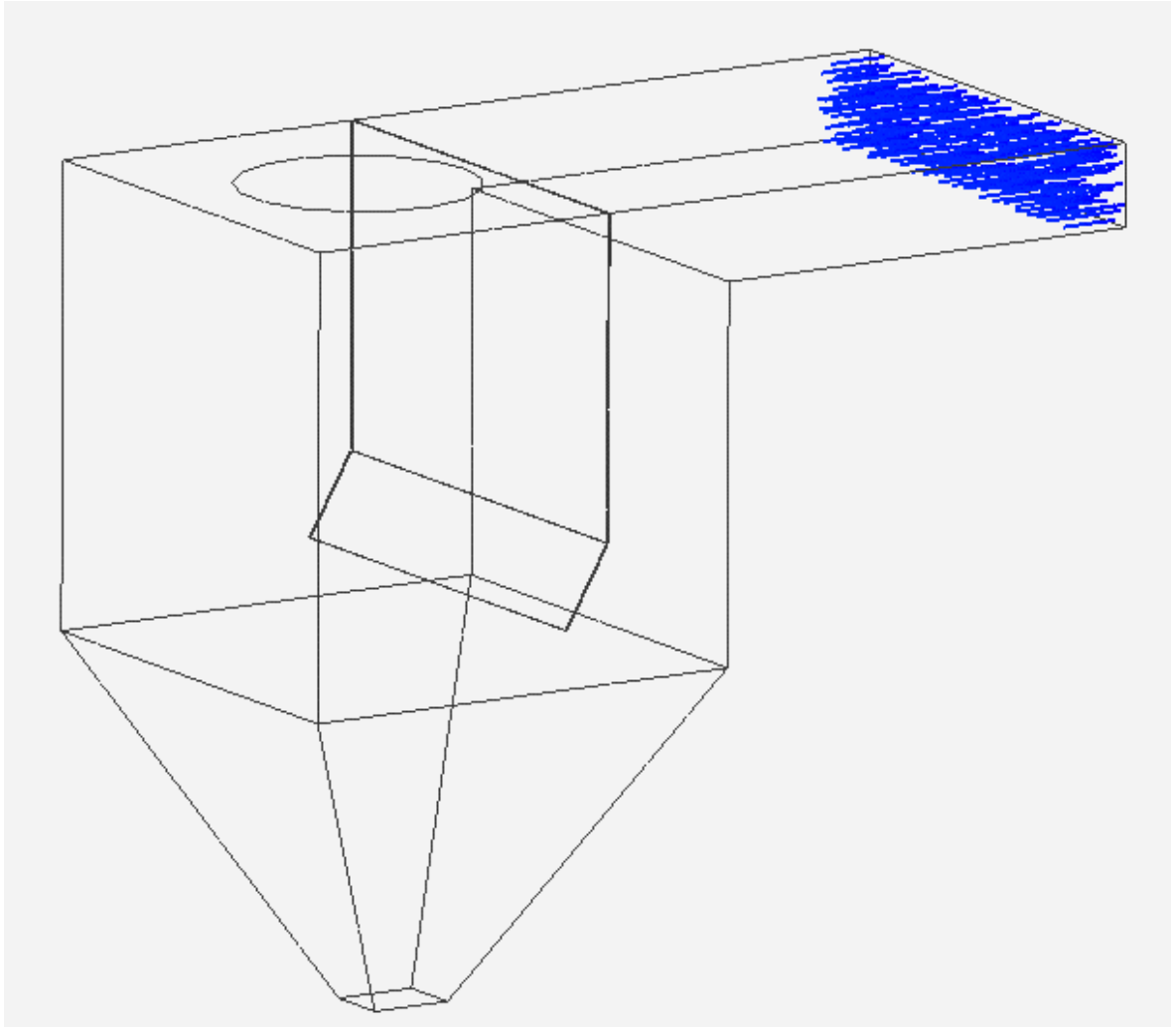


DUST CAKE FUNCTION



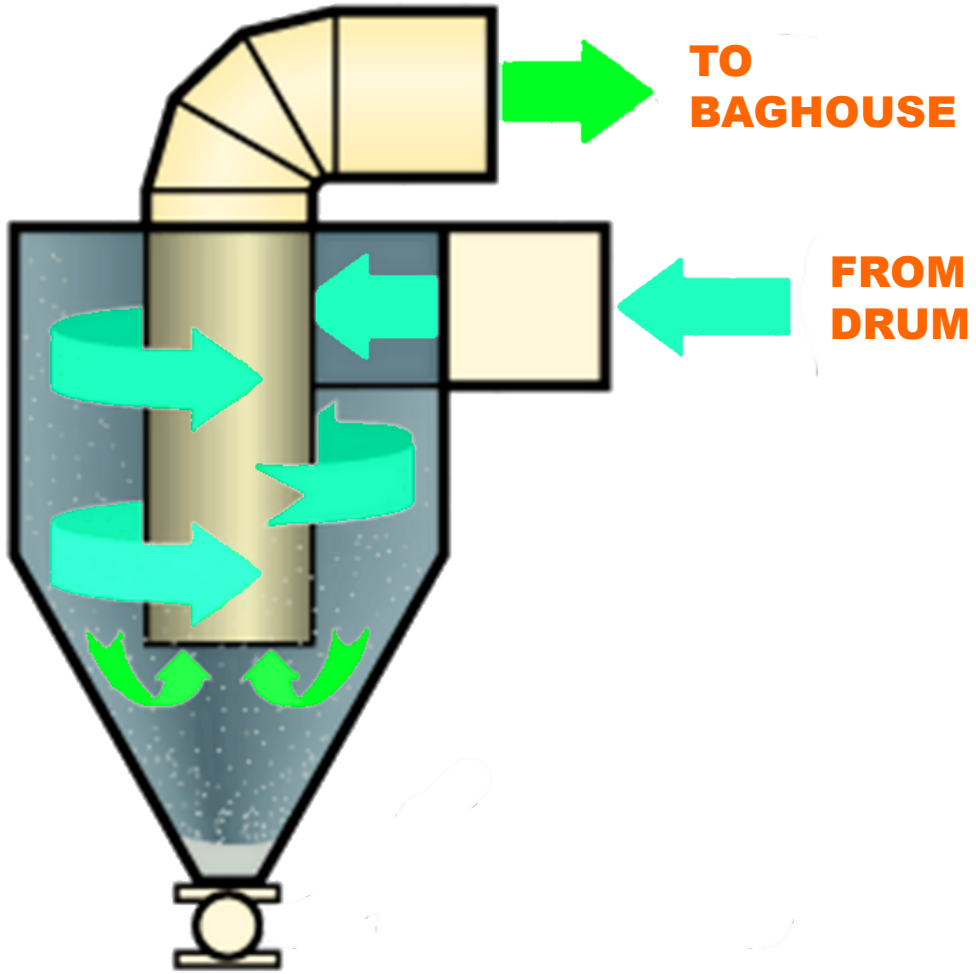


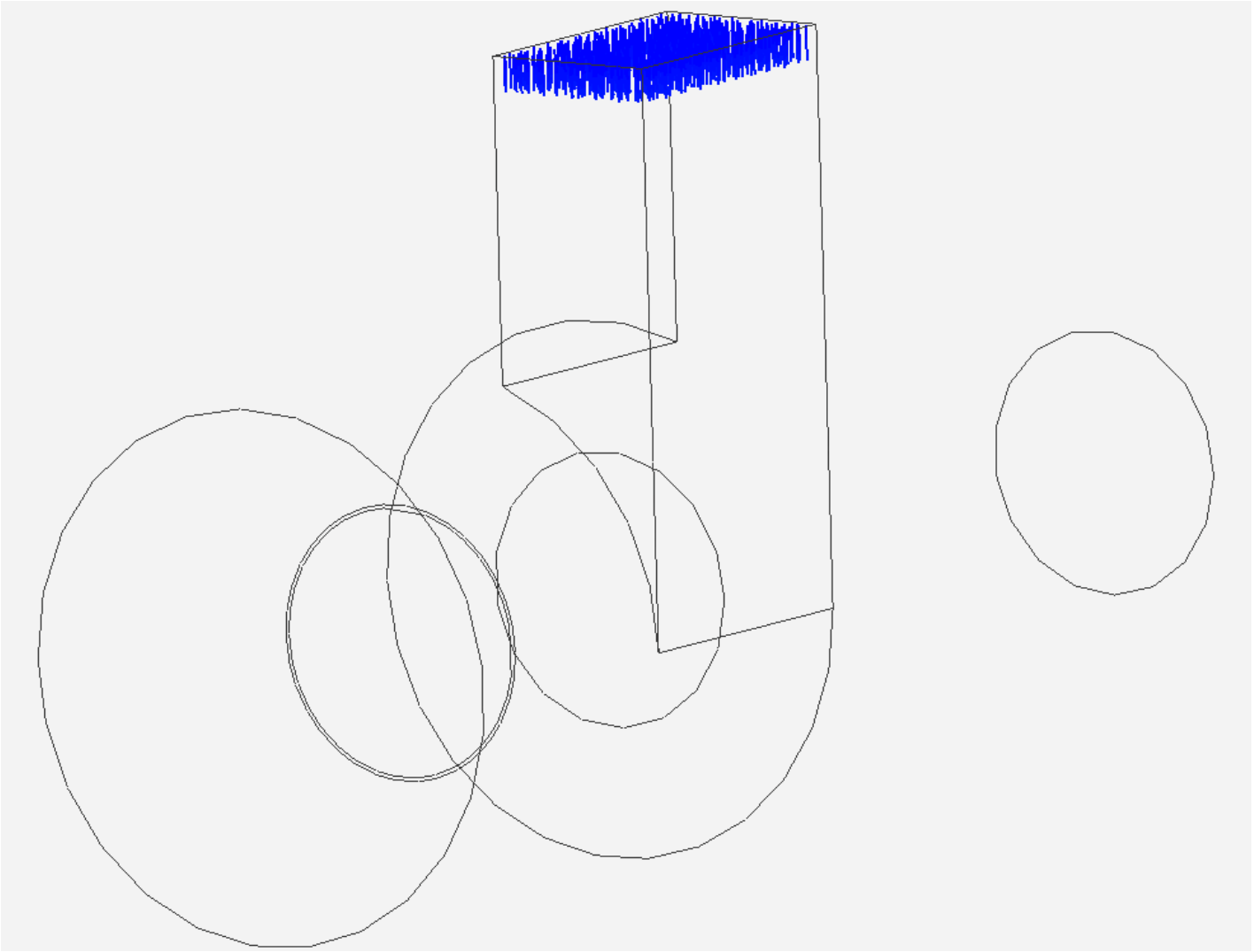
Primary Collectors: Knockout Box



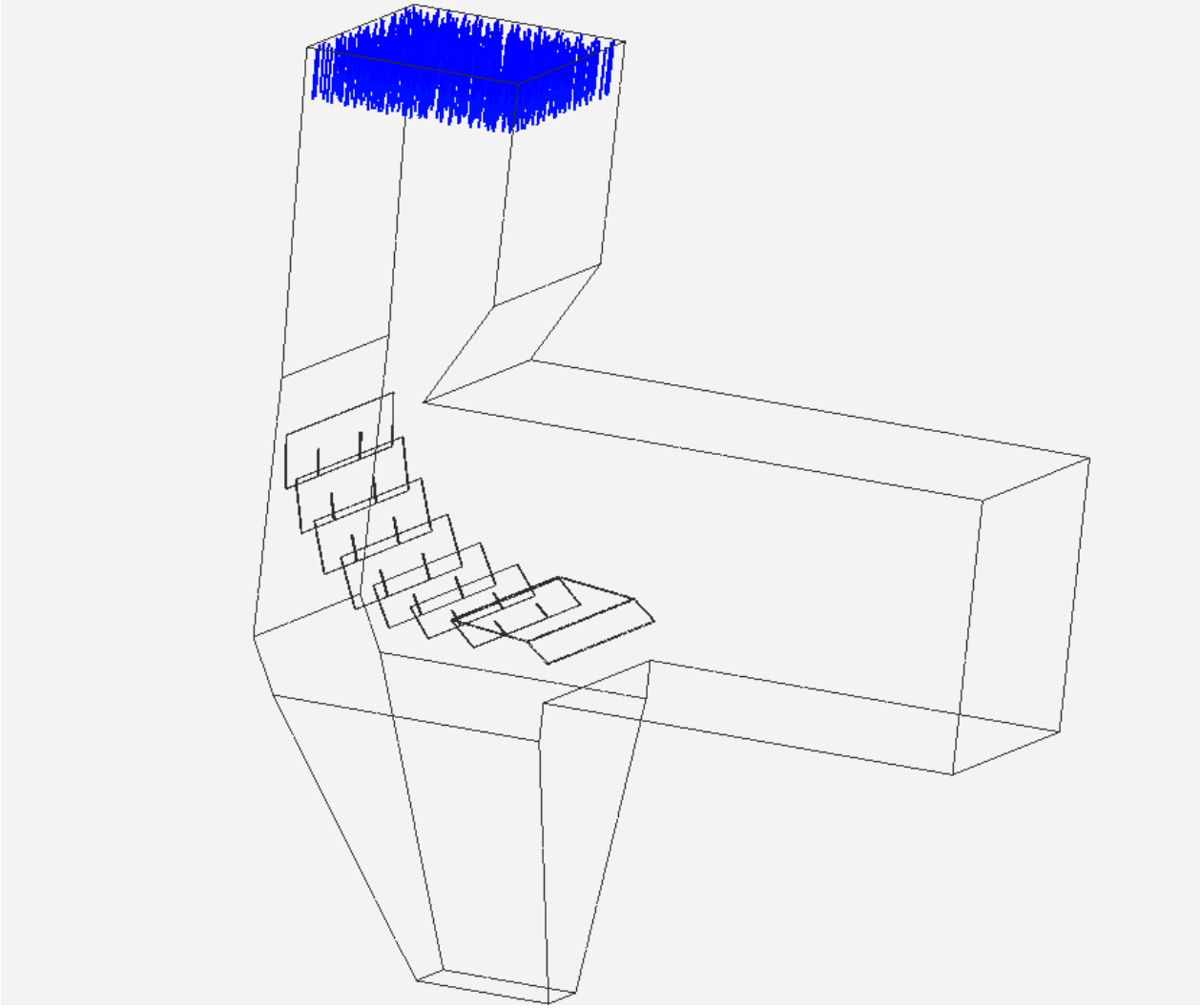
- Low internal gas velocities
- Effective for removal of large particles only
- May have baffle plate to enhance particle removal

Primary Collectors: Cyclones





Primary Collectors: Inertial Separator



Let’s Talk Felts…

Dust carryout: up to 10% of production rate!

What’s the big deal?

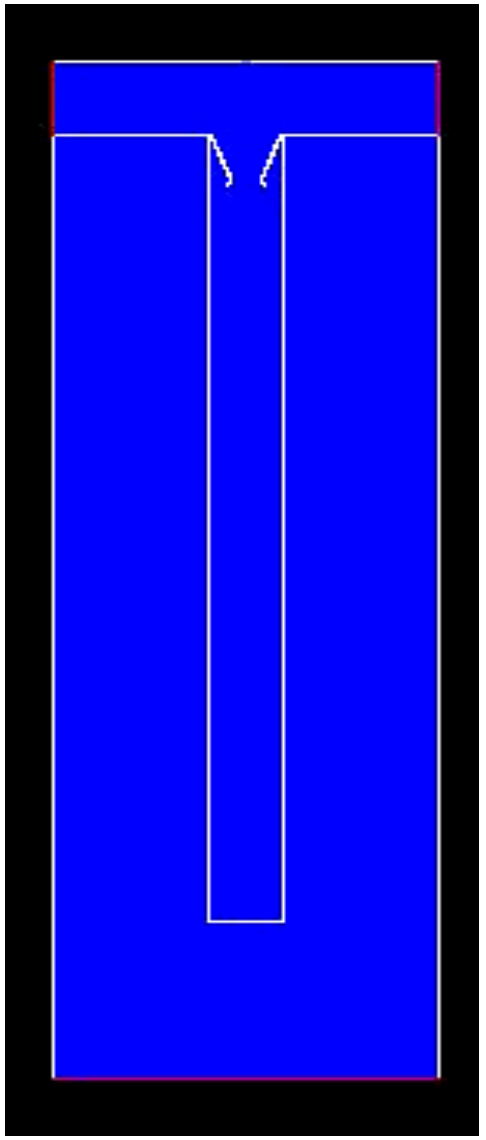
BAGHOUSE PERFORMANCE!

Let's Talk Felts…

When in doubt… Keep it low!

- Over-cleaning reduces bag life !
- Aggressive pulsing breaks up dust cake
- Maintain adequate dust cake thickness: 3-5inWC

It's better to pulse more often at a lower pressure!



Let’s Talk Cleaning…

- Blowpipes must properly align with the bags
- Inspect holes annually for deformation
- Use only dry, compressed air

Mudballs

- **High Baghouse ΔP**
- **Low Exhaust Temps**

BAD DAY!!!

HYDROCARBON CONTAMINATION

LIQUIDS DON'T BURN – ONLY VAPORS BURN.

