



Railroad Emissions – Background and Mitigation Options

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February 24, 2011

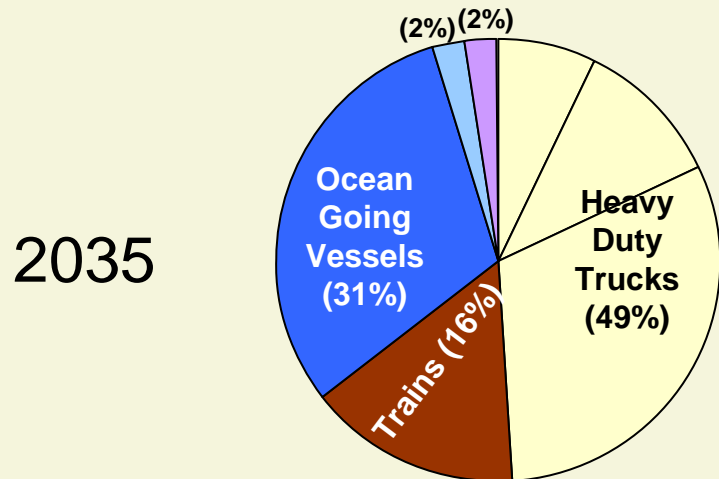
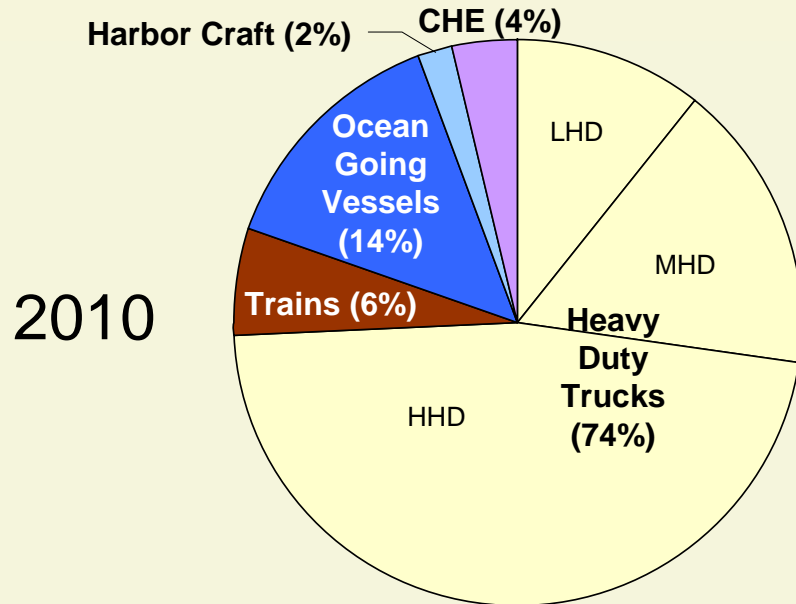
Presentation outline

- What will affect railroad emissions over the next 25 years?
- What are the options for reducing emissions?
- Points of discussion for Steering Committee

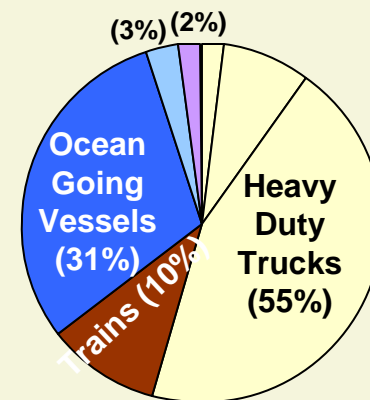
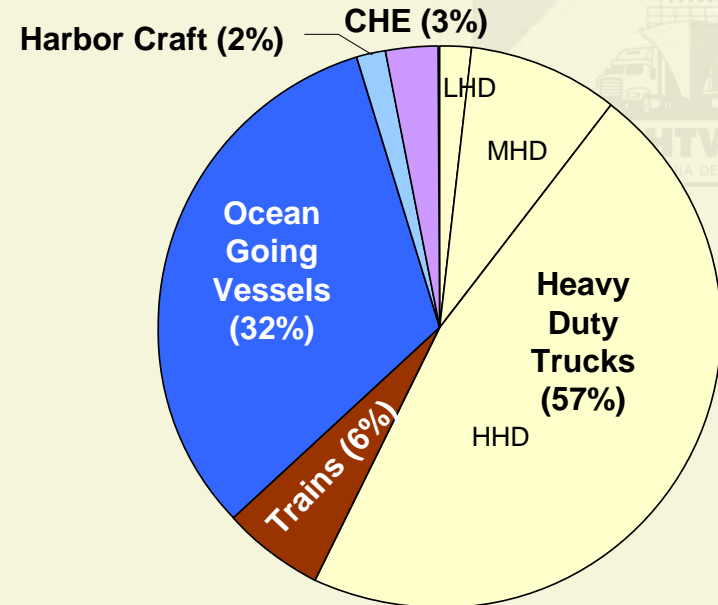


