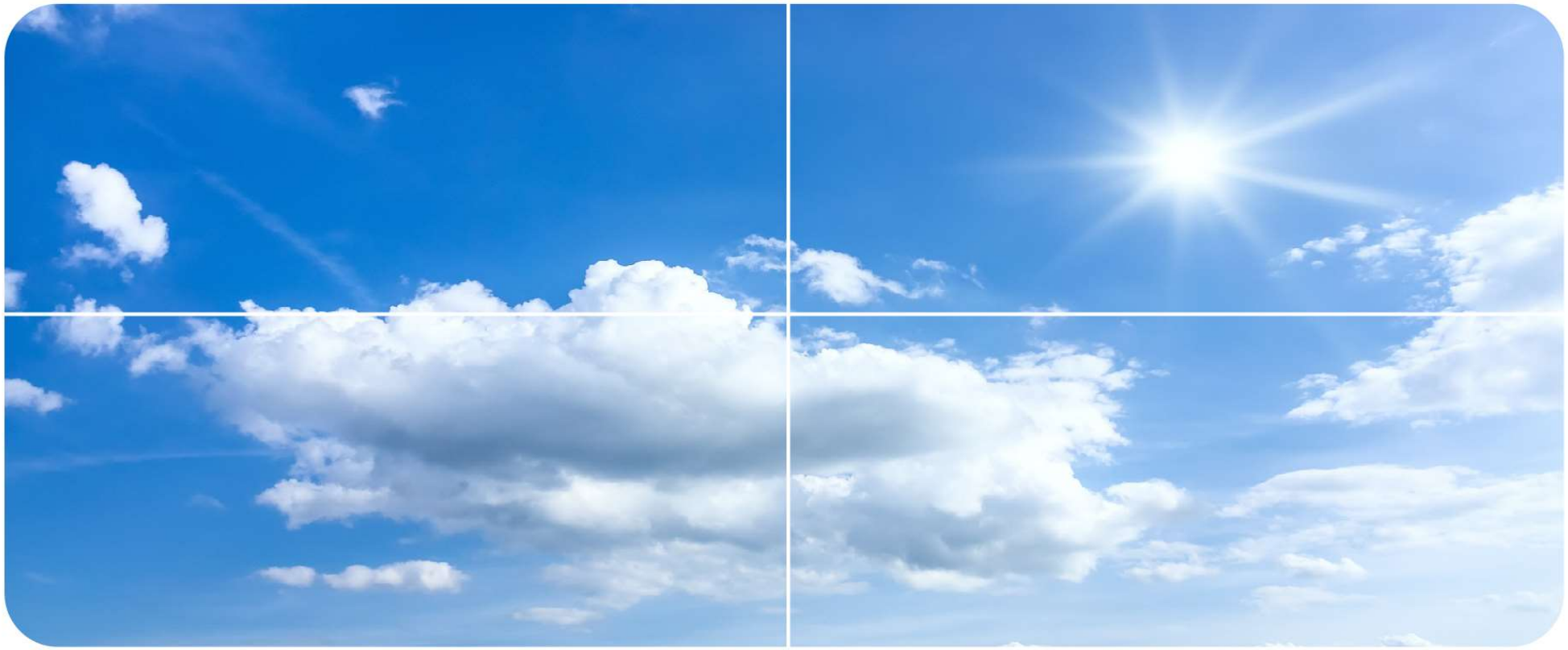

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Air pollutant dispersion modelling results for Serbia

(emission reductions and dispersion modelling result for all 2030 prospective scenarios)

Elsa Real, INERIS

10/09/21

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Presentation Outline

01

Wrap-up of the methodology and scenarios

02

Air pollution in Serbia in 2030 – Focus on LV exceedances

03

Construction of a WAMC scenario that avoid LV exceedances

04

Conclusion

01

Wrap-up of the methodology & scenarios

Wrap-up of the methodology

2015

Reference year

2030

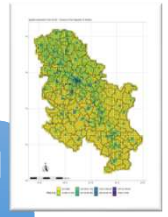
WEM scenario

WAM A scenario

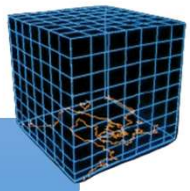
WAM B scenario

WAM C scenario

Emissions calculation at national level for each detailed activity sector (more than 90 sub-sectors)



Temporalization and spatialization of national emissions over Serbia



Use of a chemical transport model (CHIMERE) to simulate concentrations over Serbia with a 5km x 5km resolution and an hourly timestep

Calculation of exceedances of concentrations Limit Values at the stations location with adjustment of model results when 2015 measurements are available

Calculation of population exposure (concentrations crossed with the inhabitant-densities in each grid) for particles, NO_2 and ozone for Health Impact Assesment

SCENARIOS

3 emission projection scenarios elaborated at the beginning of the project as followed:

- **WEM: with existing measures - baseline**. Scenario including policies and measures adopted and implemented by 1.1.2019

- **WAM A: with additional measures A**. Full implementation of all relevant EU directives and Regulations not yet fully transposed and implemented

- **WAM B: with additional measures B**. More intensive control scenario than WAM A. In addition to WAM A, introduction in some sectors, of stricter ELVs and introduction of national financial and fiscal policies and measures in key emission source categories (such as scraping and promotion schemes for passenger cars and household wood/coal appliances)

  + one additional scenario based on air pollution dispersion results & defined to avoid remaining exceedances of LV

