Introducing
Baker Petrolite BPR 45165
Coker Antifoam

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Agenda

- First a word from our sponsor
- Other Baker Petrolite coker products
- Antifoam technology
- Introducing BPR 45165, a new type of coker antifoam

Baker Petrolite

- #1 Worldwide Supplier of Oilfield Products and Chemical Services
- Leading Global Supplier of Refinery and Petrochemical Process Additives
- Based in Sugar Land, Texas
- 2,500 Employees
- Serving Markets in over 70 Countries

Baker Petrolite Industrial Division

Core Applications Technologies

- Refinery Process Chemicals
- Finished Fuels Additives
- Petrochemical Process Additives
- Water Treatment Chemicals

Committed Partner
of Refining and Petrochemical Industries

Coker Unit Chemical Applications

- Fractionator and Gas Plant Corrosion Control
- Main Fractionator Ammonium Chloride Control
- Distillate Stability Additives
- Blowdown System Water Clarification
- Cutting Water Recycle Clarification
- Furnace Antifoulants
- Coker Odor Control
- Coke Drum Antifoam

Coker Corrosion Mechanisms

- Hydrogen blistering and cracking
- Sulfide stress corrosion cracking
- Ammonium bisulfide corrosion
- Under-deposit corrosion

Problems with Corrosion

- Equipment Damage
- Unplanned outages
- Reduced/lost throughput
- Column tray corrosion and fouling
  - Pressure drop
  - Poor separation
  - Plugged strainers

How do you know if you have corrosion?

- Equipment performance
- Corrosion history
- Corrosion monitoring
  - HYDRAFLUX^{SM} CMS real time hydrogen flux monitoring
  - Corrosion coupons, probes
  - UT Measurements
- Analytical testing
  - Process water iron, CN spot test readings
- Ionic Equilibrium Modeling
  - Ammonium chloride salt deposition calculations

Corrosion Mitigation Strategies

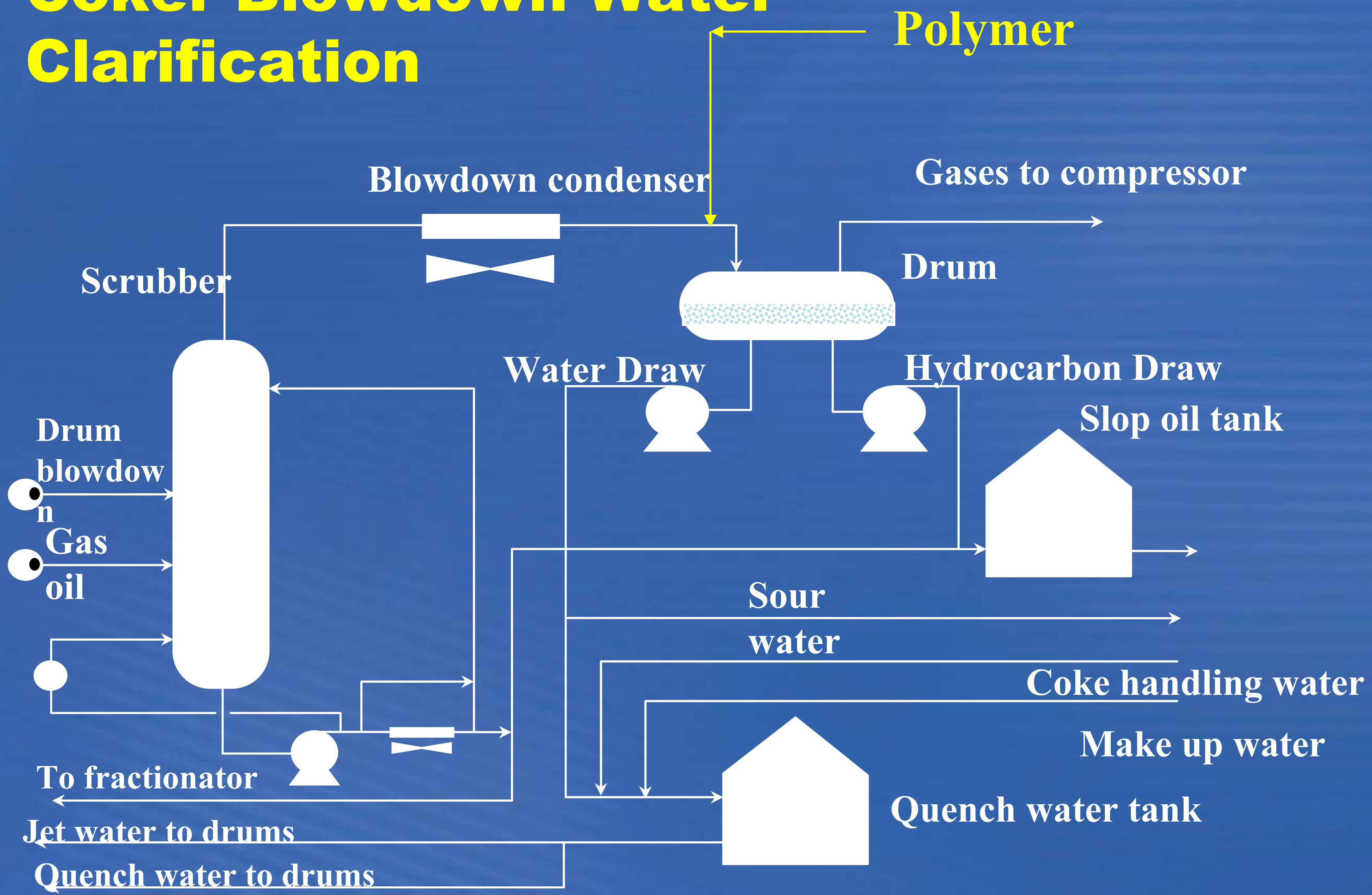
- Wash water system modifications
- Corrosion inhibitor applications
- Ammonium Polysulfide injections for CN control
- Ammonium chloride dispersants for controlling fractionator salt fouling and under deposit corrosion