Goods movement emissions 2010 vs. 2035

NOx Emissions, South Coast Air Basin



PM2.5 Emissions, South Coast Air Basin

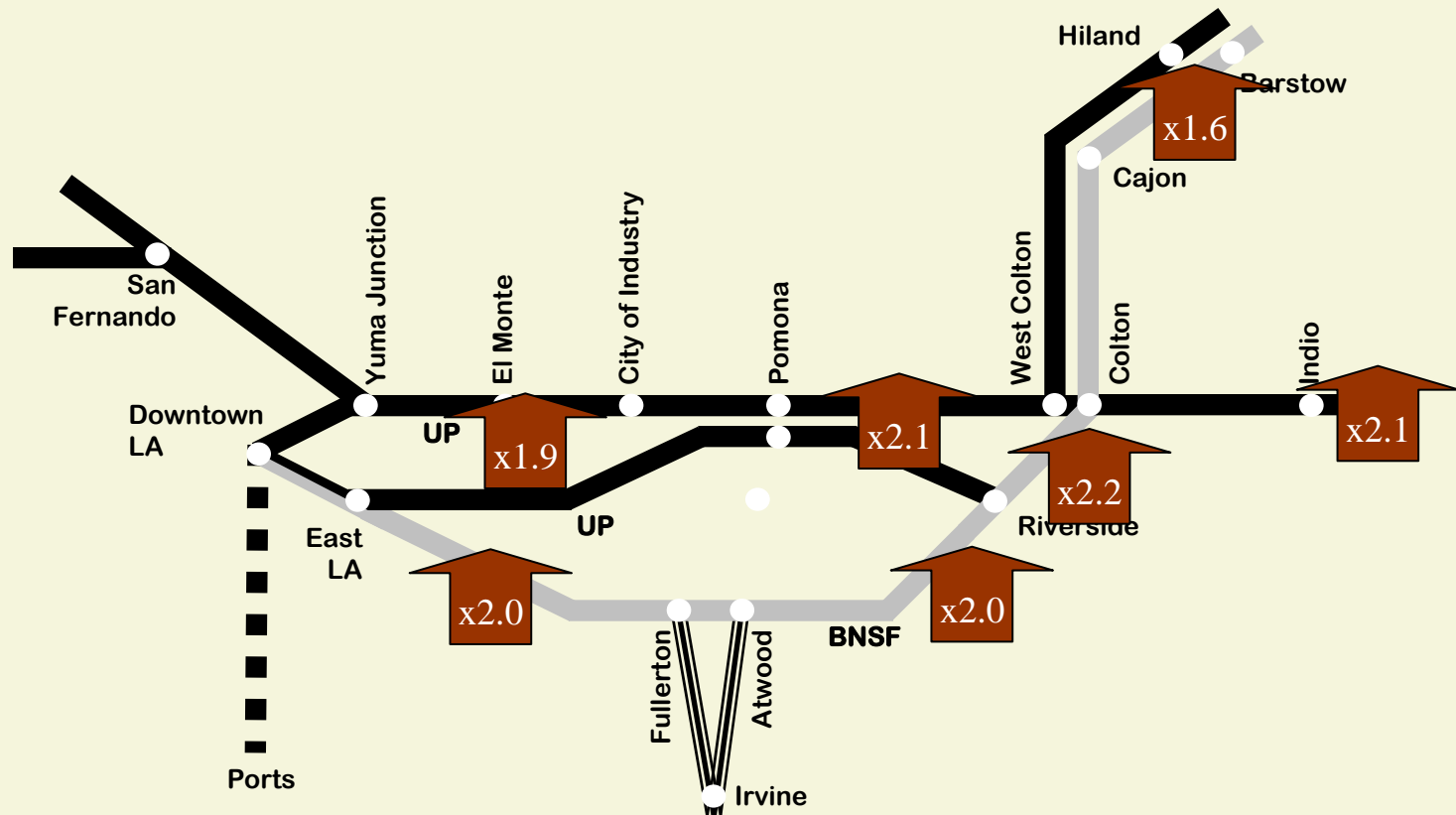


Key factors affecting rail emissions