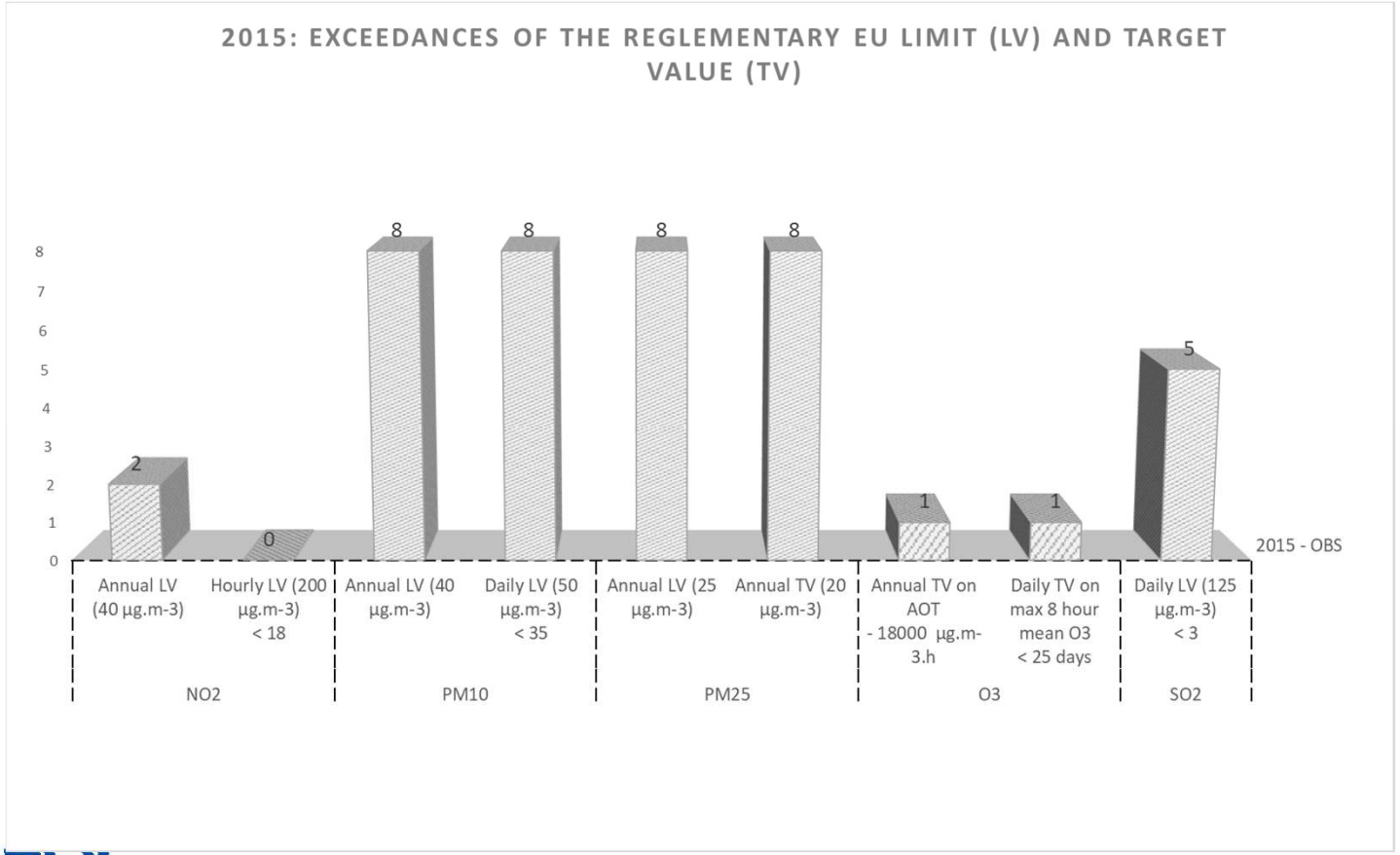
- **WAM C: With additional measures C**. Full control scenario. In addition to WAM B, new measures **including local specific measures** aiming to ensure compliance with air quality limit values (Directive 2008/50/EC, especially for particle matters PM_{10} and $PM_{2.5}$)

02

Air pollution in Serbia in 2030 – Focus on LV exceedances

LV exceedances: observed situation in 2015

Pollutant	Number of stations in 2015
PM10	10
PM2.5	10 – based on PM10 + annual ratio
NO2	29
SO2	33
O3	4



LV exceedances: observed situation in 2015

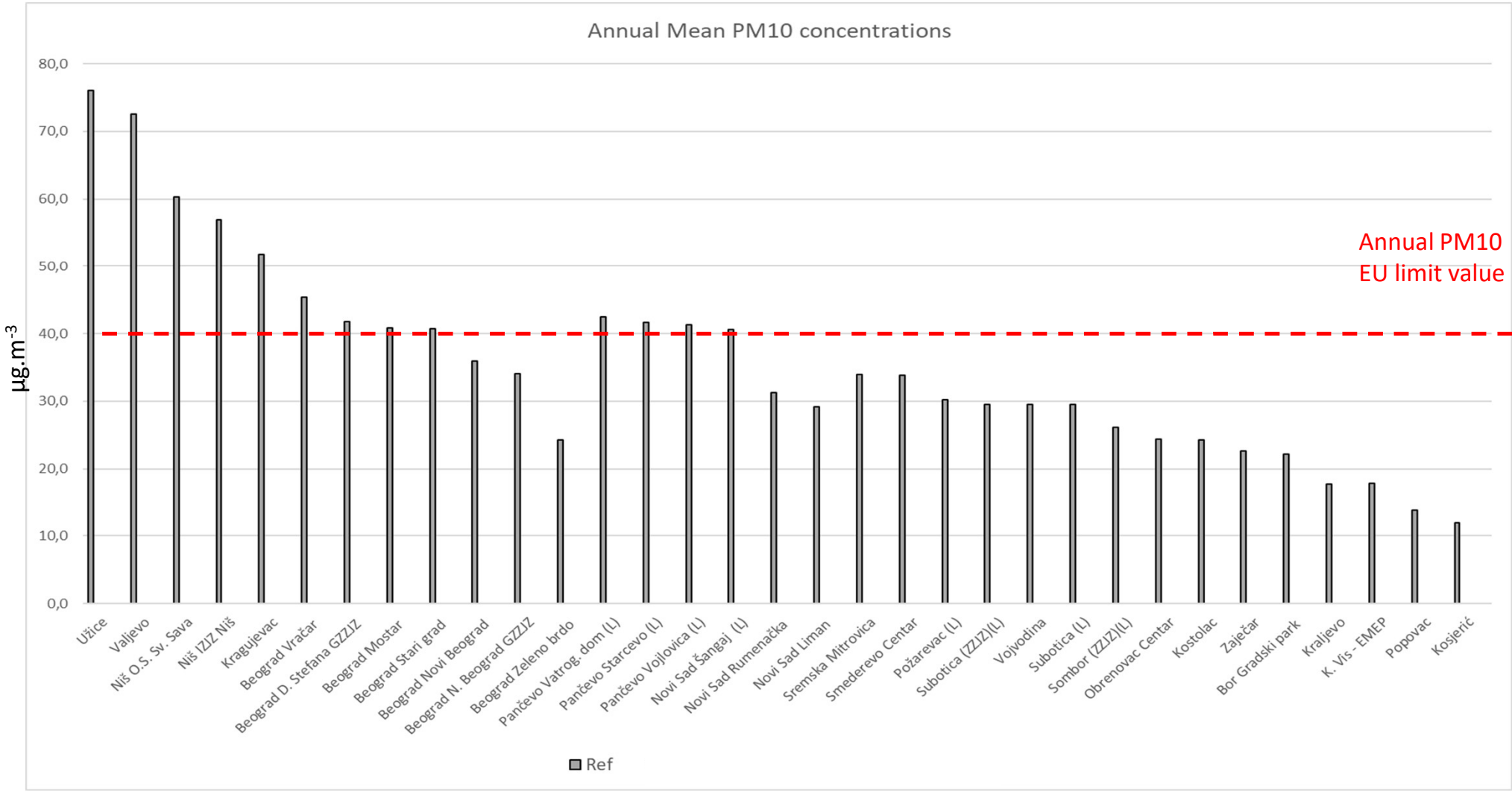
Pollutant	Number of stations in 2015
PM10	10
PM2.5	10 – based on PM10 + annual ratio
NO2	29
SO2	33
O3	4

The number of PM measurement stations in 2015 is low and does not represent the whole Serbia.

