Indoor Air Pollution
at the Jerusalem Central Bus Station 2014-2017

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1 INTRODUCTION

The Jerusalem Central Bus Station (JCBS) is located in the city center, in a closed building, with a passenger volume of 60,000-100,000 and more than 1,000 buses every day. Passenger boarding and alighting takes place within the closed building, which has no effective ventilation, thus causing severe air pollution problems, due to the accumulation of pollutants emitted from the diesel engine buses. The present study included statistical processing of data obtained from a continuous air monitoring station adjacent to the passenger bording area. A comparison was made between the JCBS monitoring data and a permanent monitoring station located on the rooftop of the central bus station building.

2 DATA COLLECTION & ANALYSIS

The data included $PM_{2.5}$, NO, NO_2 & NO_x that were continuously monitored during a 40 month period, from May 2014 to August 2017. A comparison was made between the indoor JCBS monitoring data and the outdoor data obtained from a permanent monitoring station located on the rooftop of the bus station building that monitored ambient PM_{10} as well as nitrogen oxides and meteorological data.
For the monitored air pollutants, half-hour, hourly, and daily averages and standard deviations were calculated, according to the Israeli Clean Air Law Ambient Air Quality Standards, as well as WHO guidelines.

3 RESULTS AND DISCUSSION

Figure 1 shows hourly $PM_{2.5}$ concentrations at the passenger docks compared to ambient concentrations on the rooftop based on 40 month period during 2014-2017. $PM_{2.5}$ concentrations at the passenger boarding platform were more than 2 times the ambient air concentrations measured on the rooftop of the station.

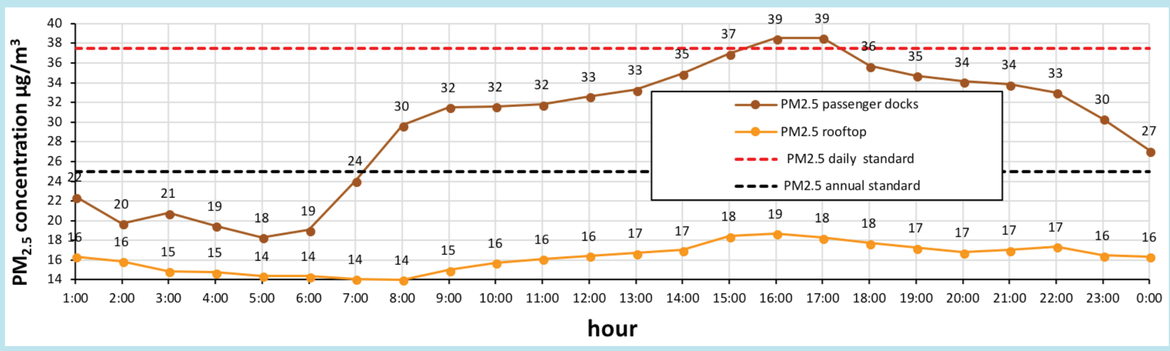

Figure 1: $PM_{2.5}$ hourly distribution concentrations at the passenger boarding area compared to ambient concentrations on the rooftop 2014-2017.

Figure 2 shows the improvements of the ventilation system at the JCBS: A significant decrease in $PM_{2.5}$ annual concentration in 2017 (18µg/m³) as compared to the concentrations measured in 2014 (38µg/m³). The annual concentrations on the rooftop of the station did not show significant changes during the measured period and reached maximum level of 19µg/m³.

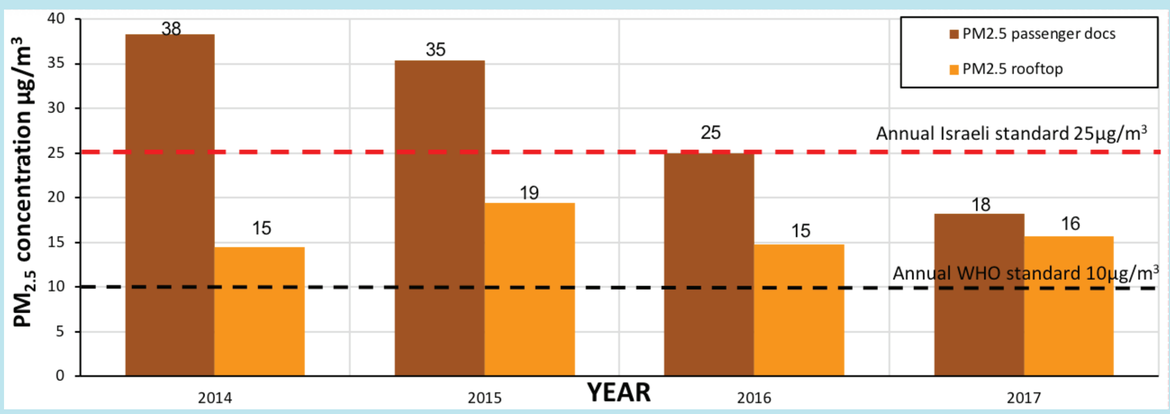

Figure 2: $PM_{2.5}$ annual averages concentration at the passenger boarding platform compared to rooftop concentration, 2014-2017.

