

**I PRO 346**  
**BP Whiting Refinery Expansion:**  
**Developing Lake Michigan Wastewater**  
**Cleanup Options**  
*Spring 2008*

**Midterm Report**

*15 March 2008*

**Advisors:**

Jeffrey Zalc, *BP* • Javad Abbasian, *IIT* • Satish Parulekar, *IIT*

**Team:**

Sahar Ashrafi • Ray Ballard • Chris Chock • Yak Yong Chung • Hana Fakhouri • Anthony Ferrese • Fernando Gomez • Laura Haak • Katherine Hammes • Jichul Kim • Alex Leasenby • Richard Lewis • Zhi Li • David Malon • Henry Michael • Miri Park • Kirsten Reimann • Ben Roberts • Jong Mu Song • Willy Taracena • Josie Truong • Russel Ucci • Anna Vassi • Andrew Witek • Jaewon Yoo • Yin Zhao

## **1.0. Revised Objectives**

### **A. Current Objectives**

I PRO346 will focus on familiarizing itself with British Petroleum's (BP) wastewater treatment plant (WTP) for its oil refinery in Whiting, IN. Specifically, this I PRO will analyze the current permits and their stipulations regarding the amount of ammonia and total suspended solids (TSS) in the wastewater being dumped in Lake Michigan. Ultimately, possible methods and designs will be devised to reduce the levels of ammonia and TSS remaining in treated wastewater. These designs will take the form of a process flow sheet with a computer simulation to model the designs. At the culmination of this I PRO we will have several different models for possible upgrades to the Whiting refinery wastewater treatment plant to reduce the levels of ammonia and TSS in the wastewater entering Lake Michigan as well as a cost to implement each solution.

### **B. Changes**

No changes were made to this objective.

## **2.0. Results to Date**

### **A. Current Data Results**

For the past three years BP has been planning a \$3.7billion upgrade to its Whiting refinery to process Canadian heavy crudes. This upgrade will provide several hundred new jobs in the Whiting area and allow the refinery to process 90% Canadian heavy crude instead of mixing it with a minimum of 70% light crude, primarily from the Middle East. Not only will this result in less crude oil coming from politically unstable regions, but it will also allow the plant to increase its gasoline and diesel production by 15%. Unfortunately, the Canadian heavy crude contains a significant amount more nitrogen and sulfur which, with the ever increasing standards for gasoline and diesel, need to be removed. In order to move forward with this project, BP filed for a new permit with the State of Indiana to allow the Whiting refinery to increase the allowed levels of ammonia and TSS in its wastewater to be increased by 50%. This new permit was approved both by the State of Indiana and by the Environmental Protection Agency (EPA) and falls well under the federal maximum for ammonia and TSS waste. However, when the media and public hear of the new permit, there was a public outcry against any increase in the disposal of waste into Lake Michigan. Because of the massive outcry, BP decided that, although it knew of no current technology that could remove ammonia and TSS down to the standards set by the original permit, BP would not implement its design for the Whiting expansion until they could come up with an acceptable design for the wastewater treatment plant which would not increase the amount of ammonia and TSS being dumped into Lake Michigan. If no solution presented itself BP stated that it would scrap the entire project thereby losing nearly all of the \$3.7billion budgeted for the expansion.

## **B. Outputs from Research**

The outputs from this research will help us students to be able to learn and know current issues with BP, whitening refinery.

## **C. Deliverables**

The written reports are the only deliverables for this IPRO. No products are being created.