BLINDED BAGS

CRITERIA:

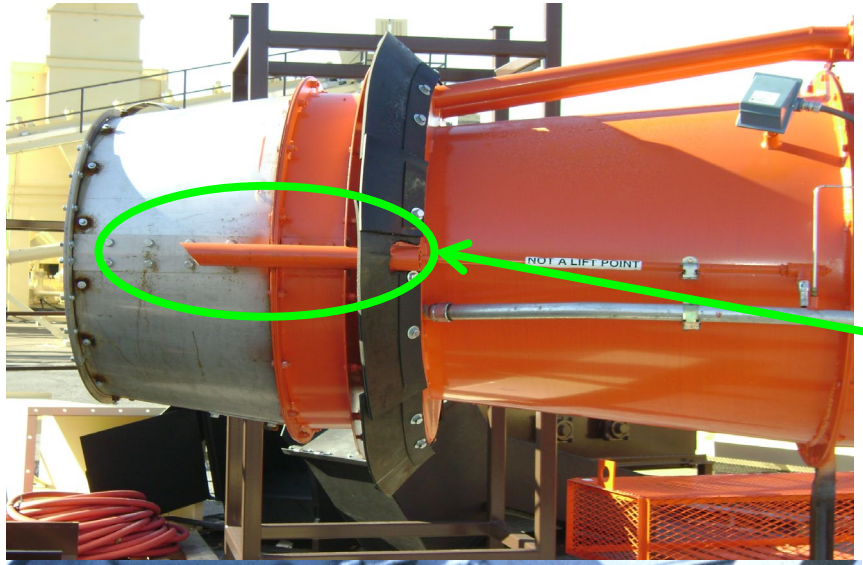
- BAG WEIGHT *DOUBLE* THAT OF NEW FELT AFTER CLEANING
- PERMEABILITY < 2 CFM AT 0.5 INWC
- DUST PENETRATION > 50% THROUGH FELT

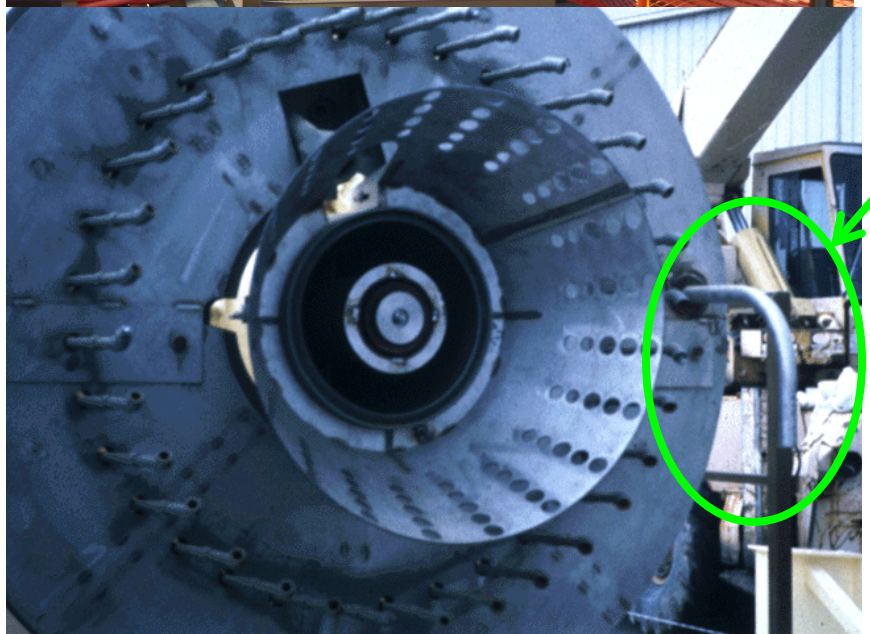
BURNER SUCTION

Rule of Thumb

Burner Suction

Set Point





PITOT TUBE

Assessing Evidence of Corrosion

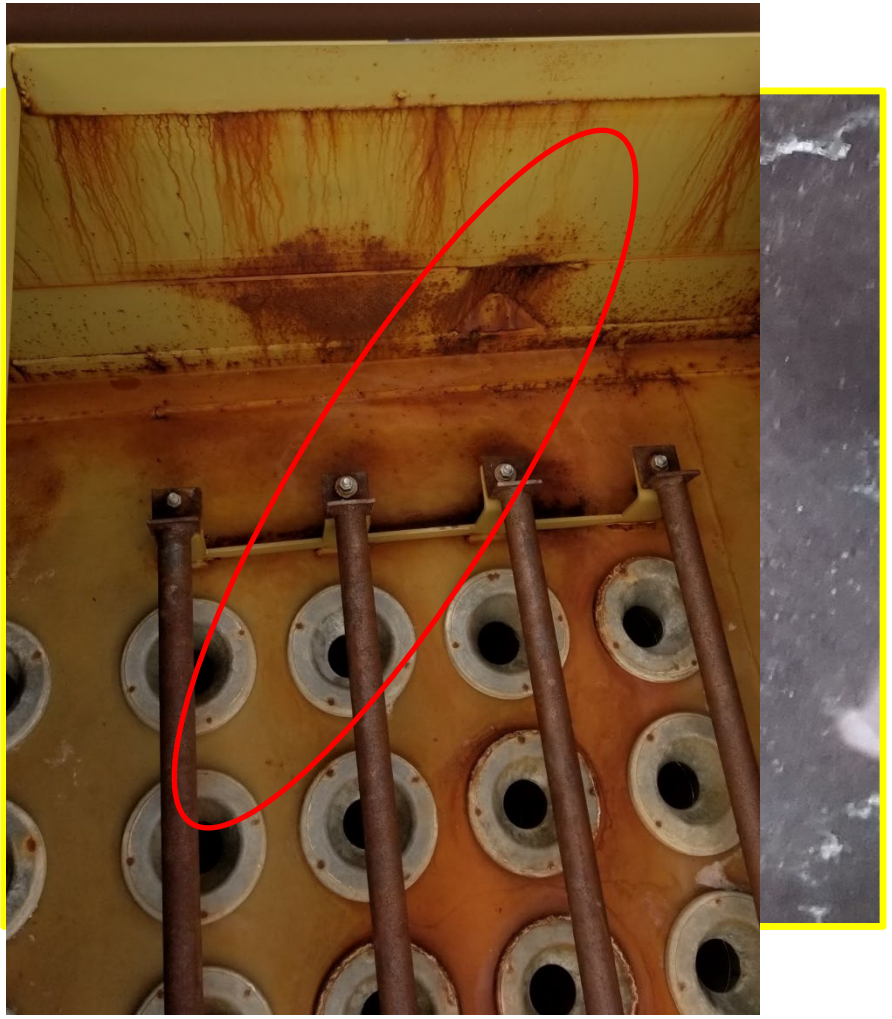
Non-Critical Corrosion

But how do we know which is which?

Critical Corrosion

Differences in Corrosion Severity

What differences do you see with these two photos?



Corrosive Residues

Sulfur residues have a similar, but yellow appearance

Chloride re
have a ch
white appe

Non-Critical Corrosion

- Typically has causes that are *more* easily fixed such as:
  - Low stack temperatures
  - Baghouse leaks in the form of:
    - Deteriorated Door Seals
    - Broken or cracked welds
- The corrosion in the baghouse shown here was solved by removing flights in the drum, and increasing the temperature in the baghouse by roughly 30 degrees.
  - The customer typically saw aggregate moistures near 8-10%

Critical Corrosion

- Typically has causes that originate from somewhere other than the baghouse itself.
  - Corrosive compounds from various sources:
    - Asphalt Cements
    - Aggregates
    - RAP
    - Additives
    - Fuels
- White / Yellow residues are a tell-tale sign of critical corrosion.
- Critical corrosion needs to be solved at the source of the corrosion, not by simply modifying baghouse temperature.

Abrasion

Severe bag leaking

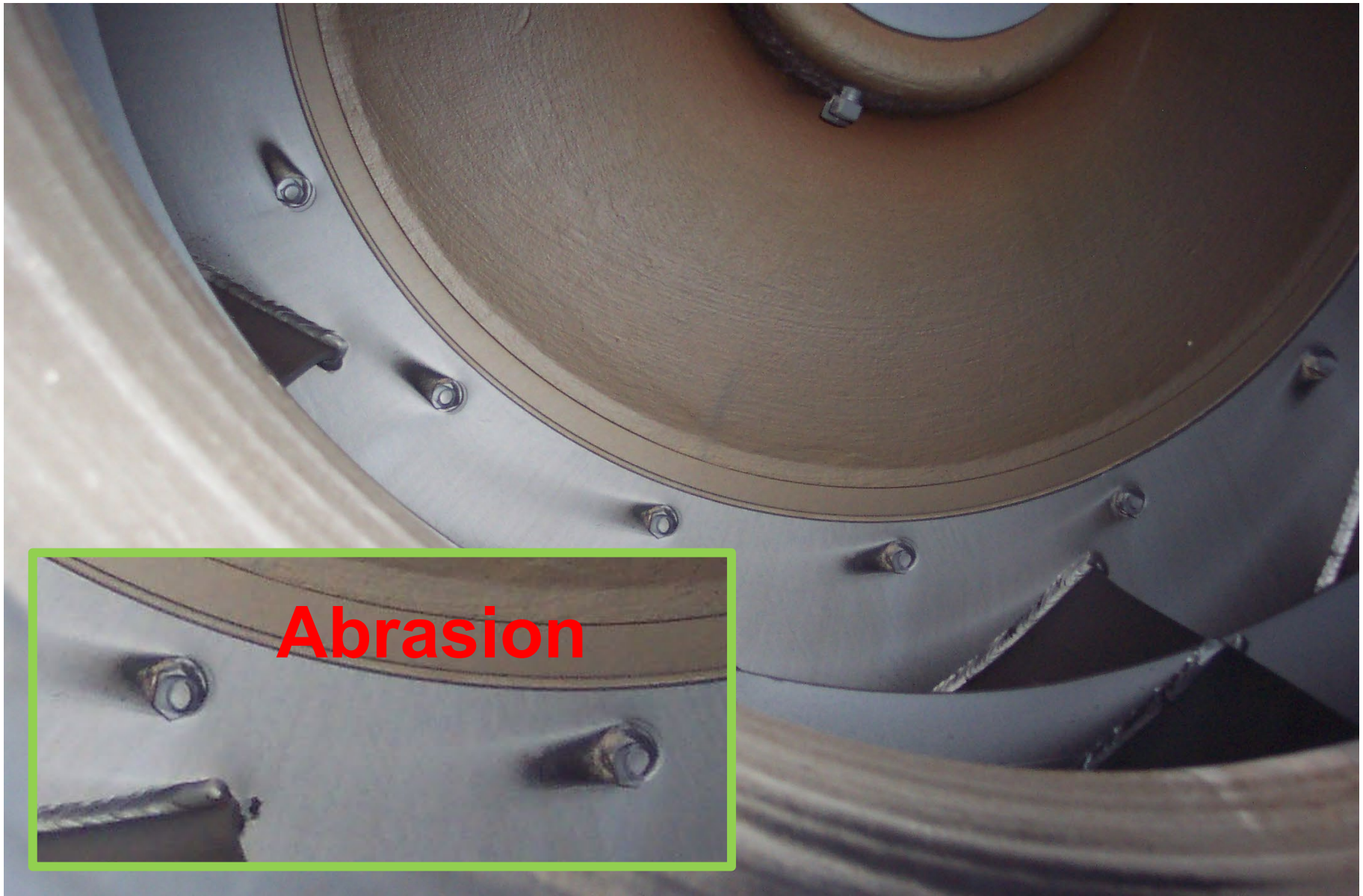
This should throw a **RED** flag.

