Intersection of Life-Cycle Analysis Data and Emissions Inventories: A Case Study of Mobile Source Fuel Production

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Overview

- Context
- Mobile Source Fuel Example
- Today's session

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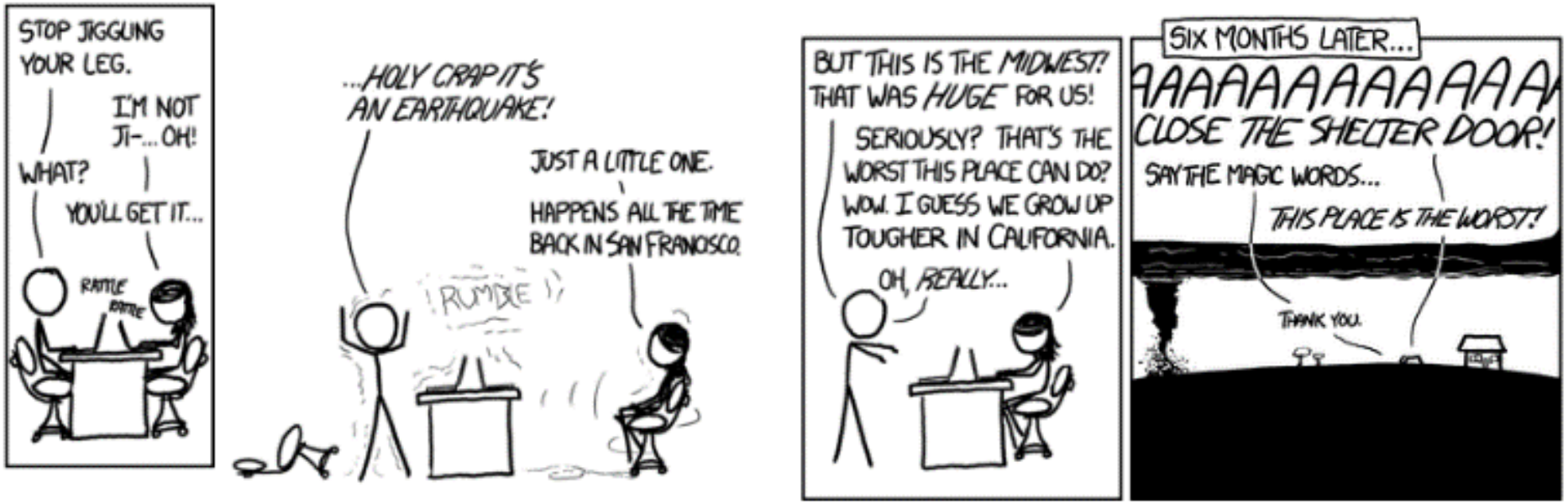
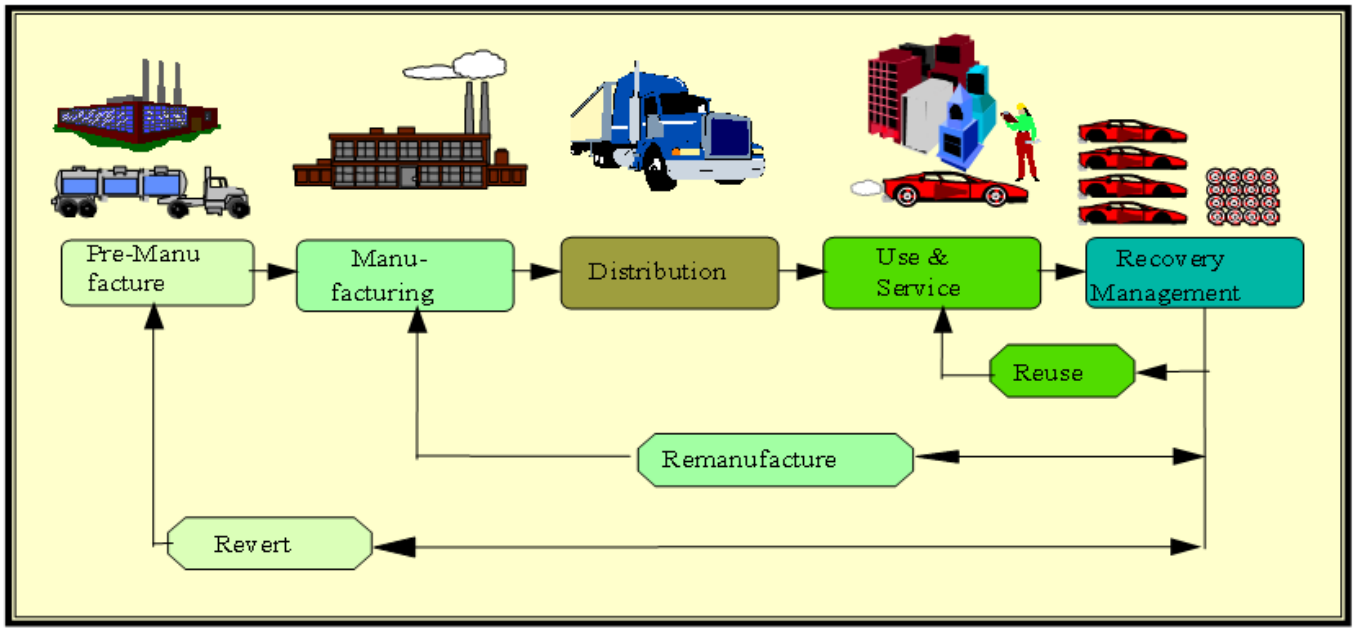
Context: A Difference of Perspective



