IPRO 346
INTERPROFESSIONAL PROJECTS PROGRAM

BP Whiting Refinery Expansion :

Developing Wastewater Cleanup Options

Midterm Presentation

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IPRO 346 Objectives

- To understand the regulatory, social, environmental, and technical aspects of the planned upgrade to BP's Whiting refinery
- To find alternatives to the wastewater cleanup issue that has been the source of controversy
- To explore and evaluate (preferably using HYSYS or any other simulation software) technical options.

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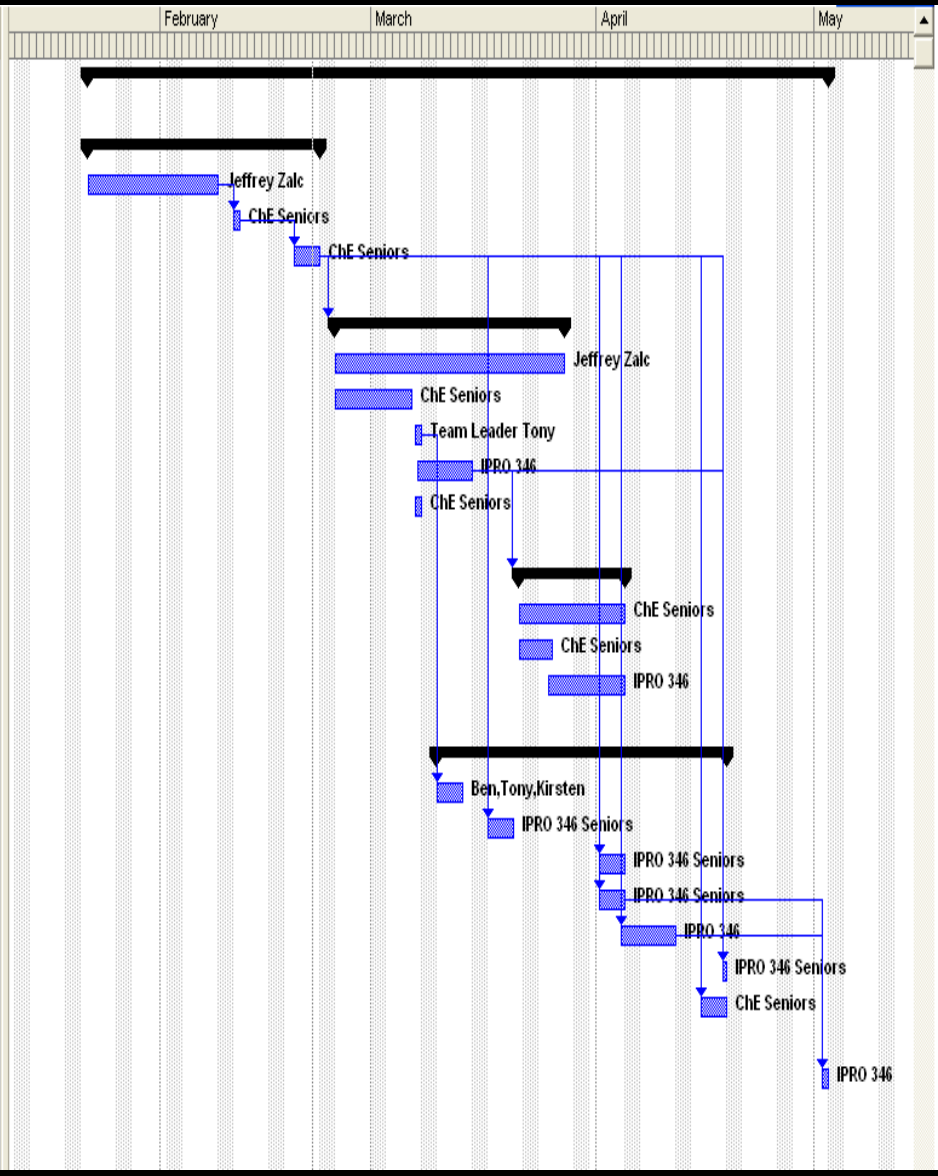
Gantt Chart

