Quantitative Analysis
Unregulated
Tier 4
Near Zero Emission
Locomotives

December 8, 2021
South Coast Air Quality Management District
Diamond Bar, California
Proposed Rule 2306
KLW NZE32CE DE T4L

3218 bhp
Reduces emissions by over 98%
Reduces fuel consumption between 25-35%
Increases starting tractive effort up to 50%
What is a locomotive?

EPA defines a locomotive as a self-propelled piece of on-track equipment designed for moving or propelling cars that are designed to carry freight, passengers, or other equipment, but which itself is not designed or intended to carry freight, passengers (other than those operating the locomotive) or other equipment. Traditional locomotives are propelled by a single prime mover engine. Non-traditional locomotives, which are propelled by two or more engines, are rated in total power by the sum of the rated power of each engine.

Minimum brake horsepower: 1006
Maximum brake horsepower: 1006 to 5,000 and above
Switch locomotive: 1006 bhp to 2300 bhp
Line Haul locomotive: 2301 bhp to 5,000 bhp and above

EPA Locomotive Emission Tier standards:
- Uncontrolled
- Tier 0
- Tier 1
- Tier 2
- Tier 3
- Tier 4
- Tier 5**

* Reference Code of Federal Regulations Title 40 1033.901 Definitions.
** Proposed by the California Air Resources Board in April 2017 and not yet adopted by the U.S. EPA.
<table>
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<th>SWITCH SERVICE</th>
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Observations and Analysis of Near Zero Emission Locomotives

- Rail yards in California are full of unregulated locomotives operating in switching services throughout the state.

- Unregulated locomotives generate a minimum of 13.0 to 17.4 gp / bhp-hr or more of NOx and a minimum of 0.32 to .44 gp / bhp-hr or more of PM.

- Replacing these unregulated locomotives with Near Zero Emission locomotives would remove 99% of the NOx and PM currently being emitted in the yards.

- Existing unregulated locomotives in these yards will emit more NOx and PM in 1 year than the Near Zero Emissions locomotives will in 100 years.