2019 INTERNATIONAL EMISSIONS INVENTORY CONFERENCE

Collaborative Partnerships to Advance Science and Policy

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collaborate verb

col·lab·o·rate | \ kə-ˈla-bə-ˌrāt \

collaborated; **collaborating**

Definition of *collaborate*

intransitive verb

1 : to work jointly with others or together especially in an intellectual endeavor
// An international team of scientists collaborated on the study.

2 : to cooperate with or willingly assist an enemy of one's country and especially an occupying force
// suspected of collaborating with the enemy

3 : to cooperate with an agency or instrumentality with which one is not immediately connected
// The two schools collaborate on library services.

WHY IS COLLABORATION SO IMPORTANT IN THE EMISSIONS INVENTORY FIELD?

- Emission inventories are highly complex datasets made up of thousands of unique data elements
- None are easily measured outright
- Expertise in specific sectors are usually limited to those actively working in that sector
- Almost impossible for one individual or a team of individuals to know everything about any specific sector, let alone all of the sectors that comprise an inventory
- The geographic scope of inventories has expanded with a focus from local to global
- Also, the world is changing… regulations, policy, technology and pollutants are all evolving to require a greater understanding and a finer detailed knowledge of specifics around all emissions sectors

REGULATIONS, POLICY & SCIENCE EVOLUTION

- Success breeds challenges: As we have reduced emissions from major sectors over the many years of the Clean Air Act implementation, we are challenged to have better emissions estimates from sectors not previously focused on
- As new processes evolve and sectors emerge as more primary, we are challenged with better estimating emissions from those sectors in order to develop accurate and appropriate regulations and policies
- As we gain new understanding of the science around pollutant formation (e.g., secondary organic aerosols, volatile chemical products) that provides feedback that requires a better understanding of emissions
- And the cycle continues… the more we better understand these new processes and develop better emission estimates, we also continue to evaluate the impacts of air quality on public health and the environment. As air quality standards change, so does the need to better understand the emissions
- Emission inventories are the foundation of all air quality management programs… it all starts here

TECHNOLOGY

- Improvements in measurement technology are rapidly changing our ability to estimate emissions
- Source measurement tools such as FTIR and other open path measurements are improving our capabilities to more accurately measure multiple compounds
- Satellite capabilities are improving significantly and analytical methods to process those data are improving
- Citizen science and the emerging air quality sensors field will be a game changer for having more local-scale information that can be used in source-receptor analyses

TECHNOLOGY

- Improved computational capabilities allow for faster and more automated processing of emissions data that lead to more accurate and improved inventories
- These technologies will allow for better ability to process and share voluminous datasets (aka "Big Data")
- Algorithms employing artificial intelligence (AI) and machine learning (ML) can replace the need for some detailed measurements but with some caution as we will always need the ability to ground-truth these new approaches
- That said… those verifications will lead to better algorithms that will only enhance our ability to better estimate emissions from sources that are challenging and expensive to measure outright
- So there is a cycle here just like in the regulations and science evolution

EMERGING POLLUTANTS

- As new pollutants emerge there is a need to better understand and estimate emissions around those pollutants to protect public health and the environment
- While we still need to improve our measurement capabilities for the pollutants we know, we also are acutely aware of how many pollutants are out there that we don't know a lot about and we will face significant challenges in the future around estimating emissions for those pollutants

HOW DOES IT ALL HAPPEN?

- Working together is the only way we meet these challenges
- It starts here with all of you and with what you do every day and what you will do and hear over these next several days
- Collaboration is not just saying we will work together, but it is a willingness to listen to new ideas, to share knowledge openly and to recognize new opportunities to improve upon what we do
- Be open to new ideas and new ways of thinking… but also do not be afraid to challenge new ideas and encourage analytical dialogue around those ideas to make sure new technologies and new approaches provide outcomes that are superior and improve upon the quality of our data

WHY IS COLLABORATION SO IMPORTANT IN THE EMISSIONS INVENTORY FIELD?

- What you do every day matters!
- Emissions inventories are the foundation of all air quality management programs
- It is how we measure progress along with ambient air concentrations, but inventories are the basis upon which all of our analytical assessment tools (modeling, control effectiveness, projections and trends) are built
- Through the implementation of the Clean Air Act Amendments we have made incredible success in reducing emissions and improving air quality. We did not do that as individuals but as engineers and scientists working collaboratively over the past 30 years
- We have new challenges going forward around emerging pollutants, new policies and regulations and rapidly advancing technology. If we are to be successful in meeting these challenges, we will not do them individually, but must do them together in a collaborative fashion

"Science is a field which grows continuously with ever expanding frontiers. Further, it is truly international in scope. … Science is a collaborative effort. The combined results of several people working together is often much more effective than could be that of an individual scientist working alone."

— John Bardeen

From his second Nobel Prize Banquet speech (10 Dec 1972). In Wilhelm Odelberg (ed.), *Les Prix Nobel en 1972* (1973).