- Introduction
- Refining Group
- Regulatory Group
- Tar Sands Group
- Wastewater Group
- Future Work

	Task Name	Duration	Start	Finish
1	**IPRO 346**	**68.88 days**	**Tue 1/22/08**	**Fri 5/2/08**
2				
3	**Initialize**	**23.88 days**	**Tue 1/22/08**	**Fri 2/22/08**
4	Define the Problem	14 days	Tue 1/22/08	Fri 2/8/08
5	Structure Groups	1 day	Mon 2/11/08	Mon 2/11/08
6	Project Plan	3.88 days	Tue 2/19/08	Fri 2/22/08
7				
8	**Research**	**18.75 days**	**Mon 2/25/08**	**Thu 3/27/08**
9	Background	23.88 days	Mon 2/25/08	Thu 3/27/08
10	Discuss Technical Options	8.88 days	Mon 2/25/08	Thu 3/6/08
11	Create New Subteams	1 day	Fri 3/7/08	Fri 3/7/08
12	Research Technical Options	5.88 days	Fri 3/7/08	Fri 3/14/08
13	Determine Appropriate Software	1 day	Fri 3/7/08	Fri 3/7/08
14				
15	**Design**	**9.88 days**	**Fri 3/21/08**	**Fri 4/4/08**
16	Modeling/Simulation	10.88 days	Fri 3/21/08	Fri 4/4/08
17	Costing	2.88 days	Fri 3/21/08	Tue 3/25/08
18	Recommendations	8.88 days	Tue 3/25/08	Fri 4/4/08
19				
20	**IPRO Deliverables**	**24.88 days**	**Mon 3/10/08**	**Fri 4/18/08**
21	Code of Ethics	3.88 days	Mon 3/10/08	Thu 3/13/08
22	Midterm Report	3.88 days	Mon 3/17/08	Thu 3/20/08
23	Abstract	3.88 days	Tue 4/1/08	Fri 4/4/08
24	Poster	3.88 days	Tue 4/1/08	Fri 4/4/08
25	Presentation	5.88 days	Fri 4/4/08	Fri 4/11/08
26	Information CD	0.88 days	Fri 4/18/08	Fri 4/18/08
27	Final Report	3.88 days	Tue 4/15/08	Fri 4/18/08
28				
29	IPRO Day	1 day	Fri 5/2/08	Fri 5/2/08