Blowdown System Water Clarification

- Problems with emulsion:
  - Level control difficult
  - Water in skim oil
  - Excessive oil in recovered water
- Solution:

  Proper polymer resolves emulsion

Coker Blowdown Water Clarification



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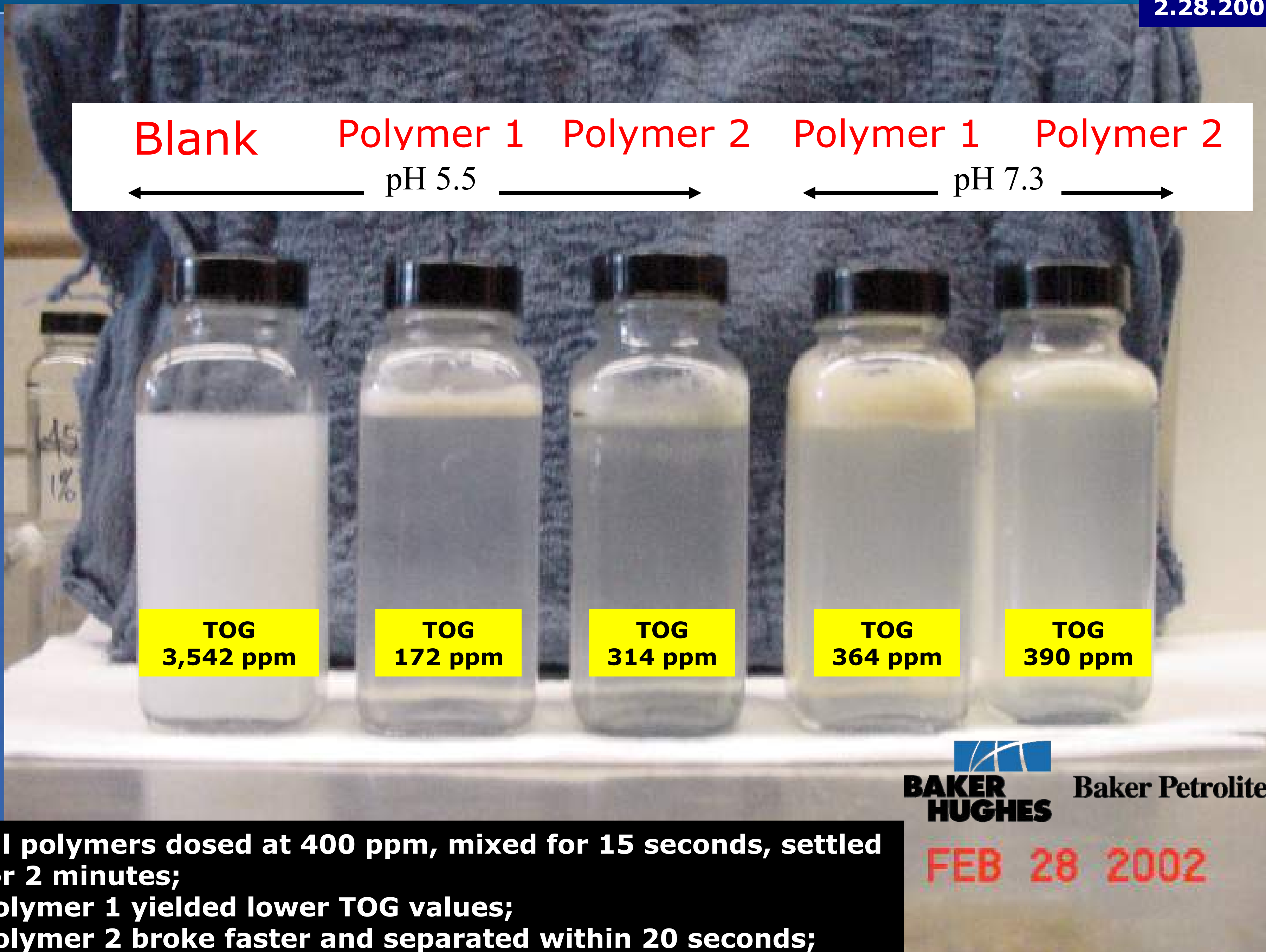


