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## Closed Coke Slurry System (CCS System)

TRIPLAN

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The Future In Delayed Coker Operations...

**The Closed Coke Slurry System**

## CLOSED COKE SLURRY SYSTEM (CCS SYSTEM)

To understand the future a look at available coker solids handling systems:

### ➤ PAD/PIT Systems

- Most common procedure for 95% of coker units
- Environmentally questionable
- Poor reliability record
- Difficult sludge handling
- Low cost design

### ➤ Gravity Flow Dewatering Bin Systems

- Only one installation
- Expensive/ tall design
- Difficult sludge handling via decanter/ settling tank

### ➤ Slurry Dewatering Bin System

- Coke & water is pumped into a dewatering bin
- Overflow of sludge and foam to settling tank/ skimming decanter
- Difficult sludge handling

***What can you expect from the new innovative  
Closed Coke Slurry System...?***

**Fluidized operation:**

**A step change in coke handling operation  
between cutting and load-out**

- **Efficient coke dewatering**
- **Environmentally sound system**
- **Clever sludge & water management**

## ***How the CCS-system works:***

- **No overflow of sludge & foam to settling tank**
- **Total coke batch is used as filtration bed in the dewatering bin resulting in**
  - **Fast water entrainment within 6 hours**
  - **Effective fines retention of > 99.5 % in bed**
- **Consequent separation of clean water from remaining settled fines via clean water basin**
- **No further sludge handling required**

## ***Typical Economical opportunities → compared to other systems***

(actual achievable return figures to be defined on a case by case basis)

- **Cycle time reduction with shorter drainage time: up to 4 hrs achievable for greenfield coker**
  - E.g. 1 hour gain equiv. To 10 Mio €/year on uplift effect for clean products
  
- **Manpower savings (O&M) through consequent automatisisation: 6...8 operators & technicians**
  
- **Freshwater savings with remarkable steam plume reduction: approx. 300 m<sup>3</sup>/Batch**
  
- **No losses/ outage time for PAD/PIT repair work (e.g. crane & grizzly)**
  - E.g. 200 hours/ year equiv. To 5 Mio €/year on uplift effect for clean products
  
- **Space requirement savings of up to 90% compared to PAD/PIT systems for greenfield coker**

## ***Environmental and Safety benefits...***

- **Benchmark for zero dust coker, zero Volatile Organic Components (VOC's) & minimum steam plume losses**
- **Creates safe and healthy environment for fellow workers and neighbourhood**
- **Improves fire and accident records for coker units instantly**
- **Effective fines- & water-management / mess free sludge handling**
- **Unmatched system reliability (99,5% +) through unique design & construction features plus material selection**

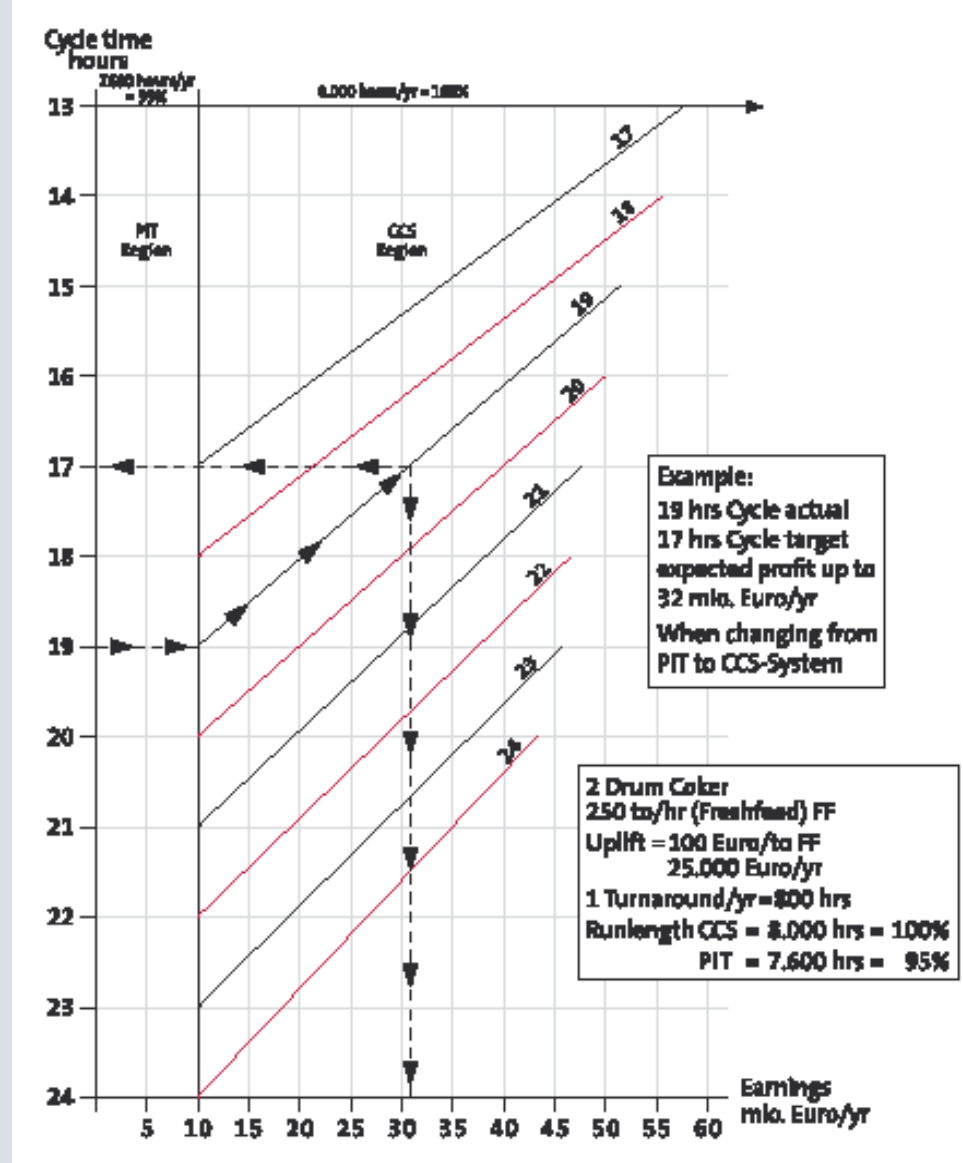
## CLOSED COKE SLURRY SYSTEM (CCS SYSTEM)

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### Cycle Time Reduction enables more clean Products