Gantt Chart

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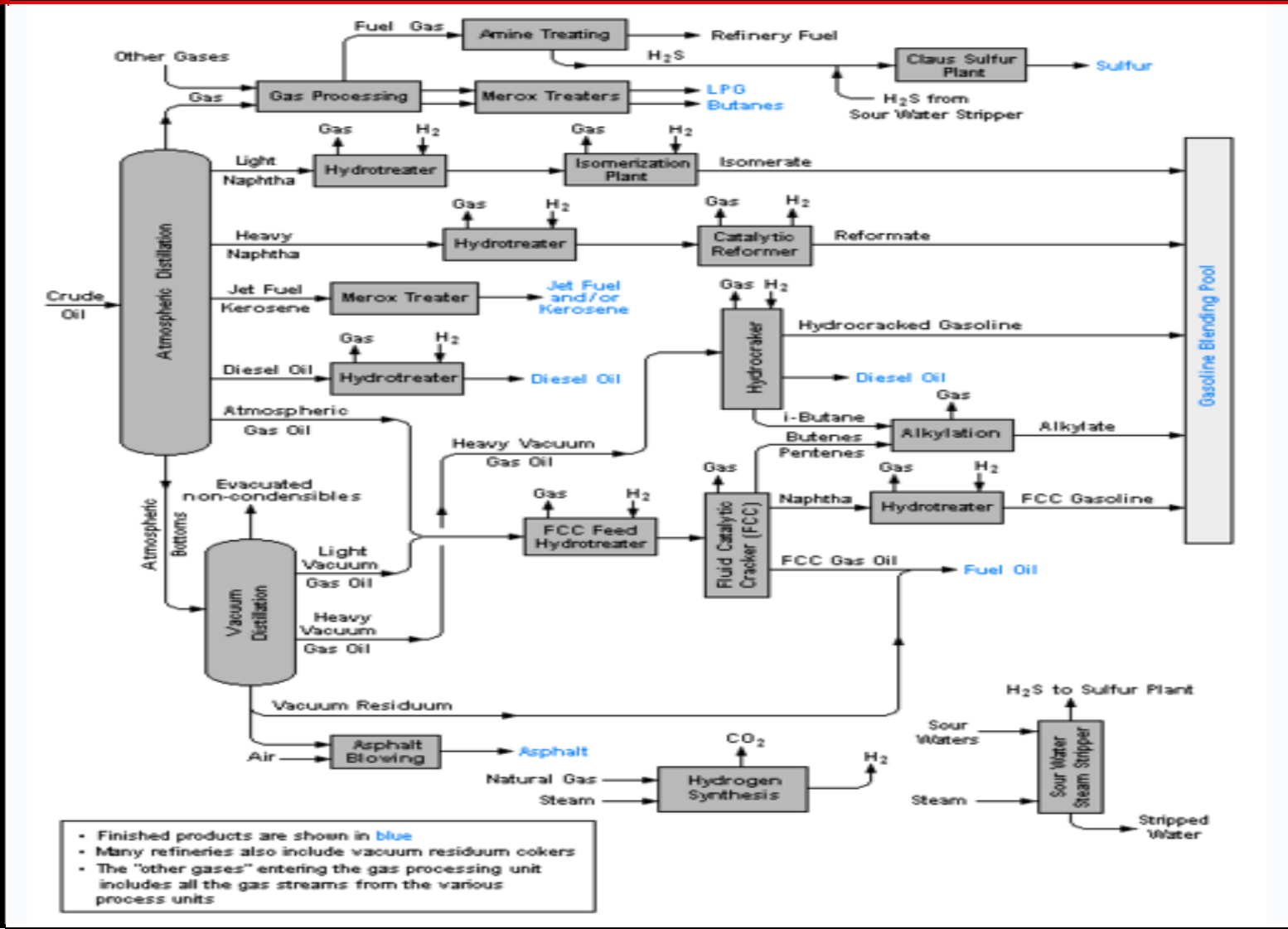
Flow Diagram of Typical Refinery



Water Quality Standards

- **Tier 1** maintains and protects existing uses and water quality conditions necessary to support such uses
- **Tier 2** maintain and protect “high quality” waters -- water bodies where existing conditions are better than necessary to support CWA § 101(a)(2) "fishable/swimmable" uses
- **Tier 3** maintain and protect water quality in Outstanding State Resource Waters (OSRW)

- BP Whiting Refinery Falls in **Tier 2** and **Tier 3**.

Mixing Zone and Alternative Mixing Zone

Mixing Zone

EPA has been pushing to eliminate mixing zones that include bioaccumulative chemicals, such as mercury. The BP permit does not allow a mixing zone for mercury. The mixing zone authorized in the BP permit applies to TTS and ammonia, and federal and state law authorizes mixing zones for these parameters

Alternative Mixing Zone

IDEM is proposing to allow a discharge induced mixing zone through a diffuser in Lake Michigan which produces a mixing volume of lake water that is 37.1 times greater than the discharge volume of 21.4 million gallons per day from Outfall 001.

The alternate mixing zone will encompass a 182 feet radius from the diffuser.