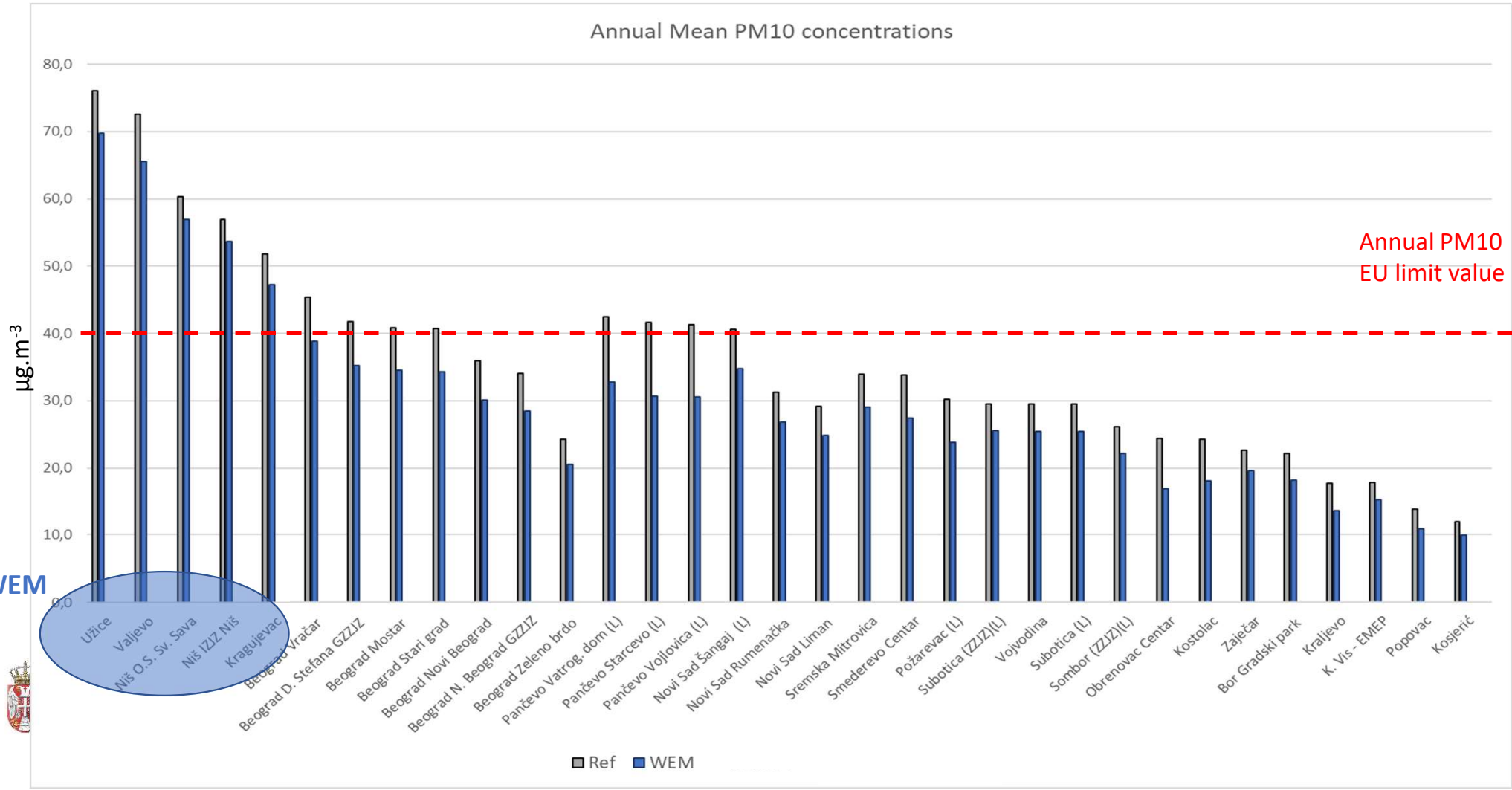
For this reason, exceedances are also calculated at the localisation of more recent stations (stations for the year 2019), adding 23 stations to the 10 already in place in 2015.

However, for these stations, simulated data are not adjusted to the real measured concentration as they are no measurements for the year 2015.