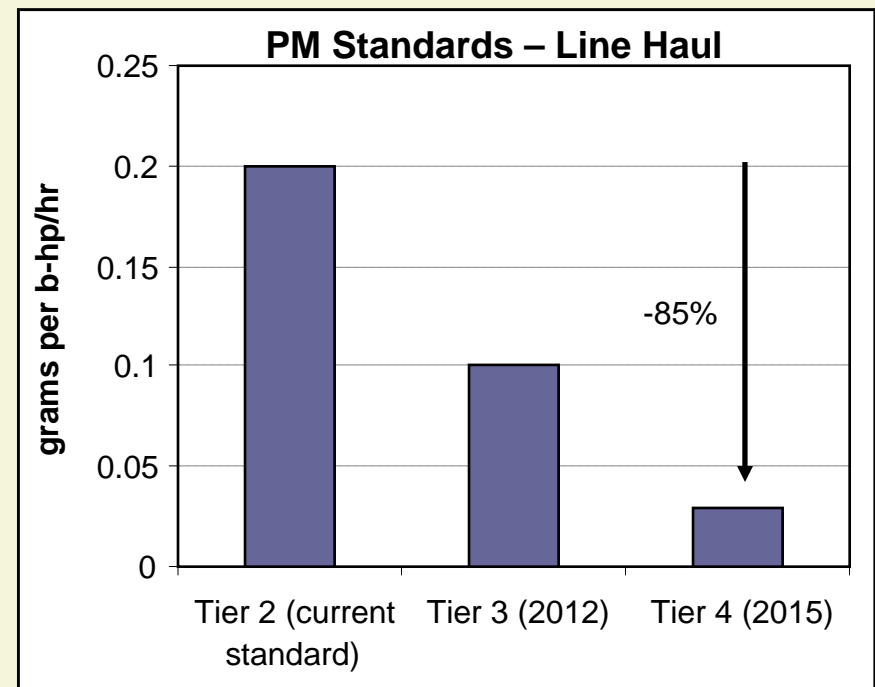
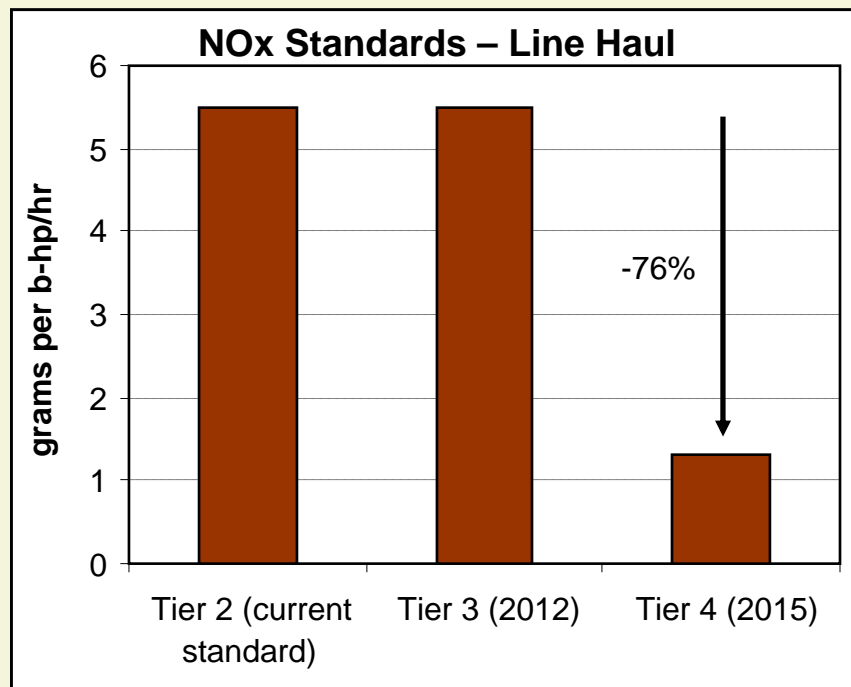
Growth in rail activity

- Driven mostly by port container throughput
- Also limited growth in carload, bulk, auto traffic