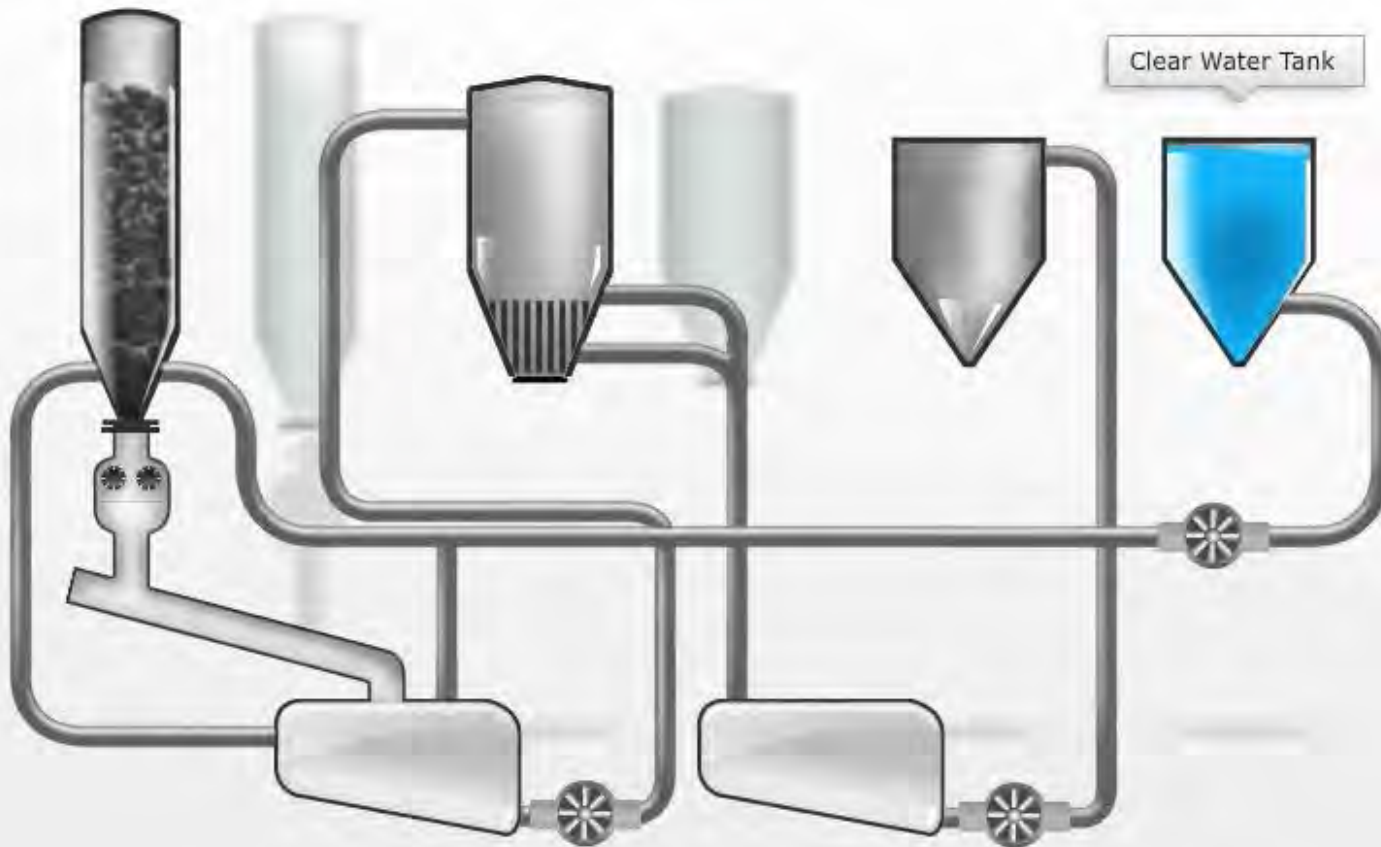
Cycle Time Reduction with shorter drainage time up to 4 Hours achievable for Greenfield Coker.

Downstream Equipment capacity permitted.