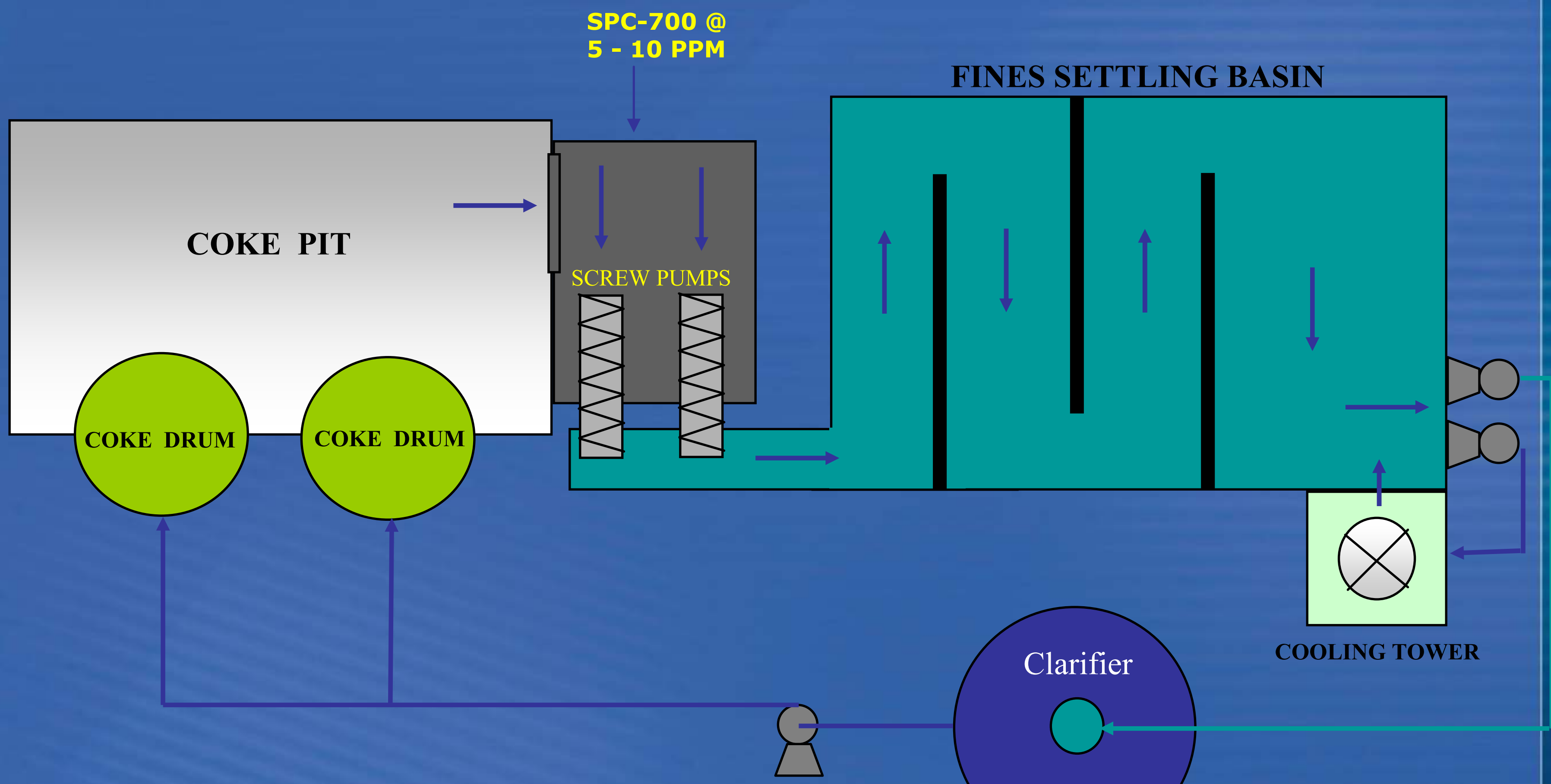
All polymers dosed at 400 ppm, mixed for 15 seconds, settled for 2 minutes;
Polymer 1 yielded lower TOG values;
Polymer 2 broke faster and separated within 20 seconds;
Lower pH aided to breaking the emulsion

