

API 2007 Pipeline Conference
April 17, 2007

***CRUDE OIL QUALITY &
PIPELINE SYSTEMS***

What it is

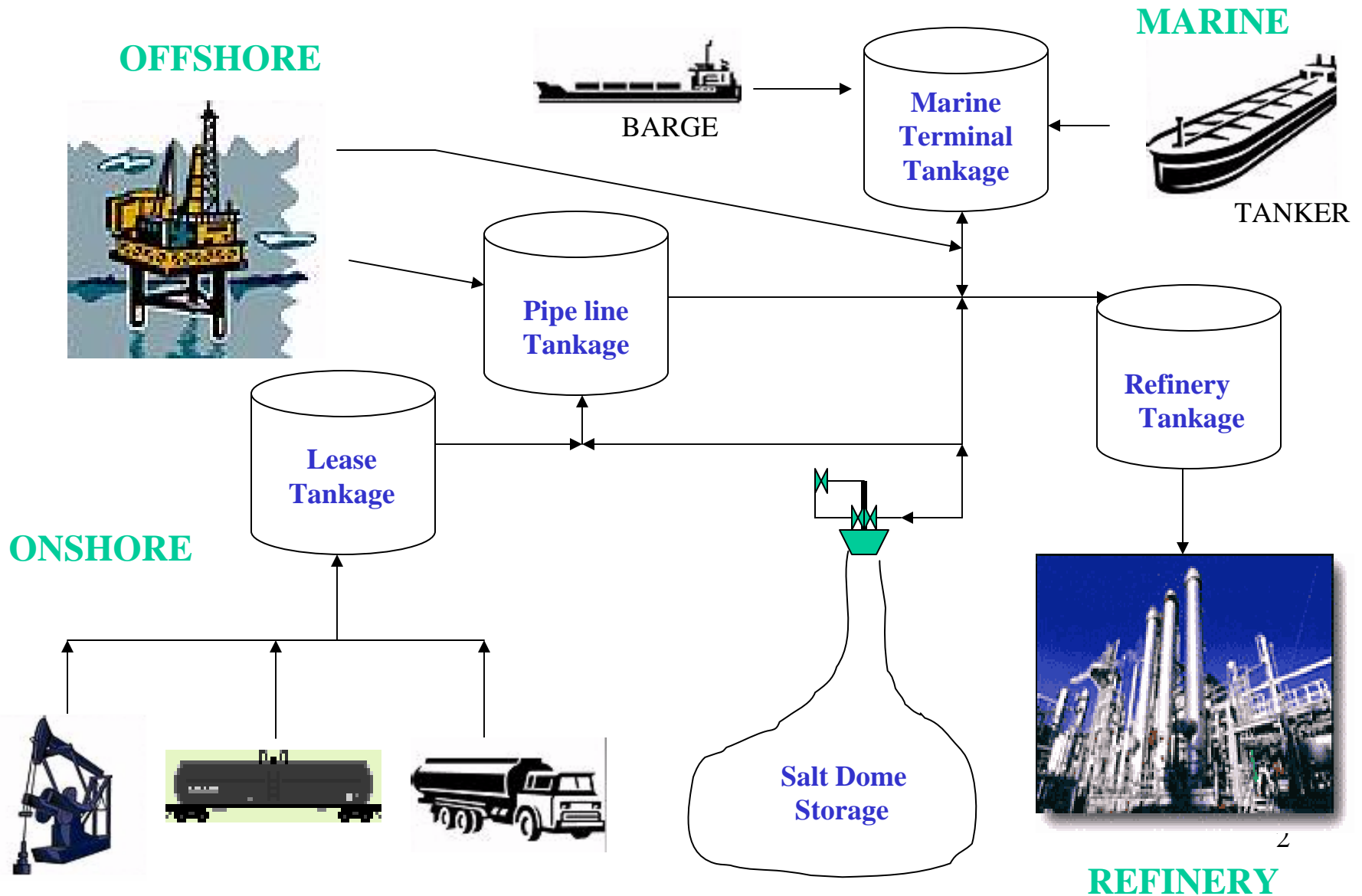
Why it is important

What we can do to make it better