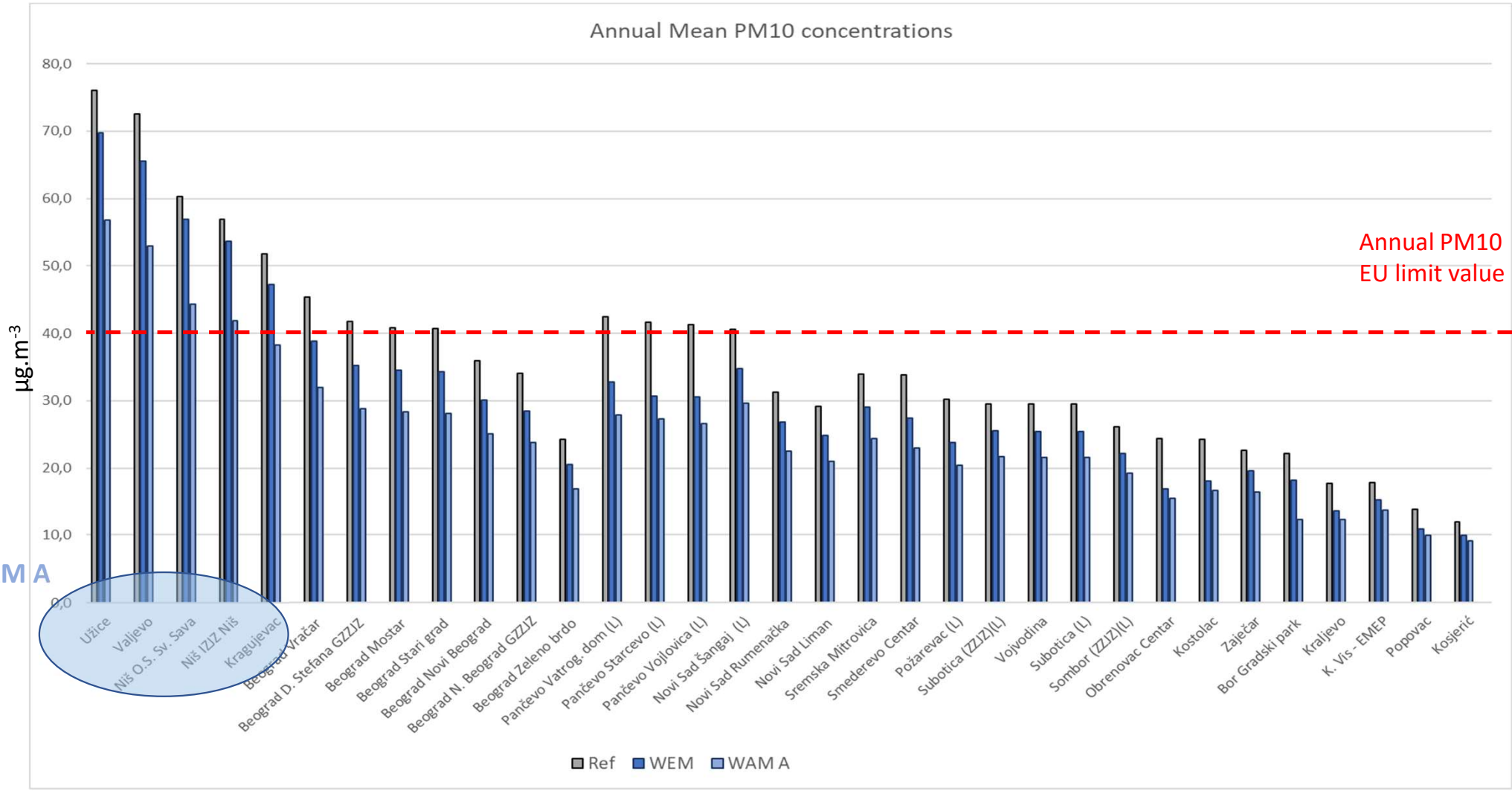
PM10 – LV on annual mean concentrations (40 µg.m^{-3})



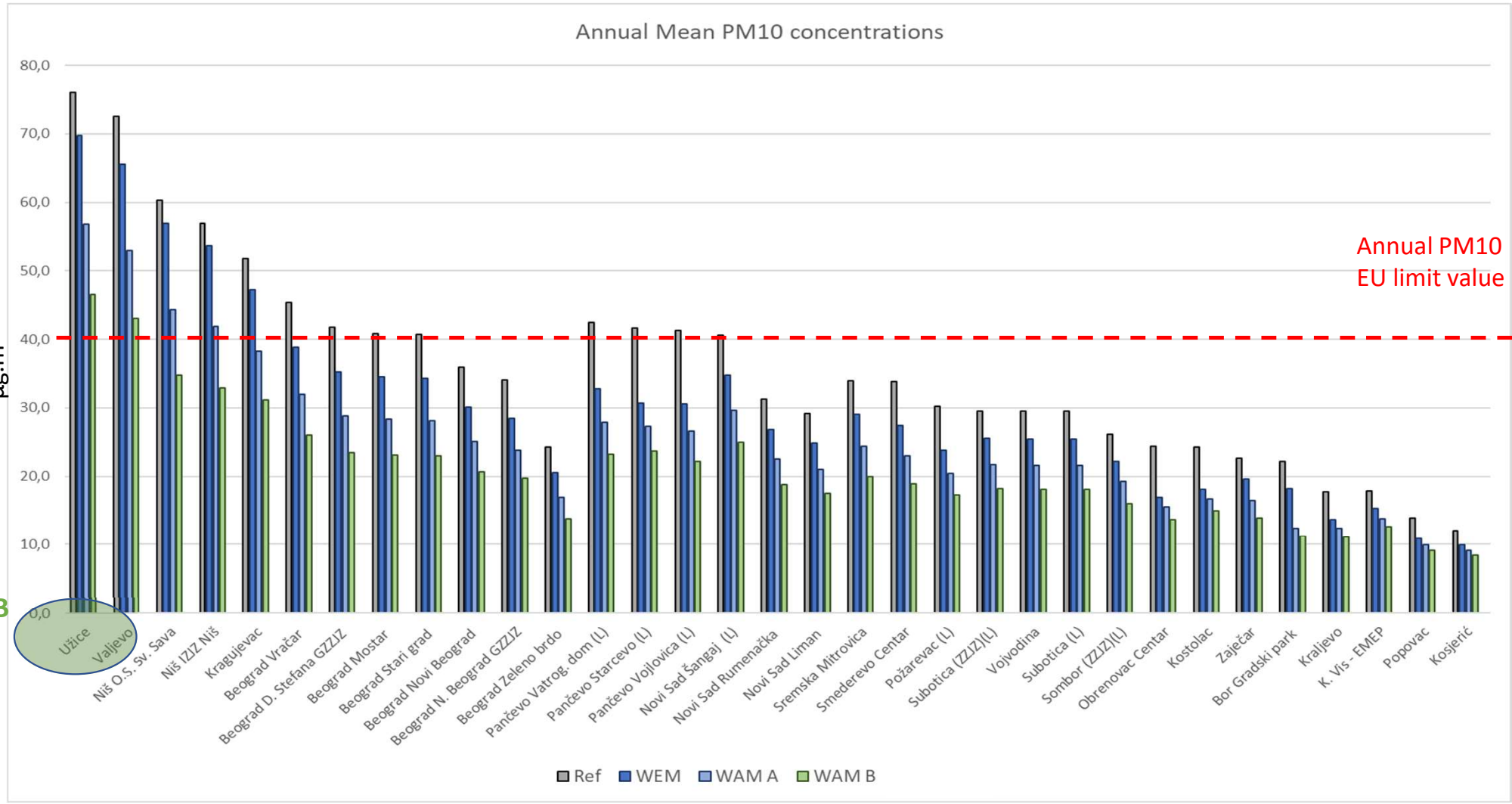
PM10 – LV on annual mean concentrations (40 µg.m^{-3})