Blowdown System Water Clarification

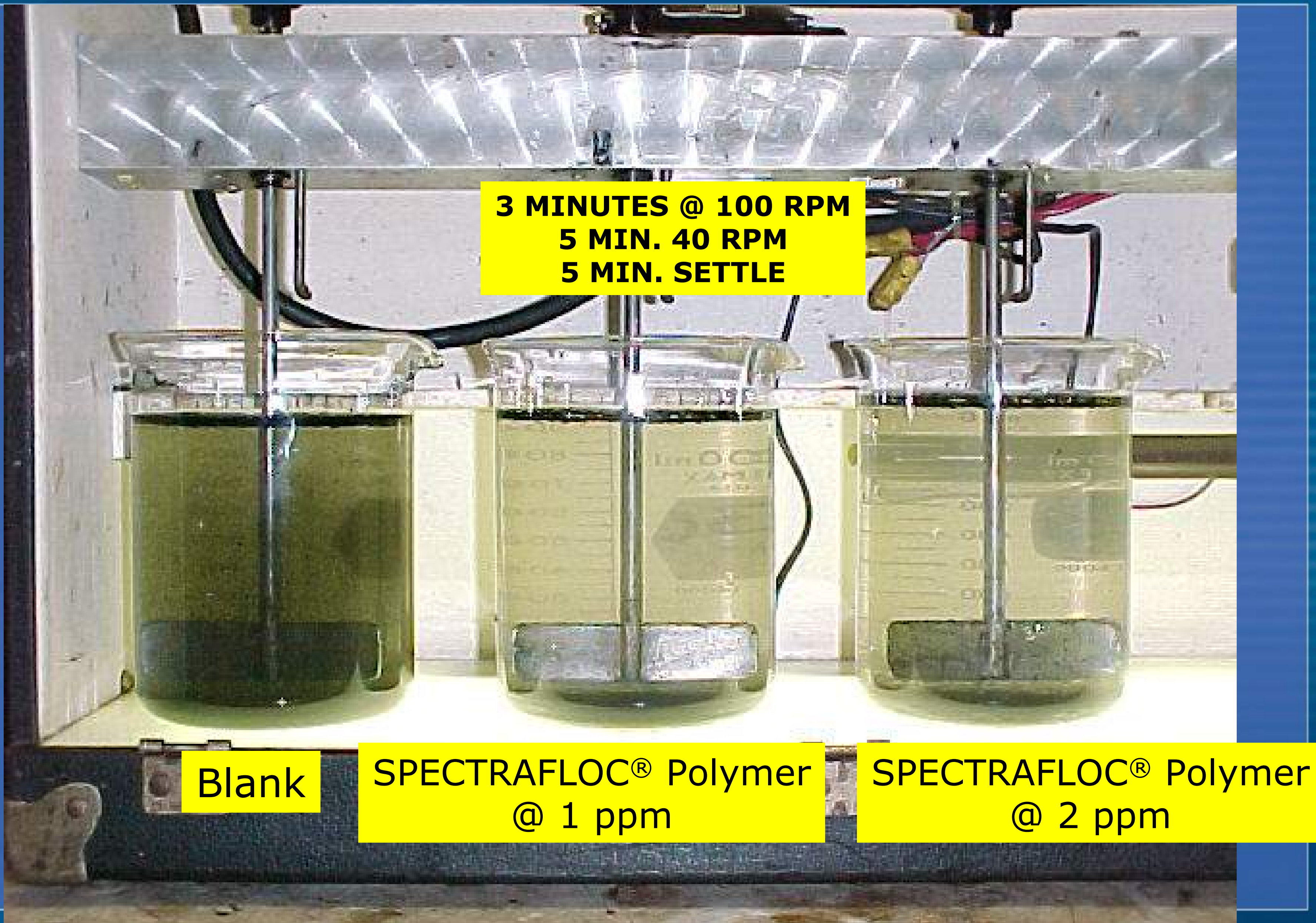
- **Benefits**
  - No hydrocarbon recovery necessary in recycle water tank
  - Fewer hydrocarbon emissions from water recycle system
  - Less hydrocarbon gunking in quench/cutting water equipment
  - Level control easier

