I. TEAM CHARTER

Team Name:

CCR Solutions

Motto:

"Improving the earth, one ash pond at a time."

Logo:

Team Information:

The team is composed of ten students with a wide range of skills. For further information, please see appendix A.

Team Purpose:

Team Vision/Mission

The purpose of the IPRO 302 team, sponsored by Sargent & Lundy, is to evaluate the environmental and cost impacts of closing an ash pond at an active power plant, as well as consider alternative beneficial uses for coal combustion residuals (CCR) and wastewater that can contribute to a sustainable solution.

Objectives

- Current status of regulations for CCR and wastewater
- Alternatives for disposing of ash
- A recommended alternative for disposal or reuse of the bottom ash
- A recommended alternative for treatment and disposal of wastewater
- Cost impact of closure of an existing unlined ash pond

Background:

History and Problem

The TVA Kingston Ash Spill occurred on Monday December 22, 2008. Coal fly and bottom ash slurry spread out when an ash dike burst in the Kingston Fossil Plant in Roane County, Tennessee. The TVA and EPA estimated that the spill spread out 1.7 million cubic yards wide. They first projected that the spill would be cleaned in six weeks. Later, however, staff attorney for Southern Environmental Law Center, Chandra Taylor, said it would take months, possibly years.

Bottom ash is produced in a dry-bottom coal boiler, which is usually found in electric power plants that burn coal. The coal is ignited and the incombustible portion of this material, not collected in the flue as fly ash, is known as dry bottom ash. This dry bottom ash is heavier, which is why it falls to the bottom. It then drops down to a water-filled hopper at the bottom of the boiler. The bottom ash/water mixture is then stored in an ash pond. A major concern is that contaminants from the bottom ash can leach into groundwater and then into drinking water.

Technology Involved

A steam power plant is used for converting the potential chemical energy of fuel into electrical energy. This process uses a boiler and a turbine that drive an electric generator. The boiler device is used for turning water into steam. There is a steam jet that issues from the spout, this in turn spins the highly engineered blades of the turbine and the generator. The generator consists of a bar magnet that spins inside a stationary coil or wire. The magnet directs the electricity to use and storage.

There is a belt conveyor that transports coal to the furnace where it is burned on a traveling grate stoker. A bellow supplies air for combinations. A chimney or stack is used to remove the combustion gas and a heater is used to heat the air from the bellows before it is blown into the furnace. During the process, it is imperative to maintain a consistant balance of heat for the coal; too hot or too cool of an environment can be detrimental to the efficiency of the burning coal.

The technology involved is continually being adjusted to make the process ever more efficient. For example, two steel drums were added that connect to a number of steel tubes. These are arranged in the furnace so that the hot gases have to pass through the bank of tubes on their way out. A boiler feed pump is used to replenish the water from the steam that has been evaporated, and a feed water heater is used to heat the water before pumping it into the boiler.

Ethical Issues

1. The storage of bottom ash can negatively affect the environment in the areas surrounding the power plant. (1)
    a. Valuable land used for storage of waste
    b. Difficult to convert land back to usable property (1)
    c. Potential contamination of water sources
        Damage to drinking water. (1)
        Killing off of aquatic life, destruction of fishing industry (2)
    d. Direct damage to land created by ash spills
        Destruction of vegetation and wildlife (1)
        Leakage into the groundwater creating wider area affected (1)
        Arsenic-laced water (1)
        Increase in other potentially hazardous metals in environment (2)
            - Nickel
            - Selenium
            - Lead
            - Mercury
            - Copper
            - Zinc
            - Arsenic
            - Boron
            - Manganese
    e. As of March 31, 2010, there are 101 sites deemed contaminated by deadly pollutants (2)
2. There are also safe handling issues related to being in contact with the byproduct, due to trace amounts of chemicals that can be found. (1)
3. Hazardous residuals
    a. Human loss of life due to contaminated water
    b. Genetic defects or medical issues due to toxins in the water, including but not limited to: (2)
        Cancer
        Birth defects
        Memory loss
        Learning difficulty
        Loss of coordination
        Disorientation
        Headaches
        Abdominal pain
        Convulsions
        Hypertension
        Renal dysfunction
        Loss of appetite
        Fatigue
        Sleeplessness
        Hallucinations

Numbness
Arthritis
Vertigo
Permanent damage to the central nervous system

4. There is potential for widespread damage due to limited detection equipment in many locations. (1)
5. Dangers arise from toxins and may be worse now than ever before due to the increased regulation on particulate matter dealt with in the form of smoke or other types of air waste. (1)