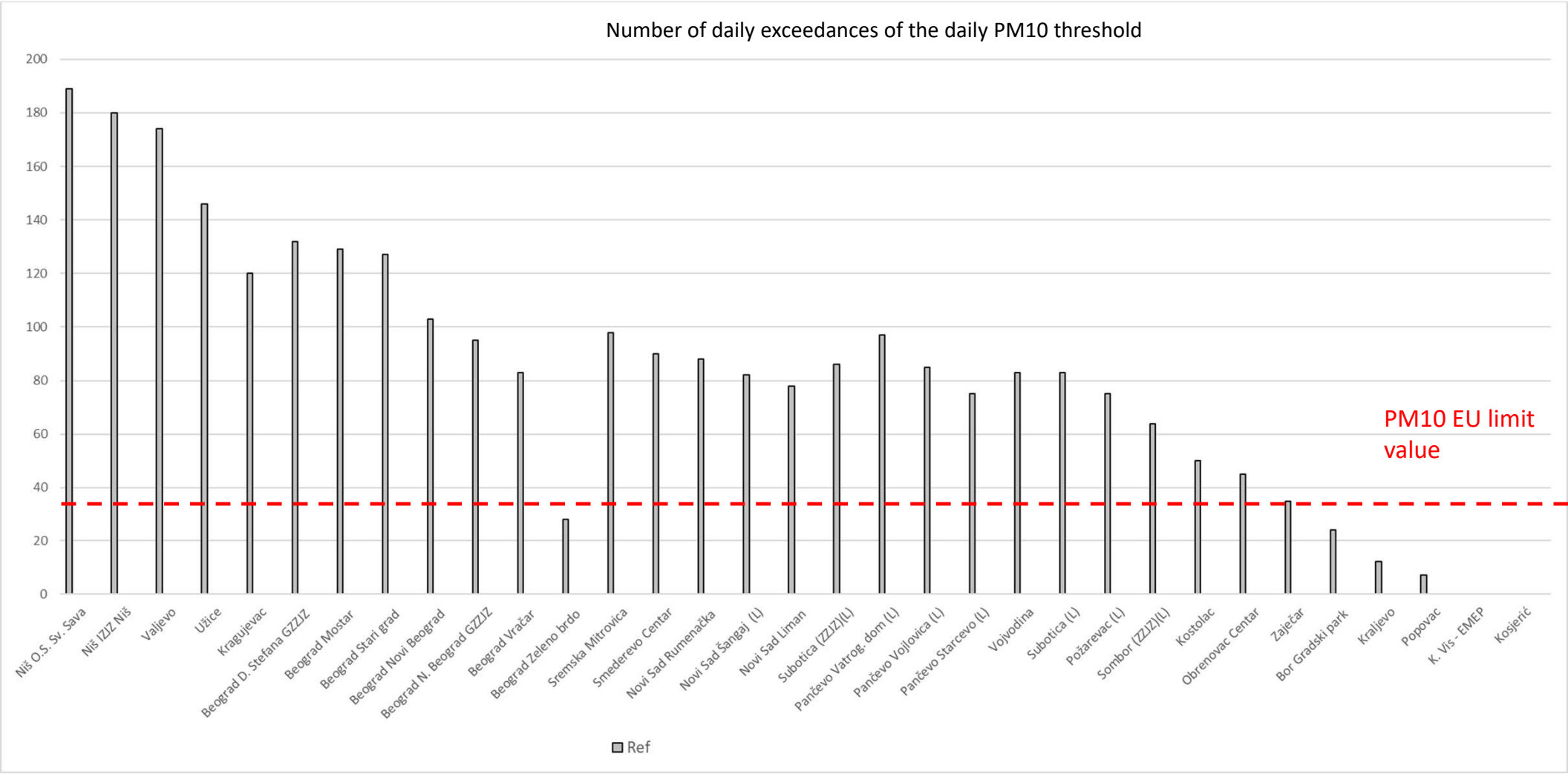
PM10 – LV on annual mean concentrations (40 µg.m^{-3})



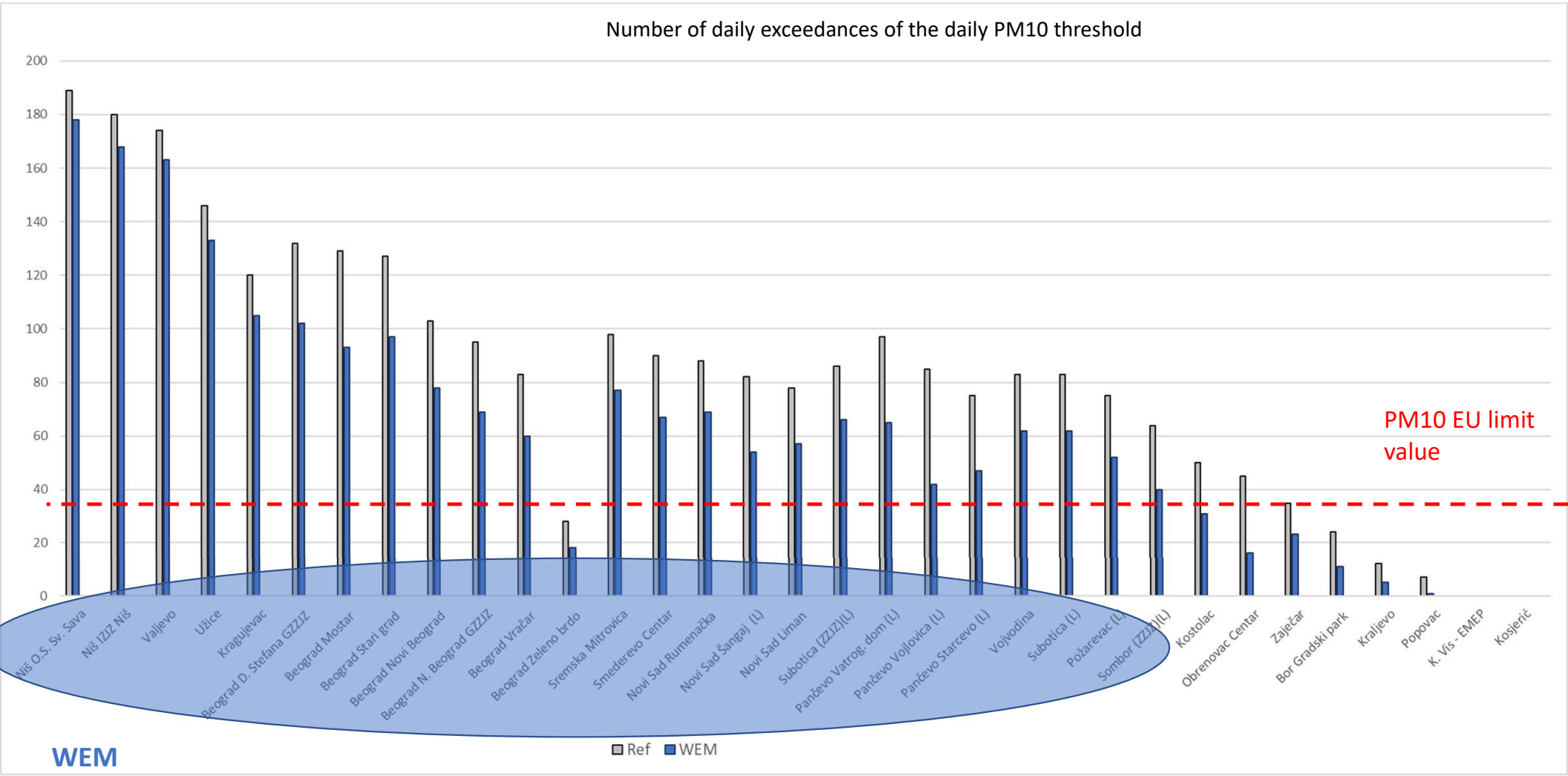
PM10 – LV on annual mean concentrations (40 µg.m^{-3})



