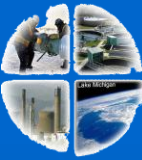


IPRO 346

Expansion of the BP Whiting Refinery

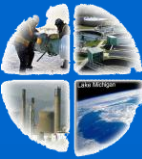




IPRO 346 Overview

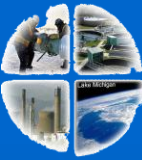
- Problem:
 - BP Whiting Refinery

- Objectives:
 - Initial Investigation
 - Technical Options
 - Final Design



The BP Whiting Expansion

- Increase in heavy Canadian crude oil
- Higher pollutants
- Increase in ammonia and total suspended solids (TSS)



The New Permit

- Ammonia effluent limitations

	Monthly Average	Daily Maximum
Existing	1,030 lbs/day	2,060 lbs/day
Proposed	1,584 lbs/day	3,572 lbs/day

- TSS effluent limitations

	Monthly Average	Daily Maximum
Existing	3,646 lbs/day	5,694 lbs/day
Proposed	4,925 lbs/day	7,723 lbs/day



Social Issues

- Public Outcry
- Fact vs. Fiction
- “I don’t want a refinery in my backyard.”



Team Management

- Keeping Pace
 - Dates
 - Progress

- Challenges
 - Unique Solutions for Unique Problems



Management Continued

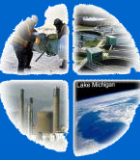
- Single Point of Accountability

- Resource Management System
 - Budget
 - “The proof is in the pudding”

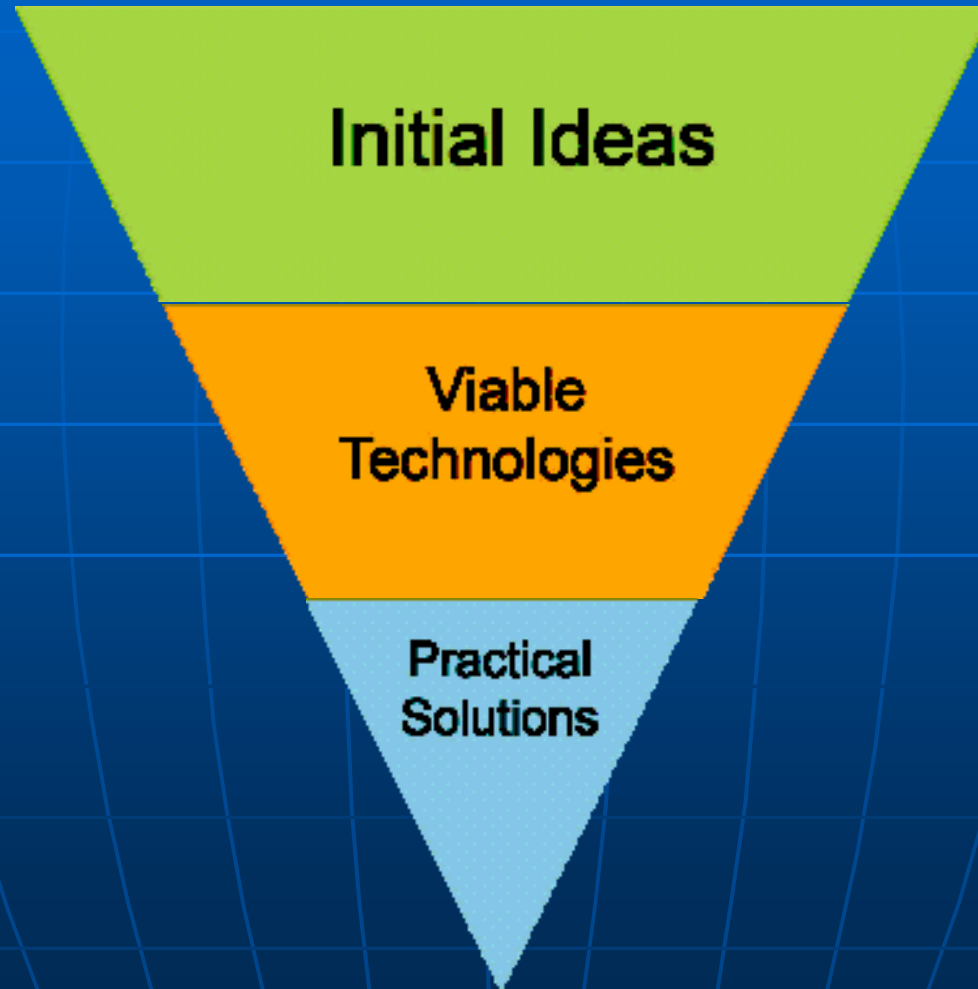


Team Principles

- Code of Ethics
- Who's Your Sponsor?



