



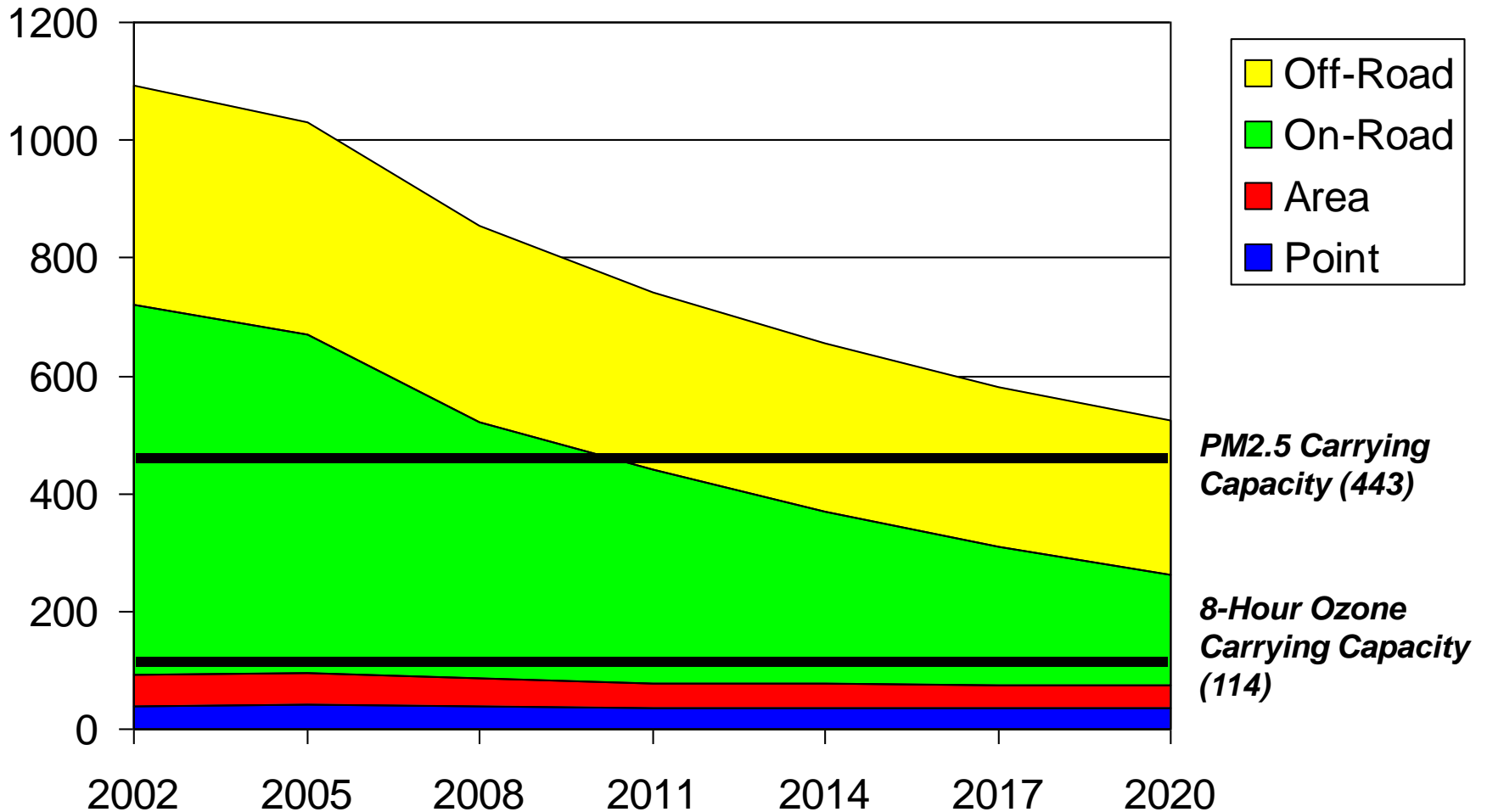
Session 2: Heavy-Duty Introduction



Randall Pasek

Off-Road Mobile Source Manager

NOx Emissions Trend by Source Category

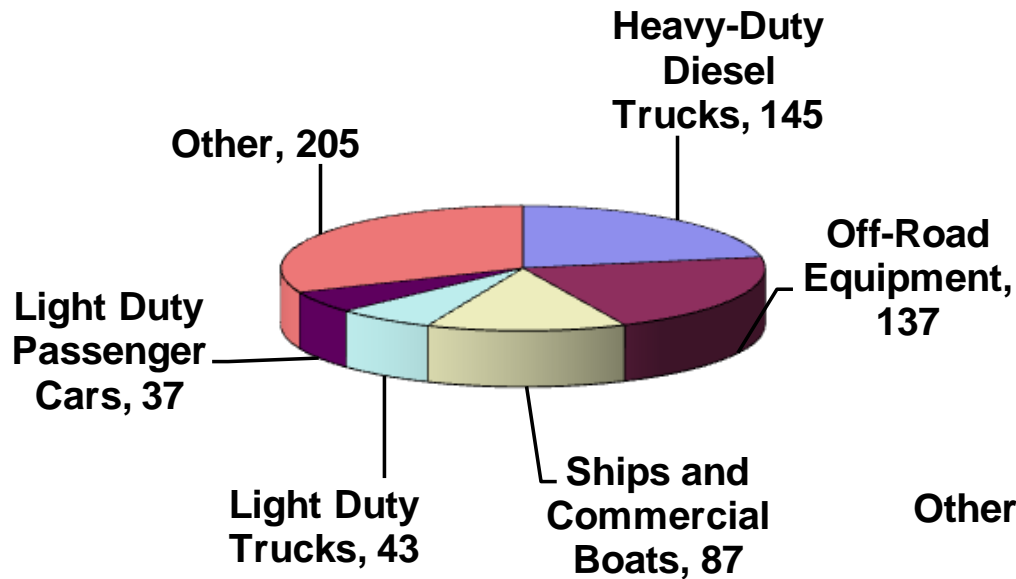


