

# Rail Pollution Concerns - Flagstaff

## 1. Sources of Railroad Pollution

- Diesel Combustion
  - Traditional freight and switcher locomotives burn diesel, emitting fine particulate matter (PM<sub>2.5</sub>) and nitrogen oxides (NO<sub>x</sub>), both linked to respiratory and cardiovascular disease ([prospect.org][1])
  - Older “Tier 0–2” locomotives (built before 2008) can emit up to 90% more PM<sub>2.5</sub> and 80% more NO<sub>x</sub> than newer Tier 4 engines ([prospect.org][1]).
- Noise & Vibration
  - Rail noise contributes to “high annoyance” stress, particularly for non-white and low-income communities; in 2020, ~7.9 million people nationwide were highly annoyed by rail noise—1.48 × their share of the population ([arxiv.org][3]).
- Greenhouse Gases
  - Freight rail emits roughly 2 % of U.S. transportation CO<sub>2</sub>; electrification could cut these emissions substantially ([sciencedaily.com][4]).

## 2. Health Impacts

- Fine Particles (PM<sub>2.5</sub>)
  - In the Bay Area, an annual increase of just 2.1 µg/m<sup>3</sup> PM<sub>2.5</sub> from coal trains was projected to cause +6 premature deaths/year, +22 asthma cases, +28 heart-disease hospitalizations, and +58,000 asthma-days—mostly borne by communities of color ([ucdavis.edu][2]).
  - Diesel PM<sub>2.5</sub> is classified as a toxic air contaminant and linked to lung cancer in long-term rail-yard workers ([prospect.org][1]).
- Nitrogen Oxides (NO<sub>x</sub>)
  - NO<sub>x</sub> exposure exacerbates asthma and can form ozone, further impacting lung function ([prospect.org][1]).
- Noise Stress
  - Chronic rail noise correlates with hypertension, sleep disturbance, and cognitive impairments in children ([arxiv.org][3]).

## 3. Environmental Justice & Disparities

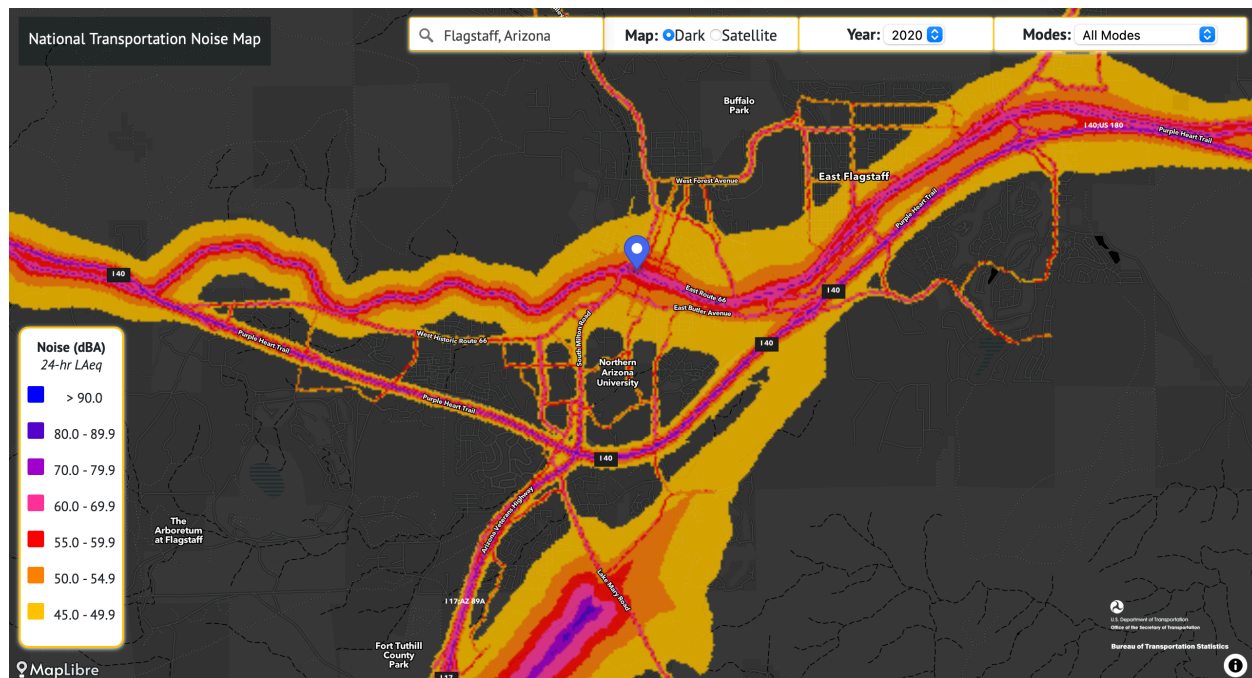
- Disproportionate Exposure
  - Black and Hispanic residents experience 29%–41% higher PM<sub>2.5</sub> exposure from coal trains than white residents ([ucdavis.edu][2]).
  - Rail yards and **heavy-haul corridors** often sit adjacent to lower-income and non-white neighborhoods, perpetuating historic inequities ([prospect.org][1]).
- Cumulative Burden
  - Communities already facing traffic, industrial, and airport pollution bear the added load of rail emissions, compounding health risks.