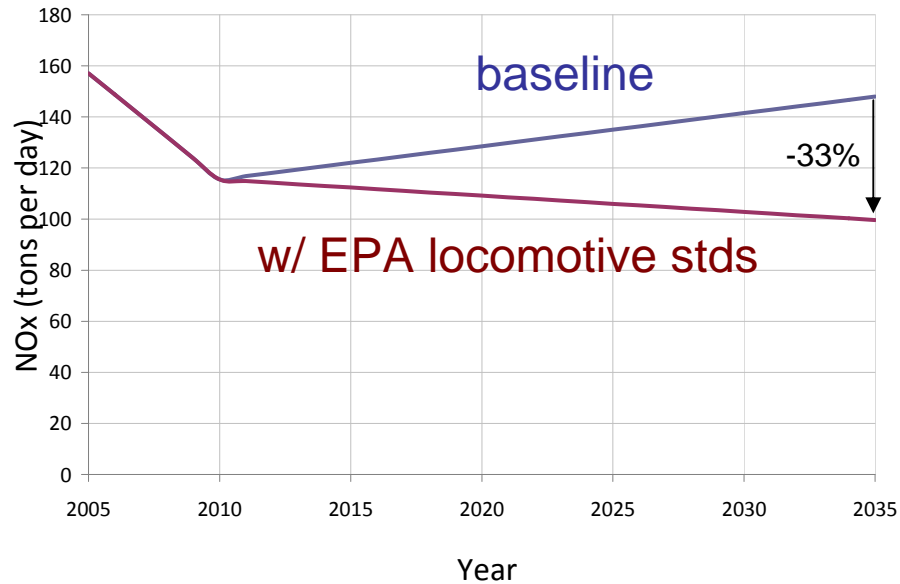
EPA locomotive emission standards

- New 2015 locomotives will have 76-85% lower emissions than Tier 2 line-haul

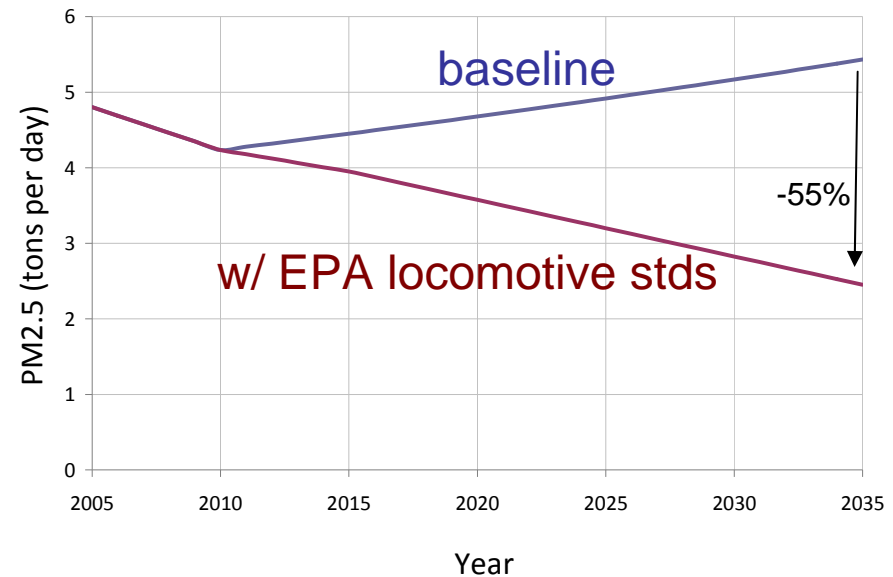


Effect of EPA standards

Locomotive NOx Emissions, California



Locomotive PM2.5 Emissions, California



Emission reduction strategies

- Line-haul strategies
- Switcher strategies

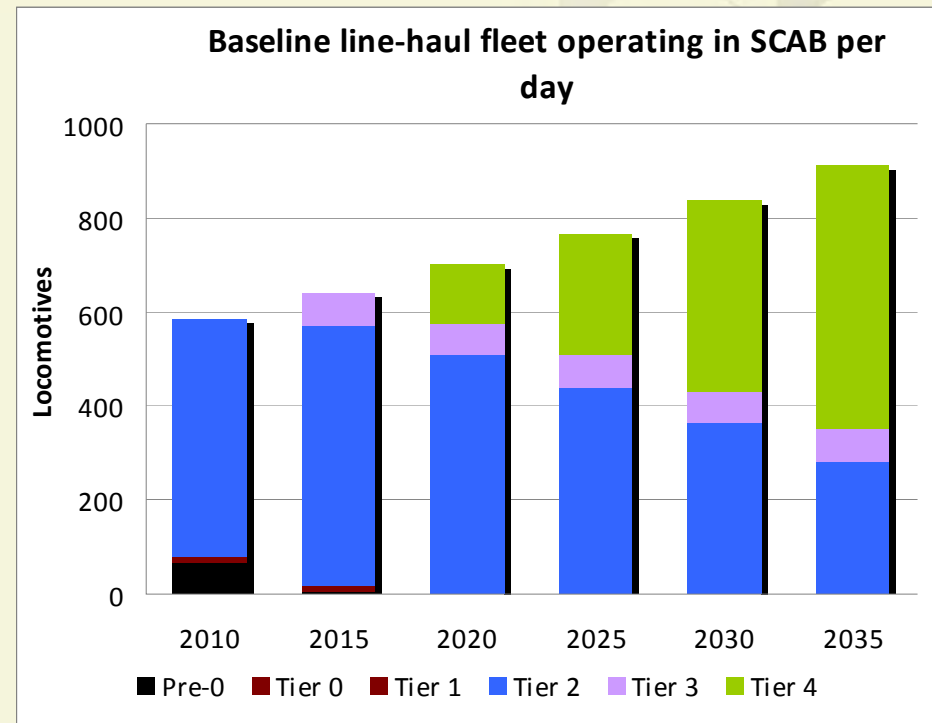


South Coast Air Basin, 2010

| Locomotive Type | NO _x | | PM _{2.5} | |
|---------------------|-----------------|---------|-------------------|---------|
| | tons/day | percent | tons/day | percent |
