Minutes of Meeting: **EPC Maintenance & Reliability Subcommittee**
Minutes written by: Jorge Blanco

Meeting Date: December 12, 2013

Meeting Location: Technip Stone & Webster Technology, Houston, TX
Hosted by Muhammad Imran

Members Attending:

In person
Dan Barnett – BDEnergy
Muhammad Imran - Technip
Jorge Blanco - Alstom
Keith Wade - Zeeco

On Phone conference & Live Meeting:
Mark Karrs – Becht Engineering
Dave Sankey – BASF
Dane DeRouen - BASF
Carl Matherne - BASF
Trobie Thompson – Sasol
Dave Oulton – Nova
Mike Pelton – LyondellBasell
Jimmy Cleavinger - ChevronPhillips

Meeting Started at 9:05 am

Antitrust statement: The Antitrust Statement was read to kick off the meeting.

Minutes of the October 31, 2013 meeting were read and approved

Next Meeting Schedule

January 23, 2013	Dow Chemical Hosted by John Holbrook
February 20, 2014	Zeeco Hosted by Keith Wade

Discussions:

Tutorial Session:

Mike Pelton edited the abstract for the Convection Section tutorial; it was approved by the members in attendance. Trobie will update the abstract on Confex.

Mark Karrs presented a rough draft of the presentation he is preparing for the Steam System Tutorial. Mark asked for help in collecting additional pictures, drawings, etc. for his presentation. He will send a list of what he is looking for to the S/C members who have offered their support.

Trobie Thompson's draft of the Radiant Section presentation was reviewed everyone agreed it covered the basis.

Trobie reported that the sequence in which the tutorials will be presented was re-arranged so that the Decoke Tutorial will follow the Radiant Coil Tutorial. See the table that follows at the end of these notes.

Paper Session:

Trobie reviewed key due dates for the conference, concentrating on the dates required for the authors to submit their papers and presentations. The following dates were agreed to:

The author sponsors are requested to contact their author(s) and request that the draft of their papers be submitted not later than **January 10**. The S/C needs them in hand by January 17 for review during the meeting of January 23. The draft of the presentations must be submitted no later than **February 14th.** They will be reviewed during the meeting of February 20.

Session Schedule:

Preliminary EPC Session Schedule: Trobie presented the preliminary session schedule showing that the M&R Sessions are scheduled for ***Tuesday, April 1*** (see yellow highlighted areas).

Monday **March 31**	**9:30 AM**	**Ethylene Plant Environmental Paper Session** **Chair: Walter Postula** **Co-Chair** ***Room: Quarterdeck***	**Keynote Presentations** **AIChE 8:00 AM** **EPC 1:30 PM**	**2:30 PM**	**Ethylene Plant Feedstock Paper Session** **Chair: Mark Brayden** **Co-Chair: Joe Lally** ***Room: Chart***
	9:30 AM	**Ethylene Plant Rotating Equipment Paper Session 1** **Chair: Michael Sicker** **Co-Chair: Dennis Shepherd** ***Room: Chart***		**2:30 PM**	**Ethylene Plant Rotating Equipment Paper Session 2** **Chair: Michael Sicker** **Co-Chair: Dennis Shepherd** ***Room: Quarterdeck***
Tuesday **April 1**	**8:00 AM**	**Ethylene Plant Maintenance & Reliability Furnace Tutorial** **Chair: Trobie Thompson** **Co-Chair: Muhammad Imran** ***Room: Chart***	**11:30 AM – 1:30 PM Networking Luncheon**	**2:00 PM**	**Ethylene Plant Maintenance & Reliability Paper Session** **Chair: Trobie Thompson** **Co-Chair: Muhammad Imran** ***Room: Quarterdeck***
	8:00 AM	**Ethylene Plant Process Control Paper Session** **Chair: James Hackney** **Co-Chair: Sasha Vragolic** ***Room: Quarterdeck***		**2:00 PM**	**Ethylene Plant Fundamentals Paper Session** **Chair: Jack Buehler** **Co-Chair: Brian Bahr** ***Room: Chart***
Wednesday **April 2**	**8:00 AM**	**Ethylene Plant Safety Paper Session** **Chair: Rick Swain** **Co-Chair: Anne Balinsky** ***Room: Chart***		**2:00 PM**	**Ethylene Plant Safety/Technology Low Temperature Embrittlement Tutorial** **Chair: Rick Swain** **Co-Chair: Bob Krinock** ***Room: Chart***
Thursday **April 3**	**8:00 AM**	**Ethylene Plant Operations Paper Session** **Chair: Carl Harry** **Co-Chair: Jeff Edwards** ***Room: Chart***			

The following Table updates the status of each section of our Sessions.

