Characterization and Breadth of Rail Yard Specific Inventories

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Agenda

- Background
- Emission Sources at Rail Yards
- Types of Rail Yards
- Emission Inventory Methods
- Summary and Comparison of Results
- Conclusions

Rail Yard Inventories Prepared

- A total of 9 rail yard emission inventories are evaluated in this paper:
  - 8 California facilities
  - 1 Michigan facility
- All inventories were prepared to support state air quality agency programs.

Rail Yard Inventories – History

- California Air Resources Board Health Risk Assessments
  - 2004 – Roseville Rail Yard Study
  - Since 2004, 17 additional Rail Yard Health Risk Assessments (HRAs) have been prepared for California rail yards.
  - Sierra Research completed the emission inventory analysis for 8 of these HRAs.
- Lake Michigan Air Directors Consortium Midwest Rail Study
  - 2009 – Issued contracts for evaluation of emissions from rail yards located near PM2.5 monitors
  - Sierra Research provided inventory analysis for the first yard (located outside of Detroit) in this study.

Emission Sources at Rail Yards

- Locomotives
  - Line haul and switch locomotives
  - Locomotive APUs
  - Service and maintenance activities
- Rail maintenance equipment
- Heavy equipment
- Reefer cars and TRUs
- Delivery vehicles

Emission Sources at Rail Yards (cont'd)

- Cargo handling equipment
- Drayage trucks
- Portable equipment
- Space and water heaters
- Storage tanks
- Sand towers
- Solvent use (paints, degreasers, etc.)
- Wastewater treatment plants

Types of Rail Yards

- Classification Yards
  - Separate railcars from inbound trains and reassemble railcars into outbound trains

Types of Rail Yards (cont'd)

- Service and Maintenance Yards
  - Perform basic locomotive service operations (fueling, sanding, oiling, etc.)
  - Scheduled and unscheduled locomotive maintenance
  - Locomotive load testing
- May be a stand-alone facility or part of other multipurpose yards

Types of Rail Yards (cont'd)

- Intermodal Yards
  - Operations where cargo is transferred from one mode of transportation to another
    - Train-to-truck or truck-to-train
  - Container and chassis storage
  - Cargo handling equipment maintenance facilities

Types of Rail Yards (cont'd)

- Specialty Yards
  - Yards that are designed to handle a specific type of cargo
  - Operations are unique to the type of cargo handled
  - Bulk cargo (chemicals, grain, coal, etc.) or automobiles

Characteristics of Rail Yards Evaluated

Facility ID	Classification	Service/ Maintenance	Intermodal	Specialty
Facility A	X	X		
Facility B				X
Facility C	X	X	X	
Facility D		X	X	
Facility E		X	X	
Facility F	X		X	
Facility G			X	
Facility H	X	X		
Facility I	X			

Typical Emissions Sources by Yard Type

- Emission sources vary by yard and yard type.
- Locomotives (line haul and switch) and heavy equipment are generally present at all locations.
- Cargo handling equipment, TRUs, and drayage trucks are generally found at Intermodal facilities.
- Presence of stationary sources (generators, wastewater treatment plants, heaters, etc.) varies by location.

Emission Inventory Methods

Emission Inventory Methods

- Basic building blocks for an inventory are population data, activity data, and emission factors.
- Minimal guidance exists for preparation of emission inventories for locomotive activities or rail yards.
- Due to variability in operations, the best procedure is to build the inventory from the ground up using site-specific data to the extent possible.

Inventory Methods – Locomotives

- Emissions determined using combination of emission factors and activity data for various operations, such as:
  - Line haul locomotive activity data
  - Switch locomotive schedules
  - Time required for maintenance and service events
  - Time-by-throttle-notch-position data by activity

- Emission factors, by model and Tier, compiled from multiple resources including EPA data collections.