Presenter: Aaron L. Dillard, ConocoPhillips

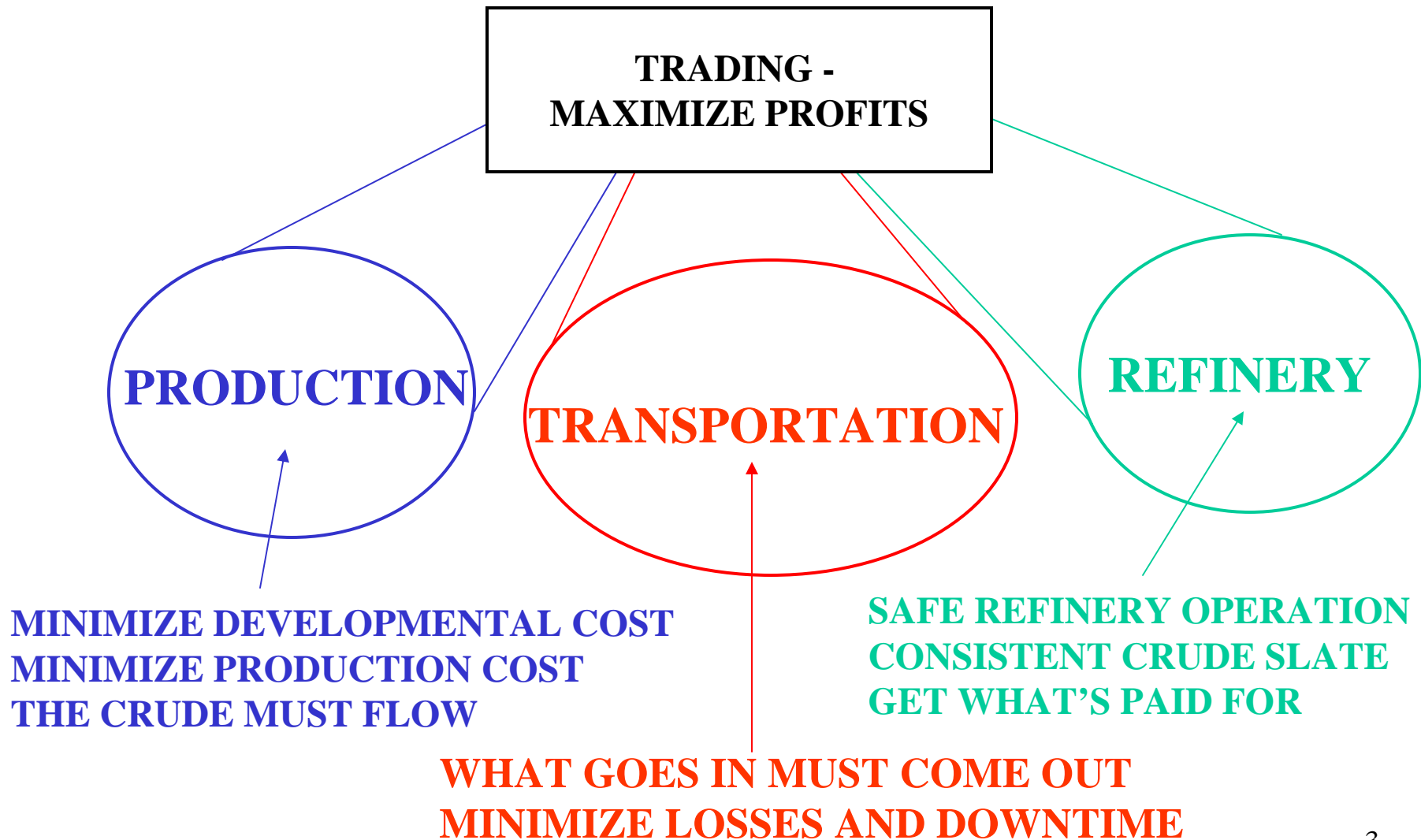
CRUDE OIL QUALITY GROUP

CRUDE OIL TRANSPORTATION SYSTEM



CRUDE OIL QUALITY

DRIVING FORCES BY INDUSTRY SEGMENT



WHAT IS CRUDE OIL?