Cutting Water Recycle Clarification

- Problem with coke fines in cutting water
  - Erosion of pumps and cutting equipment
  - Solids build up restricts flow
- Solution: Coagulant settles fines rapidly



NOTE:
Inject SPC-700 at 0.2 to 0.3 percent solution


3 MINUTES @ 100 RPM
5 MIN. 40 RPM
5 MIN. SETTLE
Blank
SPECTRAFLOC® Polymer @ 1 ppm
SPECTRAFLOC® Polymer @ 2 ppm

Cutting Water Recycle Clarification

- **Application Benefits**
  - Provides cleaner, less abrasive recycle water
  - Reduces water pump and jet nozzle erosion
  - Lower pump, seal, valve and jet nozzle repair and replacement costs
  - Less equipment downtime for repairs

Baker Petrolite introduces

BPR 45165 Antifoam

A new type of coker antifoam

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Baker Petrolite BPR 45165 Antifoam

- Past improvements in antifoam technology have primarily benefited other units
- BPR 45165 Antifoam
  - Not only reduces silicon contamination of coker products
  - It also provides better foam control
  - Retards build up of foam

Questions for rest of talk

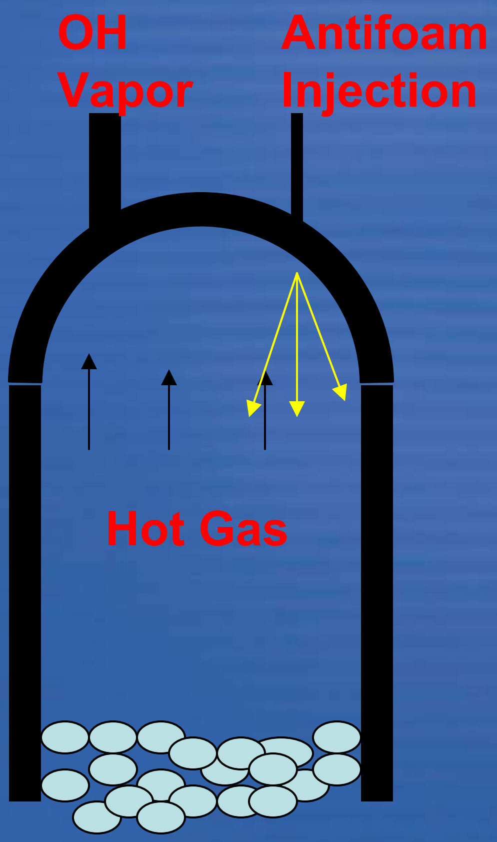
- What is silicone antifoam?
- How does it end up in coker liquids?
- How can you reduce contamination?
- What are the benefits of the new antifoam?
- What are the test results of the new antifoam?