What else should you inspect?

Severe bag leaking

Inspect the Fan Wheel!

Severe bag leaking



ASTEC™

Dust Control Options

BUILT TO **CONNECT**

Lafarge Seminar

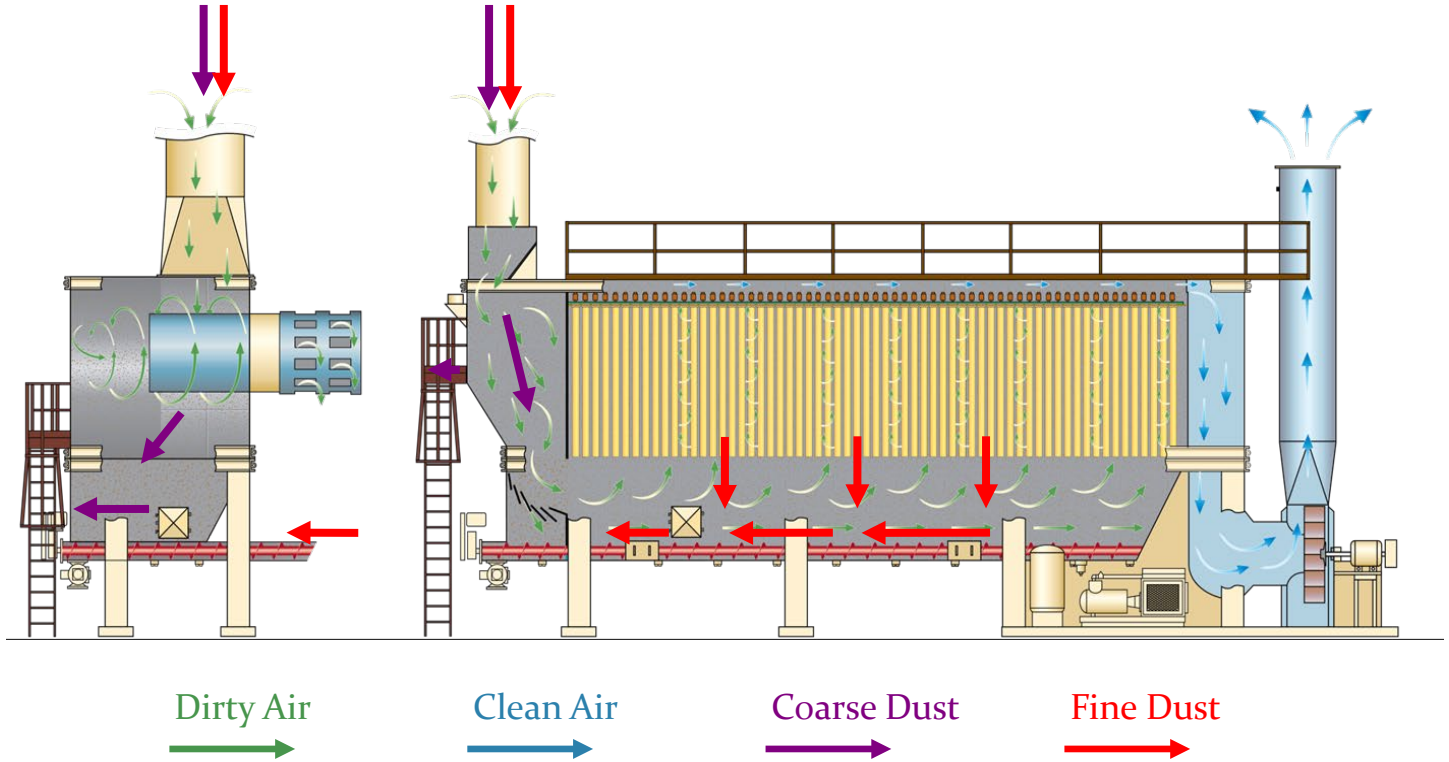
May 16-17, 2022

Available Options

Astec currently offer six distinct dust control scenarios:

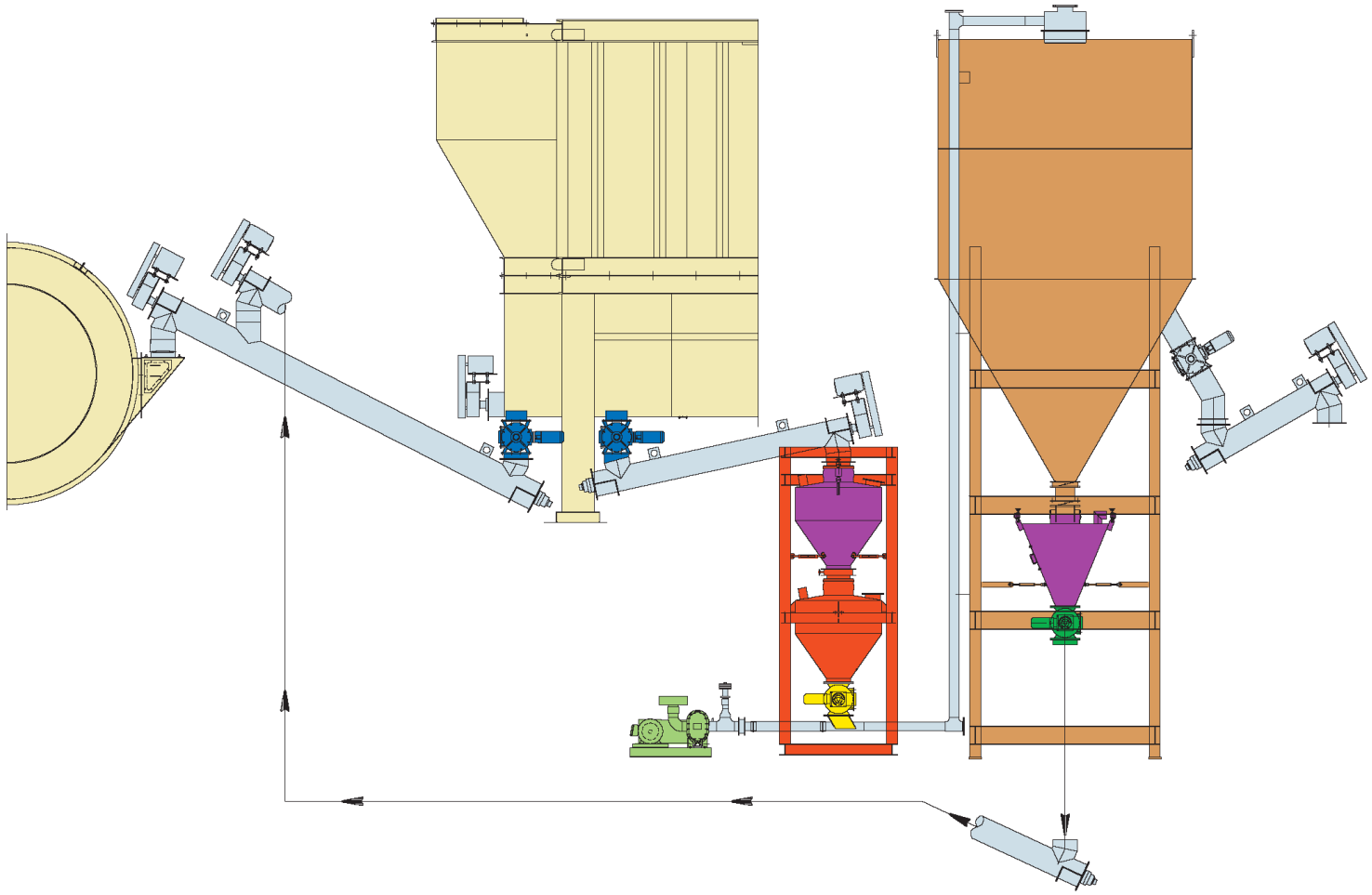
- Automatic Control
- Split Return with Weigh Pot
- Split Return
- Split Return with Surge Pot
- Return All with Surge Pot
- Return All