| Freight Line-Haul | 14.3 | 72% | 0.62 | 81% |
| Freight Yard/Switch | 2.6 | 13% | 0.07 | 10% |
| Passenger | 2.9 | 14% | 0.07 | 10% |
| Total | 19.7 | 100% | 0.76 | 100% |

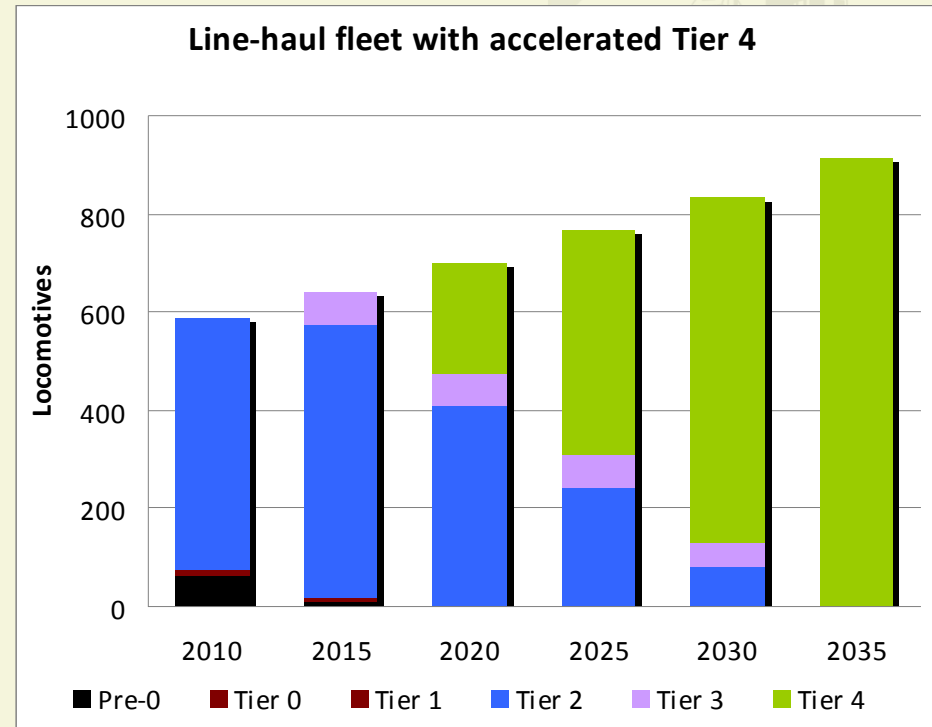
Line-haul locomotives in Basin

- Approx. 600 line-haul locos operating in SCAB on a given day
- Tier 4 locos
 - Introduction in 2015
 - 18% of fleet in 2020
 - 62% of fleet in 2035



Accelerate Tier 4 deployment

- Hypothetical goal – 100% Tier 4 by 2035 implies:
 - 350 more Tier 4 locos on a given day
 - 1,400 more Tier 4 locos in fleets
- Costs
 - ~\$3M per locomotive
- Challenges
 - New technology – performance, uptake, and deployment uncertain