Inventory Methods – Non-Road Sources

- Equipment specifications and activity data generally collected onsite through physical equipment inventories and records review.
- Emission factors from:
  - CARB OFFROAD Model
  - CARB CHE Model
  - USEPA NONROAD Model

Inventory Methods – On-Road Sources

- Emissions calculated using a variety of data including:
  - Drayage truck gate counts
  - Container lift counts
  - Distance traveled within facility
  - Estimates of idling time

- Emission factors from either CARB EMFAC model or USEPA MOBILE6.2 model

Inventory Methods – Stationary Sources

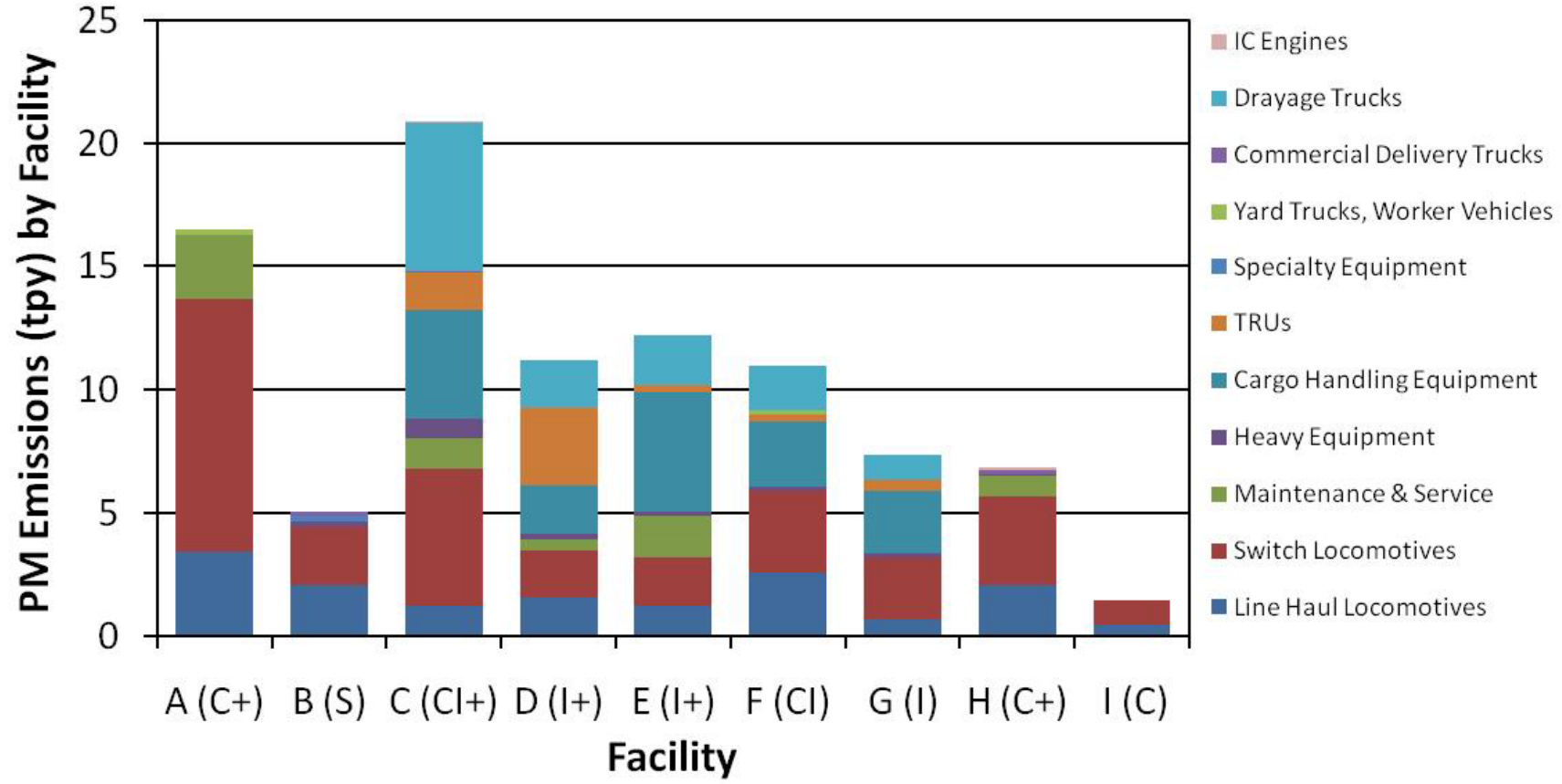
- Equipment specifications and activity data compiled through onsite audits and records reviews.
- Emission factors from USEPA's AP-42 document.

Results

Particulate Matter Emissions

- Only individual sources with greater than 0.05 TPY of emissions were included in the analysis.
- Only combustion PM was included.
  - Fugitive dust and brake/tire wear PM emissions were excluded.
- Facility total PM emissions ranged from 1.4 TPY to 18.3 TPY.