General Airflow and Dust Flow



Option 1 – Automatic Control

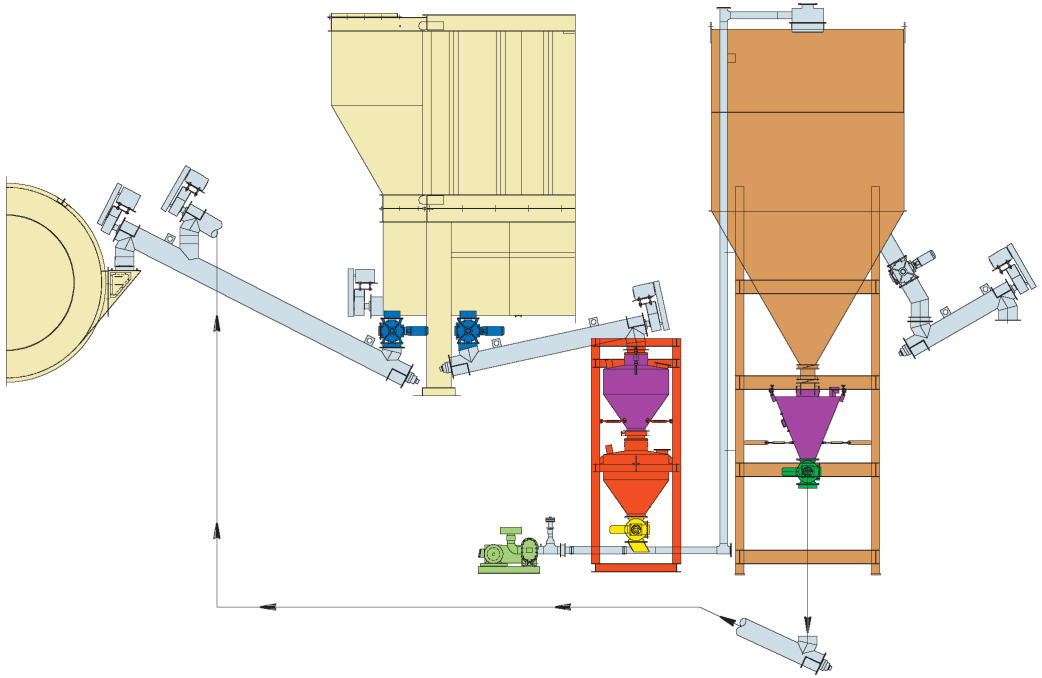
Commonly referred to as “Illinois run-around System”



Option 1 – Automatic Control

Advantages

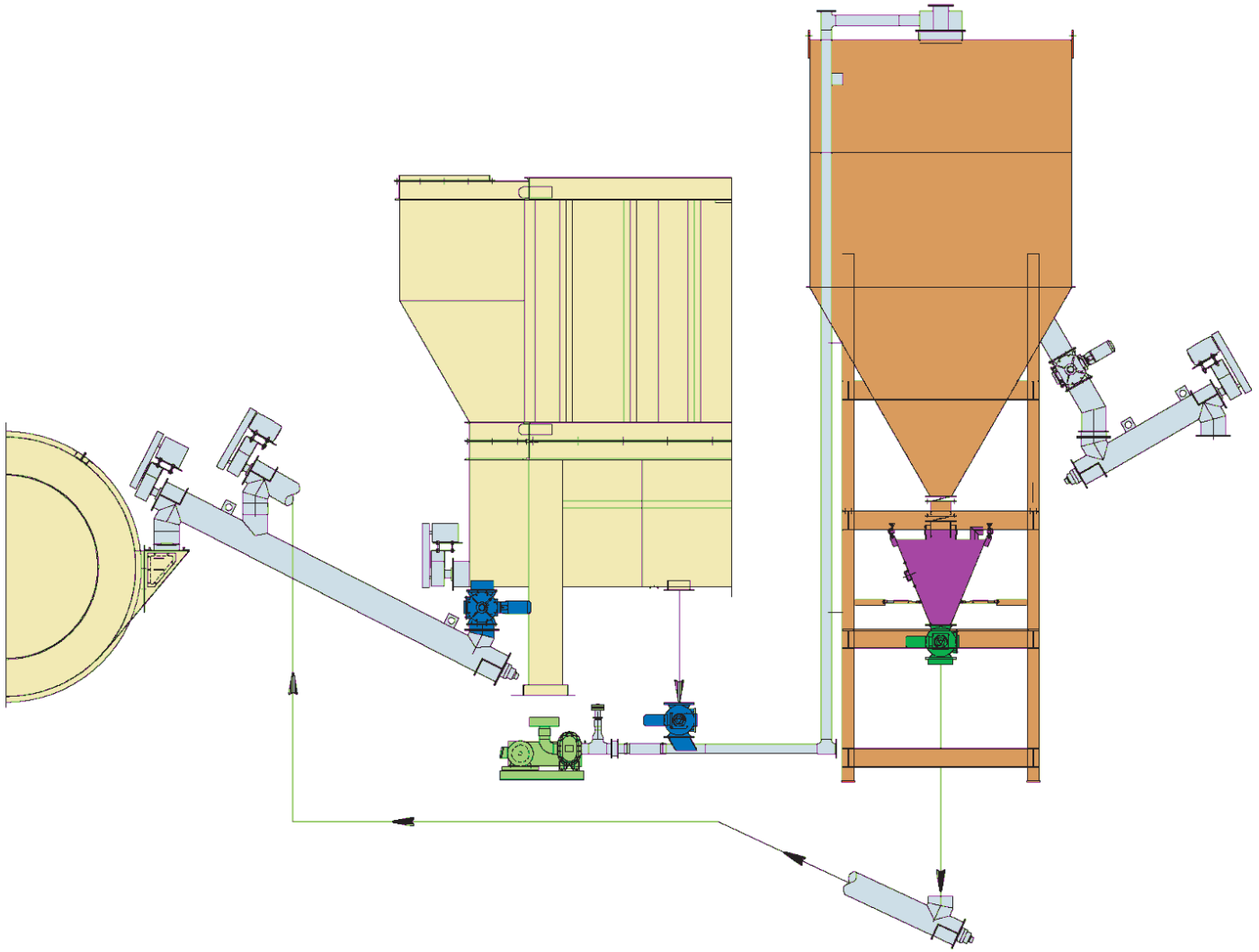
- Only system that ACCOUNTS for ALL dust in system to automatically calculate required AC content
  - Weighing of fine dust leaving baghouse provides amount of fine dust needed for return
  - AC flow is automatically adjusted based on measured change in fine dust component
  - More dust can be added than is removed, if needed, because of silo
  - Ensures steady dust flow from baghouse at start up and mix design transitions



Disadvantages

- Highest cost
- Most complex

Option 2 – Split Return w Weigh Pot

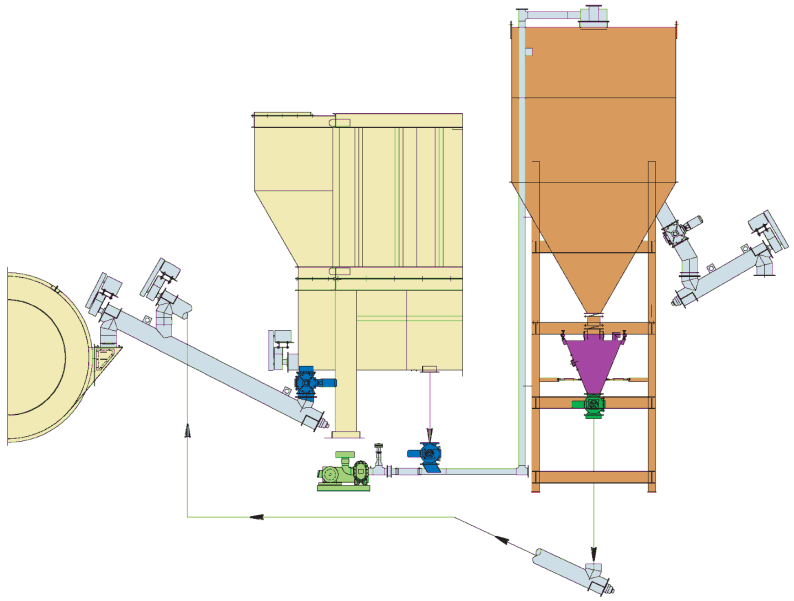


Option 2 – Split Return w Weigh Pot

Advantages

- Allows for wasting of dust if aggregate blend cannot meet specifications
- More dust can be added than is removed, if needed, because of silo