Problems With Silicone Antifoam

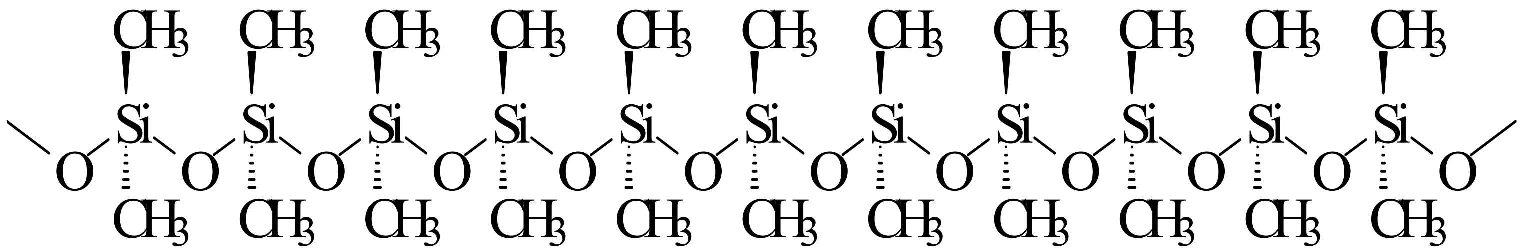
- Best for controlling foam
- Contaminates coker products
  - Carry over
  - Decomposition
- Silicon (Si) in products poisons catalysts

How does silicon end up in liquid products?

- Entrainment - controlled by:
  - Injection away from OH
  - Use carrier to blow antifoam to foam front
  - High boiling carrier to prevent flashing
- Decomposition - controlled by product selection



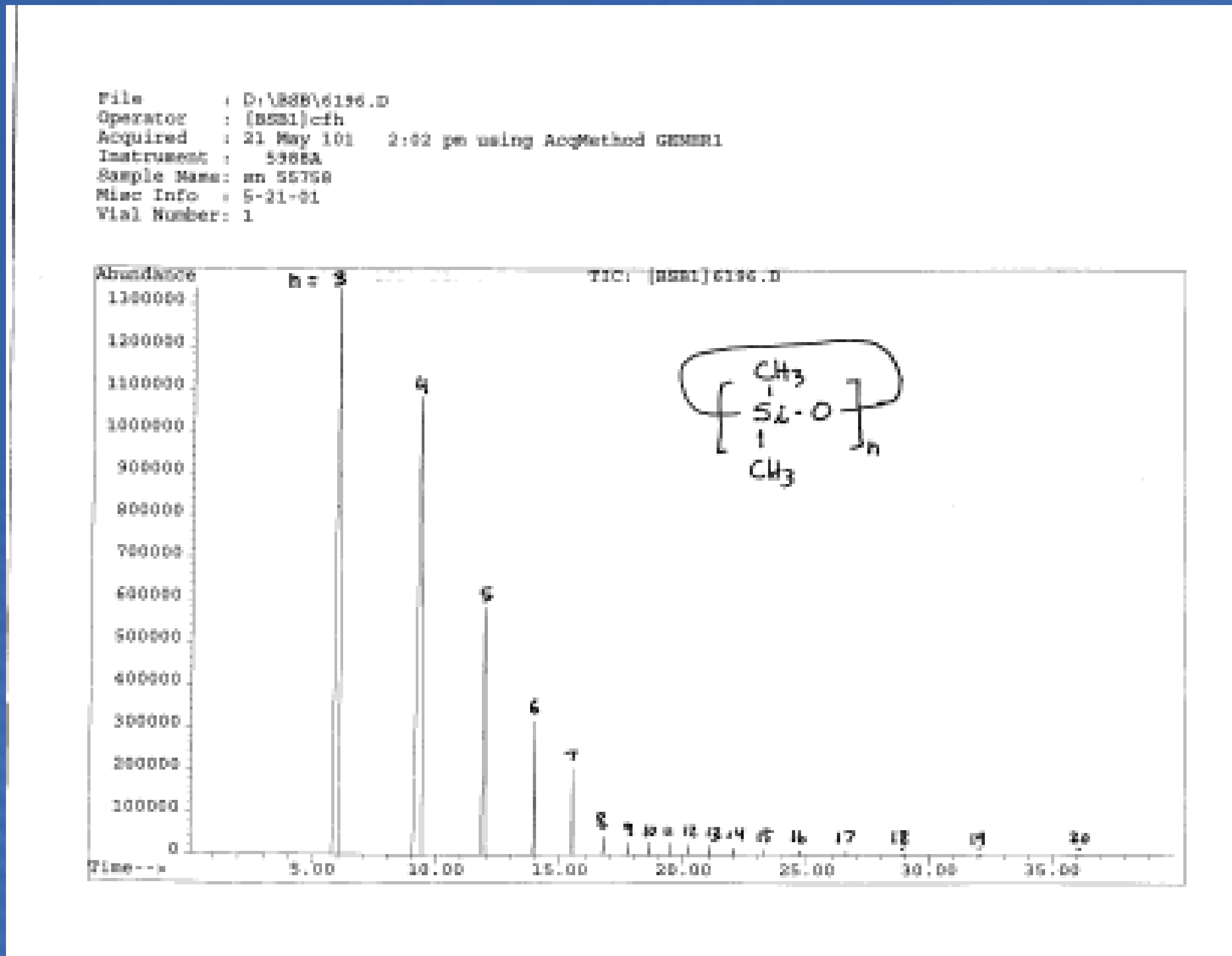
Poly dimeythylsiloxane (Silicone)