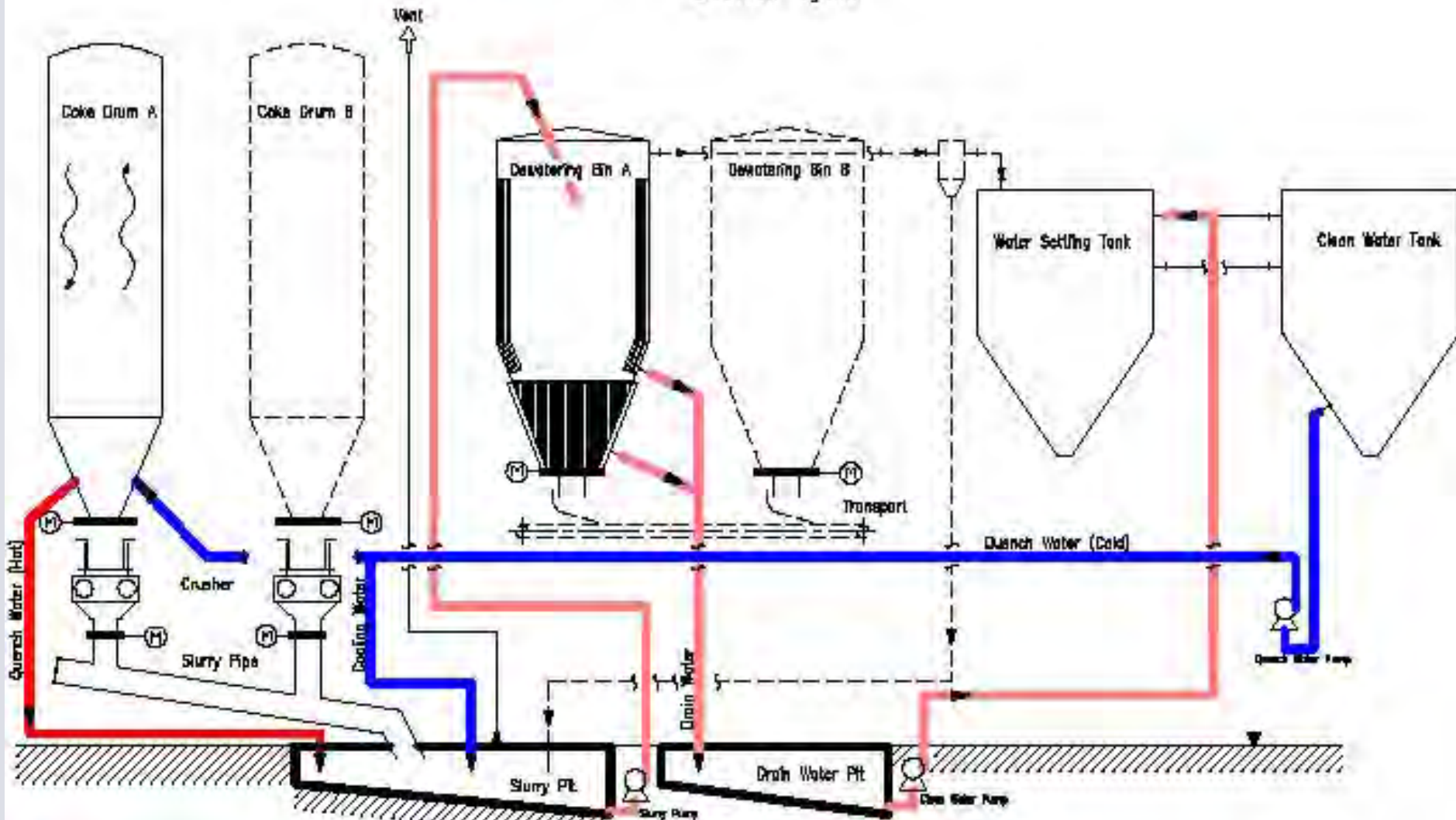
# Quench Cycle



## CLOSED COKE SLURRY SYSTEM (CCS SYSTEM)

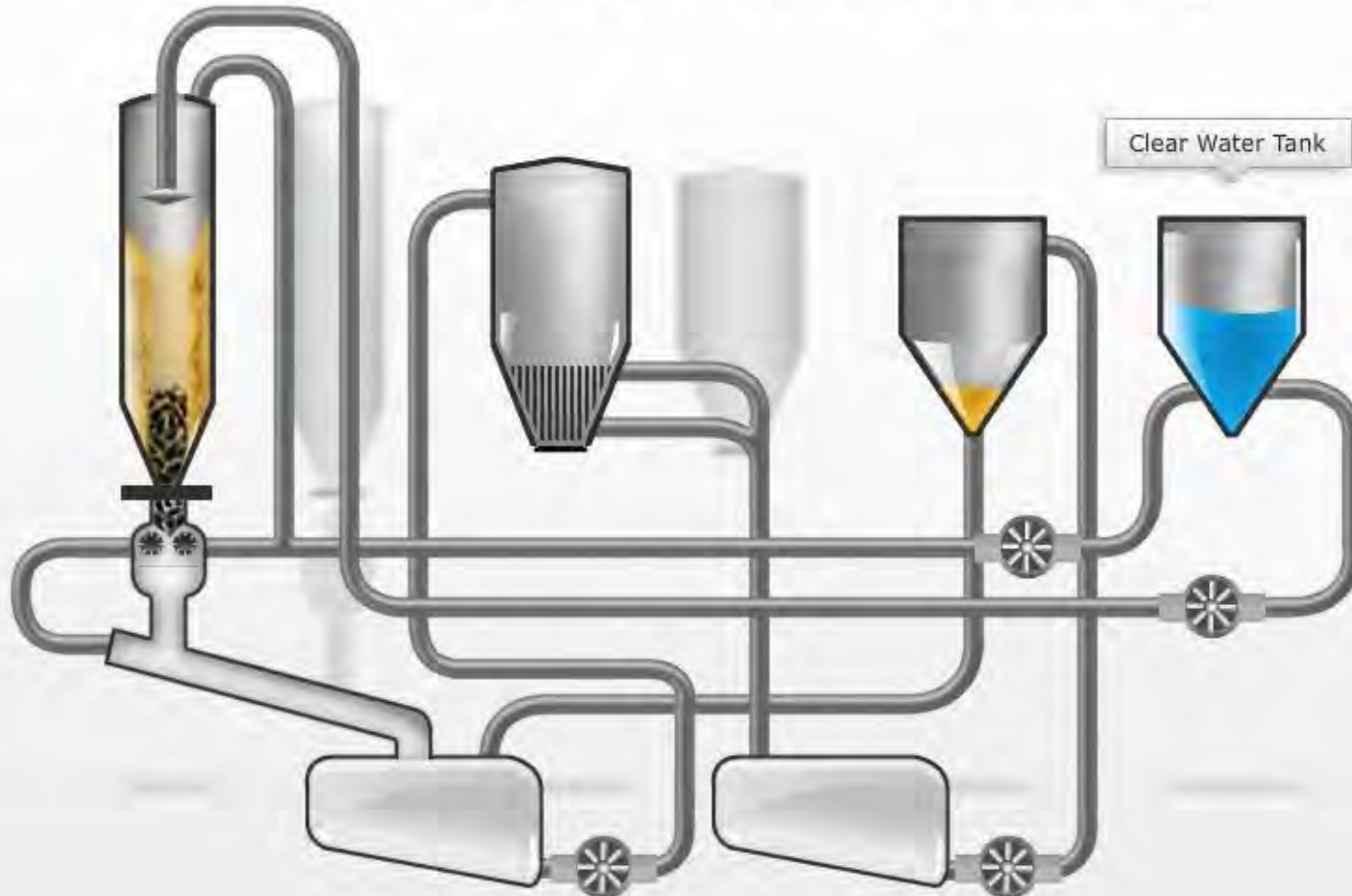
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### Quench Cycle



