Fast Facts

- 20,000 route miles in 22 states and District of Columbia
- 30,000 employees
- $2.2 billion annual payroll
Fast Facts Continued

- 2013 Revenue: $11.2 billion
- 2014 Capital Spending: $2.2 billion
- 72,560 freight cars
- 4,073 locomotives
Locomotives

- Two Major Locomotives Types
  - Road – 2501 units
  - Yard and Local – 1584 units
Road Locomotives

- Used on intermodal trains, unit trains and major freight trains between terminals
- High Horsepower
  - 3800 to 4400
- Weigh 415,000 to 432,000 pounds
- Majority of fleet built since the year 2000
- Life expectancy 20 to 25 years
Road Locomotives (continued)

- Road Locomotives are built by two builders:
  - General Electric (GE)
  - Electro-Motive Diesel (EMD) (Progress Rail/ Caterpillar)
Yard and Local Locomotives

- Used in rail yards and on local trains to spot cars at industries
  - Average fewer miles per loco than a road loco
- Lower horsepower locomotives (2000-3000 hp)
- Lighter weight 250,000 – 390,000 lbs.
- Grouped into 4 and 6 axles

EMD SD40-2
A Typical 6 Axle Yard and Local Locomotive
Yard and Local Locomotives

- Majority have been cascaded down from road service
- Oldest of the fleet (average age 28 years)
  - Parts are still plentiful from many market suppliers
  - Still very reliable

EMD GP38-2
A Typical 4 Axle Yard and Local Locomotive
Locomotive Regulations

- **49 CFR Part 229** – Federal Railroad Administration
  - Codifies minimum safety requirements for locomotives
  - Requires periodic inspections
  - Prohibits using locomotives when standards not met

- **40 CFR Parts 92 and 1033** – Emissions Regulations for locomotives and locomotive engines
  - Developed by US EPA with collaboration of railroads and locomotive builders
  - Focusses on reduction of NOx, PM, VOC and CO with an emphasis on NOx and PM
    - All calculations in grams/brake horsepower hour
Emissions Regulations

- Tiered approach
  - Phases in emissions reductions over time with 4 Tiers
- Emissions are based upon Line Haul (Road) and Switch Duty Cycle
  - Line Haul – above 2300 horsepower
  - Switch – 2300 horsepower and below
- Applies to all locomotives built after 1973
  - Locomotives that were built after 1973 and prior to 2000 regulations must be brought to Tier 0 and Tier 0+ standards when overhauled
Locomotives that were retrofitted to Tier 0 standards or built as Tier 1 or Tier 2 must be upgraded to higher emissions standards at next overhaul which are the plus (+) levels under Part 1033.

*Locomotives built prior to 2000 must be retrofitted to Tier 0 during overhaul.*
Overhauls are ongoing and conversions to the Plus (+) standards increase monthly.
Emissions Reductions
(EPA Switch Duty Cycle)

40 CFR Part 92
(Year 2000)

40 CFR Part 1033
(Year 2010)

- Regulations mainly apply to locomotives being overhauled
Yard and Local Fleet Emissions Make Up

- Exempt units built before 1973 – no regulations apply
- Majority of fleet Tier 0 and 0+
- Tier 2 locomotives are a handful of gensets and 710ECO repowers
Challenges in the Yard and Local Locomotive Fleet

• No true switcher or reliable low horsepower locomotives are built today
  – Last switcher built in 1984
  – Last 4 axle locomotive was built in 1991

• No longer can older road locomotives be cascaded down to yard and local service
  – Current road locos too heavy and long for local service
    • Weight and curve restrictions at local industries

• The genset locomotives from all builders have not lived up to performance and reliability expectations
Genset Experiment

- NS tried Gensets from both major manufacturers
  - Both 4 and 6 axle versions
- Performance Issues
  - Slow to load
  - Must get all engines running to kick cars – defeats multi engine concept
  - Too light - limits wet rail pulling ability
Genset Experiment (Continued)

- Reliability less than required
  - EPA certifies engines meet emissions not reliability
  - Engine durability issues
  - Parts availability issues
  - High power electronic failures
  - 40 year old locomotives are more reliable

- Only one Class 1 railroad still purchases gensets
What works for Yard and Local Locomotive Emissions Reductions

- **EMD 710ECO Retrofit kits**
  - True locomotive engine
  - Performance and reliability as expected

- **Challenges**
  - Current yard and local locomotives are reliable
    - Hard to justify cost
    - Competes for other capital spending
      - I.e. Track, bridges, etc.
Emissions Reductions through Slugs

- Locomotive without an engine
  - Electricity for traction motors provided by another locomotive called a mother
- Useful concept where train speeds are below 20 mph and two locomotives are needed
  - Above 20 mph not enough power available from mother loco
Other Methods for Emissions Reductions – Electric Layover System

- Eliminates idle emissions
- Electric heater to keep engine coolant warm and batteries charged
  - Locos don’t use antifreeze
- Useful in the winter time when auto engine start stop is not that effective
Current Emissions Experiments

- **Natural Gas – Mother/slug set**
  - Under development
  - Major Issue is FRA acceptance
  - FRA still working on regs

- **Battery Powered Locomotive Experiment**
  - Working on the second battery iteration
  - Further research and development required