Mercury Limitations

- BP is allowed to pour small amounts of toxic metal into Lake Michigan till 2012
- Federal records analyzed by the Tribune show BP puts 2 pounds of mercury into the lake every year from the Whiting Refinery
- Under standards adopted by EPA in 1995, BP's annual discharge of the metal should be reduced to 8/100th of a pound

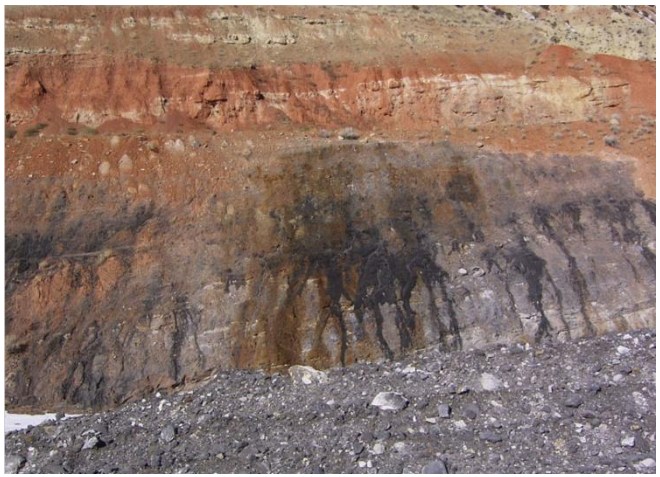
Proposed BP Permit Limits Monthly Average

	Current lbs/day	Draft/Proposed lbs/day
BOD	4,161	4,161
COD	30,323	30,323
O&G	1,368	1,368
Phenolics	20.33	20.33
Sulfide	23.1	23.1
Total Chromium	23.9	23.9
Hex Chrom	2.01	2.01
TSS	**3,646**	**4,925**
Ammonia	**1,030**	**1,584**

Emission Comparison

Emissions Comparisons			
	Total Suspended Solids pounds per day monthly average	**Ammonia** pounds per day monthly average	**Notes**
BP Refinery – Whiting	4,925	1,584	
Chicago – Stickney Plant*	144,115	60,048 summer 96,077 winter	* One of seven plants
Racine, WI	9,007	No Limit*	* Plant currently produces 1,501 lbs./day/avg.
Milwaukee, WI	59,047	13,187 – 32,870*	* South Shore plant only. Jones Island has no ammonia limit
Saginaw, MI*	8,006	1,334 – 1,975	* Discharges into Saginaw River which flows to Lake Huron
Detroit, MI	233,000	No Limit*	* Plant currently produces 88,877 lbs./day/avg. Discharges into Detroit River which flows into Lake Erie

What is Tar Sands?



- Deposits of bitumen, a heavy black viscous oil that must be rigorously treated to convert it into an upgraded crude oil before it can be used by refineries to produce gasoline and diesel fuels
- Substantially heavier than other crude oils
- Can be found in three places in Alberta - the Athabasca, Peace River and Cold Lake regions - and cover a total of nearly 140,200* square kilometers

Bitumen / Heavy Oil

Heavy crude oil

- Any type of crude oil which does not flow easily
Properties include higher viscosity and specific gravity, as well as heavier molecular composition
- Generally a diluent is added at regular distances in a pipeline carrying heavy crude to facilitate its flow.
- Some petroleum geologists categorize bitumen from tar sands as extra heavy oil although bitumen does not flow at ambient conditions

Bitumen

- Mixture of organic liquids that are highly viscous, black, sticky, entirely soluble in carbon disulfide
- Composed primarily of highly condensed polycyclic aromatic hydrocarbons.
- Most bitumens contain sulfur and several heavy metals such as nickel, vanadium, lead, chromium, mercury and also arsenic, selenium, and other toxic elements