## CLOSED COKE SLURRY SYSTEM (CCS SYSTEM)

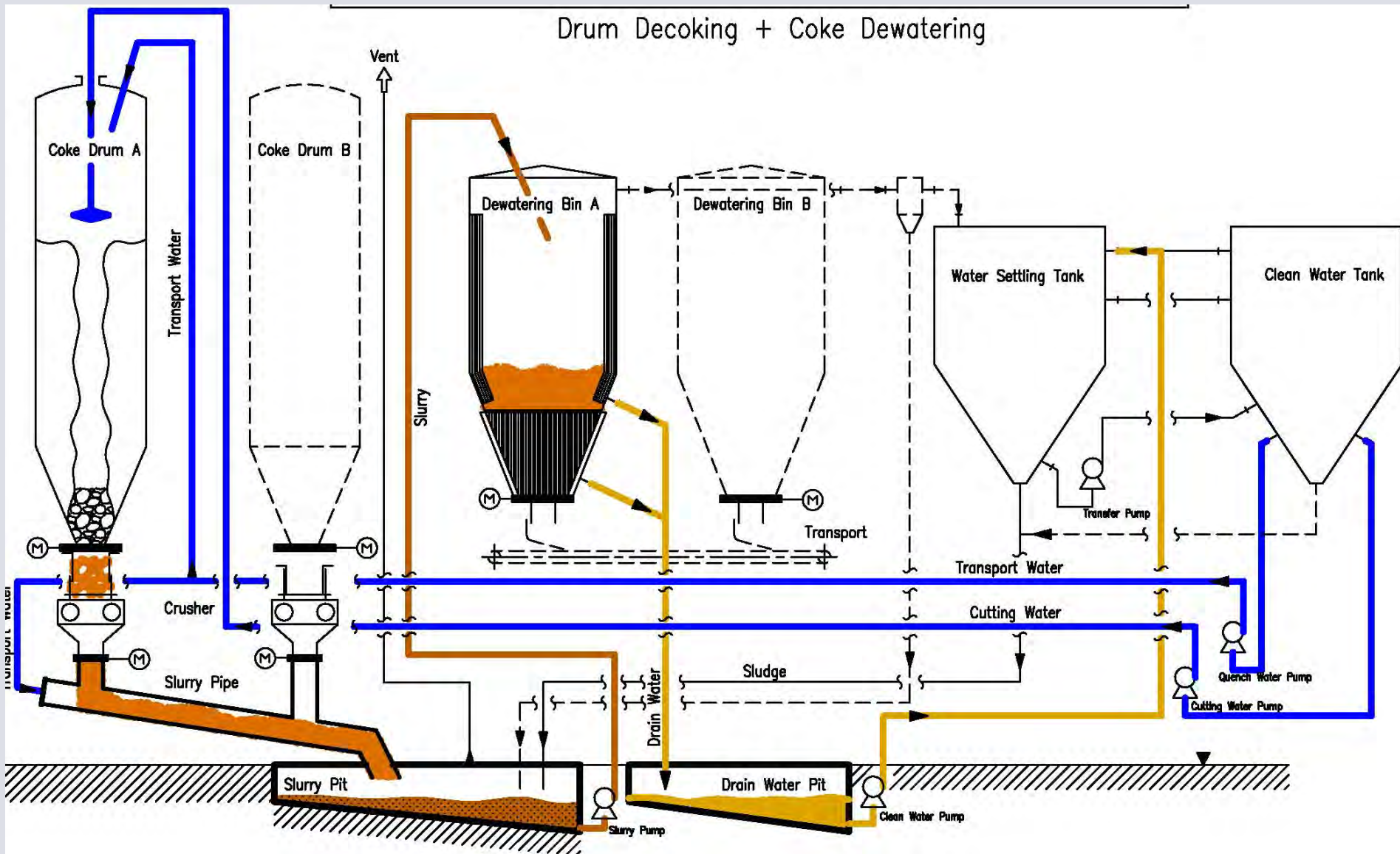
## Drum Decoking + Coke Dewatering





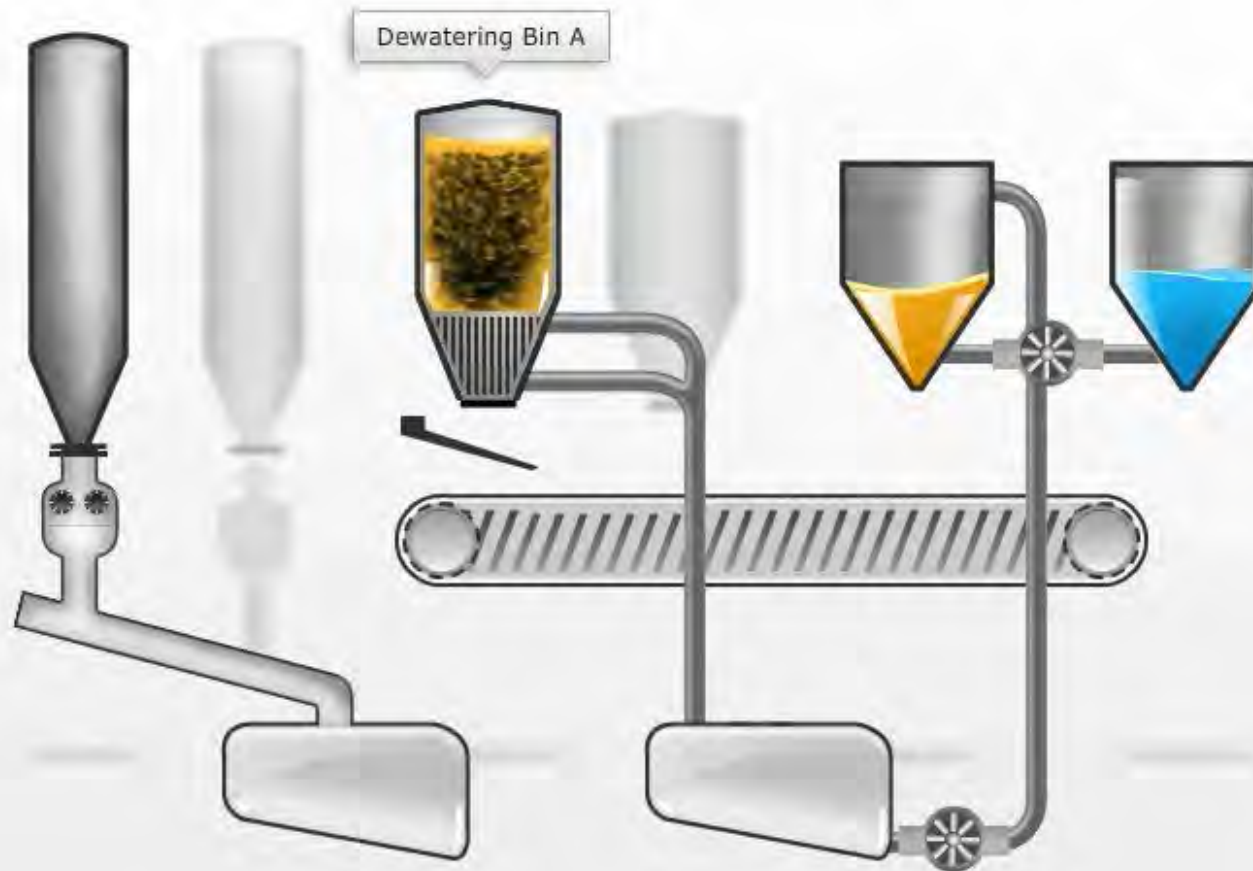
CLOSED COKE SLURRY SYSTEM (CCS SYSTEM)