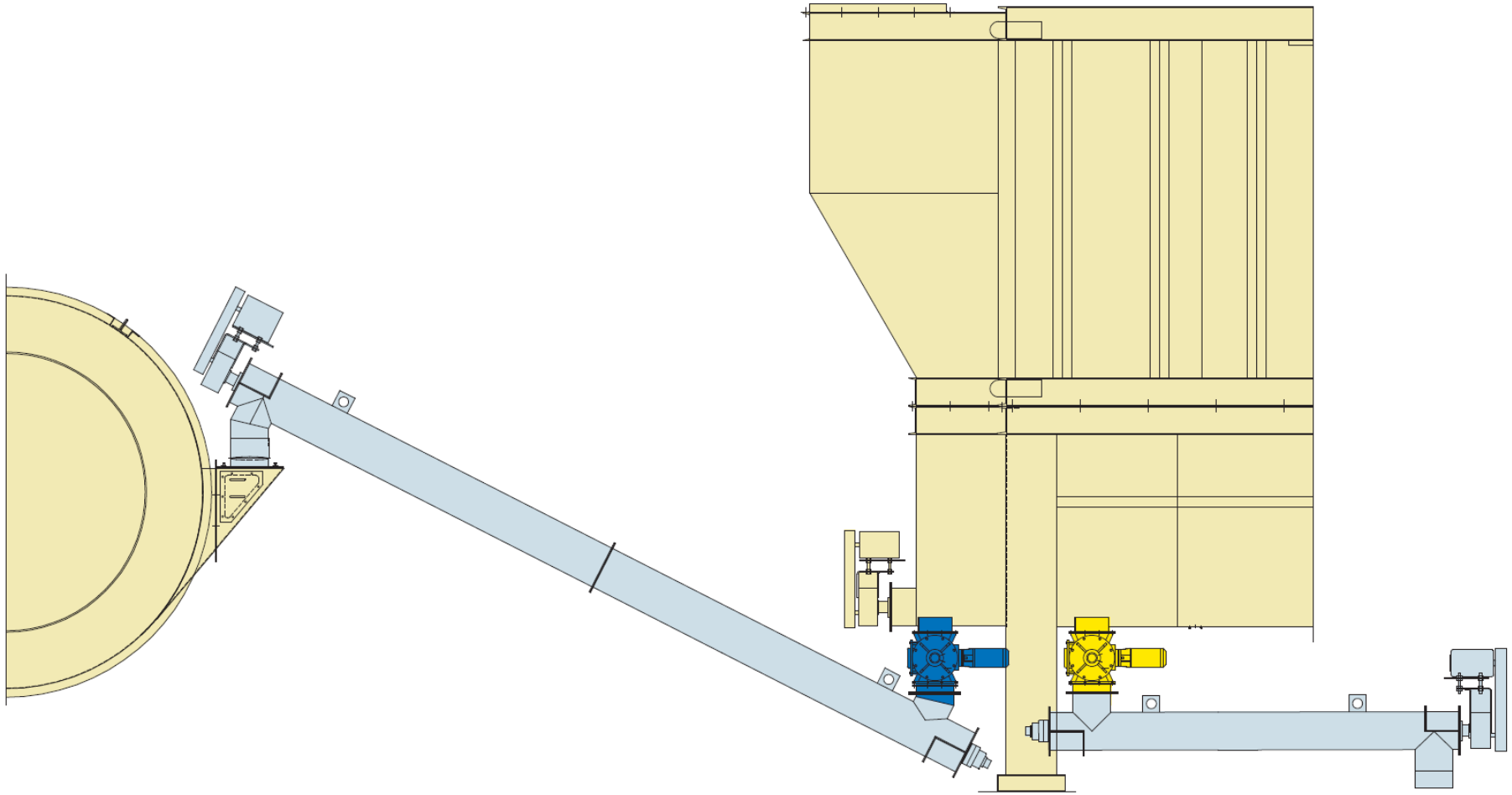
- Disadvantages
- Amount of dust moved to silo is unknown
- Amount of dust to return is trial and error
- AC flow rate is trial and error
- Since the fine dust is not metered as it leaves the baghouse, required change of AC flow is unknown



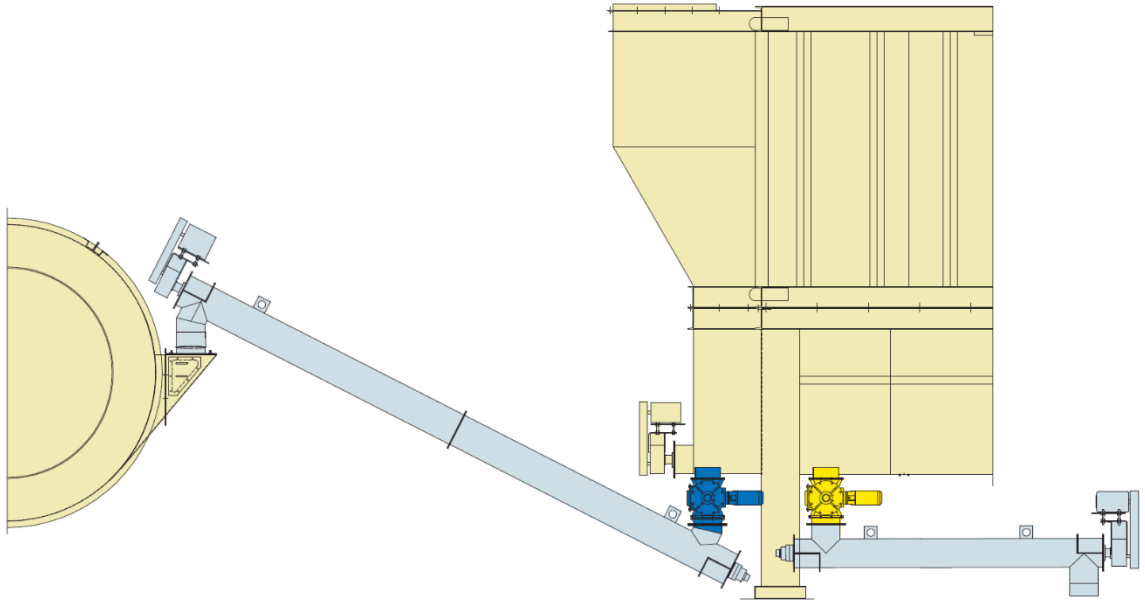
Note:

- Most common dust control system
- Balances control, cost, and reliability

Option 3 – Split Return



Option 3 – Split Return



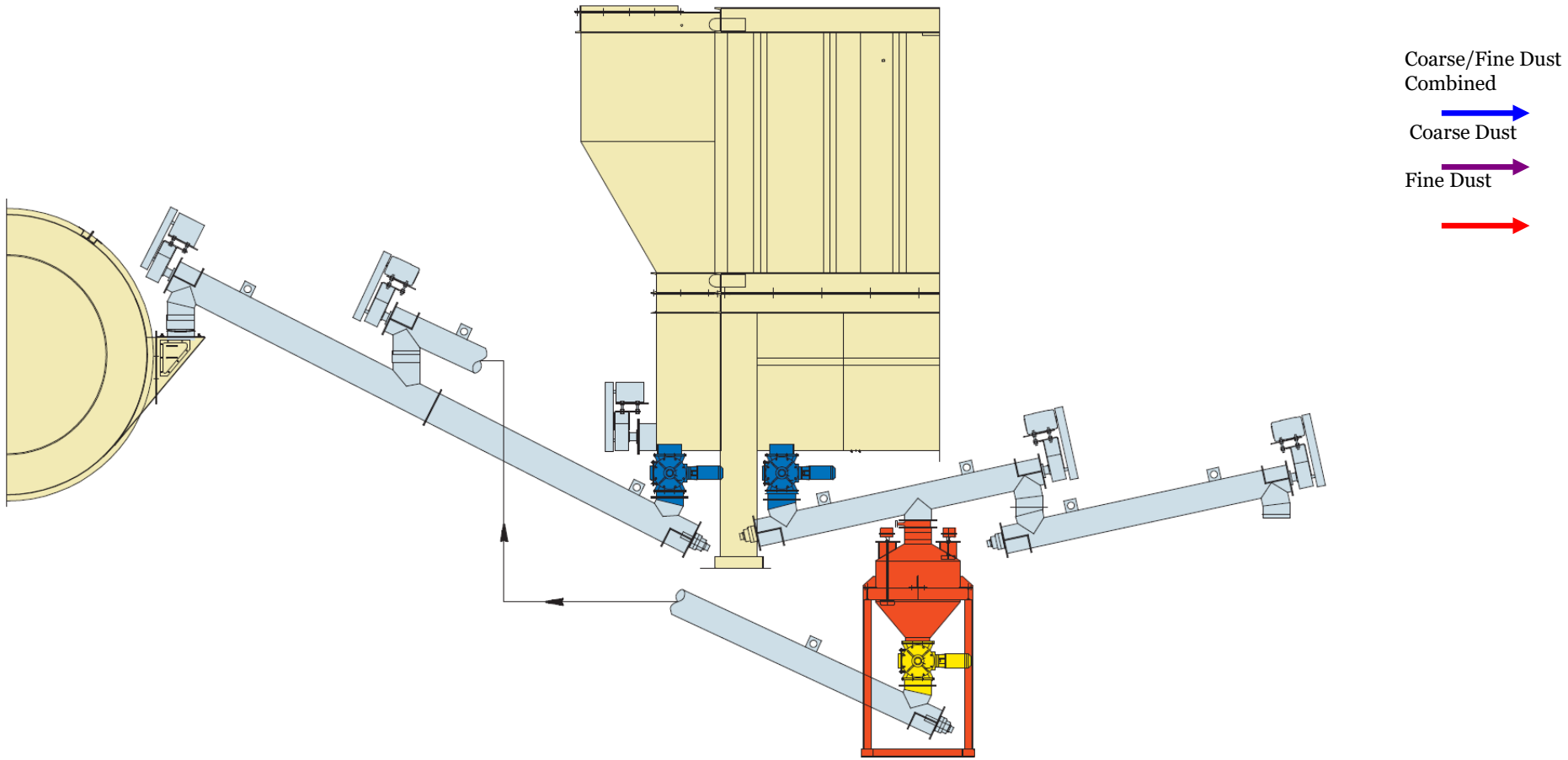
Advantages

- Allows for wasting of dust if aggregate blend cannot meet spec

Disadvantages

- Amount of dust to waste is trial and error
- AC flow rate is trial and error
- Since the fine dust is not metered as it leaves the baghouse, required change of AC flow is unknown