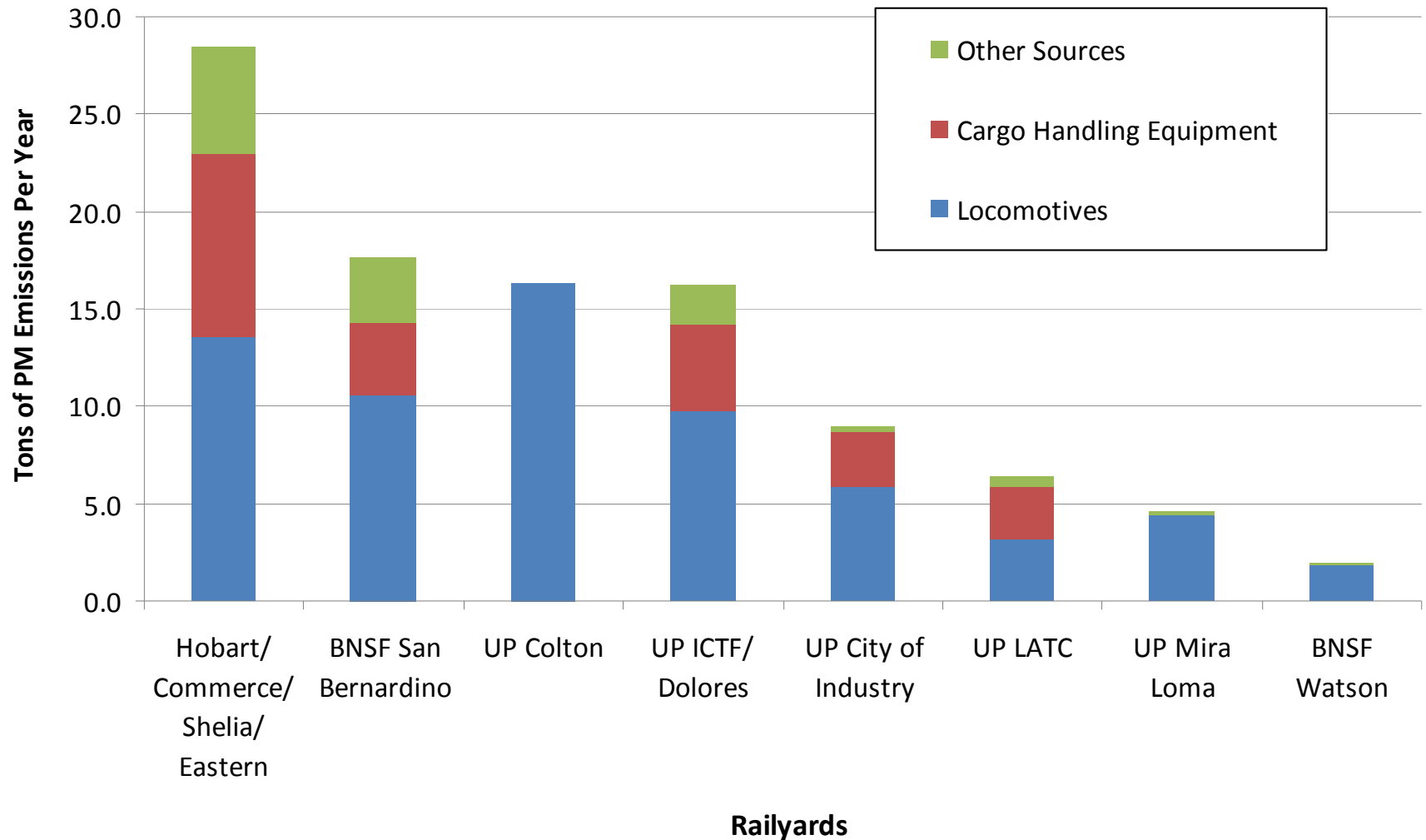
Electrification

- Challenges
 - Difficult to electrify entire system
 - Intermodal yards
 - Low volume segments
 - New technology, cost
 - Transition zone outside Basin
- Opportunities