https://xkcd.com/

Two different perspectives often view the same event (or data) very differently.

Context: Life Cycle Assessment and Emissions Inventories Perspectives



http://grimstad.uia.no/puls/climatechange/graphics/lca_stages.png

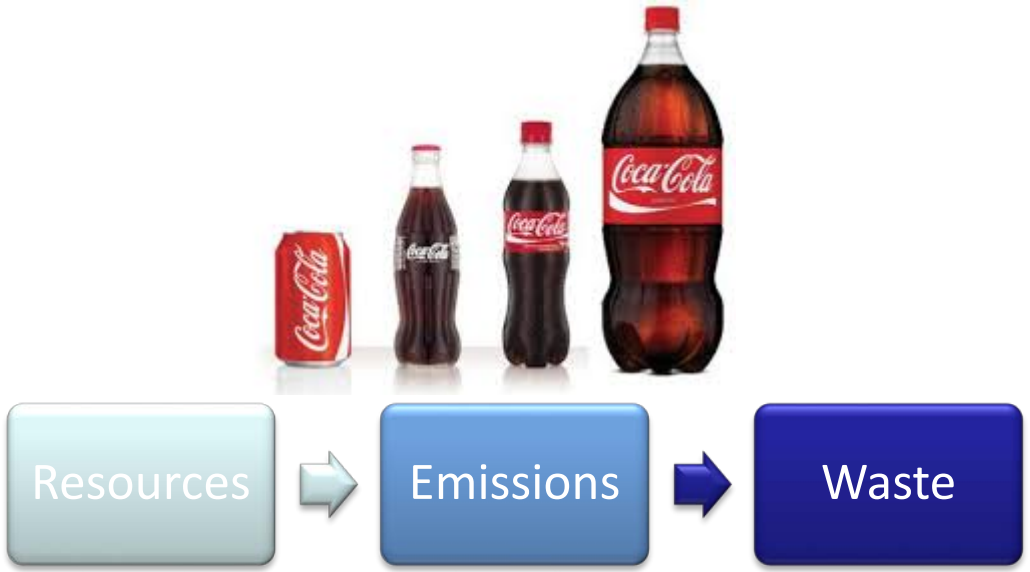
A life cycle perspective sees a series of sub-processes within a defined system boundary.

Context: Life Cycle Assessment and Emissions Inventories Perspectives

An emissions inventory perspective sees a series of individual sources that may relate to any number of processes. Both perspectives are “right”.

