FINAL Minutes of December 10, 2020 Ethylene Producers' Environmental Sub-Committee Meeting
(December 10, 2020, Rev. 1)

Following are the minutes of the December 10, 2020 Ethylene Producers' Environmental Sub-Committee Meeting, held via teleconference with Walter Postula, Shell Global Solutions (US) Inc., as host.

Present: Rick Beleutz, LyondellBasell
Ahmad Hamad, Siemens
Brandon Lithgoe, NOVA Chemicals
Andrés Muñoz Gandarillas, Neste
Jennifer Port, ExxonMobil Chemicals
Walter Postula, Shell Global Solutions (US) Inc.
Gerardo Ruiz-Mercado, US EPA (AIChE Environmental Division)
Jason Trembly, Ohio University (AIChE Environmental Division)
Mark Ulrich, Linde Engineering Americas

Absent: Benjamin Burns, SASOL North America
David Elam, TRC Solutions
Jacob Hilbrich, ChevronPhillips
Dan Lutz, Ineos
Ted Heron, The Catalyst Group
Brad Hopper, BASF
Patti Long, Eastman
Arijit Pakrasi, Edge Engineering and Science
Mark Schmidt, Dow
Jeffrey Seay, University of Kentucky (AIChE Environmental Division)
Debalina Sengupta, Texas A&M (AIChE Environmental Division)
Dick Siegel, R&B Consulting Services (AIChE Environmental Division)
Edward Soliz Jr., SASOL North America
Gary Wojnowski, BASF
Russell Wozniak, Dow

The teleconference began at 9:02am with Walter Postula reading the Ethylene Producers' Committee (EPC) anti-trust statement:

> No activity of the committee shall involve the exchange, collection, or dissemination of information among competitors for the purpose of bringing about or attempting to bring about an understanding or agreement, written or oral, formal or informal, express or implied, among competitors, with regard to costs, prices, pricing methods, terms or conditions of sale, distribution, production quotas or other limitations on either the timing or volume of production or sales, or allocation of territories or customers.

The meeting agenda was published in advance and is included below:

1) Reading of Anti-Trust Statement [9:02 AM]
2) Review Submitted Abstracts (see attached) [9:04 AM]
    . So far there are only two! And technology is asking for us to transfer one to their session

i. Georgios Bellos (Dow) “Electrification and Thermal Issues for Achieving Zero Net Emissions”
ii. Gunther Kracker (Linde) and Jens Becker (LyondellBasell) “Electrification of Steam Cracking and Related Challenges”

3) Previously discussed
. Waste plastic liquids a steam cracker feed (Andrés Muñoz, Neste, planning paper) – submitted to Feedstock Contaminants
a. Use of fixed sensors for LDAR compliance (per Gary, mpact2wo is interested in presenting) – withdrawn
b. Rejected papers from 2020 session (see September 10th minutes for abstracts)
i. “Flare Instrumentation – Minimum Expectations,” Derek Stuck, Spectrum Environmental
ii. “The Proposed Ethylene Production NESHAP and Potential Complications with Reclaimed Water Use,” Bill Celenza and Sarah Shank, KBR
iii. “Proposed Ethylene MACT Flare Requirements,” Herman Holm, Spectrum Environmental
iv. “A Novel Approach of Converting Industrial Wastewater into Energy,” Chad Felch, Siemens (Ahmad Hamed sponsor?)

4) Other potential topics “in the works”? [9:35 AM]
5) Review of Action Items [9:50 AM]
6) Important Date Reminders
- September 11, 2020 – Call for abstracts opens
- November 20, 2020 – Call for abstracts closes
- December 13, 2020 – Papers accepted or rejected
- January 15, 2021 – Draft schedule available
- January 18, 2021 – Program goes live
- March ??, 2021 – Paper submission closes
- April 18-22, 2021 – Spring Meeting – Dallas, TX

7) Adjourn [10:00 AM]

Review Submitted Abstracts: As of the time of the teleconference there were two abstracts in the Environmental Session (see Agenda item 2). The Dow abstract has been requested by the Technology session and will be transferred.

Previously Discussed: The Waste plastic liquids as steam cracker feed (Neste) was submitted to the Feedstock Contaminants session. Gary, via e-mail, informed us that mpact2wo had withdrawn their submission. Jake had trouble connecting to the telecon, but informed Walter via e-mail that he had reached out to the authors of the rejected papers from 2020. Jake had not received any response.