PM Emissions by Source Category



C: Classification S: Specialty I: Intermodal +: Maintenance and Service Operations

PM Emissions (cont'd)

- Maintenance and Service Activities
  - Emissions from locomotive service and maintenance are evident, but not dominant.
- All Yard Types
  - Emissions from switch locomotives exceed emissions from line haul locomotives.

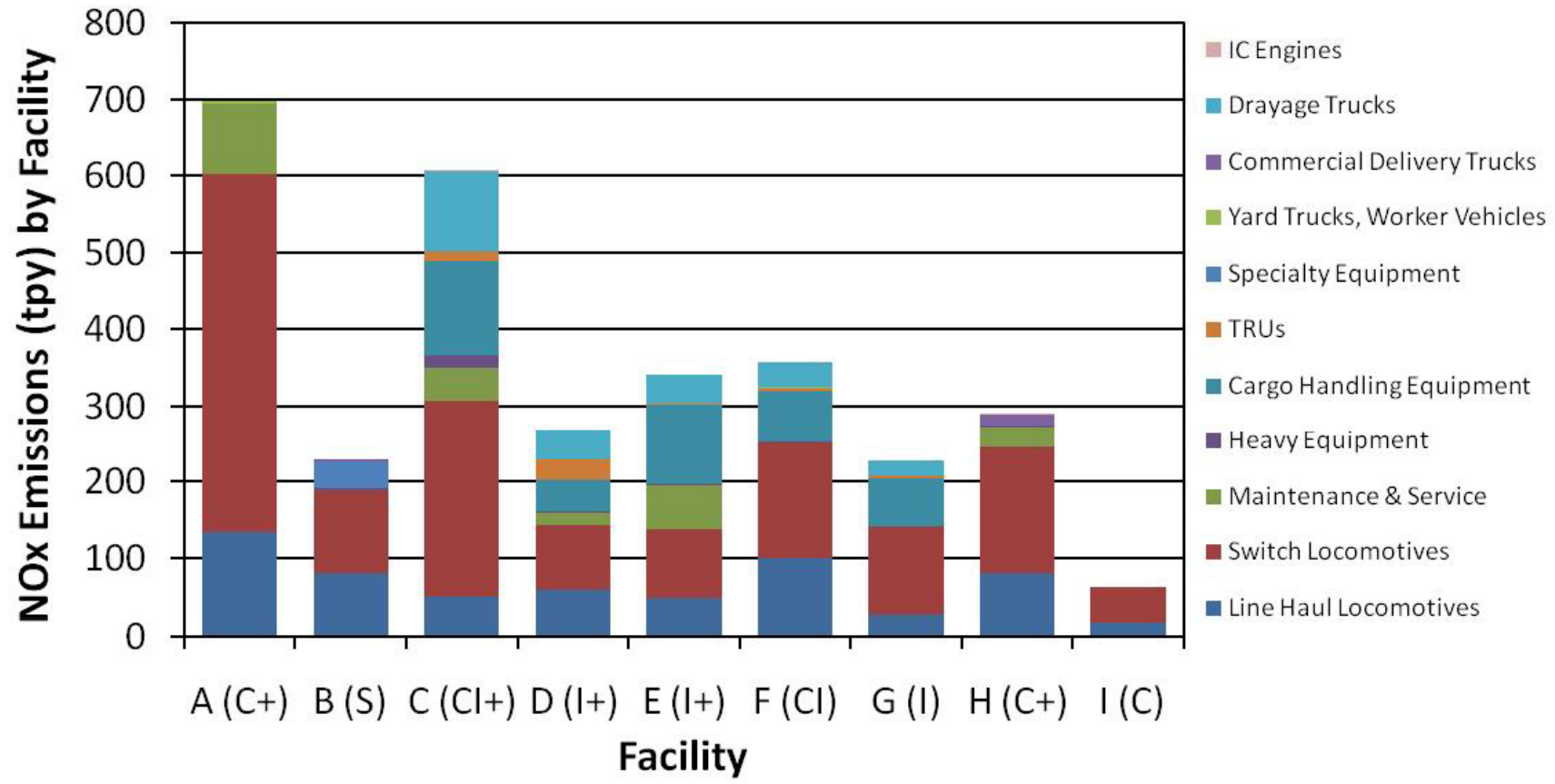
PM Emissions (cont'd)

- Intermodal Yards
  - Significant emissions from non-road and on-road equipment – represents 35%-76% of total PM.
  - Considerable variation between facilities.
- Specialty Yards
  - Locomotives were the dominant emission source.
  - Non-road and on-road equipment represented about 14% of the total PM emissions.
- Stationary Equipment
  - Not a significant source of emissions at any of the rail yards analyzed.