Option 4 – Split Return with Surge Pot



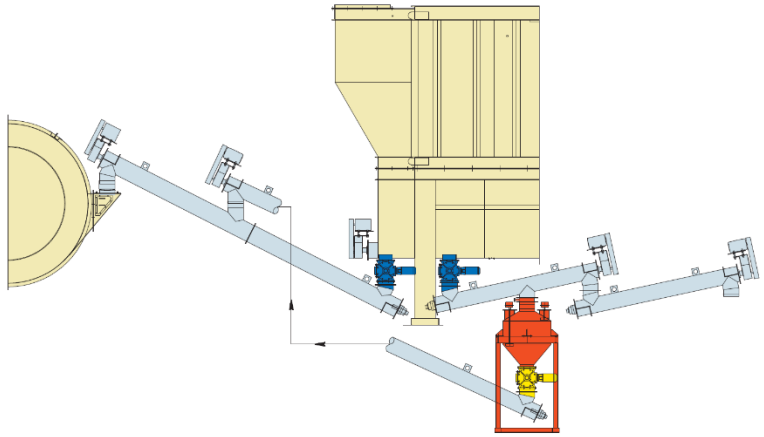
Option 4 – Split Return with Surge Pot

Advantages

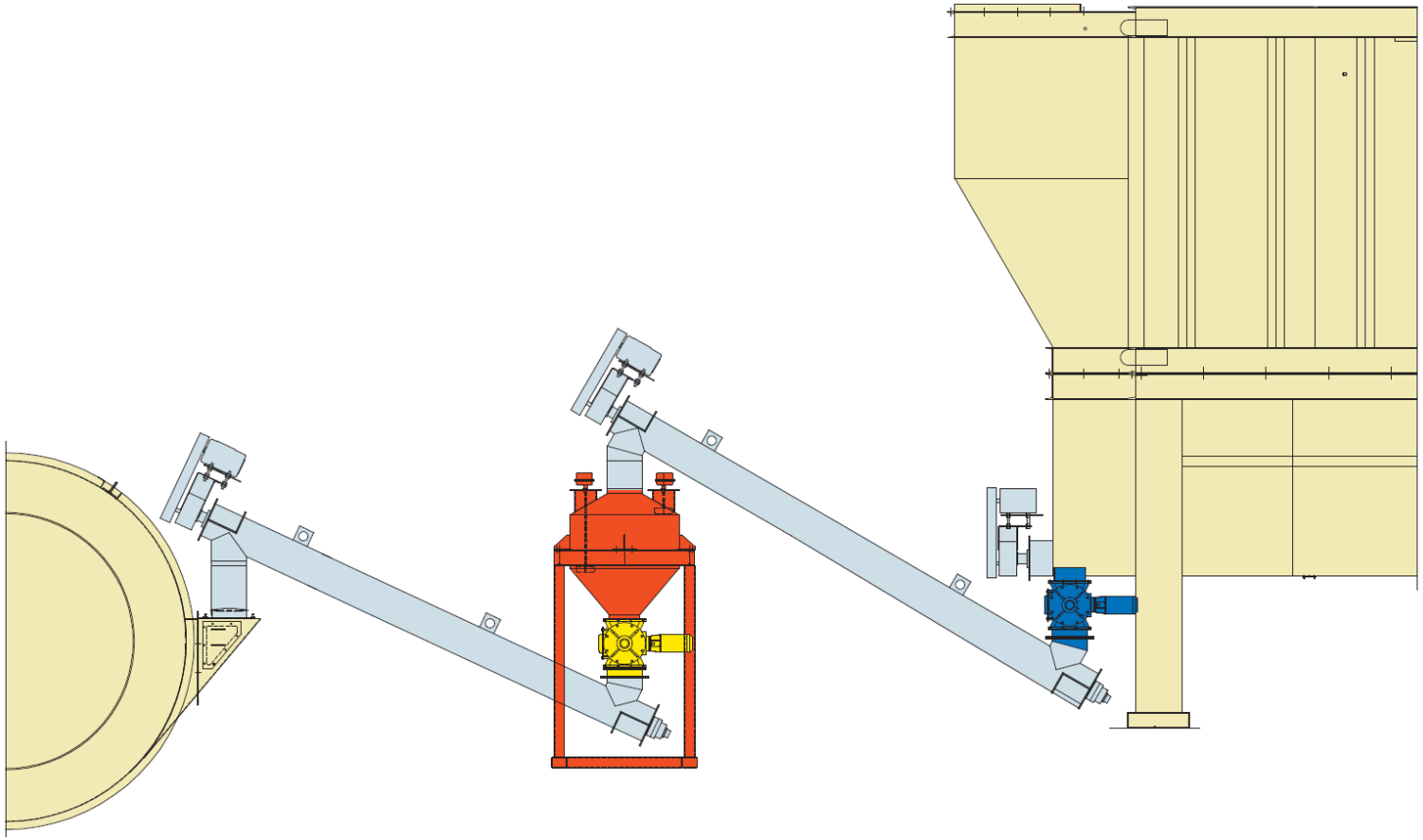
- Allows for wasting of dust if aggregate blend cannot meet spec
- Ensures steady dust flow from baghouse at start up and mix design transitions

Disadvantages

- Amount of dust to waste is trial and error
- Cannot add dust without additional mineral feed system
- AC flow rate is trial and error
- Since the fine dust is not metered as it leaves the baghouse, required chang of AC flow is unknown