Customer/Sponsor involved

Sargent & Lundy LLC will act as the sponsor for IPRO 302. They have "provided comprehensive consulting, engineering, design, and analysis for electric power generation and power delivery projects worldwide." Their organization is headquartered in Chicago's Loop. They have had past experience with sponsoring IPROs at IIT. They have provided the group with the essential background information, an open-ended problem, and they will provide guidance throughout the semester and beyond through their professional reviews of our reports and presentations. (3)

Business/Societal Costs

- Research costs money often without immediate benefit. There are many occasions when businesses are reluctant to risk investing in research because of the potential money loss.
- Another business related cost is abiding by the ever changing governmental regulations surrounding the conveyance of CCRs. This may become time consuming and difficult to achieve.
- The existence of bottom ash storage ponds can have societal and community costs. Since conveying CCRs from a coal power, to plant, to a storage area can negatively affect the water quality of the surrounding areas, the surrounding communities can be negatively affected.

Team Values Statement:

Key Question to ask when unclear: What is the basis for _____ decision/idea?

Desired Behaviors

- I treat teammates, the team and the IPRO project with respect
- I show up for meetings, and finish my own work on time
- I share all information with team members
- I look for ways to help fellow teammates
- I ask questions whenever something is unclear
- I communicate clearly about time and obligation conflicts

Additional Behaviors for Leaders

- I give and receive timely feedback
- I encourage open discussion in all teammate interactions
- I encourage team member development

Conflict Resolution

As a project team, we need conflicts because:

- They help raise and address any problems
- It energizes work to be on the most appropriate issues
- They help people learn how to recognize and benefit from differences
- They avoid "Group Think"

However, we need to prevent conflict from becoming a problem. To achieve this goal, the Conflict Resolution Steps are:

1. ***Analyze the problem.*** Look at a problem from another angle on this problem to get a better understanding. Re-trace the steps to find the key points that led to a split point-of-view.
2. ***Discuss the possible solution.*** Allow everyone to express their views.
3. ***Build consensus.*** Condense and mediate all the potential solutions. Find the best approach to obtain general satisfaction.
4. ***Resolve the conflict.*** Create a general solution for this case of conflicts to avoid additional effort to resolve problems in the future.

II. PROJECT METHODOLOGY

Work Breakdown Structure:

To achieve the wide range of goals our team has identified, we recognized the need to divide the group into four sub-teams. Each team is responsible for different areas of the project which are complimentary to the main goal of this IPRO. Team members were placed in respective sub-teams in accordance with their strengths and interests.

The overall team leader is Nicole Firnbach, who will set up an agenda for each class meeting and direct activities according to the developed plan. Sub-team leaders were chosen to improve communications and cohesiveness between groups, the team leader, and advisors.

Team Advisors:

Myron Gottlieb
Don Tijunelis

Regulations Team
The regulations team will research current and pending EPA regulations on coal combustion residuals (CCR). This team's research tasks include:

- Pending provisions to CCR regulations
- Identifying the differences between the different types of hazardous materials classifications proposed for CCRs
- EPA approved applications for reusable CCRs
- Regulations concerning wastewater management and decontamination

Regulations Team Members: TBD

Current CCR Management Team
The current CCR management team will be responsible for researching and identifying the various bottom ash handling systems that are currently in use. This team's tasks include:

- Identifying current bottom ash handling systems in use globally
- Researching the current methods for CCR reuse
- Identifying the benefits and costs of these systems
- Analysis of current ash pond use in the U.S.

Current CCR Management Team Members: TBD

CCR Management Alternatives Team
The CCR management alternatives team will conduct an analysis of the various possible alternatives to bottom ash handling. This teams tasks will include:

- Identifying proposed and implemented alternatives to bottom ash handling
- Analysis of the viability of each alternative with respect to our given assumptions
- Analysis of the relevant costs and benefits for each alternative

CCR Management Alternatives Team Members: TBD

Wastewater Solutions Team
The wastewater solutions team will be responsible for researching methods for decontamination and removal of ash-pond water. Their duties include:

- Identifying current methods for wastewater removal and decontamination.
- Researching potential methods for ash-pond wastewater removal that are currently implemented in other industries.

- Analysis of the relevant costs associated with ash-pond closure, including wastewater removal and decontamination.

Wastewater Solutions Team Members: TBD

Gantt Chart:

See Appendix B

Expected Results:

Details on *expected activities* involved in the project:

Phase I - Planning
Come up with work breakdown and required steps to complete objectives.
Phase II - Research
a) Break up into teams as outlined in Work Breakdown Structure.
b) Research in teams.
Phase III - Analysis
Examine research material and compare options.
Phase IV - Decide
Choose an optimal solution based on comparisons and listed assumptions.