Despite the significant improvement, indoor daily concentrations of $PM_{2.5}$ still exceed the Israeli environmental standard 24% of the time, excluding Saturdays and holidays when the JCBS is not active. The 2017 $PM_{2.5}$ annual average was calculated as 18µg/m³, which exceeded the WHO standard by 1.8 times.

Similar observations were recorded for NO_2. The entire period average NO_2 concentration was calculated as 118ppb, 5.6 times the annual Israeli standard of 21ppb (40µg/m³).
Figures 3,4 show hourly NO_x/NO/NO_2 concentrations distribution at the passenger boarding area and ambient concentrations on the rooftop respectively, based on 40 month period during 2014-2017.

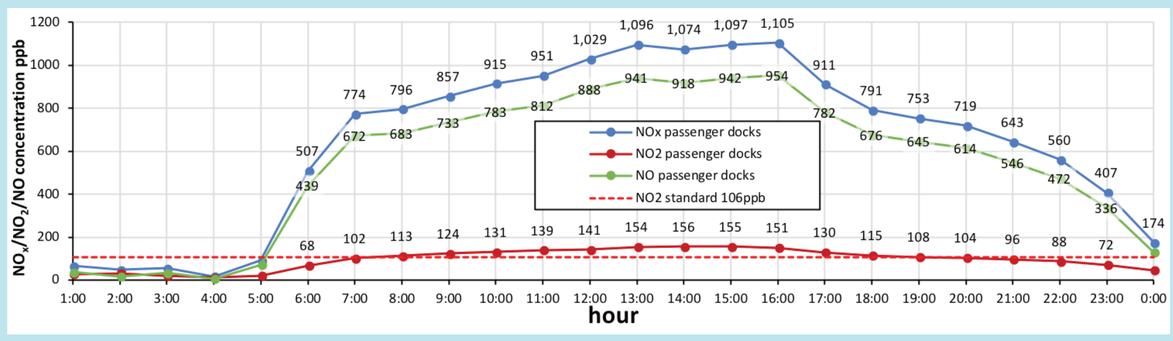

Figure 3: Indoor NO_x/NO/NO_2 hourly distribution concentrations at the passenger boarding area, 2014-2017.

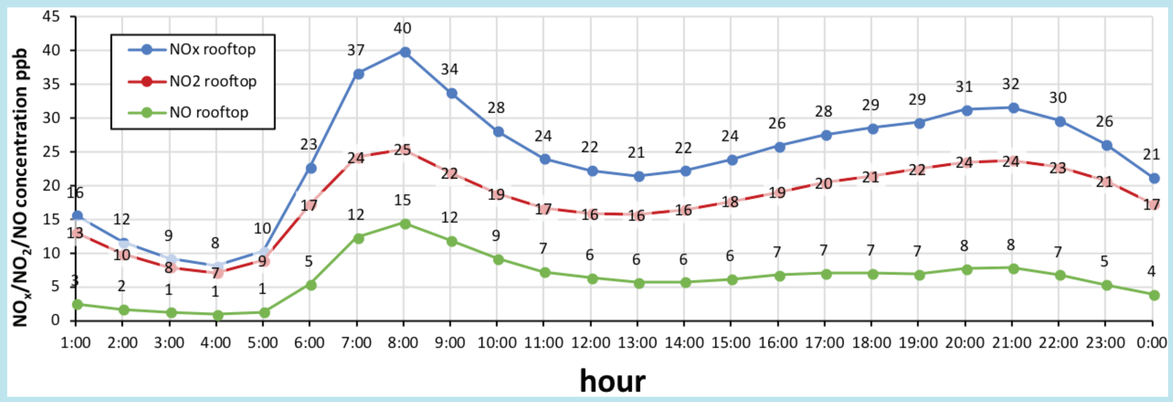

Figure 4: Ambient NO_x/NO/NO_2 hourly distribution concentrations on rooftop, 2014-2017.

4 CONCLUSIONS

The results clearly indicate that despite the improvement in the ventilation system at the JCSB, air pollutants emitted from the diesel engines of buses in the JCBS, do not effectively disperse but reach high and harmful concentrations inside the passenger boarding area of the station, significantly above ambient standards. For the present situation when it is difficult to improve the air quality inside the JCBS, it is therefore important to focus on minimizing passenger presence in the polluted areas.