2014 EPC, New Orleans, LA

M&R Subcommittee Potential Session/Papers updated December 12, 2013

	Topic	Sponsor	Author	Status	Comments	
1	Ethylene Plant Furnace Tutorial			Trobie has written and uploaded the session title description.	Suumary of the session appears following this table	
1a	Radiant Coils	Trobie Thompson	Trobie Thompson	The abstract was reviewed and approved	Draft of the presentation was reviewed.	
1b	Decoking Method	Mark Karrs	Brian Sullivan	Brian's abstract was approved		
1c	Convection Section	Muhammad Imran	Mike Pelton	Mike Pelton's abstract was approved		
1d	Steam System	Trobie Thompson	Mark Karrs	The abstract was reviewed and approved	Draft of the presentation was reviewed.	
2	Maintenance & Relaibility Considerations for Improving Furnace Efficiency and Operability.			Session Title and Description has been finalized		
2a	Improve Furnace Avaialbility and Control Downtime	Paul	Shailendar Inamdar, Linde	The abstract was reviewed and approved	Authors approval required; as well as, address, email, and telephone	High
2b	Repair and Reclamation of Ethylene Plant Equipment	Jorge	Dave Oulton	The abstract was reviewed and approved	Final	High
2c	Ethylene Furnace Reliability Engineered Solutions for Cracking Furnaces	Trobie	Mack Pierson	Mack submitted a proposal for a paper via the AIChE website. Trobie contacted him to see if he was still interested which he was, so we have taken his topic to replace the one dropped on Coil Outlet temperature measurement.	The abstract was reviewed between the Oct and Dec meetings, Trobie uploaded to Confex.	
2c	Cracking Furnace Fuel Supply Challenges, Opportunitites and Improvements	Jorge	Dan Barnett	The abstract was edited and reformatted to paragraph form, reviewed approved	Author final approval required.	High
2e	Automatic Operation of Transfer Line and Decoke Valves - Flexibility and Process Safety	Jorge	Marcel Schade, Z&J	The abstract was reviwed and approved with minor corrections.	Authors must approve. Authors must submit complete name, company, address , email and phone number.	High
2f	Optimization best practices for steam traps, lost energy, and design for safety.	Dane	Carl Matherne, co-author	Abstract was received and reviewed. Carl took recommendations and will re-submit abstract.	Author final approval required, Need all contact information from Neil Davies.	High
no	Retrofit Magnetic Couplings for Maintenance and Energy Savings (ID Fan Application)	Mark Karrs	Jake Lee, MagnaDrive Corp.	Abstract was reviewed in the previous meeting. Mark working with authors to come with a viable approach for the paper.	An ethylene end users has not been found that could co-author or present. Alternatives such as application on an induced fan in and EDC plant is a possibility.	postponed for future conference
no	Maintenance and Reliability of Coil Outlet Temperatre Measurements on an Ethylene Fruance	Dane	Joint Brown from BASF/ Nicholas Graham, Brette Hgedorn, and Paul Laskoski from CPChem	The abstract was reviewed and with a few suggestions for the author will be returned to the author	Detailed contact information required from the authors. Must list authors by priority and nominate presenter	This paper was not approved for publication

Trobie shared with the group the description of the Sessions and the abstracts as they appear online.

The abstract on the Convection Section was revised by Mike Pelton during the meeting today and will be updated on Confex by Trobie.

Ethylene Plant Furnace Tutorial
Tuesday, April 1, 2014
8:00 AM-11:00 AM

Session Overview:

One of the most maintenance intensive areas of any ethylene plant is the cracking furnaces. Overall ethylene furnace operations can make or break the profitability of an ethylene plant with respect to fuel efficiency, run time between decokes, and coil life. This furnace tutorial will focus on key sections of an ethylene cracking furnace and provide important concepts/practices that can contribute to improved short-term and long-term furnace performance. Areas of consideration include the radiant and convection section components, steam-producing systems, and decoking concepts.

Ethylene Furnace Radiant Section Tutorial

Trobie H. Thompson, Ethylene Technology, Sasol North American Operations, Westlake, LA

Abstract Text: This ethylene furnace tutorial will focus on key guidelines associated with properly operating and maintaining various components of the radiant section. This will include concepts associated with even heat distribution within the firebox, burner basics, refractory concerns, air leakage minimization, and tube replacement criteria. The session's aim is to help people new to the ethylene industry develop a better understanding of furnace parameters that affect overall performance and annual costs.