PM10 – LV on the DAILY mean threshold (not more than 35 exceedances of the 50 µg.m^{-3} threshold)

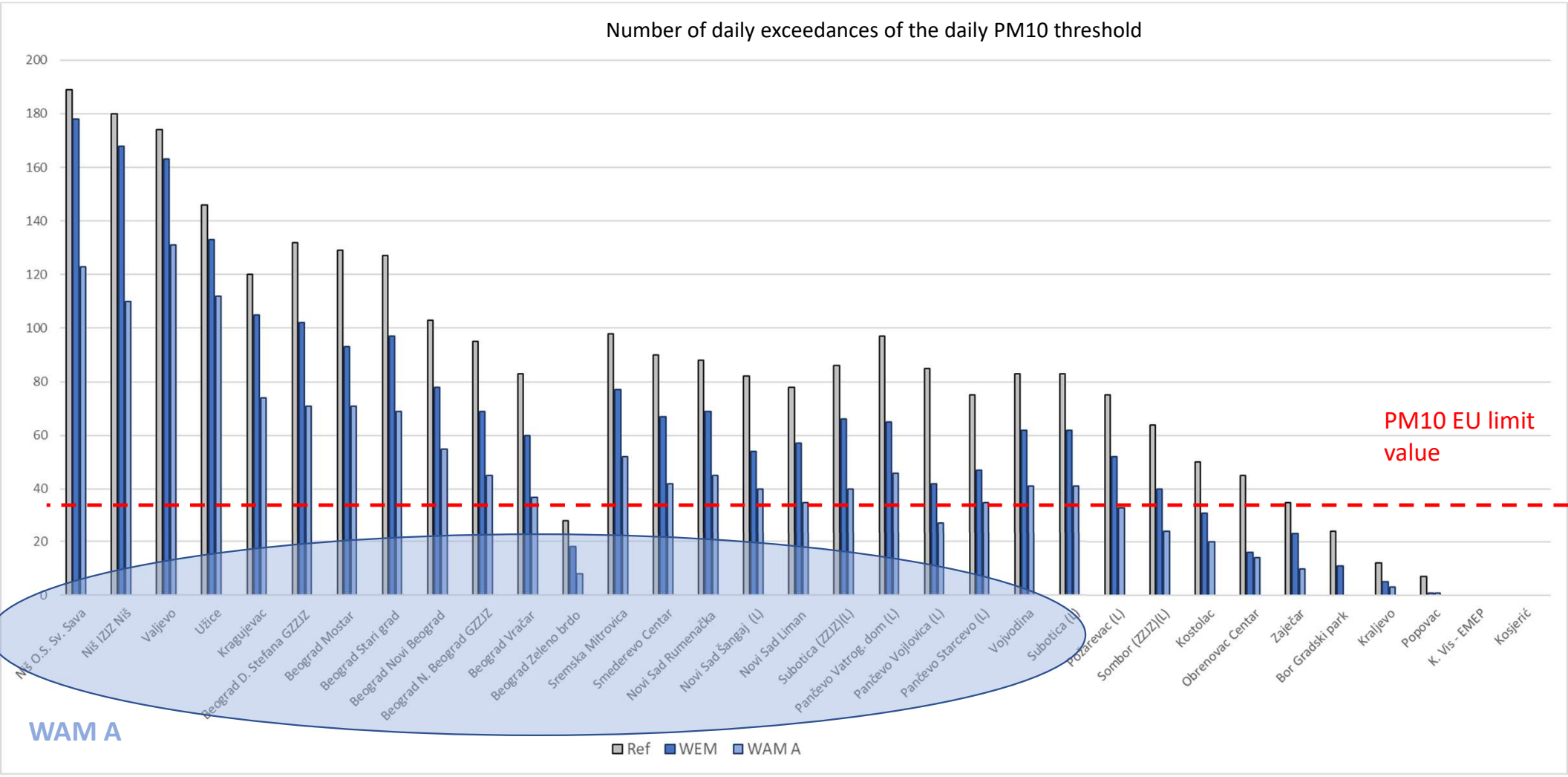


PM10 – LV on the DAILY mean threshold (not more than 35 exceedances of the 50 µg.m^{-3} threshold)