Drum Decoking + Coke Dewatering



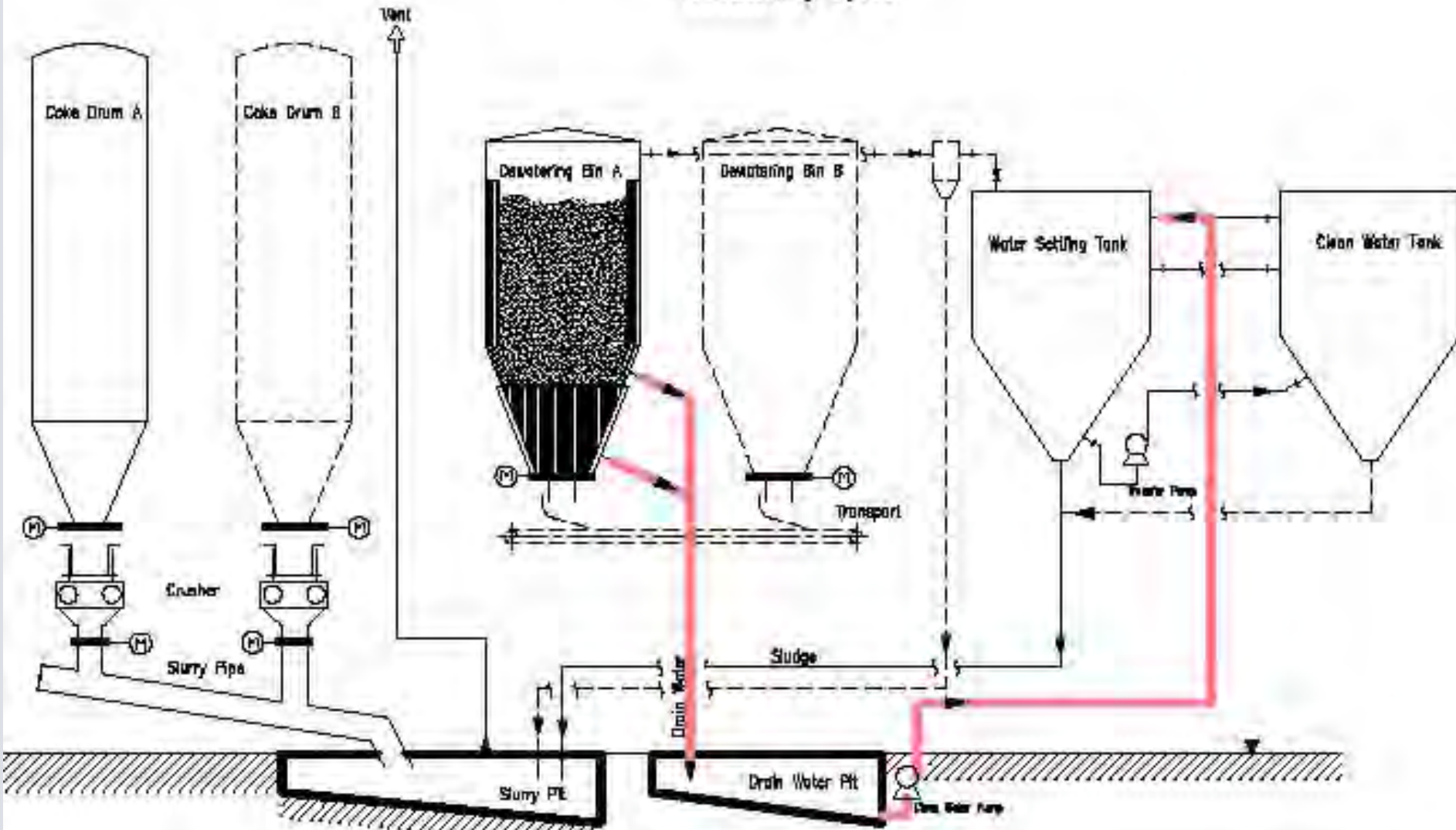
CLOSED COKE SLURRY SYSTEM (CCS SYSTEM)

# Dewatering Cycle



## CLOSED COKE SLURRY SYSTEM (CCS SYSTEM)

### Dewatering Cycle



## ***The Crusher principle....***

***....acts as a bucket-wheel type device, serving multiple purposes:***

- Holding positively back the full coke batch – no avalanche surprises
- Unlimited pulling/ 'swallow' capacity from upstream coke batch
- Coping with any type of coke
- Matches any impact loads & any cutting rates in future
- Transporting and releasing uniformly crushed coke to downstream sluice
- Independent high torque direct drive each roll
- automatic chute raising and docking to drum flange or bottom valve



## CLOSED COKE SLURRY SYSTEM (CCS SYSTEM)

## *Coke Crusher assembly*

- 80 tons of special material
- unique design and construction features
- 50 mm / 2" wall casing thickness





***Unique system components & features provides safe, reliable and long life cycle operation***

### **Double Roll Crusher with integrated Chute (Proprietary Design)**

- High Torque direct drive each roll
- Crushing ratio 10:1; e.g. 1.000 mm --> 100 mm ; 40" --> 4" resp.
- Safe & remote operation:
  - Hydraulic chute raising
  - Docking automatic to drum flange or bottom valve

## CLOSED COKE SLURRY SYSTEM (CCS SYSTEM)

**Closed Slurry Pipe** (Proprietary Design)

- Design and construction for optimum slurry transportation
- Special material selection for long life cycle

**Slurry Pump** (Proprietary Design)

- Design, construction and materials for long life cycle
- Designed to run in cavitation region