Ethylene Cracking Heater Decoking Tutorial

Brian K Sullivan, Plant Performance Improvement, Lummus Petrochemicals Business Unit of CB&I, Bloomfield, NJ

Abstract Text: Coke is deposited in the radiant coils and in the transfer line exchangers (TLEs) as a consequence of the cracking reactions that occur in ethylene furnaces. The coke must be removed on a periodic basis to maintain acceptable heat transfer and pressure drop in the system (to maximize yield and prevent unplanned shutdown of the equipment). The process of gasifying the coke with steam and/or air to remove it from the radiant coils and TLEs is called "decoking."

The decoking procedure affects the performance of the furnace and the life of the radiant coil. Moreover, improper decoking can shorten the furnace run-length. This tutorial will introduce decoking concepts and examine important factors that contribute to the safe

and successful execution of a decoke with a short duration. The following objectives will be addressed in the tutorial:

- Define the basic principles of decoking
- Introduce decoking flow schemes and philosophies
- Describe decoking objectives
- Examine the general steps in the radiant coil and TLE decoking sequences
- Review key variables that should be closely monitored to ensure a safe and successful decoking
- Highlight tips for maximizing coke burn and safety, while minimizing time and damage to equipment
- Mention instrument considerations
- Benchmark key decoking performance parameters

Ethylene Furnace Convection Section Tutorial

Michael Pelton, Ethylene, LyondellBasell Chemical Company, Channelview, TX

Abstract Text: This ethylene furnace tutorial will focus on key guidelines associated with furnace convection section arrangement and maintenance, an overview of failure modes, repairs, fouling, etc.

Ethylene Furnace Steam System Tutorial

Mark Karrs, Becht Engineering Co., Inc., Liberty Corner, NJ

Abstract Text: Cracking Furnace operation generates high temperature level waste heat in both the flue gas stream and the process effluent stream. In order to operate economically, recovery of this waste heat is accomplished by high pressure steam generation, using both convective heat transfer surface and tubular heat exchangers of various types.

The design of the associated steam generation system is covered by ASME code requirements, but the integrity of the system will be determined by operational factors, including water quality, and temperature and flow excursions.

This tutorial offers suggestions regarding the periodic inspection and preventative maintenance of the heat transfer surface, steam drum, controls and auxiliary equipment of a typical cracking furnace steam system.

Maintenance & Reliability Considerations for Improving Furnace Efficiency and Operability

Tuesday, April 1, 2014
2:00 PM-5:00 PM

Session Overview:

This session considers maintenance and reliability topics to improve efficiency and operability of ethylene furnaces. Key topics from the 2008 Furnace Survey presented by the Maintenance and Reliability Subcommittee of the Ethylene Producers' Committee are discussed. These topics are complemented with topics on the design, maintenance and operation of transfer line and decoke valve systems; fuel supply systems; coil outlet temperature measurement equipment; steam traps, and topics on the repair and reclamation of key equipment.

Improve Furnace Availability and Control Downtime

Shailendra Inamdar, Linde Engineering North America Inc., Blue Bell, PA and Robert Stegemann, Engineering Division, Linde AG, 82049 Pullach, Germany

Abstract Text: In 2008, Ethylene Producer's Committee sponsored a worldwide furnace maintenance survey among ethylene producers. Out of the 67 respondents, over 70% have furnace limited operation. Thus, for majority of ethylene producers, an unscheduled outage either affects the plant capacity or requires adjustments to the decoking schedule of remaining furnaces.

This paper is a review of approaches to manage furnace availability by reducing likelihood and duration of an unscheduled downtime. Design improvements can reduce the possibility of the most frequently reported furnace failures. The downtime can be kept to a minimum through improved maintainability as well as through better preparedness. Risk based inspection and monitoring focused on the most common failures can also avert an unscheduled furnace outage.

Repair and Reclamation of Ethylene Plant Equipment

David Oulton, Nova Chemicals Corp, Sarnia, ON, Canada

Abstract Text: Maintenance is a significant component in the productivity and profitability of many industrial enterprises. Ethylene plants are no exception to this when it comes to planned and unplanned outages where decisions will often be based on resolving the three 'R's of equipment maintenance. That is, to repair, to replace or to remain in service. The ability to fix problems without significant disruption to the operation or start-up of a plant has given rise to the concept of repair technology as a discipline in its own right. This paper discusses the attributes of repair technology and provides some examples where fundamental processes were adapted to situations

involving critical pieces of equipment such as steam turbines, radiant coils, and TLEs in order to return them to service.