Context: Life Cycle Assessment (LCA)

- Life cycle perspectives
  - evolved from interest in comparing different options across the business value chain.
  - Today, ISO standards for life cycle assessment (LCA) methods
- Focus
  - processes involved with a particular product without addressing where the processes take place
  - Looking across life cycle stages & media --> Generally focus on only a few pollutants



LCA typically focuses on resources, emissions, and wastes associated with each stage of a product life cycle in order to compare different product choices.

Context: Emissions Inventories (EI)

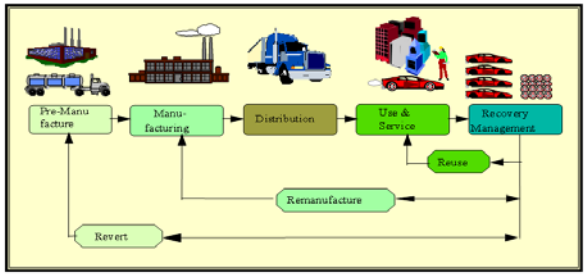
- Emissions Inventories (EI)
  - account for emissions from particular sources
  - Agnostic to larger process of a product life cycle

Focus:

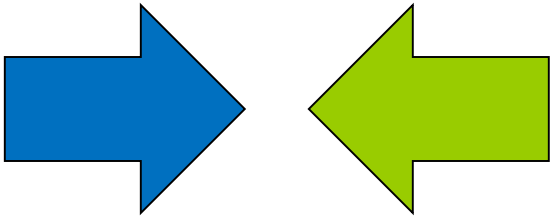
- characterize magnitude of emissions from individual sources
- air quality modeling or mitigation efforts
- number of pollutants included depends on EI

Emissions Inventories (EI) account for emissions from particular sources, regardless of how the source contributes to emissions in a larger process of a product life cycle, in order to inform air quality modeling or mitigation of emissions from specific sources.