- **A hydrocarbon mixture that exists in a liquid phase in underground reservoirs and remains liquid at atmospheric pressure after passing through surface separating facilities**
- **Crude Oil does not include Condensate, Natural Gasoline, Natural Gas Liquids or Reclaimed Petroleum**

WHAT IS CRUDE OIL QUALITY?

- **Maintaining the integrity and consistency of the refining characteristics of a crude oil stream**
- **The commonly used industry standards of gravity and sulfur, while important, do not adequately define a crude oil.**
- **Crude Oil Quality is achieved through identification of a crude's important characteristics and by protection of those parameters**

What happens to Crude Oil in the Pipeline System?

- **DEGRADATION-** Occurs during normal operations of pipeline transportation
 - TANK HEELS
 - TANK BOTTOMS
 - INTERFACES
 - WATER SLUGS
 - LINE FILL

**DEGRADATION CAN BE
MANAGED BY THE PIPELINE!!!**

What happens to Crude Oil in the Pipeline System?

CONTAMINATION - Introduction of an Outside Ingredient **NOT** normally used for pipeline transportation.

- **BY-PRODUCTS FROM REFINERY OR CHEMICAL PLANT**
- **USED MOTOR OIL**
- **HYDROTEST WATER**
- **TANK AND LINE CLEANING CHEMICALS**
- **CHLORINATED SOLVENTS**

PIPELINE CAN CONTROL CONTAMINATION OF OIL IN ITS CUSTODY !!!

What happens to Crude Oil in the Pipeline System?

- **ALTERATION** – Introduction of an Outside Ingredient normally used in pipeline transportation.

- **DRAG REDUCING AGENTS**

- **CORROSION INHIBITORS**

- **POUR POINT DEPRESSANTS**

**PIPELINE CAN CONTROL
ALTERATION OF OIL IN ITS
CUSTODY !!!**

LET'S TALK ABOUT BLENDING...

- Crude Oil, by its nature, is a blend of hydrocarbons
- But, not all blends are created equal
- Blending can occur normally (line fills, tank bottoms) and abnormally (dumbbell crudes)
- Crude Oils that are not compatible (sweet and sour, heavy and light, high metals and low metals, etc.) should never be blended

What happens to Crude Oil BEFORE the Pipeline System?

- **CONTAMINATION** – Introduction of an outside ingredient **NOT** normally used in production or marine transportation
- **CLEANING WASTES**
- **CHLORINATED SOLVENTS**
- **BUTANES**
- **PLANT BY-PRODUCTS**
- **NATURAL GASOLINE**

**PIPELINES CAN COMMUNICATE
CONTAMINATION!!!**

What happens to Crude Oil BEFORE the Pipeline System?

- **ALTERATION** – Introduction of an outside ingredient normally used in production or marine transportation.
 - **SALT WATER** (Completion fluids, cavern brine, ship ballast, slops)
 - **PRODUCTION CHEMICALS** (methanol, acids, drilling fluids, anti-foams)

**PIPELINES CAN COMMUNICATE
ALTERATION!!!**

WHAT'S A PIPELINE TO DO?