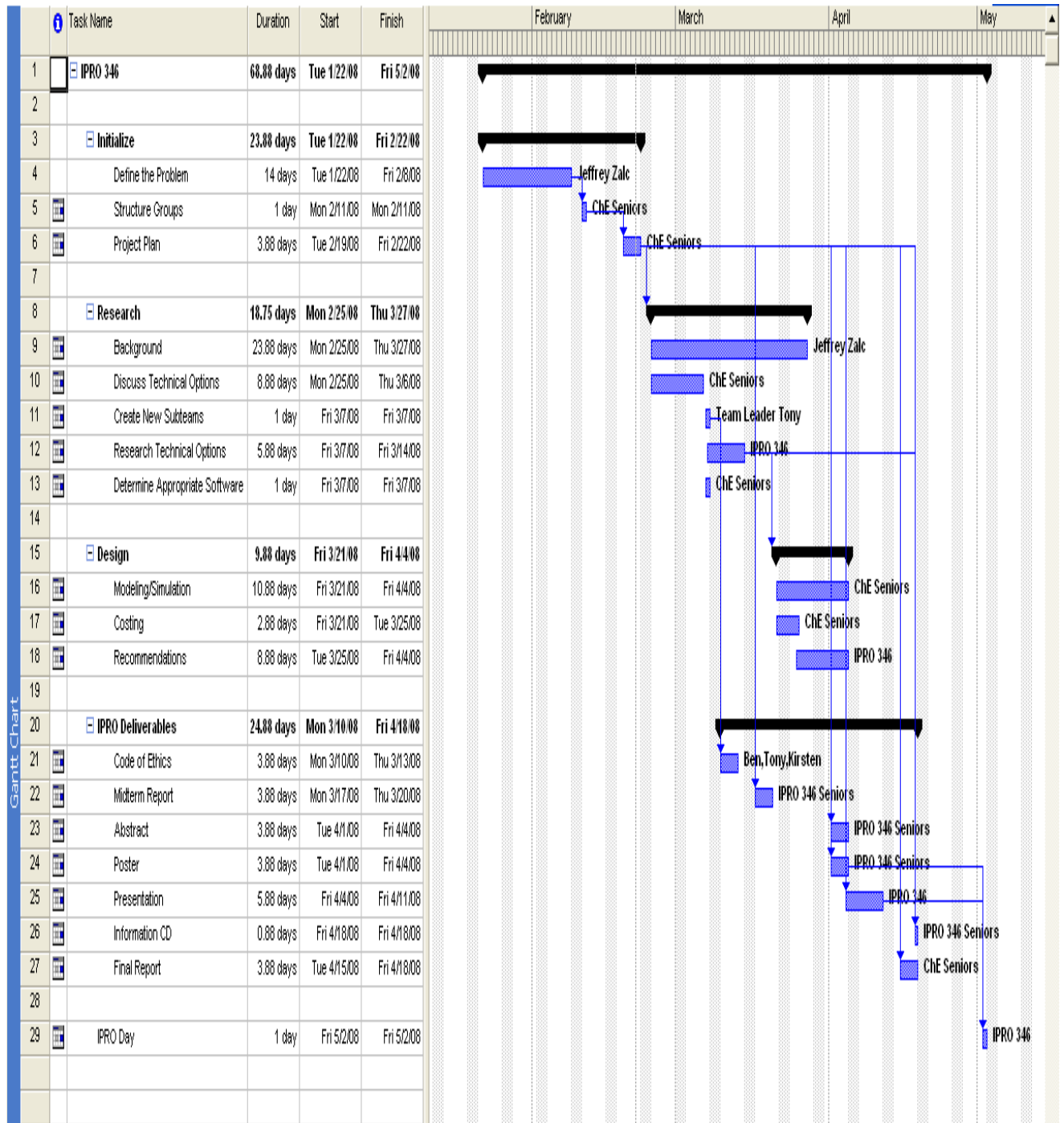
## **D. Sponsor Problem**

We do not have a sponsor.

## **E. Incorporation of Current Results**

The current findings will be combined with the research that will be completed in the next few weeks to make the final reports.

### **3.0. Revised Task / Event Schedule**



### A. Changes in Project Tasks

There have been no changes in the tasks needed to complete this project.

### B. Changes in Summary Tasks

There have been no changes in summary tasks, and all due dates have stayed the same.