Context: Intersection of LCA and EI



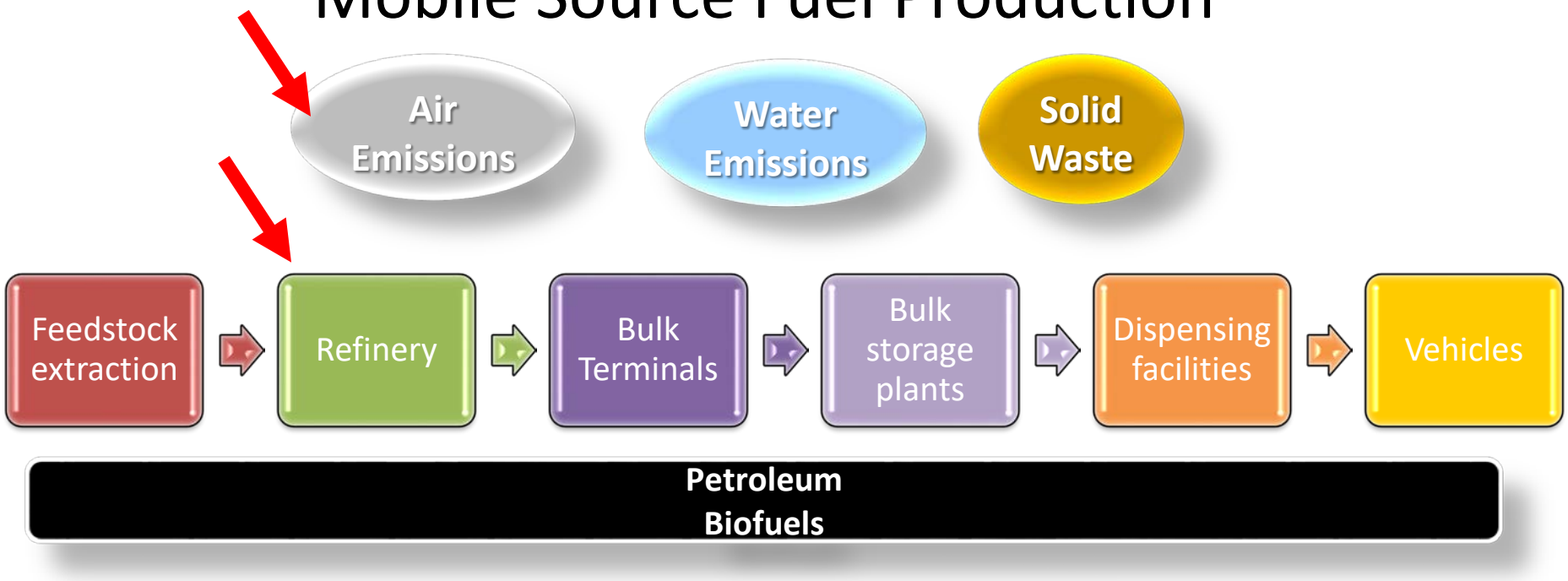
Example product life cycle



Hypothetical production facilities involved in one step of product life cycle depicted on left

Increasingly useful to look from both LCA and EI perspectives by utilizing data on multiple pollutants emitted in particular locations during a given process.

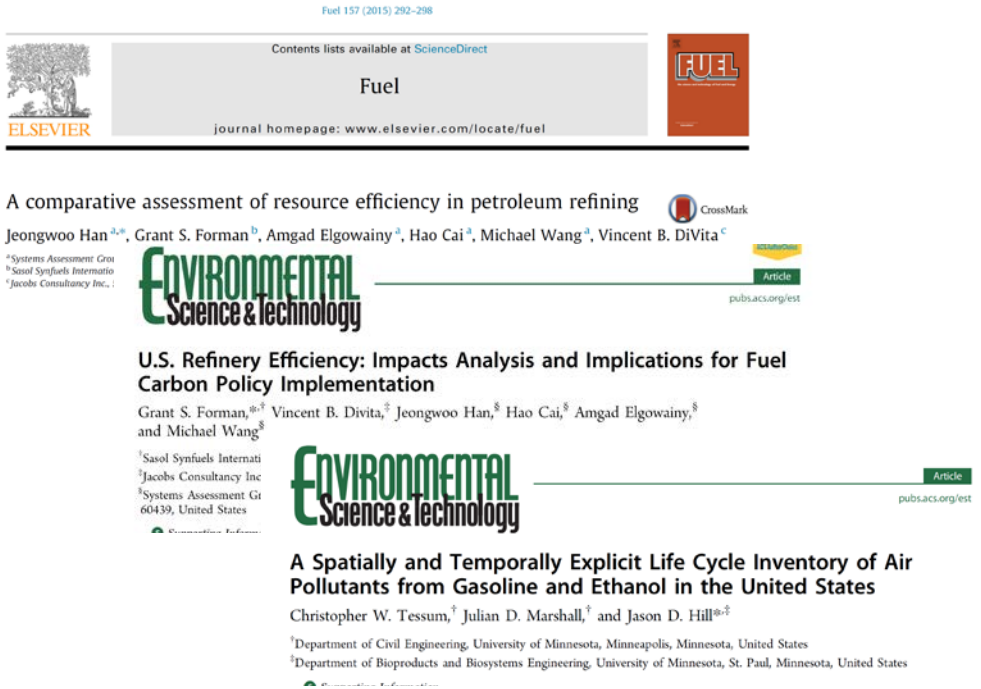
Case Study Example: Mobile Source Fuel Production



As an example, we'll look at work in progress to combine LCA & EI perspectives by integrating process-based and inventory data sources; focus today is on petroleum refinery air emissions.

