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“Clarification on Anellotech”

I have performed a very quick review of the letter from Dr. Bahary that was published in the Page 9 Opinion section of the Our Town newspaper on May 20, 2015. Here are some initial thoughts that came to mind:

1. The “low end” of the range of benzene emissions discussed by Dr. Bahary comes from Anellotech’s various reports (i.e., it is consistent with 0.00166 lb/hr benzene emission factor). The author should note that the selected factor is based on 98% control of emissions from Anellotech’s proposed process. Documentation for the catalytic oxidizer reviewed by Trinity indicates that the destruction of benzene and related compounds (i.e., the control efficiency) can be as high as 99.5%. This control efficiency would yield 0.000415 lb/hr of Benzene (or an additional 75% reduction in Benzene emissions).
2. Much of the analysis performed by Dr. Bahary utilizes “EPA documents” that allegedly cite that the “range of emissions for a benzene producing plant like Anellotech’s is about 0.1% to 1.0% of the total amount of BTX produced”. Considering that the Anellotech plant is a small scale (confined) R&D operation (starting with a rather benign raw material), it is unlikely that the production plants discussed within any cited EPA document are “like” Anellotech. Without having the specific reference (and details on the derivation of the cited emission factor), it is difficult to opine on the similarities between Anellotech and the cited production plants. However, the chemical plants (likely cited in the EPA documents) usually involve various point and fugitive sources of emissions including reactors, transfer operations, extensive heating, miles of piping with valves and other connections, storage tanks and numerous other sources (i.e., there are much more opportunities for emissions). In addition, one portion of one of the cited references (for separation processes) states that “0.1% unrecovered benzene may be a rough general estimate of the benzene emissions from separation processes”. It is important to make sure that such vague approximations are not taken out of context (and/or misused). The 0.1% factor we mention above is for Catalytic Reforming/Separation Processes, and we have not personally vetted the differences between such facilities and Anellotech. Regardless, it is likely not recommended to use emission factors (of 0.1% to 1.0% of total production) from another source type to

estimate emissions for Anellotech. Considering that these values serve as the basis for much of Dr. Bahary's letter/findings, the validity of the remainder of the document may be questioned.

3. Trinity performs hundreds of dispersion modeling projects on an annual basis. Air dispersion modeling and analysis involves extensive knowledge of atmospheric sciences. It is highly inaccurate to treat the atmosphere as a static box (of air). Contemplating the addition of a predetermined mass of benzene to a static volume of air (1 mile square by six feet high) is unscientific at best. To estimate that the atmosphere behaves as a constrained 6ft x 5280ft x 5280 ft cube is unreasonable because the atmosphere doesn't stop at 6 feet. At a minimum, the surface layer (lowest part of the boundary layer that directly interacts with the surface) is assumed to be approximately 100m (during cold months and minimal convection like during the night time). This layer is where mixing takes place, and will increase when the sun rises until the sun sets. From a stack buoyancy perspective, when there is a volume of air being discharged from a stack (especially if heated), there is a buoyancy effect. Buoyancy can occur when there's a temperature and/or pressure difference. "Plume rise" is the adjusted height of the plume centerline as it moves downstream. This depends on the temperature of the plume, ambient conditions, and initial release of plume (jet or buoyant). Plume rise is present in hot, buoyant plumes. The plume will generally rise and move in the direction of mean wind. This is very general and depends on how fast and hot the effluent is released. Furthermore, there is no scientific basis for comparing the ambient concentrations derived by Dr. Bahary (in a box of air) to risk-based ambient air thresholds from NYSDEC. This is further emphasized by Dr. Bahary wrongly comparing a daily emission rate (based calculation) to the annual guideline concentration (i.e., an apples to oranges comparison).
4. At least one reference cited by Dr. Bahary is from Wikipedia. Unfortunately, Wikipedia is not a valid reference within the scientific community.
5. Dr. Bahary's concern regarding comparisons to lawn mower benzene emissions were addressed in a May 14, 2015 letter from Anellotech. It would appear that Dr. Bahary either didn't see the follow-up letter from Anellotech or he ignored their findings. We have not fully vetted the Anellotech "lawn mower" calculations, but they appear accurate upon initial review.
6. We do take offense to the suggestion that Trinity's review was "not truly independent". In fact, Anellotech is not listed as a client within Trinity's contact database. All of our related work has been through the town and we have never been contracted to Anellotech (nor have they been consulted regarding our final work products).
7. We are unsure of the source of such information, but there is likely no source that identifies benzene as "the most carcinogenic chemical known to the EPA". A review of Unit Risk Factors (to determine carcinogenic risk) would indicate that there are many compounds that could yield a higher cancer risk (based on equivalent emission rates).
8. We encourage you to share some of the comments in the below message that I sent you on March 12. In addition, the EPA estimates 0.0099 lb of Benzene emissions (controlled) per 1000 gallons of gasoline dispensed at a gas station. If you assume that a station can fill a conservatively low number of vehicles (e.g., 25) in an hour and further assume 15 gallons per tank, the associated benzene emissions would be 0.0037

lb/hr. This hourly emission rate exceeds the 0.00166 lb/hr benzene emission rate estimated by Anellotech (with a conservatively low 98% control). (See page 48 of http://www.epa.gov/ttnchie1/le/benzene_pt2.pdf). As mentioned in the below message, it is quite likely that typical gas station emissions will exceed the emission rates that Anellotech has estimated for their operations.

Any numbers or data can be manipulated to the advantage of either side of this discussion. However, it is necessary to consider scientific principles, like comparisons, and sound judgement when evaluating such situations. It appears that the foundation or purpose of the May 20, 2015 published letter is to provide an element of alarm, shock, or concern (without the necessary research and science).

If desired, Trinity can further review the derivation of the original emission estimates provided by Anellotech (to both the DEC and the town). Our Chemical Engineers should have access to similar programs as those used by Anellotech for their estimates. At this point, such an action item is really the only remaining item to explore. As demonstrated by Anellotech, confirmed by DEC, and reviewed by Trinity, the documented emission rates do not represent a concern from a health-based perspective.