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How We Make Oil at Syncrude

Introduction

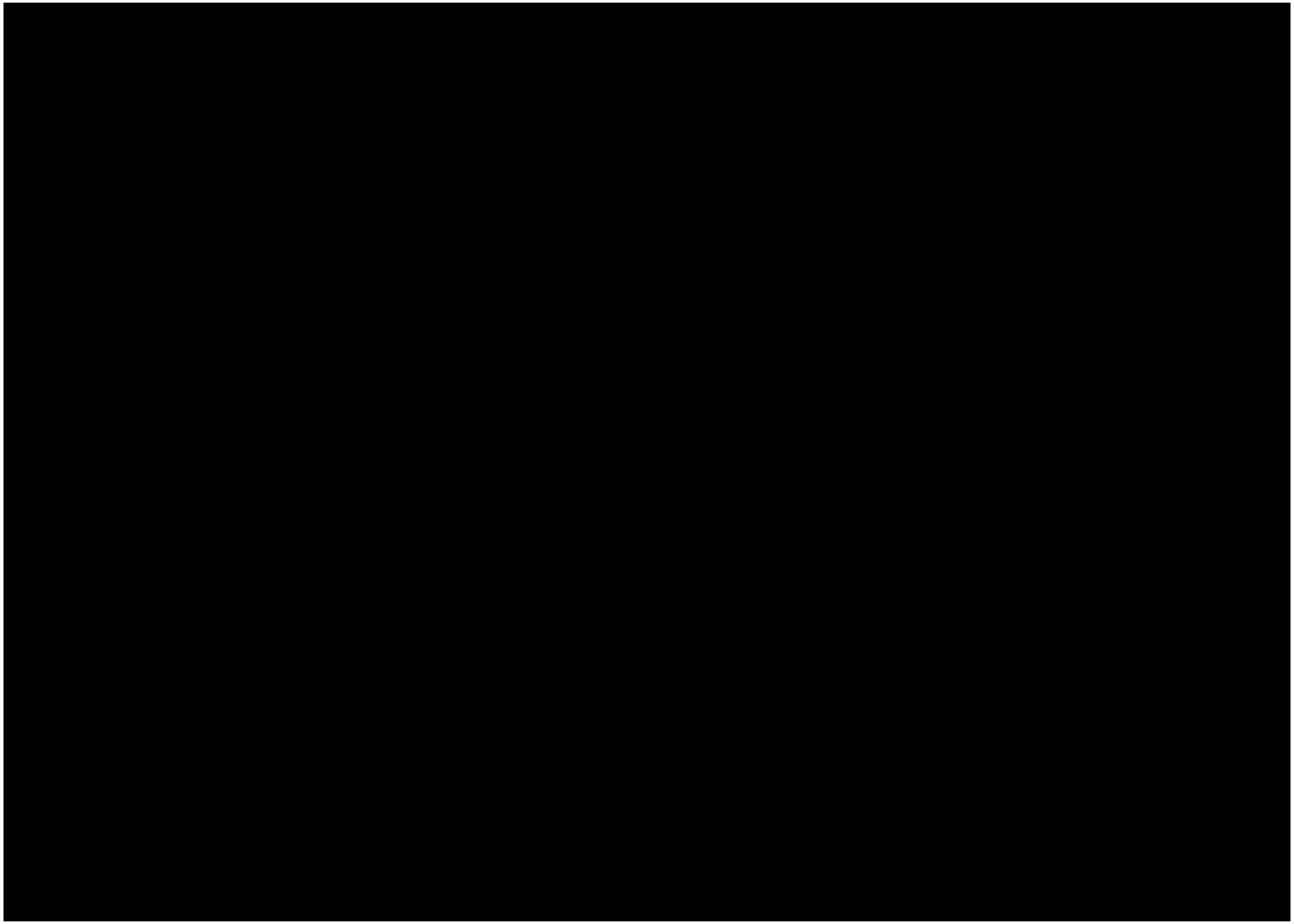
Refining Group

Regulatory Group

Tar Sands Group

Wastewater Group

Future Work



http://ostseis.anl.gov/guide/links/index.cfm

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Wastewater Treatment Plant

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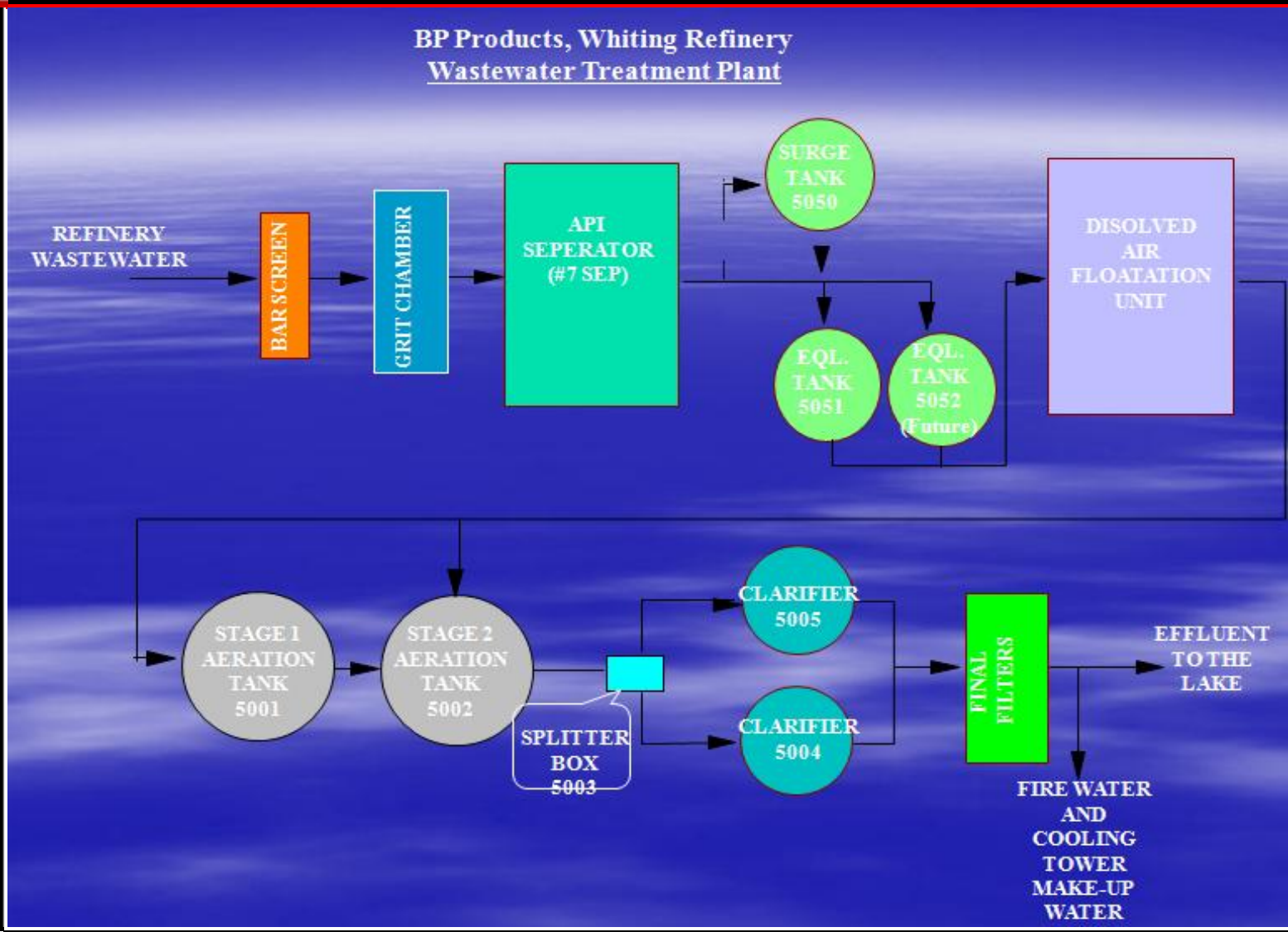

Future Work

Project Technical Requirements

•Thorough investigation and reporting of background materials related to :

Planned refinery expansion
Permitting aspects
Environmental issues

• Technical understanding and communication of wastewater treatment facilities

• Exploration and analysis of technical alternatives on wastewater treatment for BP Whiting refinery

IPRO 346 Website

- http://www.iit.edu/~ipro346s08/index.html

Thank you!