Air Emissions from Mobile Source Fuel Production at Refineries: Available Data

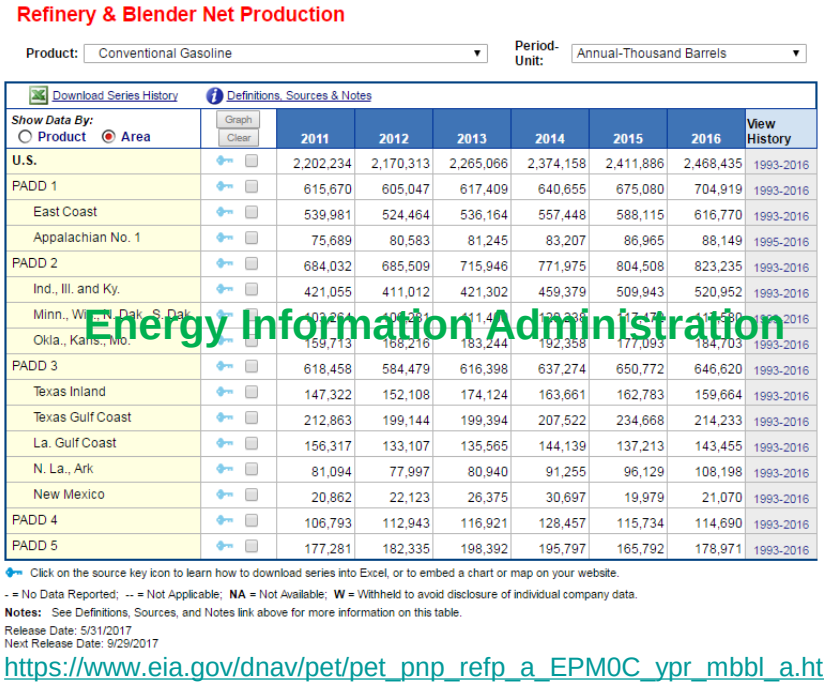
- Previous work
  - Petroleum refinery emission factors (EFs)
  - Spatial, temporal, & chemical-speciation of EFs
  - National average or very detailed individual facility
- Case Study
  - Utilize National Emissions Inventory (NEI) and GHG Reporting Program (GHG RP) + fuel production data → refinery facility specific EFs from national datasets



Lots of important work on this topic, some of which we'll hear about in today's session. Case study work takes slightly different approach for several reasons.

Air Emissions from Mobile Source Fuel Production at Refineries: Case Study Approach

- EI data:
  - petroleum refinery emissions (NEI & GHG RP)
- Life cycle data
  - Quantity of product produced at each refinery
  - Details on product produced at each refinery (e.g., crude oil API gravity, gasoline/diesel split)



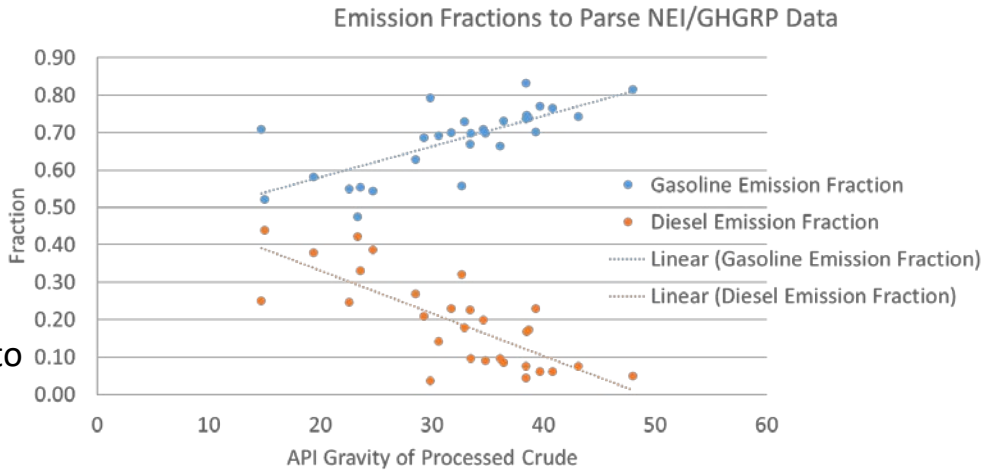
https://www.eia.gov/dnav/pet/pet_pnp_refp_a_EPM0C_ypr_mbbl_a.htm

Case study combines EI dataset with data about one of the products moving through an emissions source at a specific life cycle stage (i.e., takes a life cycle perspective on EI data).