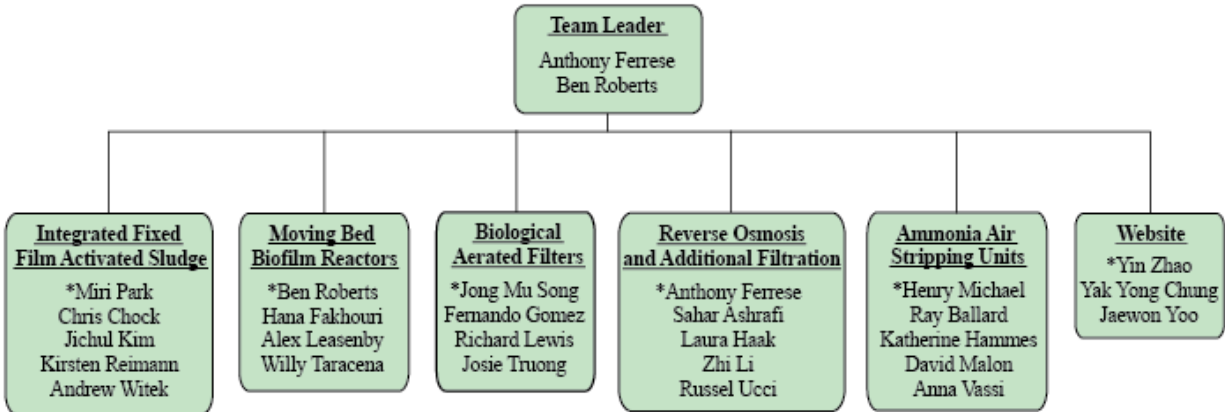
Task Name	Duration	Start	Finish
<b>I PRO 346</b>	<b>68.88 days</b>	<b>Tue 1/22/08</b>	<b>Fri 5/2/08</b>
<b>Initialize</b>	<b>23.88 days</b>	<b>Tue 1/22/08</b>	<b>Fri 2/22/08</b>
Define the Problem	14 days	Tue 1/22/08	Fri 2/8/08
Structure Groups	1 day	Mon 2/11/08	Mon 2/11/08
Project Plan	3.88 days	Tue 2/19/08	Fri 2/22/08
<b>Research</b>	<b>18.75 days</b>	<b>Mon 2/25/08</b>	<b>Thu 3/27/08</b>
Background	23.88 days	Mon 2/25/08	Thu 3/27/08
Discuss Technical Options	8.88 days	Mon 2/25/08	Thu 3/6/08
Create New Subteams	1 day	Fri 3/7/08	Fri 3/7/08
Research Technical Options	5.88 days	Fri 3/7/08	Fri 3/14/08
Determine Appropriate Software	1 day	Fri 3/7/08	Fri 3/7/08
<b>Design</b>	<b>0 day</b>	<b>Fri 3/21/08</b>	<b>Fri 3/21/08</b>
Modeling/Simulation	0 day	Fri 3/21/08	Fri 3/21/08
Costing	0 day	Fri 3/21/08	Fri 3/21/08
Recommendations	0 day	Tue 3/25/08	Tue 3/25/08
<b>I PRO Deliverables</b>	<b>7.76 days</b>	<b>Mon 3/10/08</b>	<b>Thu 3/20/08</b>
Code of Ethics	3.88 days	Mon 3/10/08	Thu 3/13/08
Midterm Report	3.88 days	Mon 3/17/08	Thu 3/20/08
Abstract	0 day	Tue 4/1/08	Tue 4/1/08
Poster	0 day	Tue 4/1/08	Tue 4/1/08
Presentation	0 day	Fri 4/4/08	Fri 4/4/08
Information CD	0 day	Fri 4/18/08	Fri 4/18/08
Final Report	0 day	Tue 4/15/08	Tue 4/15/08
I PRO Day	0 day	Fri 5/2/08	Fri 5/2/08

#### **4.0 Changes in Task Assignments and Designation of Roles and Team Organization**

##### **A. Changes to team Organization**

The team's organization has shifted into new subgroups. Team members have now been divided into subgroups researching the technical options suggested by the city of Chicago to improve the BP Whiting plants pollutant discharges of ammonia and total suspended solids. Each

subgroup has been assigned one of the following technologies: Integrated Fixed Film Activated Sludge, Moving Bed Biofilm Reactor in two different locations during the wastewater treatment process, Biological Aerated Filters, Reverse Osmosis, Ammonia Air Stripping Units, and additional filtration devices. The only subgroup which has remained the same is the website group.