Thermal Degradation of Silicone

- Begins to decompose at 350˚C
- Higher Temperature = faster decomposition
- Forms cyclic trimers and larger
- Defoaming ability reduced
- Breakdown products go overhead and contaminate product

Decomposition Products of Silicone



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Decomposition Products of Silicone Distill into Coker Products

Product	b.p. °C	b.p. °F
Cyclic D3	134	273
Cyclic D4	175.8	348
Cyclic D5	210	410
Cyclic D6	245	473

Silicon Reduction in Products

	60,000cSt ppm Si	600,000cSt ppm Si	ppm Si reduction	%Si reduction
Naphtha	34	12.3	21.7	63%
LCGO	7.9	3.2	4.7	59%
HCGO	7.3	2.7	4.6	63%

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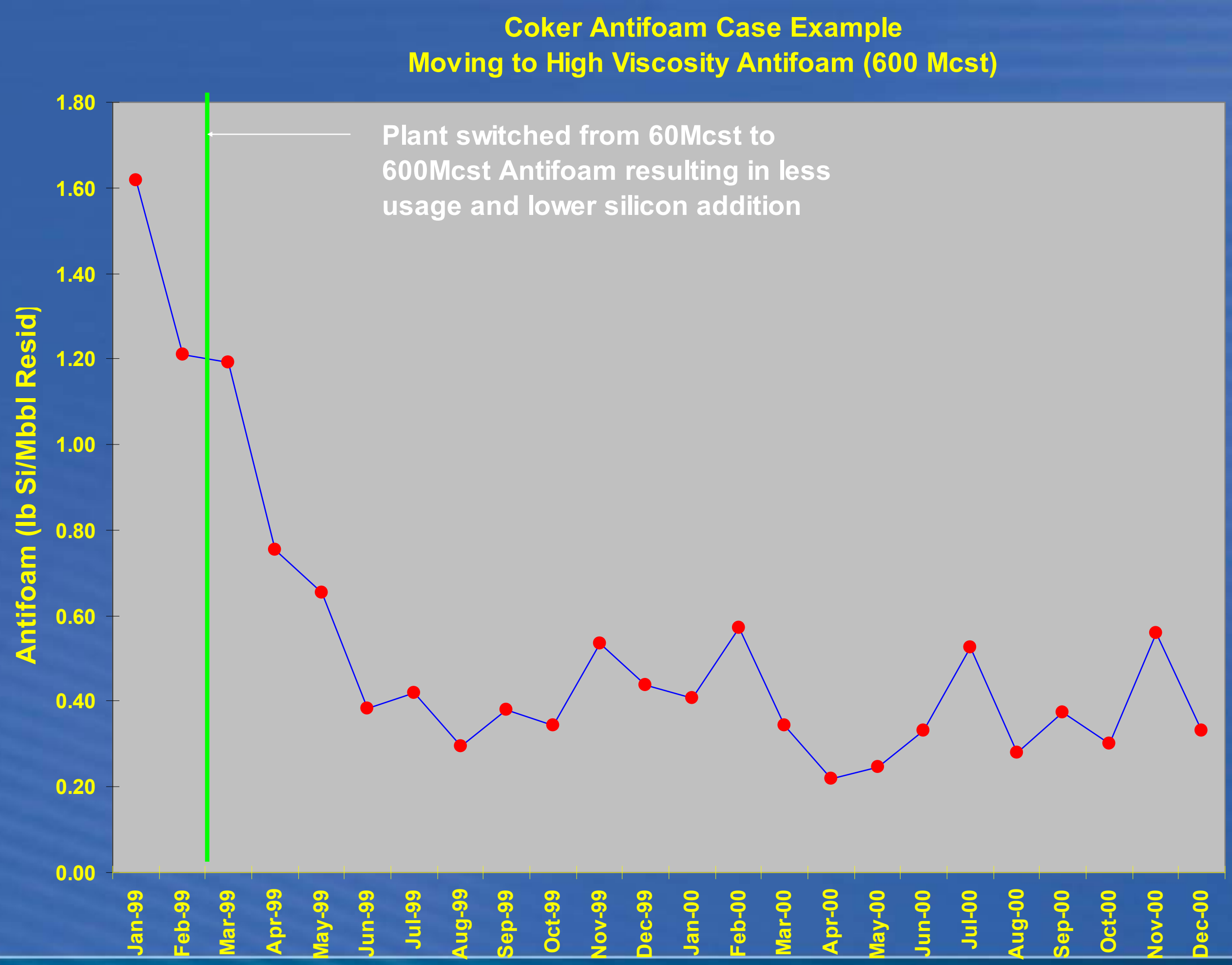
Higher MW results in Less Si to Coke Drum