Air Emissions from Mobile Source Fuel Production at Refineries: Case Study Approach

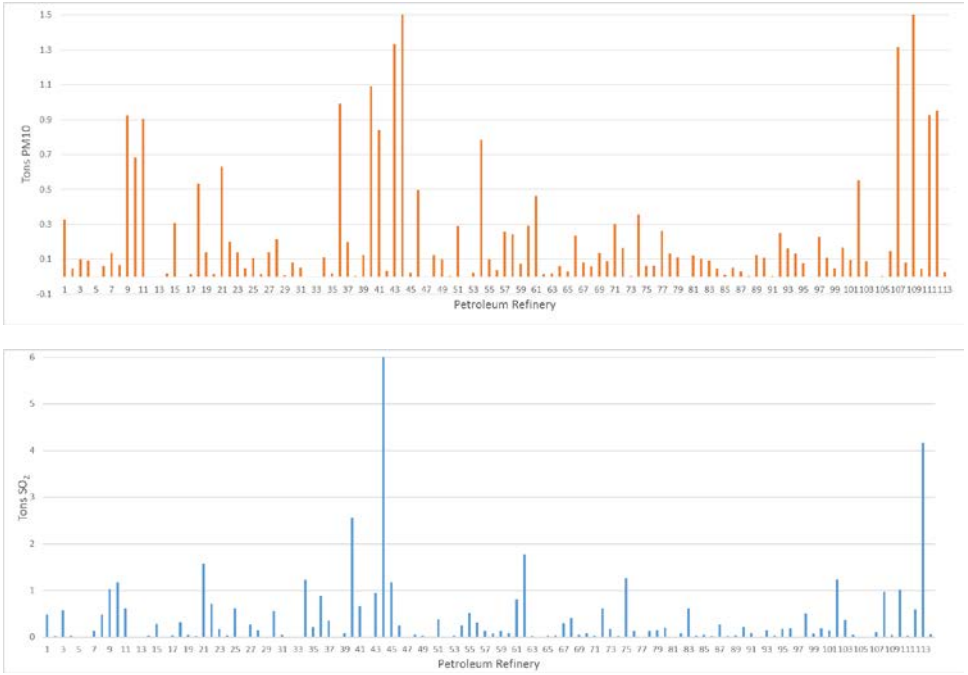
- Dilemma: How to allocate EI data from production of all products to two products (gasoline & diesel)?

- Petroleum Refinery Life Cycle Inventory Model (PRELIM) for predicting refinery performance & emissions (GHGs only)
  - apportions emissions to gasoline or diesel as a function of the crude API gravity
  - we developed reduced form model from PRELIM to allocate GHGRP and NEI emissions for individual refineries
  - used base year production data (Gas/Diesel split and crude use) from EIA to calibrate the model



To allocate emissions from one source type to specific products produced at the source type, we are using an existing model that apportions emissions based on information about feedstock material for the products being produced (API gravity of crude used to produce gasoline and diesel).

Air Emissions from Mobile Source Fuel Production at Refineries: Case Study Results (Preliminary)



Preliminary case study results allow comparisons of emissions inventories specific to mobile source fuel production across different facilities and pollutant types.

Intersection of LCA & EI: Today's Discussion

- Objective: Share and discuss different approaches to combining life cycle and emissions inventories perspectives.
- Presenters
  - Dan Loughlin, US EPA
  - Oge Kaplan, US EPA
  - Chris Tessum, U. Washington (Co-Chair)
  - David Meyer, US EPA
  - Pingping Sun, Argonne National Labs
  - Margaret Zawacki, US EPA
  - Giovanni Di Lullo, U. Alberta

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    - Molly Zawacki
    - Aman Verma, ORISE (former)
    - Alison Eyth
    - Jeff Vukovich
  - US DOT, Volpe Center
    - Alexis Zubrow
- Today's Session
  - Co-chair: Chris Tessum
    - Organizational support: Rich Cook
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