Evaluating Health Risks and Emissions from Ground Support Equipment at Schiphol Airport

Journey towards Autonomous Airside Operations

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Tijmen Kaspers, Erlangga Sunaryo, Ann Wellens & Catya Zuniga

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Introduction

As part of the BrightSky project in the journey towards Schiphol's ambitious sustainability goals to achieve an emissions-free airport by 2030 and an autonomous airside by 2050, the emissions emitted by ground support equipment (GSE) were identified, to assess their impact on air quality and health. This investigation focuses on personnel close to the source and directly exposed to the emissions.

Emissions → Dispersion → Concentrations → Impacts

The pathway from aviation emissions is complex, generating important impacts on local and regional air quality and public health through dispersion processes.

Methodology

(1) Identification of pollutants from GSE and effect to health
- Carbon monoxide (CO)
- Nitrogen oxides (NOx)
- Sulphur dioxide (SO_2)
- Particulate matter ($PM_{2.5}$ & PM_{10})
- Volatile organic compounds (VOC)
- Ozone (O_3)

(2) Identification of other emissions
- Carbon dioxide (CO_2)
- Noise

(3) Calculation of total emission using emission factors:

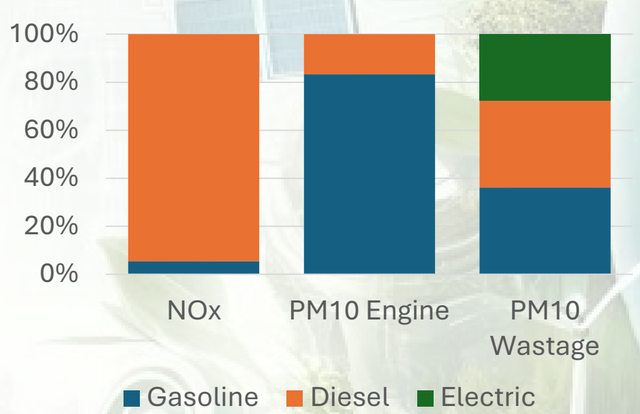
$$E = A * EF$$

Where:
- E is the emission
- A is the activity rate (fuel consumption)
- EF is the emission factor

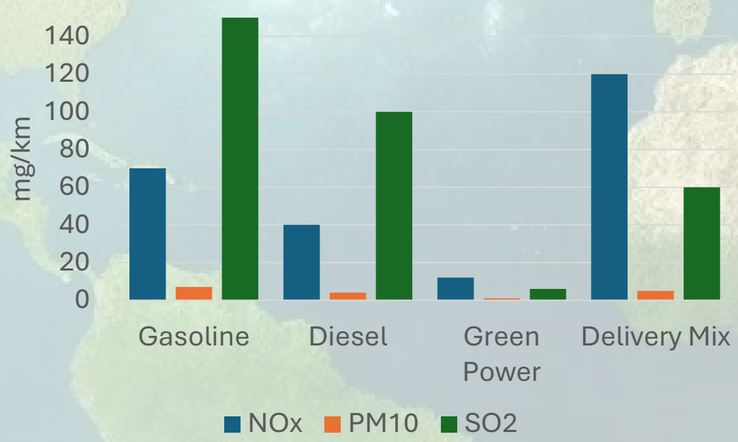
Pollutant	Affected body parts
Carbon monoxide (CO)	Brain, blood, heart & nervous system
Nitrogen oxides (NOx)	Lungs & airways
Sulphur dioxide (SO_2)	Lungs, airways & heart
Particulate matter ($PM_{2.5}$ & PM_{10})	Lungs, heart & bloodstream
Volatile organic compounds (VOC)	Lungs & airways
Ozone (O_3)	Lungs & airways

Results

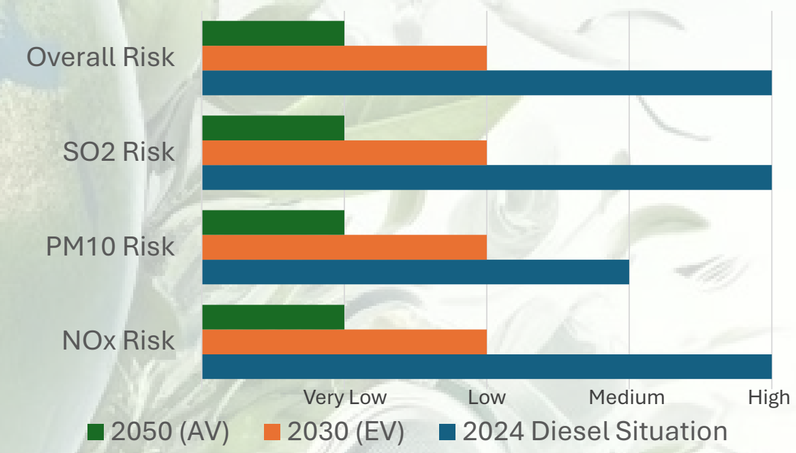
Emission Comparison for Gasoline, Diesel, and Electric Vehicles



Fuel and Electricity Emissions for Gasoline, Diesel, and Electric Vehicles



Comparison of Health Risks for Current, 2030, and 2050 at Schiphol Airport



- Diesel vehicles emit the highest levels of NOx and PM_{10} compared to gasoline and electric vehicles.
- Electric vehicles have zero emissions from the engine and minimal PM_{10} wastage, making them the cleanest option.

- Gasoline and diesel fuel production emit significant levels of NOx, PM_{10}, and SO_2.
- Green power shows the lowest emissions, highlighting the importance of renewable energy sources.
- The delivery mix, a combination of energy sources, still shows notable emissions, particularly NOx.

- Transitioning to electric (EV) by 2030 and autonomous vehicles (AV) by 2050 significantly reduces overall health risks (SO_2, PM_{10}, and NOx risks compared to diesel vehicles.
- The current diesel situation poses high health risks, while both future scenarios show substantial improvements in reducing these risks.

Conclusion

Vehicle electrification and autonomous operations minimize the number of workers operating in the apron area. This transition to electric (EV) vehicles by 2030 and autonomous vehicles (AV) by 2050 significantly reduces overall health risks in personnel, associated with SO_2, PM_{10}, and NOx emissions, compared to the diesel situation in 2024.

References

- ICAO (2022). 2022 Environmental report. Innovation for a green transformation. International Civil Aviation Organization. https://www.icao.int/environmental-protection/Documents/EnvironmentalReports/.
- Verbeek R. P., Bolech M., van Gijswijk R. N., Spreen J. (2015). Energie- en milieu-aspecten van elektrische personenvoertuigen. TNO-rapport R10386.
- WHO (2021). WHO Global Air Quality Guidelines. Particulate matter (PM2.5 and PM10), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide. World Health Organization. ISBN 978-92-4-003422-8.

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