Other Potential Topics: Andrés mentioned that the authors of the paper in the Feedstocks session are okay with moving to the Environmental session. He was also going to pursue Ghent moving their paper. Walter will follow-up on Shell papers that were planned as it was not obvious that all were submitted. Brandon planned to reach out to the Caron Capture Institute. André`s raised the question surrounding submission of “academic” papers. Subcommittee agreed that there is nothing wrong in principle with inclusion of academic paper. Subcommittee will review any submission to evaluate inclusion in the formal session. Ahmad will follow-up on the previous Siemens paper. Main Committee members (Rick, Jennifer, and Walter) will bring up need for abstracts in the Environmental session at the Main Committee meeting.

Review of Action Items: **Andrés Muñoz** will check with Ghent authors in Technology session about moving paper, Session Chair and Co-Chair will likely want to keep it in Technology. **Walter Postula** will follow-up on status of planned Shell papers. **Brandon Lithgoe** will reach out to Carbon Capture Institute. **Ahmad Hamad** will help with follow-up on 2020 Siemens paper. **Walter Postula** to schedule Environmental subcommittee telecon in February (corresponding to date of Main Committee meeting). **Rick, Jennifer, and Walter** to voice need for more abstracts in Environmental session to Main Committee.

Important Date Reminders: The dates for the 2021 Spring Meeting are listed in the “agenda” section. AIChE has pledged to communicate with EPC in early December regarding decision on 2021 being a virtual conference also.

Adjourn: The meeting/teleconference was closed at 9:45 am.

Status update as of January 7, 2021

The screenshot below shows what is in the Environmental session as of this morning. The abstracts are listed on the following pages.

Order Within Group	Accept All None	Reject All None	Transfer All None	Entry
1	☐	☐	☐	(id=619818) Quick Hit in Decarbonization – Start with the Flare . **R. Ogbongbemiga** and G. Cammack
2	☐	☐	☐	(id=619096) Electrification of Steam Cracking and Related Challenges . **G. Kracker** and **J. Becker**
3	☐	☐	☐	(id=618398) The End of the Steam Age? . **N. Rogers**
4	☐	☐	☐	(id=619124) Renewable Diesel As a Blend Component to Enhance Olefin Yields of Liquefied Waste Plastics Feedstocks . **A. E. Muñoz G.**, A. Ojala, R. Vapola, and J. Jamieson **NOTE: This paper is being submitted for this session, but was also in consideration for the Environmental session of EPC**

There may be 1 (might be 2) other potential available from the Operations subcommittee. They have yet to finalize their session. There was another offered from Maintenance & Reliability, authored by OnPoint and Motiva, but it seemed to be focused more on safety and reliability. It is attached below.

Abstract:
Effectively operating any ethylene petrochemical complex can be resource intensive, especially maintaining optimal configurations across the steam cracking furnaces while preserving equipment and tube life. It is essential for Operations to monitor and balance multiple variables in order to achieve desired throughput and reliably preserve asset longevity. This paper will document an ethylene cracker which was experiencing production constraints due to significant tube metal temperature variation caused by poor combustion. Additionally, poor combustion was pushing the fired heaters to operate against stack temperature limitations, CO excursions, and draft pressure imbalance within the fireboxes.
This paper will present OnPoint's Smart CombustionTM technology, EmberTM, that gathers real time plant data combined with John Zink derived combustion algorithms and data analytics to provide actionable insights to operators and engineers for improved combustion operations in process heating. EmberTM delivers real-time guidance for safe combustion operation over a range of changing process conditions within fired heaters and can detect deviations in certain process variables to alert operators when conditions are approaching potentially unsafe operating limits.
A case study will discuss how Motiva Enterprises is utilizing EmberTM to understand, in real-time, more detailed information about the combustion process leading to safer and more efficient and reliable operation. Increasing visibility of key parameters within the firebox, combined with key insights about the health and operation of each individual burner, have enabled operations to make simultaneous improvements of emissions, safety, throughput, reliability, and efficiency.

WSP Action Item update: Only two of the Shell papers were submitted, one in Feedstock and one in Operations. The one on Waste Plastics did not go forward. The need for more abstracts in the Environmental session was voiced in the Main Committee meeting. Several Directors mentioned that their subcommittees' had potential abstracts that could be transferred.

