Fw: ReCommunity - summary of July 27 call--Non-Deliberative

Matt Straus to: Tab Tesnau 12/10/2012 11:38 AM

----- Forwarded by Matt Straus/DC/USEPA/US on 12/10/2012 11:38 AM -----

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Date: 07/27/2012 05:02 PM
Subject: Re: ReCommunity - summary of July 27 call

Thank you for the very quick follow up Eli. have a great weekend.

Peter, 07/27/2012 05:00:40 PM

From: <Eli.Hopson@lw.com>
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Date: 07/27/2012 05:00 PM
Subject: ReCommunity - summary of July 27 call

Peter,

Thank you again for taking the time to talk with us today, and on many prior occasions. We wanted to provide you with a short summary of our discussion today, as you requested. You specifically asked us for our understanding of the chemical processes behind dioxin production, and how ReCommunity expects ReEngineered Feedstock to perform compared to current 100% coal fired boilers.

As you know, the dioxin formation process involves complicated mechanisms in fuel combustion. In the case of coal fired boilers, dioxins are predominately produced by the so-called *de novo* reaction, which requires the following four basic necessary conditions, namely:

- Cl_2 as a chlorine donor,
- polyphenols as chlorine receptors,
- optimal temperature, and
- catalysts (in fly ash).

Because ReEngineered Feedstock will be co-fired with coal and contains sorbents that remove chlorine from the flue gas, it is reasonable to expect reductions in dioxin formation compared to 100% coal firings for the reasons we discussed, which are summarized below.

Chlorine donor - molecular chlorine availability for dioxin formation is reduced:

1. **Sorbents in ReEngineered Feedstock drive Cl_2 removal**

The formation of dioxins and furans (PCDD/F) requires a chlorine donor –elemental chlorine (Cl_2). It has been well documented from lab tests and field experience that sulfur inhibits formation of Cl_2. Sulfur inhibition can be explained by the chemical reaction

$$Cl_2 + SO_2 + H_2O = 2HCl + SO_3$$

During ReEngineered Feedstock co-firing, SO_3 will be absorbed more easily by the sorbent component of ReEngineered Feedstock, which also neutralizes HCl. As a result, the above reaction shifts towards the right (improving consumption of Cl_2). Since Cl_2 concentration in the flue gas is reduced, its availability to PCDD/F formation is reduced.

2. **Cl2 is removed prior to temperatures that allow dioxin formation**

Importantly, ReEngineered Feedstock delivers sorbent to be chemically available both in the boiler and immediately after the flue gas exits the boiler. This compares favorably to traditional after-treatment technologies that remove chlorine after the flue gas temperature has dropped into the dioxin formation ideal range (300-600° F). ReEngineered Feedstock's sorbent is available earlier in the combustion process, when temperatures far exceed that of the ideal dioxin formation, at around 1,800-2,200° F. As a result, there is likely to be far less chlorine actually available for dioxin formation at the later stage in the combustion process where PCDD/F are most likely to be formed. This should lead to dioxin formation below that of a similar 100% coal fired boiler.

3. **Molar Cl/S ratios of ReEngineered Feedstock in typical 20-30% cofiring indicate successful inhibition of dioxin formation**

Extensive research has demonstrated that when the S/Cl ratio is greater than about 3, the inhibition of PCDD/F formation by sulfur is consistent. In a typical cofiring scenario, ReCommunity estimates that the total fuel mixture's S/Cl molar ratio would be about 24. This ratio is significantly above the commonly required 3 to suggest significant inhibition of sulfur on PCDD/F formation. Note that with decrease in Cl in ReEngineered Feedstock due to the thermal treatment and PVC removal, this S/Cl goes even higher.

While we believe that those factors alone are indicative of reductions in dioxin formation, we

would also note that ReEngineered Feedstock is also likely to reduce chlorine receptor availability, and catalyst concentrations in fly ash. Polyphenols are produced due to incomplete combustion. ReEngineered Feedstock is highly volatile and manufactured to proper sizes to achieve complete combustion. In fact, due to its high volatility, ReEngineered Feedstock promotes coal combustion and thus the possibility of the occurrence of a de novo synthesis is reduced. ReEngineered Feedstock also contains lower levels of the most effective catalysts for the *de novo* reaction, copper and iron. Compared to the coal Cu (1-240 ppm) and Fe (77-140,000 ppm) contents, ReEngineered Feedstock contains considerably less Cu (0-50 ppm) and Fe (0-100 ppm), and thus should contribute fewer catalysts in the fly ash to promote dioxin formation.

As a result, ReEngineered Feedstock is likely to reduce dioxin formation compared to facilities firing 100% coal.

Thanks,
-Eli

Eli W.L. Hopson

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