Option 5 – Return All with Surge Pot



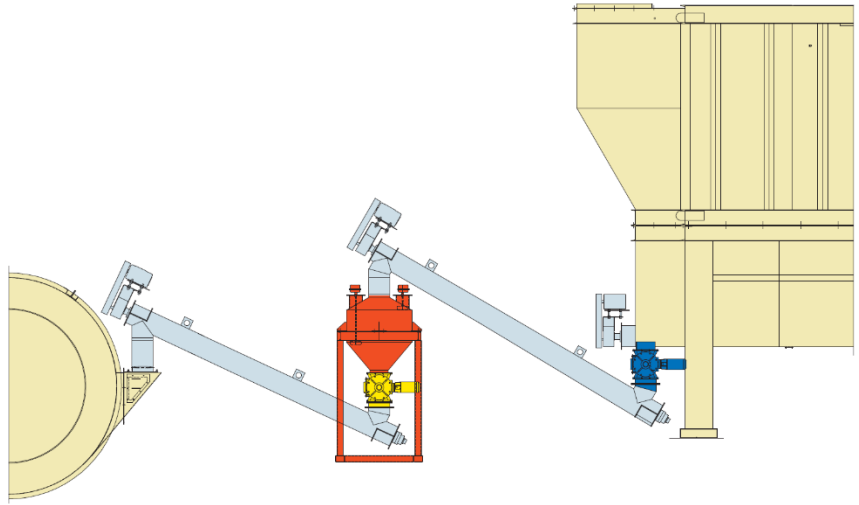
Option 5 – Return All with Weigh Pot

Advantages

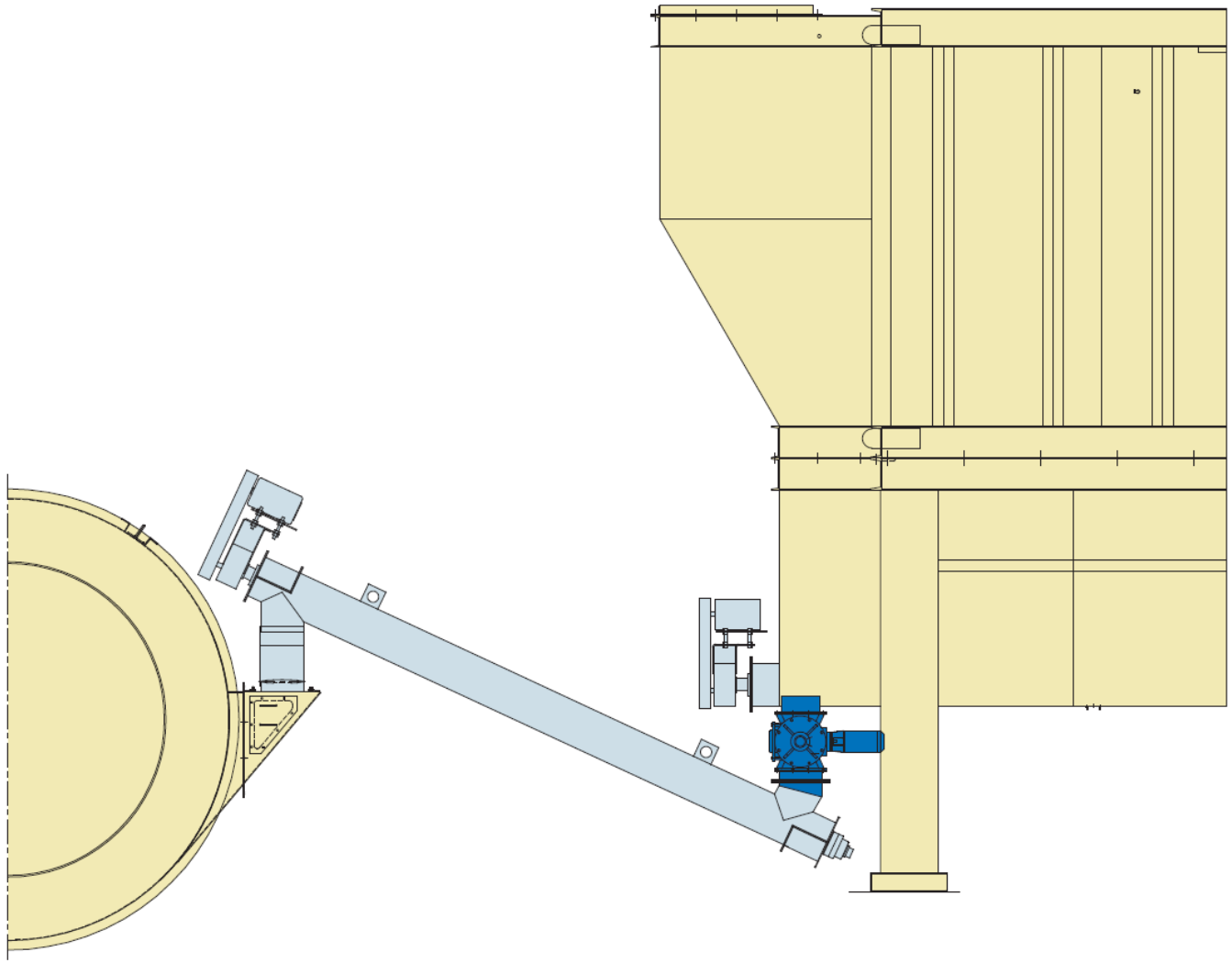
- Ensures steady dust flow from baghouse at start up and mix design transitions
- Relatively low cost

Disadvantages

- Does not control dust in mix beyond Cold Feed Blending controls
- Surge pot control



Option 6 – Return All



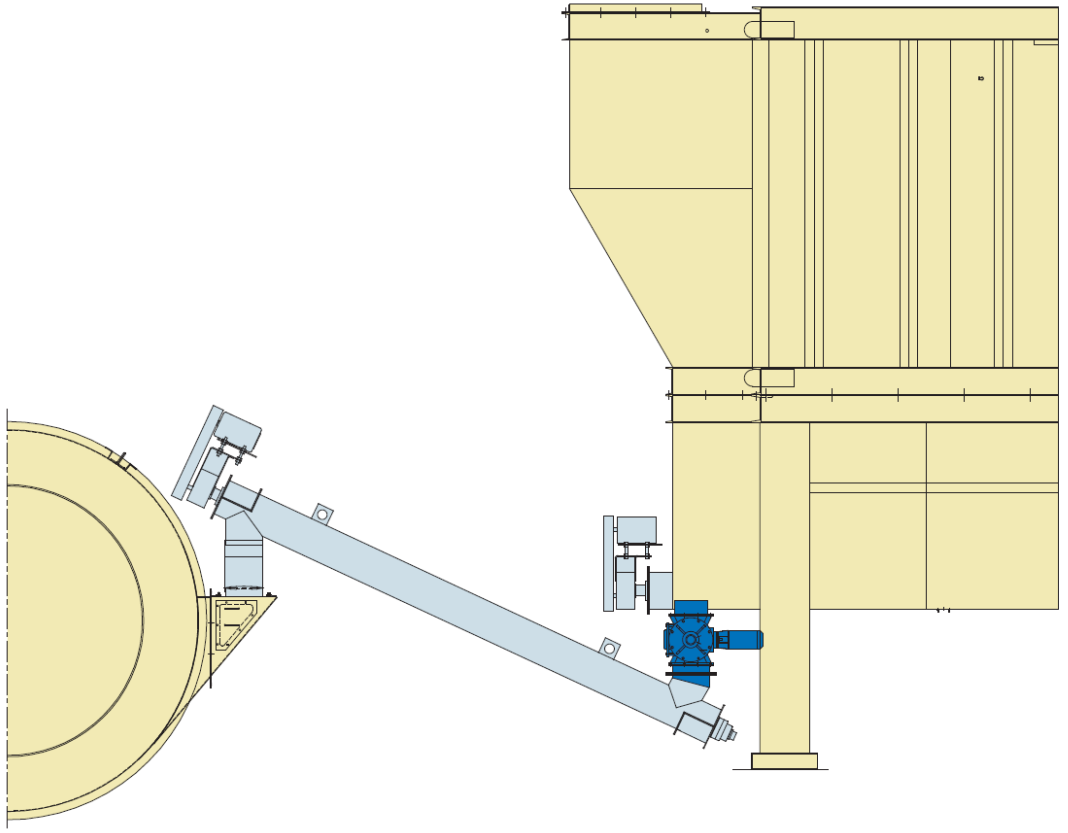
Option 6 – Return All

Advantages

- Lowest cost

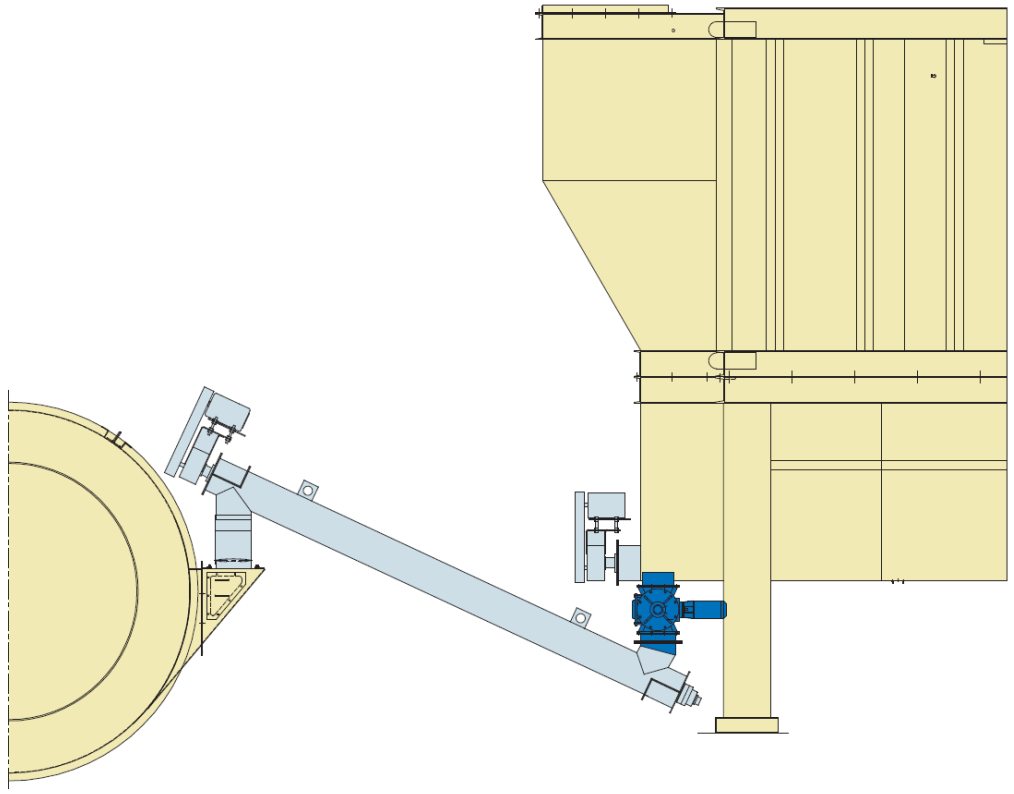
Disadvantages

- Does not control dust in mix beyond CFB controls
- All dust collected will be returned to mix
- Cannot waste dust



Additional discussion topics

- The dryer – exhaust system is not a classifier
- How much dust exits the drum can vary greatly
- Dust creation in the drum (1% to 4%)
- Does a mixer create dust?
- What about start-up dust flow?
- What about shut-down dust?
- How long to steady state?



Questions?