Expected data from research or testing involved in the project:
Options for disposal of ash and wastewater
-solutions
-costs

Expected results in terms of deliverables that will be produced by the project team:
Final report on solutions, costs and analysis with a recommendation.
- Different solutions for CCR and wastewater disposal
-Cost/Benefit analysis of solutions
-Recommended solution for CCR and wastewater disposal
~based on stated assumptions
~showing calculations
Presentation of final report to Sargent and Lundy

Possible challenges, risks and plans to overcome them:
-Little possibility for proposing new solutions
~Use already proposed solutions
-Not enough information on a solution
~Use what information is available and make note of information lack
-Assumptions may be wrong
~List all assumptions and make as few as possible

Project Budget:

Posters.....*$100.00*
- Assuming the team is responsible for posters

Trips (Includes Food and Mileage).....*$300.00*
Website Admission.....*$100.00*
- Domain access fee: $10-20
- Access to reports that charge a fee

Total Expences.....*$500.00*

Designation of Roles:

Minute Taker: Sheena
Responsible for recording decisions made during meetings, including task assignments or changes under consideration.

Agenda Maker: Nicole
Responsible for creating an agenda for each team meeting, which provides structure to the meetings and offers a productive environment for the team.

Time Keeper: Joe
Responsible for keeping the group on track and focused during meetings, and providing the team with adequate information or thoughts to foster effective brainstorming.

iGroups Moderator: Susan
Responsible for organizing the team's iGroups account, keeping it updated regularly, and contacting iGroups administrators to make the best use of this website.

Appendix A: **Team information**

Nicole Firnbach
major: 5th year Architecture
minor: Structural Engineering
email: nfirnbac@iit.edu

Jennifer Agosto
major: 4th year Business
minor: Architecture
email: jen.a.agosto@gmail.com

Shana Burnett
major: 4th year Business Administration
email: shanaburnett248@gmail.com

Sheena Enriquez
major: 5th year Architecture
email: senrique@iit.edu

Robert Herman
major: Electrical Engineering
major: Mathematics
email: rherman1@iit.edu

Daniel Kipp
major: 4th year Mathematics
major: Computer Science
email: puzzler42@gmail.com

Chad Parker
major: Business Admininstration
email: cparker7@iit.edu

Graeme Port
major: 4th year Humanities
minor: Journalism
email: gport@iit.edu

Susan Rafalko
Major: 4th year Computer Engineering
Email: srafalko@iit.edu

Joseph Sanchez
Major: 4th year Business Administration
Email: jsanch1@iit.edu

Andrew Gardner
Major: 4th year Civil Engineering & Applied Mathematics double major
Email: dan.gardner@my.wheaton.edu

Team Information			
Team Member	**Strengths**	**Knowledge/Skills to develop**	**Expectations For the Project**
Nicole Firnbach	Creative, Motivated, organized, good listener, and moral values, develop drawings and models to presentation quality	Develop an underdstanding of the chemical engineering aspect of the problem, Speech skills	Develop an economic, efficient, and environmental use for bottom ash build up in electrical power plant facilities
Jennifer Agosto	Hard-working, Sociable, Dedicated, Willingness to learn, Respectful and strong moral values	Hope to develop all of my weaknesses, especially to learn more about sustainability in the problem presented	Develop a efficient way to get rid of and handle bottom ash to prevent further
Shana Burnett	Microsoft office skills, work well with others, willingness to learn from others, great presentation skills	I would like to gain a better understanding of the energy production process and the coal industry	I expect us to come up with ideas and implement them to utilize to use ash from coal power plants

Sheena Enriquez	Organized, willingness to learn from others, productive, graphic presentation skills	Better understanding of the energy production process and its byproducts, time management skills	Utilize group dynamic to come up with an innovative way to use ash from coal power plants
Robert Herman	background in electrical engineering and mathematics, thinking logically, hard worker	Develop better time management skills and hopefully learn more about what's involved with energy production and waste	To find a better solution for the issues with bottom ash. Possibly to find more practical uses for it
Daniel Kipp	Most branches of math, Computer programming (java, c, lisp, c++, c#, python), problem solving, public speaking, relation to former coal power plant employees, analytical thinking	Develop chem. engineering background knowledge	Analyze potential solutions for bottom ash and wastewater disposal and recommend a solution that is as close to optimal as possible.
Chad Parker	Public speaking, mediocre Microsoft Office skills, work experience with power plants and personal relationships with current employees, creativity	Help develop computer skills, Learn more about the industry	Develop a better understanding of the industry, acquire some engineering knowledge while applying a my business experience
Graeme Port	Writing, communicating, work well as part of a team, motivated, organized	Learn about the chemical engineering aspect of the problem	To develop an environmental, economic, and efficient solution for bottom ash build up in electrical power plant facilities
Susan Rafalko	Hard worker, organized, good listener, dedication, adept in Microsoft Office, overall work well in groups.	Develop a better understanding about the bottom ash disposal. Improve my skills in giving a presentation or a speech.	Develop a plan that shows the impacts of closing an ash pond while also looking for alternative uses for bottom ash.