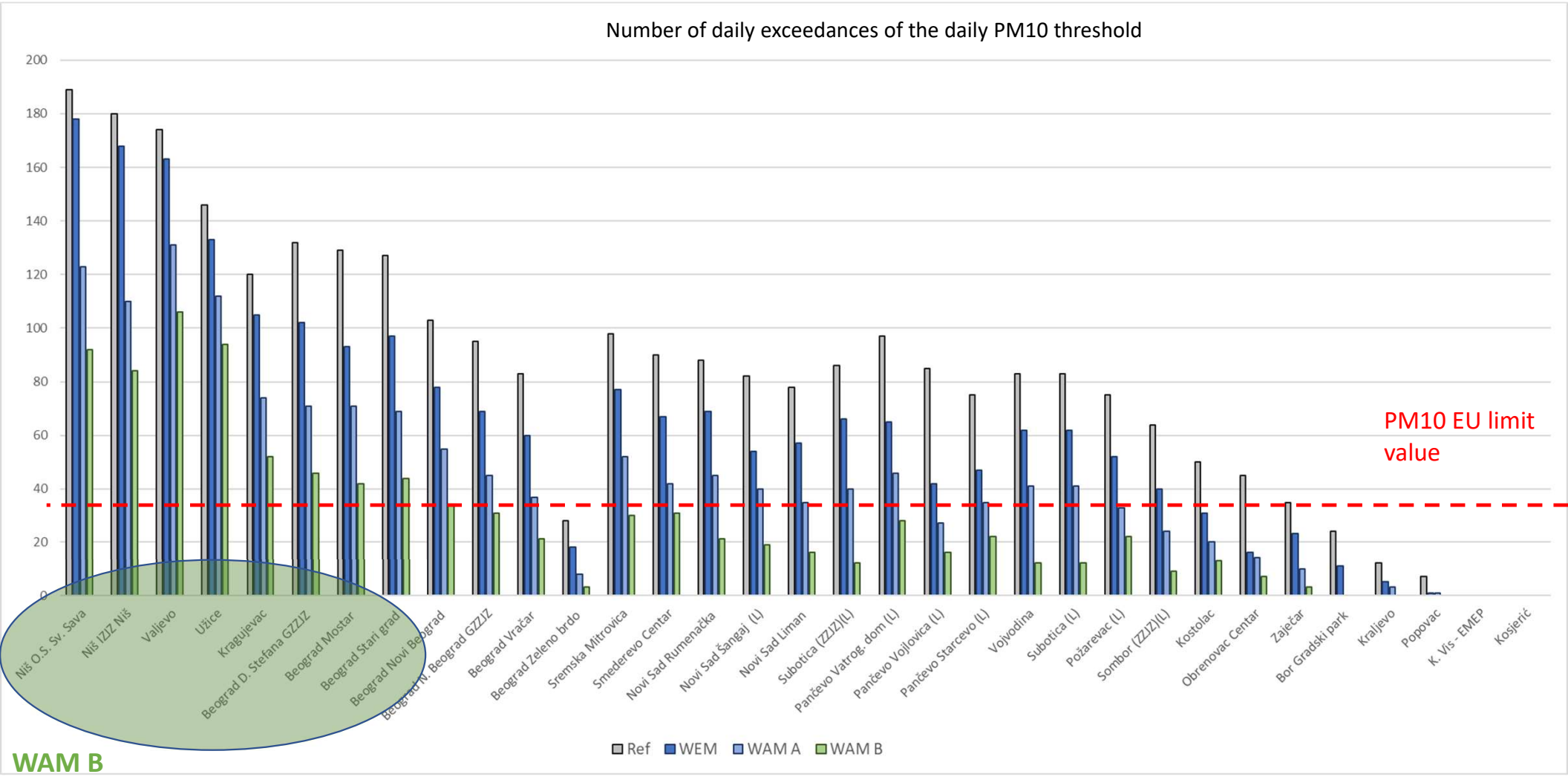


WEM

PM10 – LV on the DAILY mean threshold (not more than 35 exceedances of the 50 µg.m^{-3} threshold)

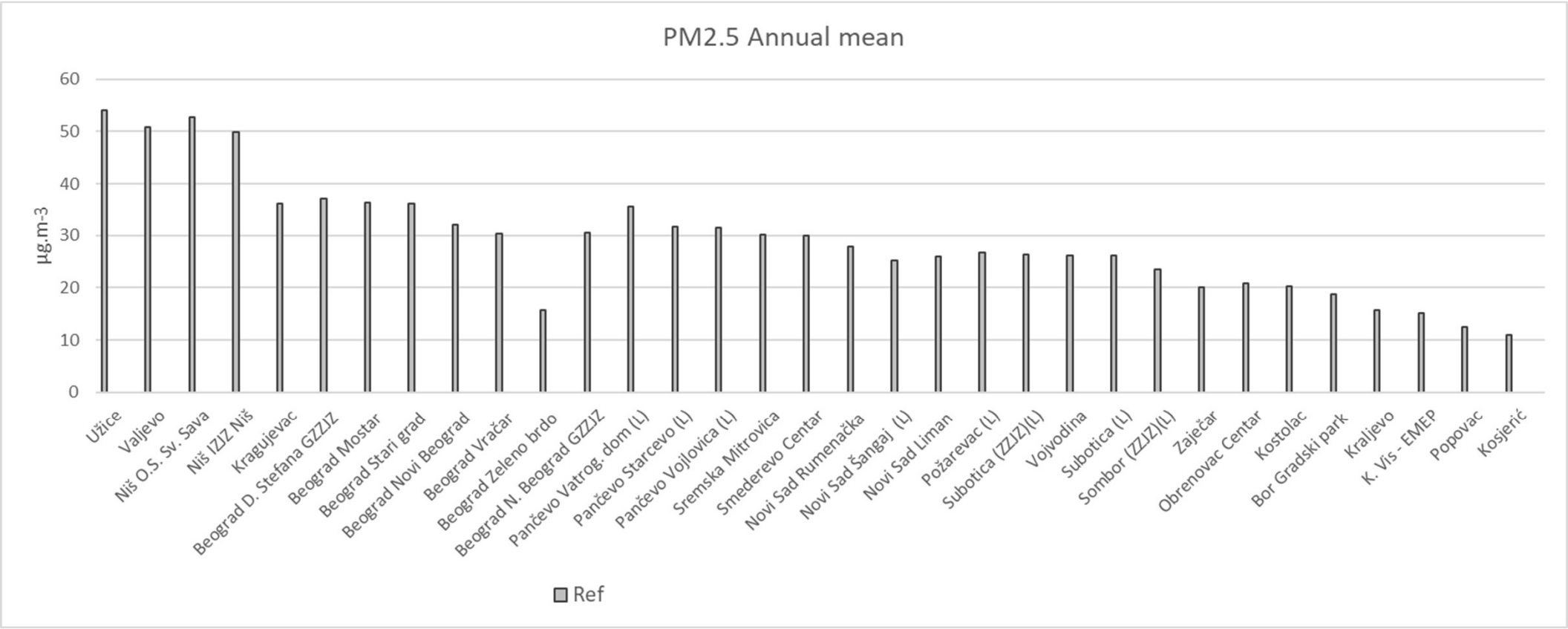


PM10 – LV on the DAILY mean threshold (not more than 35 exceedances of the 50 µg.m^{-3} threshold)