Needed Pollution Reduction (tons per day)

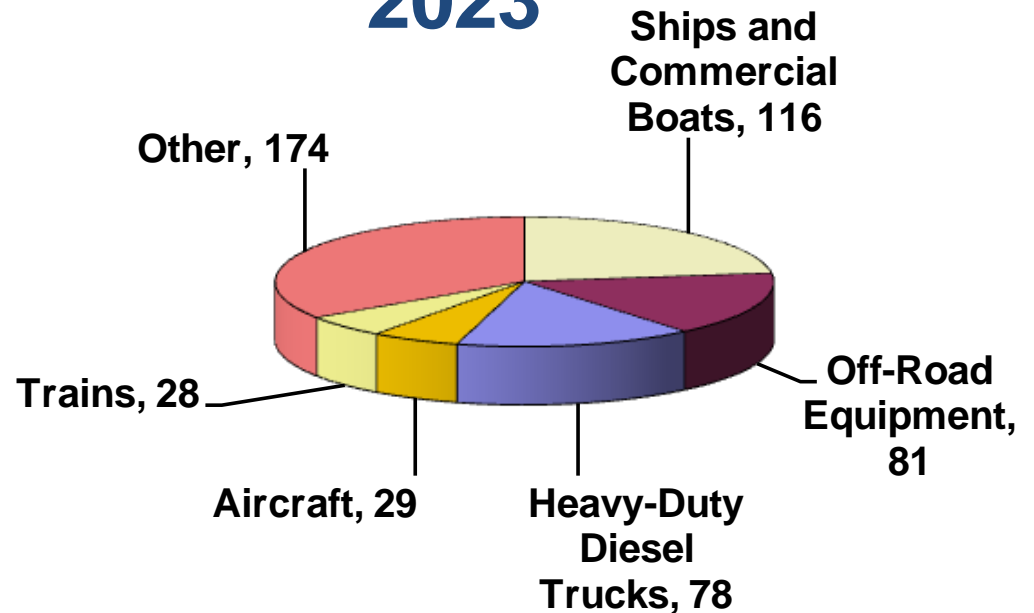
	2014	2023
NOx	203 (31%)	383 (76%)
VOC	59 (11%)	116 (22%)
SOx	24 (56%)	---
PM2.5	14 (14%)	---