Joseph Sanchez	Very hard worker, Strong writing and presentation skills, willingness to lead, full dedication to a project's success.	I would like to further strengthen my problem solving skills within a group. I would also like to gain a better understanding of project management within the energy industry.	Gain a strong understanding of the daily operations of power plants. Develop a report containing an outline of the most viable alternatives to bottom ash disposal, methods for systematically closing a plant's unlined ash pond, and a detailed analysis of the associated costs.
Andrew Gardner	Civil Engineering Major. Confident with math problems and engineering issues. Good at following directions, works very well under pressure. Good communicator, confident speaker, committed to conflict resolution.	Develop team skills in regard to research and problem solving.	Develop realistic solutions to issues involving the disposal of fly and bottom ash in coal power plants. Provide cost-effective alternatives to current pond storage method.

Appendix B: Gantt Chart

Today's Date: 1/27/2011 Thursday
(vertical red line)

Project Lead: Nicole Firnbach
Start Date: 1/11/2011 Tuesday

First Day of Week (Mon=2): 2

WBS	Tasks	Task Lead	Start	End	Duration (Days)	% Complete	Working Days	Days Complete	Days Remaining
1	IPRO Deliverables		1/11/11	4/29/11	109	1%	79	1	108
1.1	Project Plan		1/16/11	1/28/11	13	50%	10	6	7
1.2	Initial Meeting with Sargent & Lundy		1/20/11	1/20/11	1	100%	1	1	0
1.3	Midterm Review Presentation		2/16/11	3/01/11	14	0%	10	0	14
1.4	Ethics Deliverable		3/26/11	4/08/11	14	0%	10	0	14
1.5	Presentation to Sargent & Lundy		4/05/11	4/19/11	15	0%	11	0	15
1.6	IPRO Day Abstract, Brochure & Poster		4/10/11	4/24/11	15	0%	10	0	15
1.7	IPRO Day Presentation		4/14/11	4/27/11	14	0%	10	0	14
1.8	IPRO Final Day Presentation		4/28/11	4/28/11	1	0%	1	0	1
1.9	IPRO Final Project Report		4/09/11	4/29/11	21	0%	15	0	21
2	Regulations	Team 1	1/30/11	4/01/11	62	0%	45	0	62
2.1	Research Current & Pending		1/30/11	2/28/11	30	0%	21	0	30
2.1.1	CCR		2/01/11	3/02/11	30	0%	22	0	30
2.1.2	Wastewater		2/26/11	3/27/11	30	0%	20	0	30
3	Current Solutions	Team 2	1/30/11	4/01/11	62	0%	45	0	62
3.1	Identify & Research		1/30/11	2/28/11	30	0%	21	0	30
3.2	Analysis		2/22/11	4/01/11	39	0%	29	0	39
3.2.1	Benefits & Costs		3/01/11	3/31/11	31	0%	23	0	31
3.2.2	Ash Pond Use		3/08/11	4/01/11	25	0%	19	0	25
4	Alternative Solutions	Team 3	1/30/11	4/01/11	62	0%	45	0	62
4.1	Research		1/30/11	2/28/11	30	0%	21	0	30
4.2	Analysis		2/28/11	4/01/11	33	0%	25	0	33
4.2.1	Benefits & Costs		3/01/11	3/15/11	15	0%	11	0	15
4.2.2	Effectiveness		3/15/11	4/01/11	18	0%	14	0	18
5	Wastewater Solutions	Team 4	1/30/11	4/01/11	62	0%	45	0	62
5.1	Identify & Research		1/30/11	2/28/11	30	0%	21	0	30
5.2	Analysis		3/01/11	4/01/11	32	0%	24	0	32
5.2.1	Benefits & Costs		3/01/11	3/15/11	15	0%	11	0	15
5.2.2	Closure- Benefits & Costs		3/15/11	4/01/11	18	0%	14	0	18

Citations and Sources:

1. *SafeEnvironment*

http://saferenvironment.wordpress.com/2009/07/02/coal-ash-disposal-becoming-burning-issue-%E2%80%93-needs-to-be-resolved-in-eco-friendly-manner/

2. *Young*

http://www.nuvo.net/indianapolis/waste-in-our-water-the-coal-ash-problem/Content?oid=1333657

3. *Sargent & Lundy LLC*

http://www.sargentlundy.com/