Project Overview



Practical Solutions

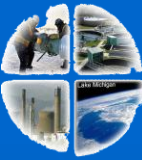


Practical Solutions

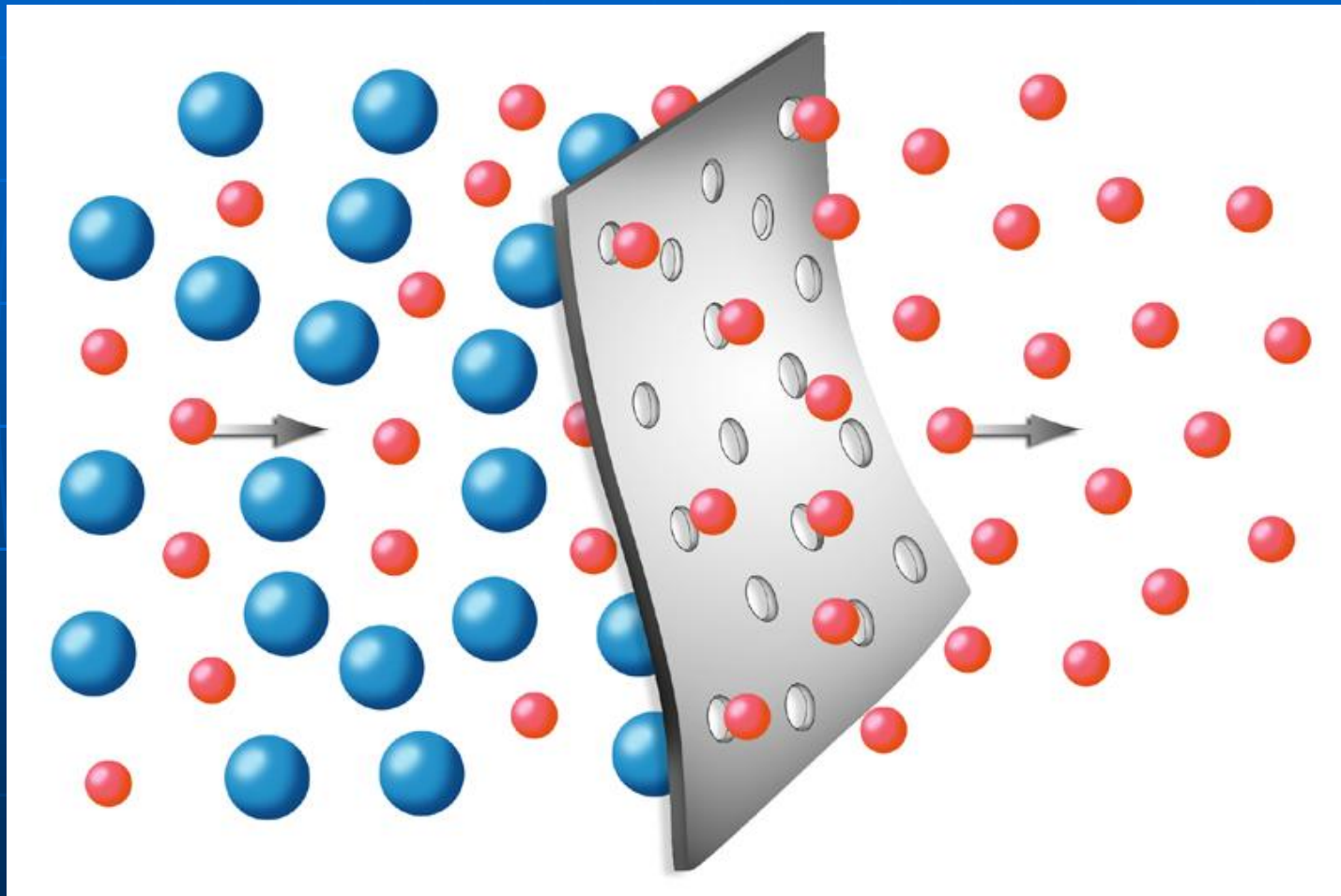
Brine Treatment Unit

Sour water Stripper

Membrane Unit



Membrane Processes





Membrane Processes

Positives

- Reduces Units
- Smaller Footprint
- High Quality Water
- Water Reuse



Membrane Processes

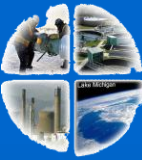
Negatives

- Membrane Fouling
- Short Life Time
- High Capital and Operating Costs

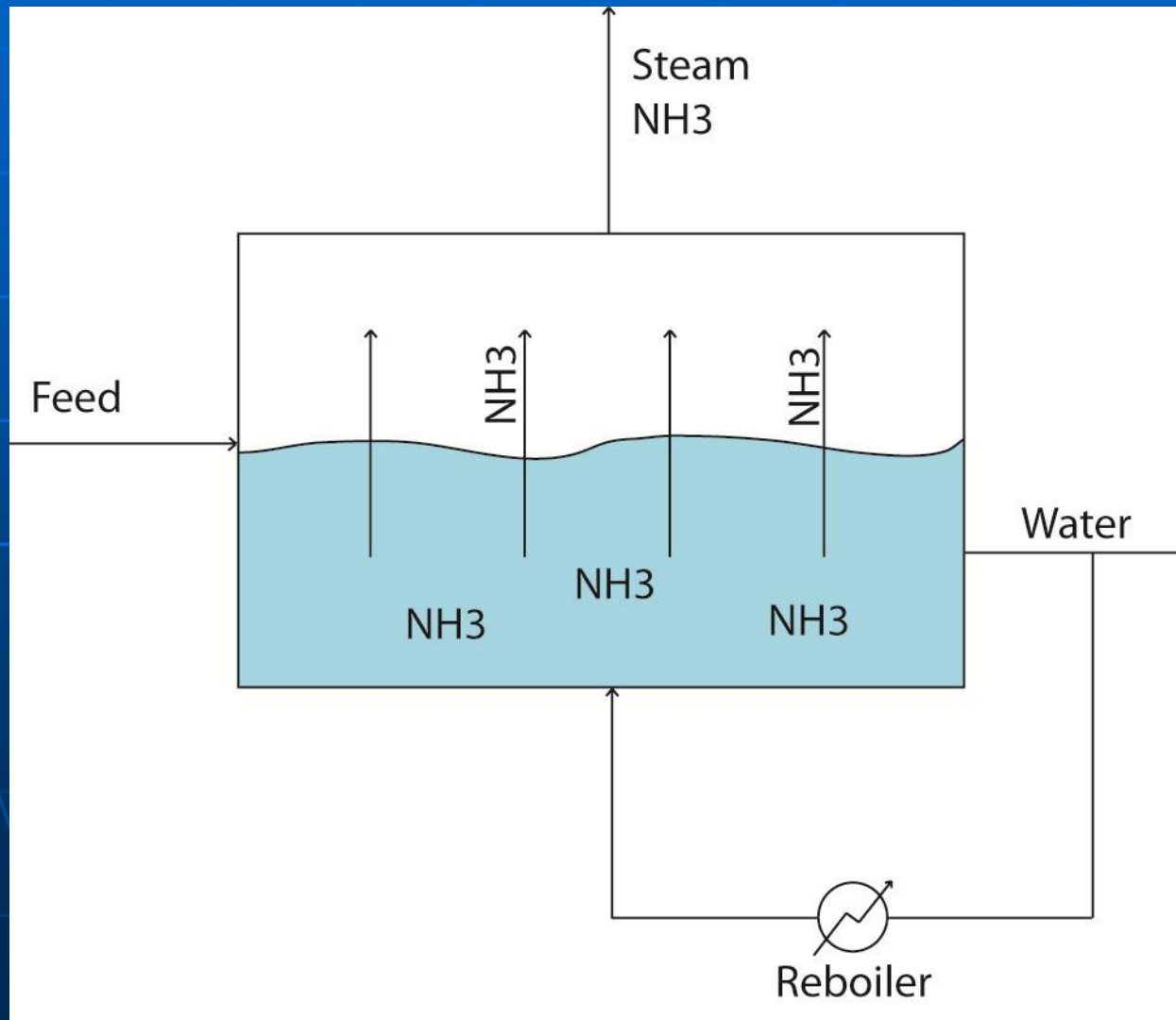


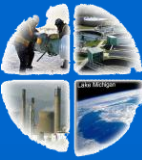
Brine Treatment

- Most Total Suspended Solids (TSS) are Oil
- Efficiently removes oil from water
- Help with upsets



Sour Water Stripper





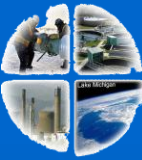
Results

Wastewater With added Units

	TSS, mg/L	Flow, MGD	NH ₃ -N, mg/L
Inlet Concentrations	15,000	22	300
Outlet Concentrations	20	22	1.0

TSS (lb/day) = 3700 ± 20%

NH₃ (lb/day) = 190 ± 20%



Results

Wastewater With Out added Units

	TSS, mg/L	Flow, MGD	NH ₃ -N, mg/L
Inlet Concentrations	15,000	22	300
Outlet Concentrations	196	22	10.3

TSS (lb/day) = 36000 ± 20%

NH₃ (lb/day) = 1900 ± 20%



Costing

Expanded Brine Treatment Unit: \$50 M

Sour Water Stripping: \$70 M

Total: \$130 ± 25%

IPRO

It takes a team

INTERPROFESSIONAL PROJECTS PROGRAM



Thank You!