Nitrogen Oxides Emissions

- Only individual sources with greater than 0.5 TPY of emissions were included in the analysis.
- For six of the CA facilities, locomotive NOx emissions were not estimated in the original reports:
  - Scaled locomotive estimates were calculated based on the NOx:PM ratio, by activity, of the two facilities where NOx was reported.
- For Yards where NOx emissions were reported and not scaled, total emissions ranged from 63-607 TPY.

NOx Emissions by Source Category



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NOx Emissions (cont'd)

- Maintenance and Service Activities
  - Emissions from locomotive service and maintenance are evident, but not dominant.
- All Yard Types
  - Emissions from switch locomotives exceed emissions from line haul locomotives.

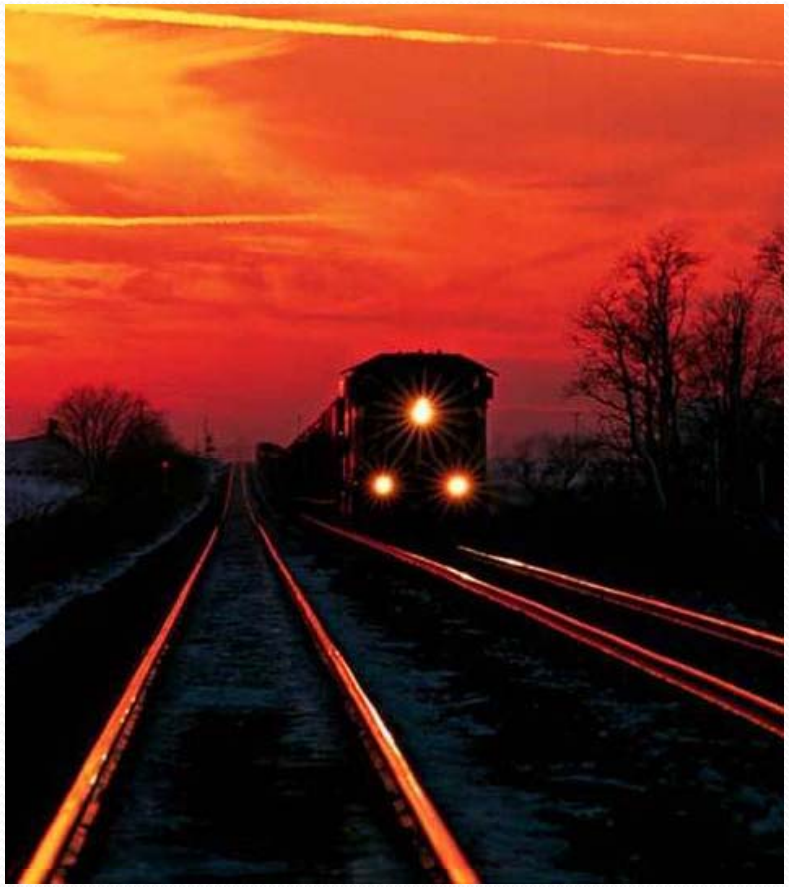
NOx Emissions (cont'd)

- Intermodal Yards
  - Non-road emissions due to cargo handling equipment represent 25-31% of the total.
  - On-road emissions due to drayage truck operations represent 8-17% of the total.
- Specialty Yards
  - Locomotives were the dominant emission source.
  - Non-road and on-road equipment together represented about 17% of the total emissions.
- Stationary Equipment
  - Not a significant source of emissions at any of the rail yards analyzed.

Conclusions

- Rail yard inventories require significant detailed data collection and processing due to the wide range of site-specific emission sources.
- Some consistency in emissions can be observed across rail yard types.

Conclusions (cont'd)



- Due to the unique nature of rail yard operations, a detailed site-specific inventory is necessary to determine facility emissions.
- Results are specific to a time period and facility and should not be extrapolated to other locations or times.

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