- **MAKE ONLY AUTHORIZED ADDITIONS**
 - **USE ONLY APPROVED ADDITIVES**
 - **MANAGE THE QUANTITIES ADDED**

- **PIPELINES CAN'T GET RID OF CHEMICALS ADDED PRIOR TO RECEIPT IN THE SYSTEM, BUT THEY CAN:**
 - **COMMUNICATE WITH SHIPPERS**
 - **WORK WITH PRODUCERS TO MINIMIZE**
 - **WORK WITH REFINERIES TO MANAGE**

- **EDUCATION WORKS**

PIPELINE CHAIN OF COMMAND

- Communication is key
 - **Field Personnel**
 - **Scheduler - Pipeline**
 - **Oil Movement Coordinator**
 - **Oil Movement Management**
 - **Scheduler – Crude Supply**
 - **Trader – Crude Supply & Trading**

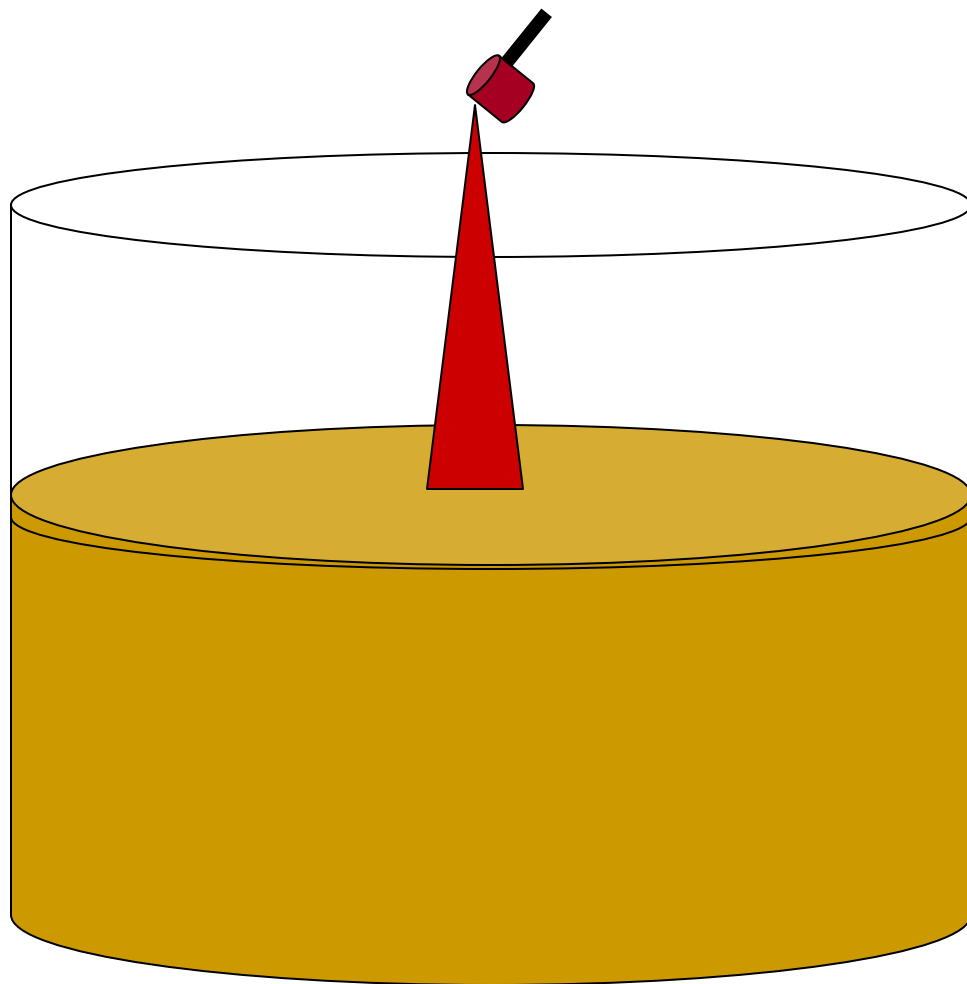
WHAT'S A PIPELINE TO DO?