## CLOSED COKE SLURRY SYSTEM (CCS SYSTEM)

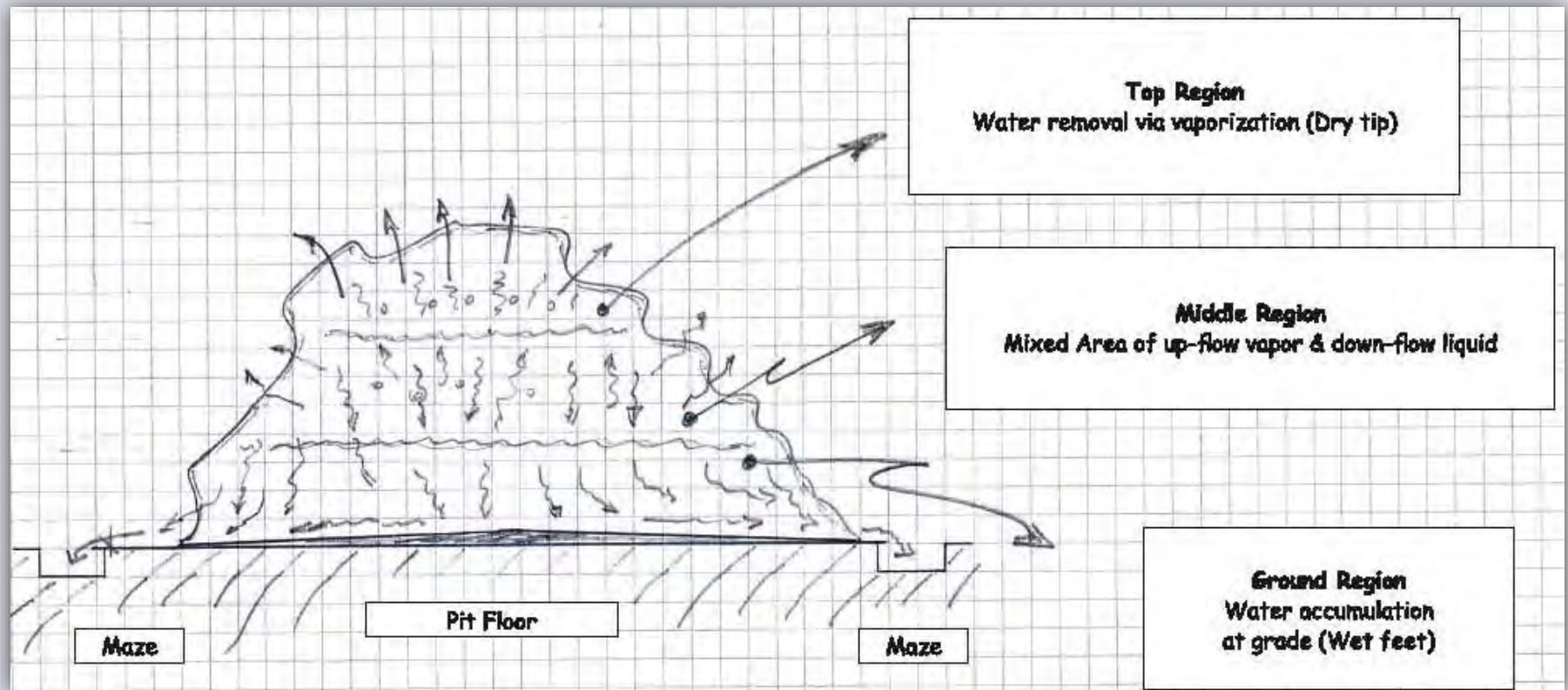
❖ **DEWATERING PRINCIPLES**▪ ***Open Pile***

- Free water drainage is hampered by counterflow steam out
- Dry surface, but wet central & floor region of pile (wet foot)
- overall high water content remaining --> 'after-drainage' during transport
- manual hosing down and handling of sludge via maze

▪ ***Closed System Dewatering***

- Drum walls and cone section fitted with screens for uniform dewatering
- Minimum travel time and short, uniform distances for water to screen
- Standardized lump size of 4" /100 mm provides maximum free channels between coke for high water velocity
- high water velocity results in maximum fines retention (sludge retention rate in Dewatering bin: 99,5 %)