\* Denotes subgroup leader

## B. Subgroup Assignments and Responsibilities

The members of each subgroup are responsible for finding information on how their assigned technical option works, as well as its advantages and disadvantages, and its cost. They must then organize the information and present it to the other subgroups for further discussion on what more information is necessary to determine the best options for the BP Whiting wastewater treatment.

In addition to these subgroups team members must also volunteer in groups to work on the project plan, midterm report, abstract, final report, and the midterm and final presentations. Each student must volunteer for at least one of these. All reports and presentations are subject to evaluation by the team before completion.

## C. Changes in Team Member Roles

All the roles have remained the same as specified in the project plan. Anthony Ferrese and Ben Roberts are the team leaders, Anthony Ferrese is the agenda maker, Miri Park and Fernando Gomez are in charge of recording minutes, Henry Michael is the time keeper, and Josie Truong is in charge of keeping attendance.

## D. Cause of Changes in Team Organization

After the initial subgroups on refinery processes completed their tasks of gaining an understanding of how a refinery works they no longer had a purpose and so were arranged into new subgroups. The new subgroups have been chosen in order to fulfill the current objectives for the project.

# 5. Barriers and Obstacles

## A. Obstacles Encountered

A main learning component in any IPRO team is working together in an organized fashion. It was apparent from the very beginning this would be a challenge given the size of our IPRO team. IPRO 346 is comprised of 30 members consisting of mostly CHE 296 sophomores. CHE296 students are lower chemical engineering classmen whose main objective is to understand how a team works as a whole. It was apparent from the very beginning this would be a challenge given the size of our IPRO team. IPRO 346 is comprised of 30 members consisting of mostly CHE296 sophomores. CHE296 students are lower chemical engineering classmen whose main objective is to understand how a team works as a whole. After identifying the problem of having too large of a group the seniors decided that in moving forward we would divide the team into subgroups allowing for smaller groups that would allow the team to achieve a higher concentration in completing assigned tasks.

### **B. Resolution of Obstacles**

After identifying the problem of having too large of a group the seniors decided that in moving forward we would divide the team into subgroups allowing for smaller groups that would allow the team to achieve a higher concentration in completing assigned tasks. A main learning component in any IPRO team is working together in an organized fashion. As with every IPRO team it is a collection of students with varying skill sets and concentrations. Thus a problem exists in delegating tasks to students that meshes with their abilities. In order to reconcile this with such a large group IPRO 346 had each team member upload a written document outlining their skills and interest so that we may more effectively delegate tasks.

### **C. Remaining Obstacles**

IPRO 346 is working a highly controversial topic, especially considering the proximity to that of the source of the problem, BP-Whiting, IN Refinery. With topics of this notoriety everyone, including members of IPRO 346, have their own opinion. Having said that students have become increasingly passionate about their views, some students believe BP is acting responsible with regards to increased effluent levels into Lake Michigan, while others feel BP is acting irresponsible and should be a leader in reducing pollution. Thus a bias exists in the group on both sides and it is important as members of this project to know all the facts and understand both sides.

### **D. Dealing with Obstacles**

In order to resolve this issue, students were asked to read many factual articles that were as unbiased as possible in order to understand the facts. This allowed students to grasp the problem in a more objective view. Although students of IPRO 346 will always have their own opinions we felt it was important to overcome the bias in keeping an objective view of the problem.

## **6.0. Midterm Presentation Slides(Attached as a Separate Document)**