Top 5 NOx Sources

2014

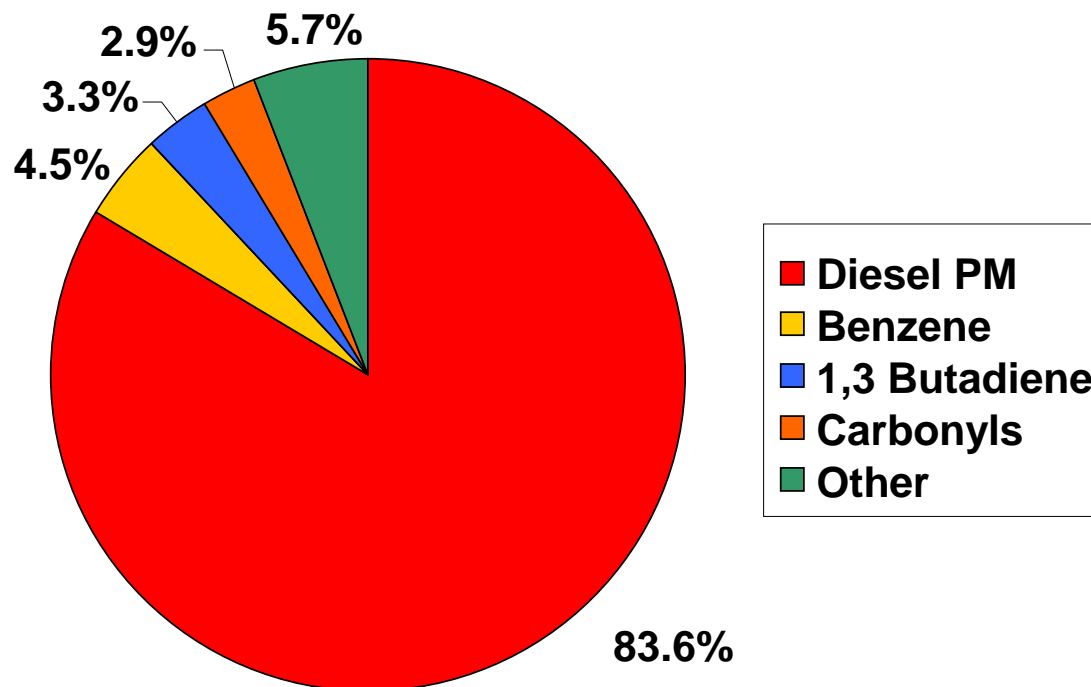


2023



Diesel PM Contributes Most to Air Toxics Risk

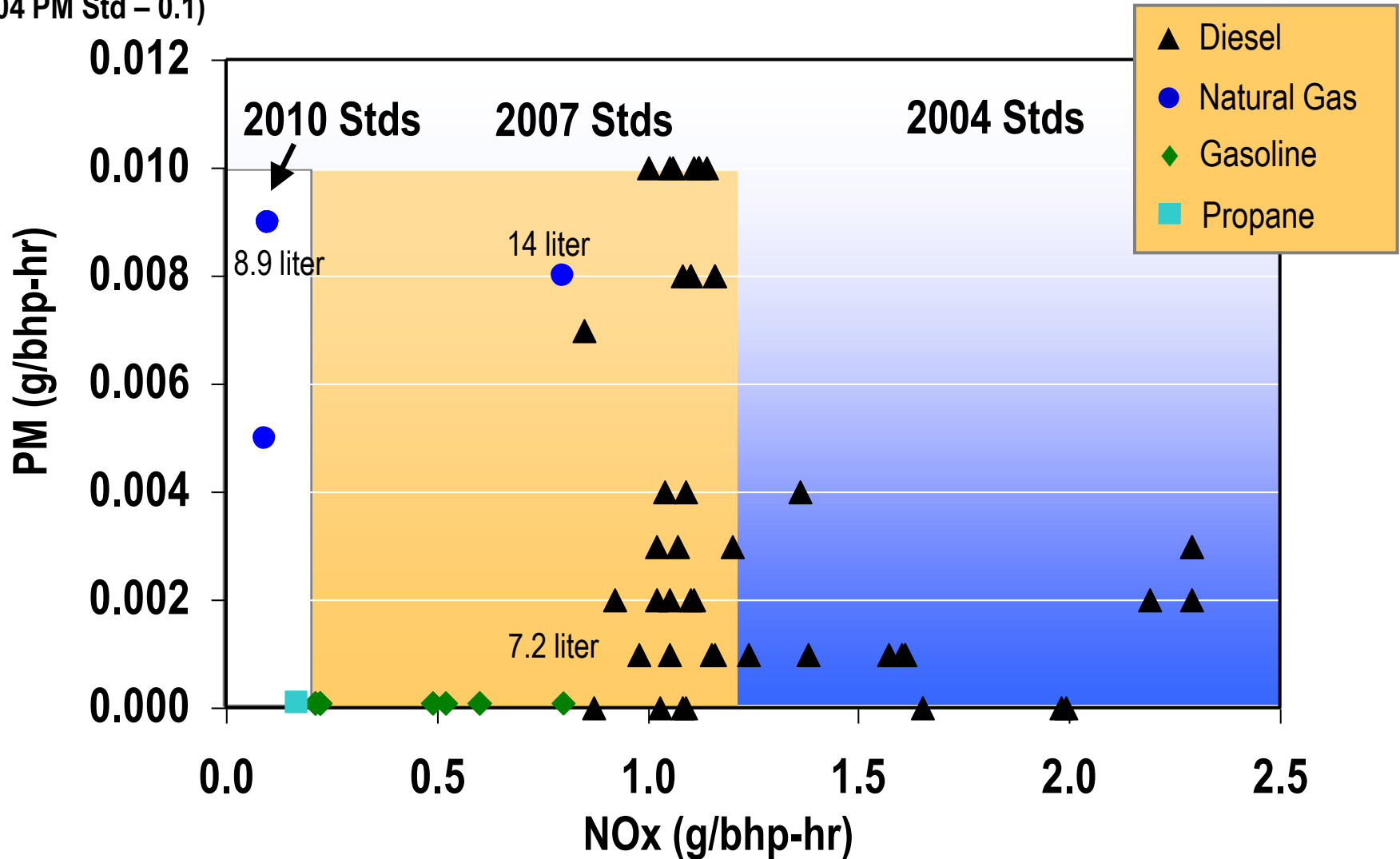
MATES III Basinwide Risk



**Basinwide Risk: 1194 Per Million
Based on Average at Fixed Monitoring Sites**

2008 Heavy-Duty Engine Certifications

(2004 PM Std - 0.1)



HDD Emission Controls

- NO_x – SCR
- PM – DPF; Alternative Fuels
- All – Hybrid (Electric/Hydraulic);
Electric (Battery/Fuel Cell)

HDD Presentations

- **Engines and Aftertreatment**
 - Adewale Oshinuga
 - SCR, DPF, and Alternative Fuels – On- and Off-Road
- **Locomotives**
 - Mike Bogdanoff
 - SCR and SCR & DPF on Locomotive Engines
- **Transit**
 - Joe Impullitti
 - Electric and Fuel Cell Bus
- **Future Projects**
 - Dipankar Sarkar