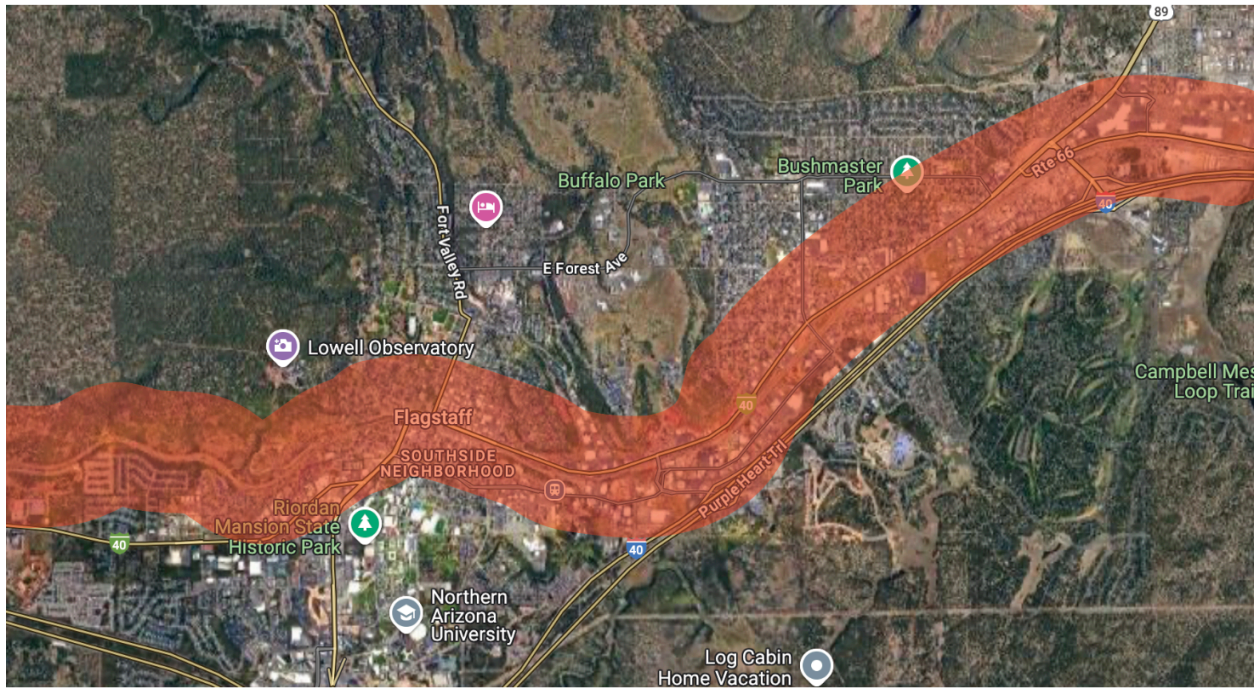
## 4. Regulatory Gaps & Industry Practices

- Stagnant Federal Standards
  - EPA's last major locomotive emissions update was in 2008; Tier 4 is still “best available,” yet 74 % of Class I line-haul locomotives remain Tier 2 or lower ([prospect.org][1]).
  - Locomotives need only meet standards upon new build or major overhaul, allowing dirty engines to linger in service decades.
- Loopholes
  - “Remanufactured” locomotives can legally remain at their original Tier, rather than upgrade to Tier 4.

## 5. Flagstaff Specific Lens

- More Pollutants
  - Flagstaff is in a heavy haul corridor “BNSF’s Southern Transcon” (LA to Chicago) averaging over 100 trains per day, with one train every ~14 minutes.
  - Diesel exhaust: BNSF locomotives in Flagstaff are predominantly older Tier 0–2 locomotives burning ultra-low sulfur diesel which emit elevated  $PM_{2.5}$  and  $NO_x$ , significantly more  $PM_{2.5}$  and  $NO_x$  than modern Tier 4 engines.
- Community Impacts
  - Environmental justice concerns with marginalized folks live in neighborhoods close to the train tracks.
  - People living within 500 meters of heavy freight rail corridors experience elevated levels of  $PM_{2.5}$  and respiratory illness, and ground vibration and noise disturbance.
  - Chronic  $PM_{2.5}$  and  $NO_x$  exposure worsens asthma, cardiovascular hospitalizations, and premature mortality—risks heightened by winter wood burning.
  - Ground vibration and noise impacts leads to sleep disturbance, hypertension, and cognitive stress, especially among children and the elderly.





500m N and S of railroad.

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## References

1. UC Davis study on coal train PM<sub>2.5</sub> health impacts ([ucdavis.edu][2])
2. Prospect article on diesel loco emissions and Tier 4 gap ([prospect.org][1])
3. ScienceDaily on Caltrain electrification benefits ([sciencedaily.com][4])
4. Huang & Seto on transportation noise disparities ([arxiv.org][3])

[1]: <https://prospect.org/environment/2023-03-14-filthy-emissions-railroad-locomotives/> "The Filthy Emissions of Railroad Locomotives—and the Rail Unions Sounding the Alarm - The American Prospect"

[2]: <https://www.ucdavis.edu/news/coal-train-pollution-increases-health-risks-and-disparities> "Coal Train Pollution Increases Health Risks and Disparities | UC Davis"

[3]: <https://arxiv.org/abs/2307.16837> "Estimates of Population Highly Annoyed from Transportation Noise in the United States: An Unfair Share of the Burden by Race and Ethnicity"

[4]: <https://www.sciencedaily.com/releases/2025/04/250416135244.htm?> "Study finds dramatic boost in air quality from electrifying railways"