Ethylene Furnace Reliability Engineered Solutions for Cracking Furnaces

Malcolm A. Peirson, Business Development, Thorpe Specialty Services Corp., Houston, TX

Abstract Text: The reliable operation of cracking furnaces has a direct and critical impact on the profitability of ethylene plants. While it can be shown that no refractory lining system can be expected to be maintenance free, decisions made during the initial design of the furnace, the selection of the material, and the selection of the installer are critical. Often the goals of the initial furnace OEM or technology supplier are not in alignment with the operating owner, with the former most concerned with short term price and suitability for specifications and the latter focusing on long term reliability and value. We will discuss specific areas within the refractory lining system that stand as examples of the results of this disconnect, and steps that can be taken to mitigate the problem. We will present the straightforward principles of The Three Keys to Reliability that can be used to focus attention on achieving an optimum long-term refractory strategy.

Cracking Furnace Fuel Supply Challenges, Opportunities and Improvements

Daniel Barnett, BD Energy Systems, LLC, Houston, TX

Abstract Text: This paper outlines the challenges faced in the design, operation, and maintenance of ethylene plant fuel supply systems. There are a number of design practices that can influence the long-term cleanliness of the fuel supply which can have a detrimental impact on the firing uniformity of the burner. If uncorrected, a degradation of fuel firing uniformity has the potential to impact cracking furnace performance resulting in shortened run length and reduction in radiant coil service life.

Among the challenges and opportunities discussed are fuel supply system design configuration for start-up fuel and plant generated streams that contribute to fuel supply. Normal operating and maintenance practices including fuel mixing drum, firing / uniformity controls and burner tip cleaning / replacement are also discussed. Among the potential improvements in design, operation and maintenance practices discussed are fuel supply system design upgrades and implementation of a fuel flow uniformity checking procedure.

Automatic Operation of Transfer Line and Decoke Valves, Flexibility & Process Safety

Marcel Schade, Z&J Technologies GmbH, Humble, TX

Abstract Text: Decoking is an important function in the operation of a furnace. This paper describes the decoking system, focusing on the transfer line and decoke valves and their operation. Switching the plant's operation between decoking and process mode is a critical task, as at least two valves have to be moved simultaneously in a defined and synchronized way. This is usually performed by means of a mechanical

linkage, to prohibit backflow of hydrocarbons into the decoke system and prevent the furnace from being totally blocked in and over-pressured.

Automatic control systems are designed to regulate the valves' positions that mimic the actions of a mechanical linkage from process to decoke mode and vice versa. The same control philosophy is applied via pre-calculated stroke, as already known from the mechanical linkage.

The system permits the valves being controlled to be placed in more convenient locations, which is not possible with mechanical linkage design. The control system compensates for the varying furnace delivery flow rates and alters the valve movement profiles accordingly. It also adds flexibility to the operation of the valves while at the same time ensuring process safety.

Steam Trap Maintenance and Design for Energy Optimization

Carl Matherne, BASF Total Petrochemicals, Port Arthur, TX

Abstract Text: Steam availability is a key resource and constraint in an ethylene plant and where turbines are used for energy optimization. A steam leak and steam trap maintenance program is an important part of the steam management and availability as it translates into lost energy and system inefficiencies through failed-open and improper trap operation. Additionally, improperly designed or poorly operating systems can lead to several system integrity problems for plant personnel such as internal erosion from two phase flow, water hammer from improper header sizing, and liquid trapped in the line inducing water hammer, and water hammer by other root causes which can damage equipment. The BASF TOTAL Port Arthur site has recognized several issues and opportunities from analysis of the steam system for energy savings, improved reliability, and safer operation.

Through the recognition of potential energy losses the BASF TOTAL Port Arthur facility annually performs steam trap maintenance. These efforts have recognized a significant savings over the last 6 years. Additionally, these efforts have uncovered design issues that increase uptime, add to process efficiencies, and make the operational units safer to operate. These efforts represent a partnership between the site and steam trap subject matter experts to uncover opportunities and provide solutions to recover otherwise lost condensate and conserve energy. This experience offers a model for developing a steam trap maintenance program and design review.

Meeting Adjourned at 10:45 am