– MAKE ONLY AUTHORIZED ADDITIONS

- Be part of the solution not the problem
- Don't “dump” anything in the crude stream without checking first

– EDUCATION WORKS

**A LITTLE BIT GOES A LONG
WAY !!!**

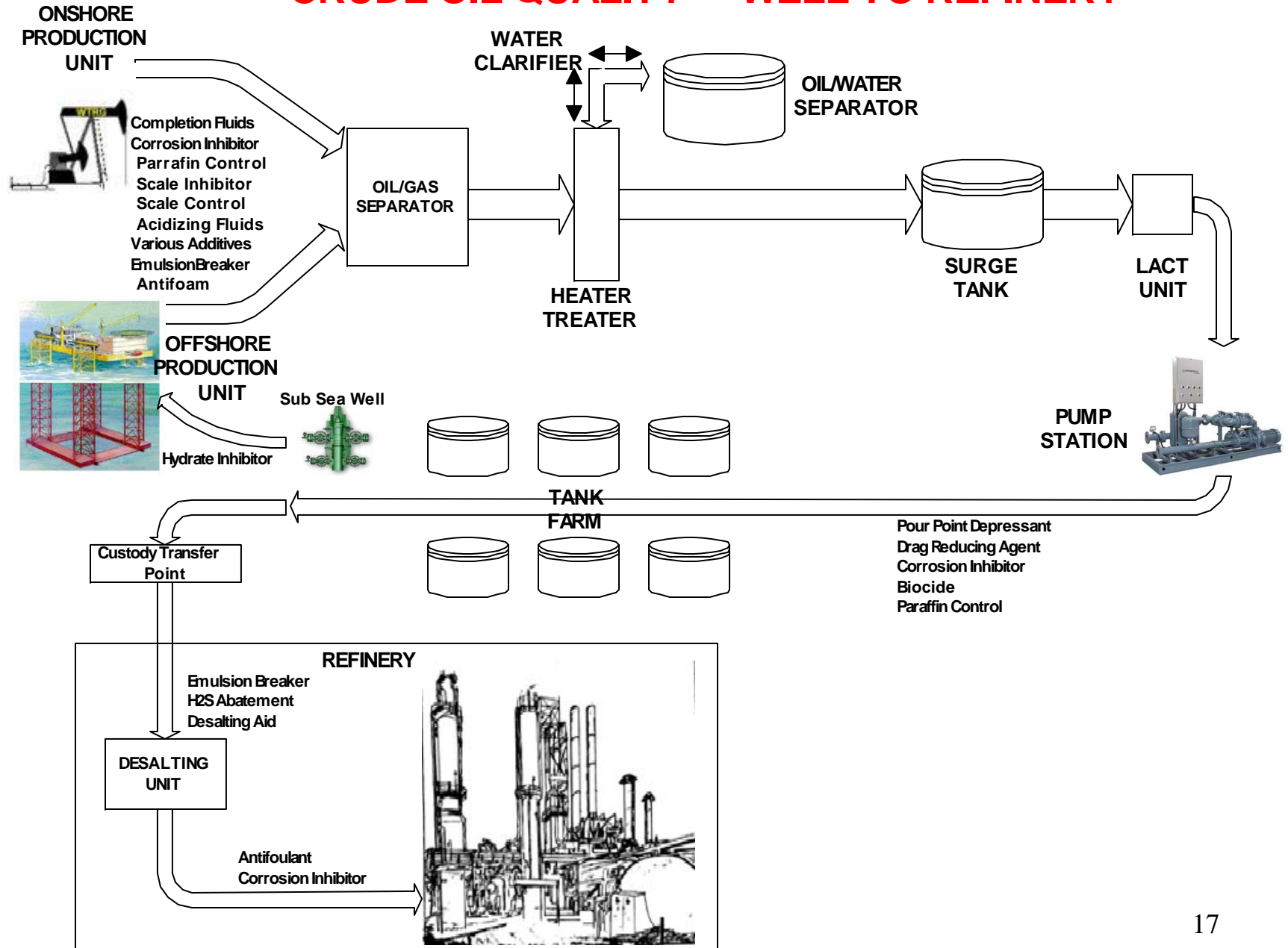


**One cup of carbon
tetrachloride can
contaminate 500
barrels of crude oil.**

EVEN TYPICAL ADDITIVES CAN SOMETIMES CAUSE REFINERY PROBLEMS

- **Coordinate all pipeline additive use with refineries**
- **Facilitate communications between refineries and**
 - **Producer**
 - **Shipper**
 - **Truck**
 - **Rail**
 - **Marine**
 - **Connecting pipeline**