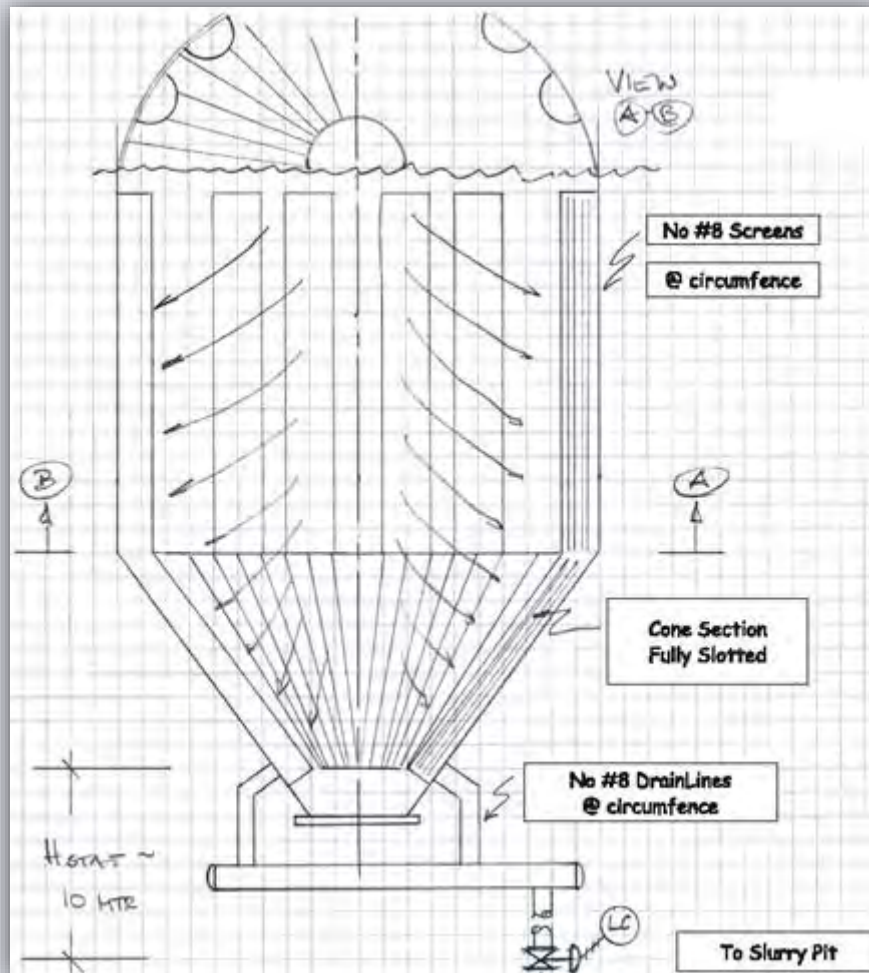
## DEWATERING IN A COKE PILE / OPEN PIT



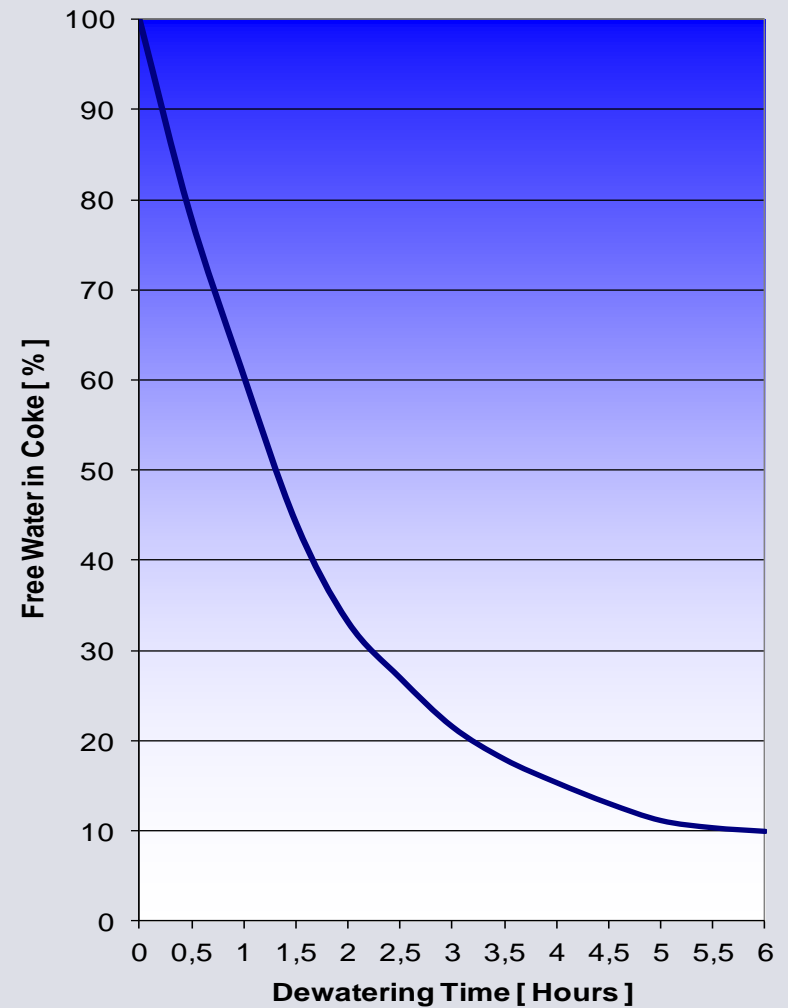
# CLOSED COKE SLURRY SYSTEM (CCS SYSTEM)

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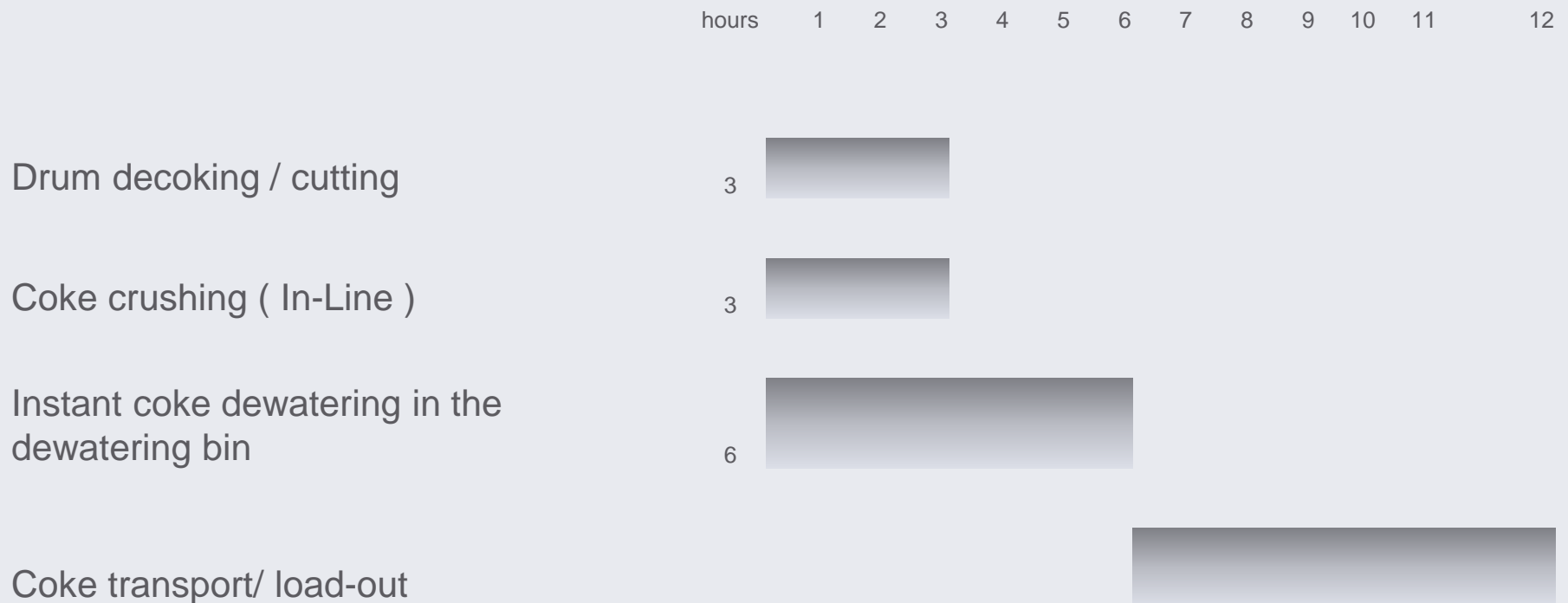
## DEWATERING BINS (PROPRIETARY DESIGN)



### Bin Dewatering Effect over Time



## Typical Dewatering Schedule



**Total Time for dewatering : 6 hours**

***Experience facts on an existing unit with over 6 Years operation,  
representing latest CCS-system technology***

- No dedicated field operators required
- Maintenance free; reliability factor 99,5% +
- 6 Years uninterrupted operation equivalent to 3.000 Cycles
- No deterioration in the slurry & cutting water pump performances
- No corrosion and erosion in the total CCS System
- No fire, no incidents
- Delivers commercially dry coke with 10% humidity
- only 0.5% of coke fines ends in the slurry pit and pumped to next coke batch

## ***How Will The Closed Coke Slurry System Be Implemented?***

### **Retrofit e.g. Replacement for Open PAD/ PIT**

- Suitable for Multi-Drum Coker
- footprint fits into any existing coker, maximum layout flexibility, even offsites
- CCS-System footprint to suit in than idle open pit or elsewhere
- Implementation within regular coker turnaround possible
- Basin construction in concrete (UG) or steel work (AG) possible