Use Higher Viscosity Silicone

- Higher Viscosity = Larger Molecule
- Larger Molecule takes longer to degrade
  - Defoams longer
  - Lower dosage required
  - Less Si in products
  - Less catalyst contamination

Introducing

Baker Petrolite
BPR 45165
coker antifoam

Why Did Baker Petrolite Develop a New Coker Antifoam?

- Limit to higher Molecular Weight
  - High viscosity difficult to handle
  - Higher Molecular weight cost more
- New type of antifoam developed
  - Effective at lower dosages
  - Less thermal breakdown
  - Prevents foam build up
  - Patents pending

First refinery trial

- Coker makes fuel grade coke
- Base case BPR 45160 (600,000 cSt) silicone defoamer
- Measured foam knock down
- Refoam after drum switch
- Si contamination of coker products

First refinery trial

- Results of BPR 45165 defoamer
  - Knocked down foam better
  - Prevented refoam after switch better
  - Could allow reduced outages
  - Reduced silicon contamination of products by over 50%

First refinery trial

Sample	Base Si (ppm)	New Si (ppm)	% Reduction
Coker Naphtha	3.29	1.29	62.5%
Coker Kerosene	4.41	1.92	56.5%

Second refinery trial

- Anode grade coke production
- Si in product poisons catalyst
- Excessive defoamer usage
- Used BPR 45160 (600,000 cSt silicone) defoamer for 4 years

Second refinery trial

Samples 1 hour before drum switch

Drum 1

Product	BPR 45160 Defoamer	BPR 45165 Defoamer	% Reduction
Naphtha	58	35.9	38%
LCGO	38.8	10.3	73%
HCGO	5.5	2.2	60%

Drum 2

Naphtha	33.8	8.2	75%
LCGO	28.7	3.2	88%
HCGO	1.8	0.9	50%

Second refinery trial

- New defoamer reduced Si in product
- More efficient to add antifoam early
  - Foam easier to prevent than knock down
  - Use less antifoam
- Kept foam down after drum switch
- New material easy to handle

Summary

- First trials short (few weeks)
  - Proved silicon reduced in liquid products
  - Showed improved foam control
- Baker Petrolite seeks to work with refineries on longer evaluation to:
  - Prove improved foam control
  - Demonstrate lower outages
  - Increase coker profitability