CRUDE OIL QUALITY – WELL TO REFINERY



WHAT'S A PIPELINE TO DO?

– CHEMICALS ADDED PRIOR TO PIPELINE RECEIPT

- Tell the shipper when you know there is a chemical being introduced into their crude oil. (Can they manage the situation?)
- Tell the producers when a problem occurs. (Can they do better in the future?)
- The pipeline is the middleman; refiners rely on you.

– EDUCATION WORKS

WHAT'S A PIPELINE TO DO?

– COMMUNICATE WITH SHIPPERS

- One refinery estimates it lost \$1,000,000 in just three months when a heavy crude was blended into a lighter crude. Don't assume crudes are all the same.
- Tell the shipper of known alteration and unavoidable degradation.
- Let the shippers know when they are the problem (small batch size, unreasonable delivery schedules, etc.)

– EDUCATION WORKS

WHAT'S A PIPELINE TO DO?

–UTILIZE BETTER WATER DETERMINATION METHODS:

- **Centrifuge Method:**

- Oldest and most frequently used water determination method
- Accuracy +/- 10% of reading at best
- Measures only “free” water
- Sensitive to emulsification

- **Karl Fischer Method:**

- Portable/ simple/ results in seconds
- Accuracy +/- 3% of reading or better
- Measures “free” and “bound” water
- Not sensitive to emulsions

- **Karl Fischer method routinely finds 0.1-0.2% more water in any given crude sample**

WHAT'S A PIPELINE TO DO?

– WORK WITH PRODUCERS TO MINIMIZE

- Ask the producers to be forthcoming about what is being added and how the crudes are changing.
- Field personnel see what is going on - communicate the issues.

– EDUCATION WORKS

WHAT'S A PIPELINE TO DO?

– WORK WITH REFINERY and SHIPPER TO MANAGE

- Ask the refinery to tell you about problem chemicals.
- Ask the refinery to tell you of known incidents of inconsistent crude that created problems (both economic and safety-related)
- Ask the refinery to cooperate with the pipeline when a problem occurs - Pipeline can't get rid of it; the refinery needs to be involved in any mitigation.

– EDUCATION WORKS

What Next?

1. Education for producers, transporters and refiners
2. Would a database of problem chemicals help?
3. What do you, a pipeline professional, need to know to better manage crude oil quality?

**Education &
Communication
WORKS**



Crude Oil Quality Group (COQG)

Mission Statement

The Crude Oil Quality Group (COQG) is dedicated to the belief that maintaining the integrity and consistency of the refining characteristics of crude oil streams is of importance to all parties involved in crude oil activity, from production locations to the refinery. The COQG believes the commonly used industry standards of gravity and sulfur do not adequately define crude oil quality, and should be expanded to include other characteristics. The COQG is opposed to the alteration of crude oil streams, such as through the injection of processed gas liquids, without the knowledge and consent of the parties involved.

To promote these beliefs, the COQG will strive to:

- Communicate our beliefs to the oil industry at large;
- Create and sponsor forums for open communications and the sharing of information and ideas to better educate the crude oil industry;
- Be pro-active in the advancement of our beliefs with all areas for the crude oil arena, including production, transportation, trading, and refining sectors;
- Improve the overall quality of crude streams through the promotion of crude quality programs on common carrier transportation systems; and
- Be closely involved with various industry associations to further promote our beliefs.