Raphael Ogbongbemiga (Siemens), ***Quick Hit in Decarbonization – Start with the Flare***

The pressure for sustainable, low carbon emissions operation is growing from the public, investors, and regulators. While decarbonization is a popular buzzword, practical programs for achievement are difficult to find. The logical starting point is to look at the flare and think about where the emissions originate. An effective flare management plan is a practical driver for reducing emissions. It can also improve the economics of a facility and enhance operational flexibility.
In this paper/presentation, we look at how chemical processing plants can improve flare management practices to maximize hydrocarbon recovery, minimize carbon emissions, and reduce operating costs associated with continuous flaring. Good flare management practices include (but are not limited to):

Flaring assessments to determine current routine, non-routine, and emergency flaring operations
Examination of flaring root causes and identification of reduction opportunities
The development of a flare minimization plan with clear and achievable flaring reduction targets.
Maintenance of the plan with proper change management practices to accommodate updates to the facility.
The identification and monitoring of flaring key performance indicators (KPIs) to promote the right actions by facility stakeholders.
The paper/presentation will outline common flaring challenges that are typically seen in these facilities and discuss available mitigations that have both economic and operational rational for adoption. We will also provide a framework for a sustainable drive towards a low-emission operation with systematic and periodic assessment of an operator's flaring operations to identify opportunities and implement changes that reduce demand on the facility's flaring systems.

Gunther Kracker (Linde) and Jens Becker (LyondellBasell),
Electrification of Steam Cracking and Related Challenges

With increasing societal and legislative pressure on our petrochemical industry, especially with regards to Green House Gas (GHG) emissions, there is a clear demand for viable technological solutions which effectively reduce GHG emissions from steam cracking. Far beyond merely storing and reutilizing CO2, we need to directly reduce CO2 emissions from steam cracking and correlated steam supply. A promising key technological option to do so is the electrification of equipment and utilization of renewable power from carbon neutral energy generation.
The paper and associated presentation provides a general overview on potential electrification measures specific to steam cracking technology and discusses the state of their developments. It deep-dives on selected electrification measures within the steam cracking process, such as the electrification of large turbo-compression machinery. Specific challenges and limits related to these concepts as well as fundamental pre-conditions for their technical application are assessed.

Some of the individual measures discussed are substantiated by practical examples and experiences from an existing European petrochemical complex, providing guidance for their technical feasibility in real world applications. This will include a review of reliability data based on long term experiences.

Finally, the paper elaborates on different combined overall plant electrification concepts over two distinct time horizons, i.e. mid-term solutions for partial electrification and long-term solutions for full electrification of steam cracking technology.

Nick Rogers (TechnipFMC), ***The End of the Steam Age?***

The low energy, low emission cracker of the future is likely to see a major shift in the way that energy is developed and utilized within the ethylene plant. This presentation will look at what to expect in future cracker designs where low carbon electrical power is imported to drive the main compressors within the cracker.
The drive to reduce CO2 intensity of crackers will lead to re-design of cracking furnace so that the same fired duty goes into the cracking process but less fuel gas is fired for the purposes of making steam. This reduces overall fuel gas consumption which can lead to new opportunities for excess fuel gas, whilst the reduced furnace VHP steam production enables large steam turbine drivers to be replaced with electric motors.

Impacts on all major utility systems on both gas and liquid cracker designs are illustrated as well as the implications for revamp projects.

Discussions on potential uses for any excess steam and fuel gas are shared.

Some high-level implications from switching turbines to motors will be presented based on recent vendor feedback.

Andres E. Muñoz G (Neste), ***Renewable Diesel As a Blend Component to Enhance Olefin Yields of Liquefied Waste Plastics Feedstocks***

Demand for polymers and chemicals is increasing, as is their importance to society with the continuous development of advanced materials providing innovative solutions for the most demanding and everyday problems alike. Unfortunately this growth will contribute to an estimated 70% annual waste generation increase by 2050[1]. Steam cracking lies at the heart of meeting this demand and remains closely coupled with consuming fossil resources. In previous works, the suitability of renewable hydrocarbons as a drop-in steam cracker feedstock and the substantial environmental benefits that can be seen in the subsequent products have been presented [2,3]. To complement its commitment to reducing fossil oil dependency and related climate emissions, while offering a viable and scalable solution to address the plastic waste issue, Neste plans to refine liquefied plastic waste into high-quality drop-in raw material for the petrochemical industry. As part of this work it was surprisingly found that, due to their unique composition, renewable hydrocarbons have a synergistic effect when used as the major component in blends with liquefied waste plastic. In this paper the steam cracking performance of hydrocarbon streams originating from liquefied waste plastics is examined and beneficial effects of dilution with renewable hydrocarbons, as opposed to a fossil naphtha, are discussed.