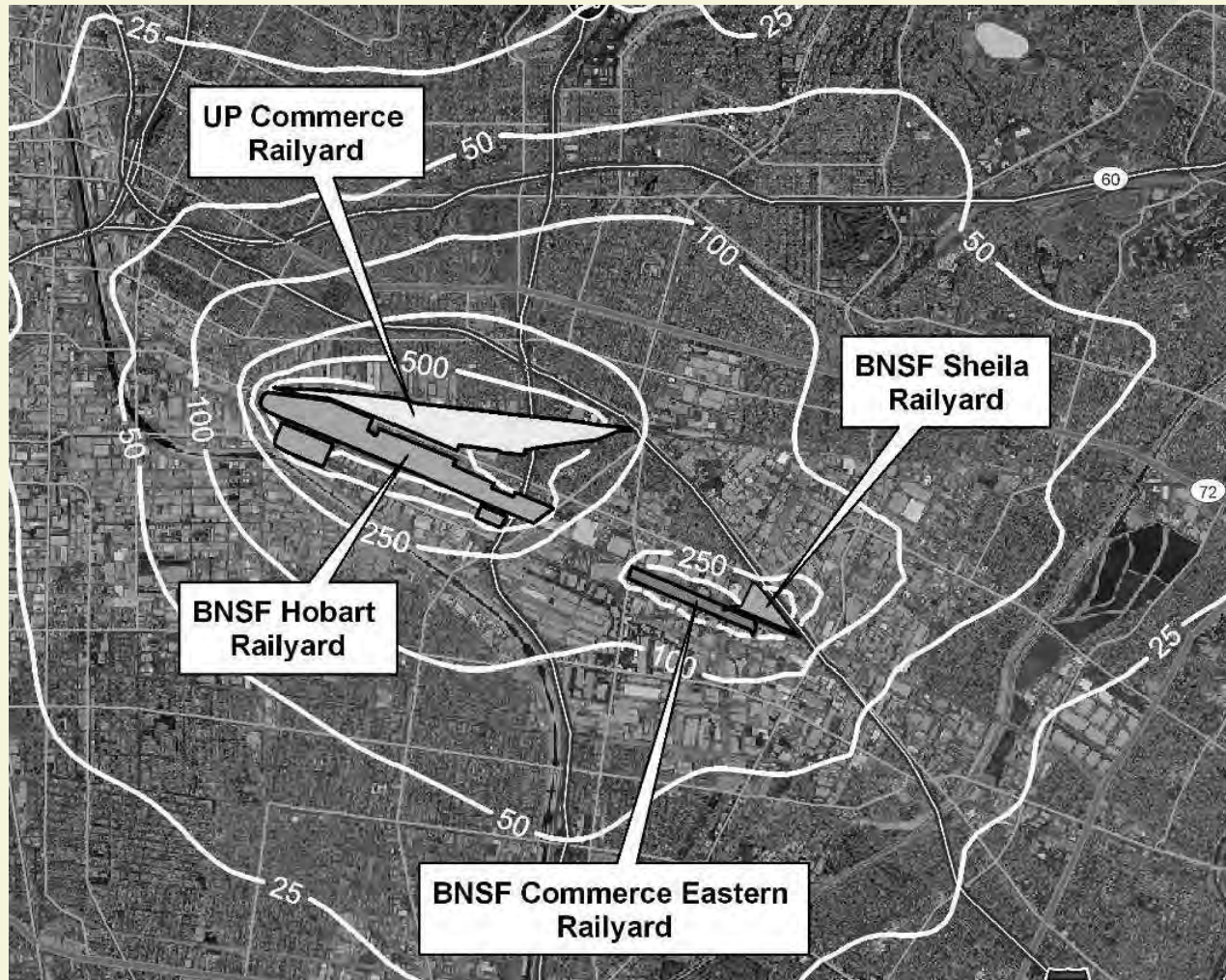
Railyard emissions

Diesel PM Emissions from Major Southern California Railyards, 2005

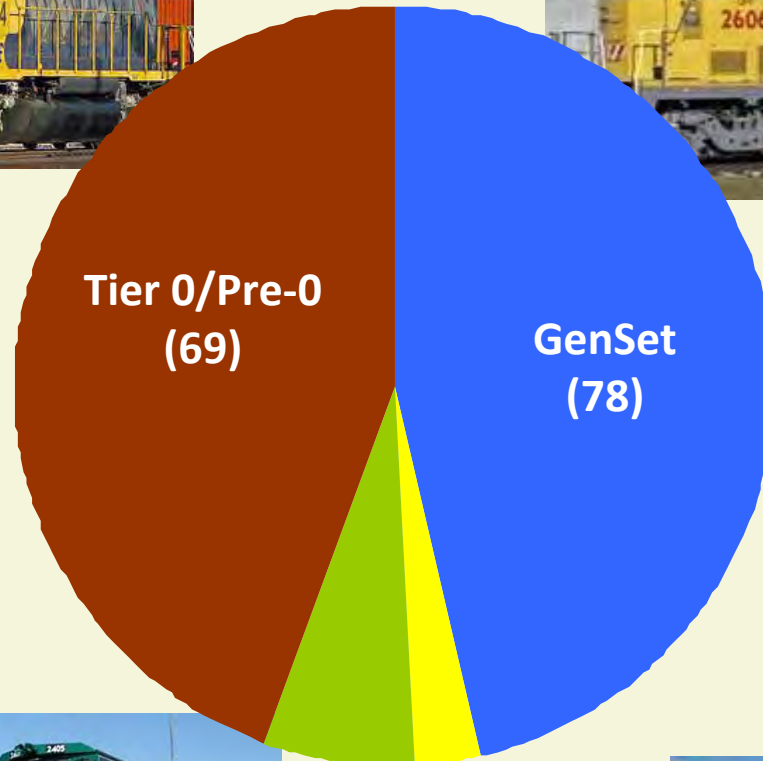


Example of railyard HRA

Estimated Potential Cancer Risks from Railyards (chances per million people), 2005

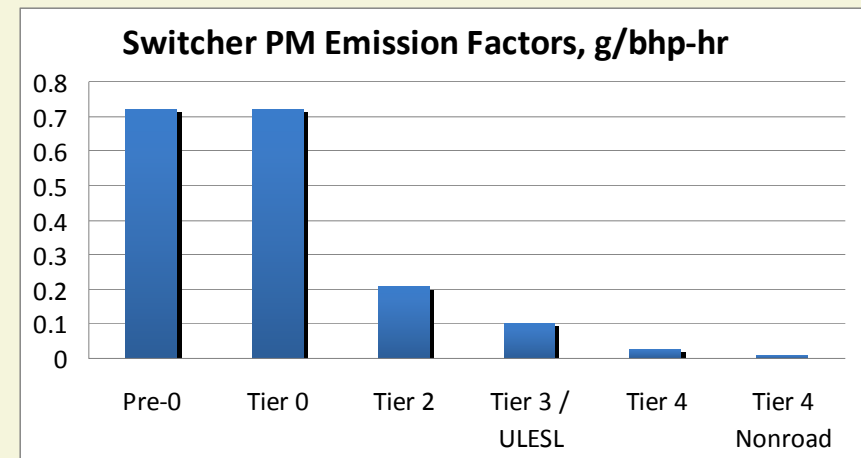
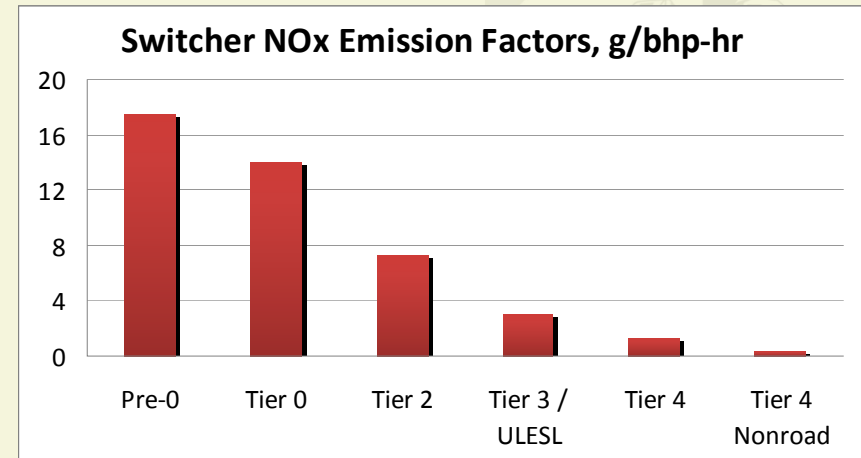


Switcher locomotives in Basin



Switcher emission reduction strategies

- Replace older switchers with GenSets
- Upgrade GenSets with exhaust retrofits
- Upgrade GenSets to Tier 4 nonroad



Next steps for consultant team

- Refine calculations of strategy emissions benefits and costs
- Further assess operational impacts
- Implementation options in Goods Movement Plan



Discussion points

- To what extent should the Regional Goods Movement Plan incorporate railroad emission reduction strategies?
- How can the region implement accelerated locomotive turnover and/or retrofit strategies?
- How to address both regional emission reduction targets and localized health impacts?