### **Greenfield installation**

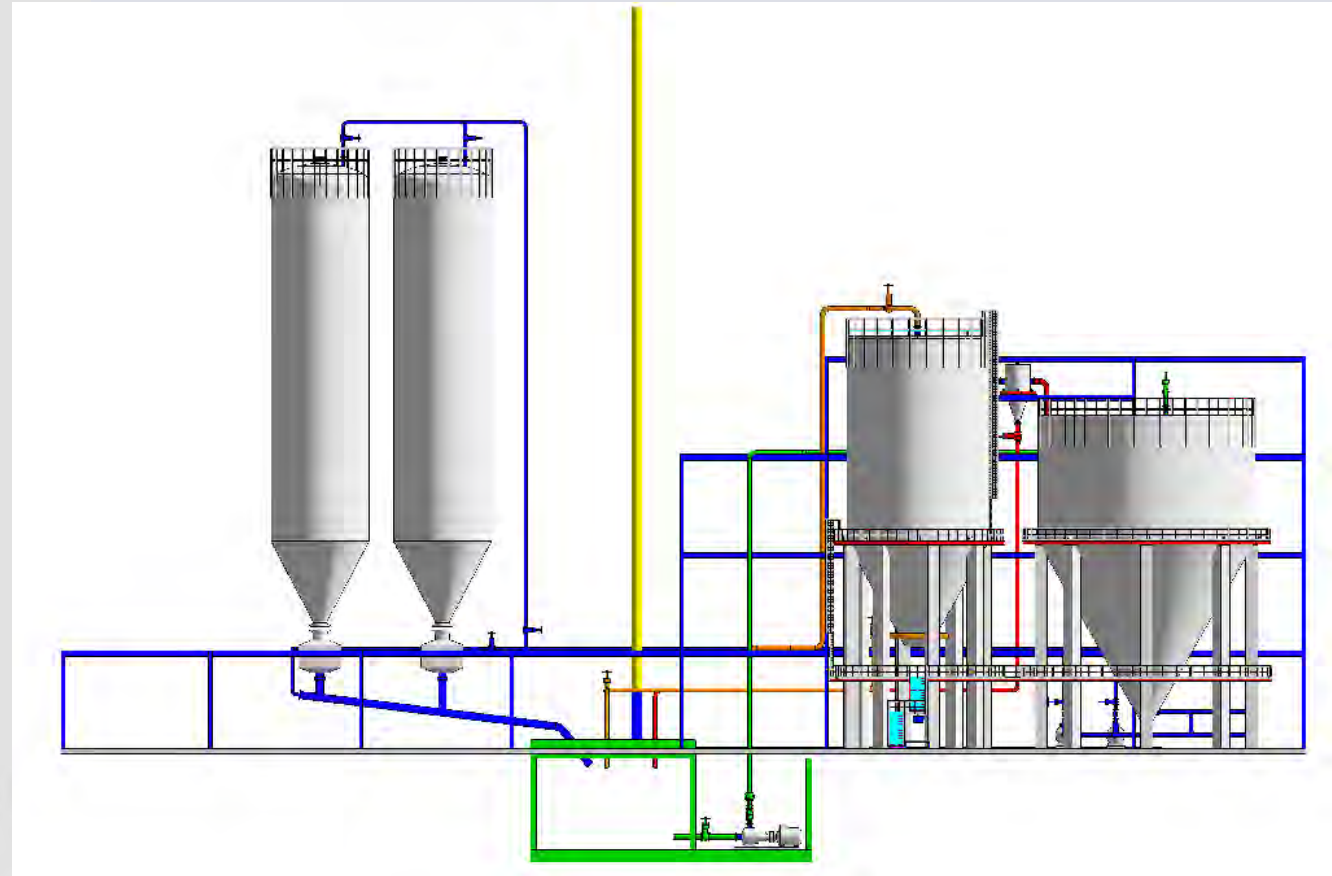
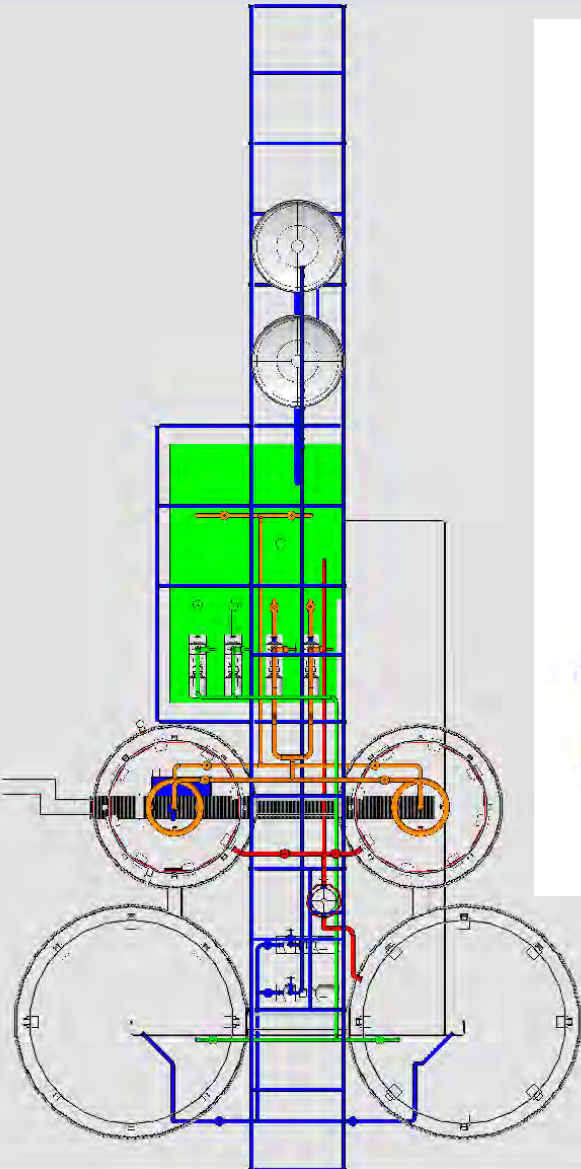
- takes away authorities environmental concerns during project approval phase
- for optimum project embedding, early involvement in FEED phase suggested
- higher throughput with shorter cycle time possible with planned-in of downstream equipment capacity reserve



## ***Summary - main advantages of the CCS-System***

- **Immediate and sustainable Health, Safety and Environmental benefits**
- **Payout time < 1.5 years for greenfield application achievable**
- **Proven state-of-the-art technology**
- **Automated operation**
- **Typical refining process steps, high workers acceptance level**

# CLOSED COKE SLURRY SYSTEM (CCS SYSTEM)



**TYPICAL LAYOUT FOR 2 DRUM COKER**

**Thanks for your attention**

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