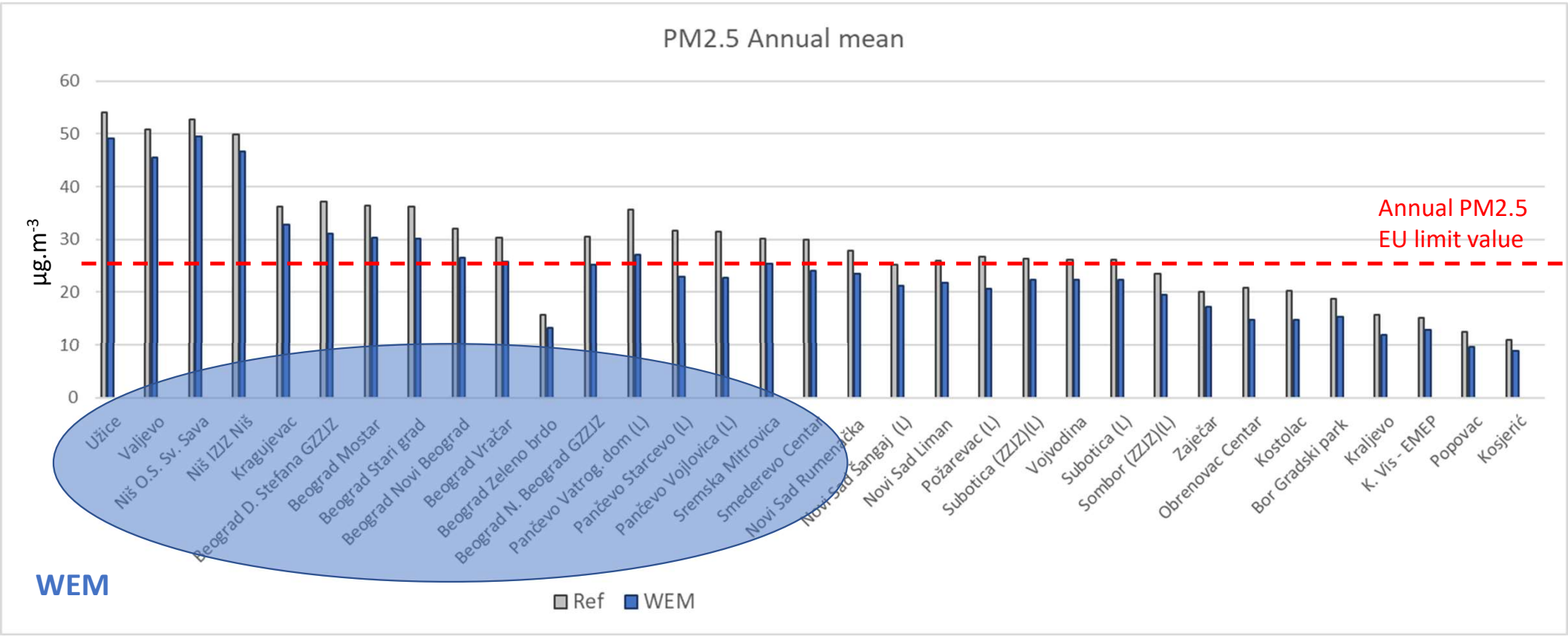


WAM B

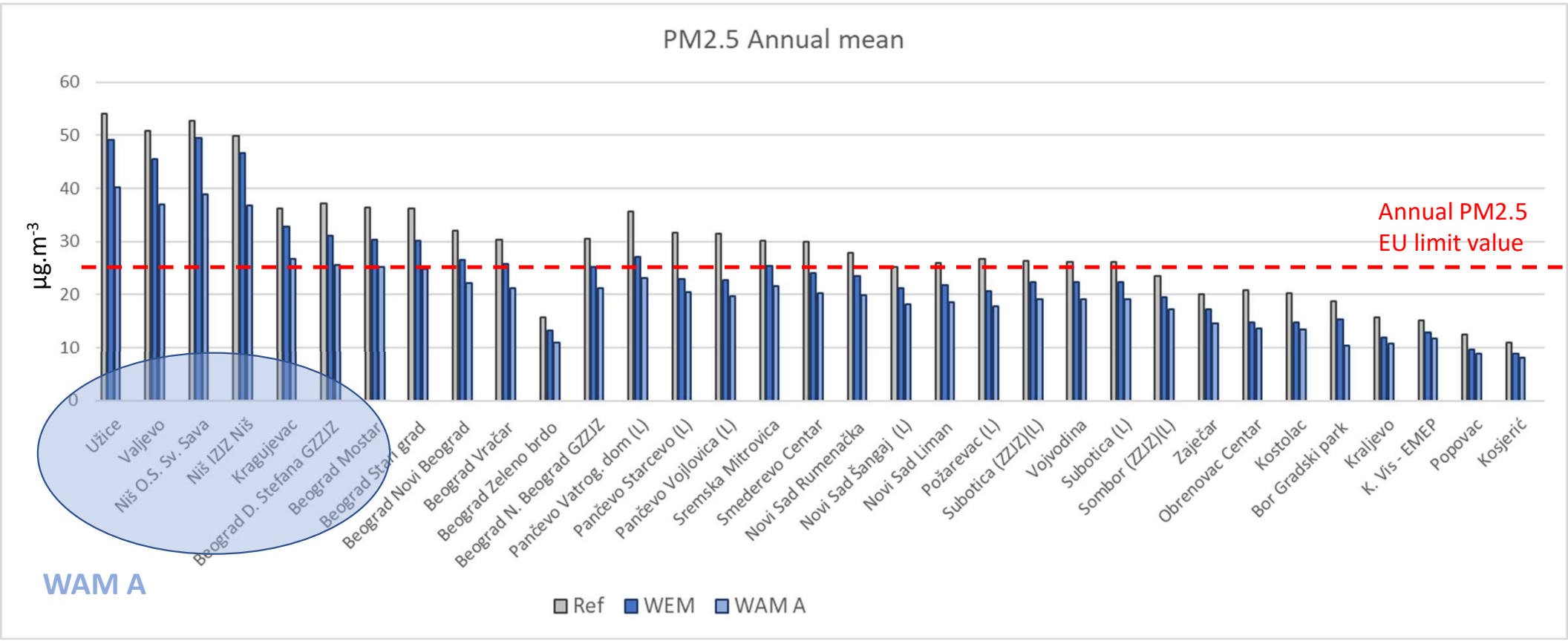
PM2.5 - LV on ANNUAL mean concentrations (25 µg.m^{-3})



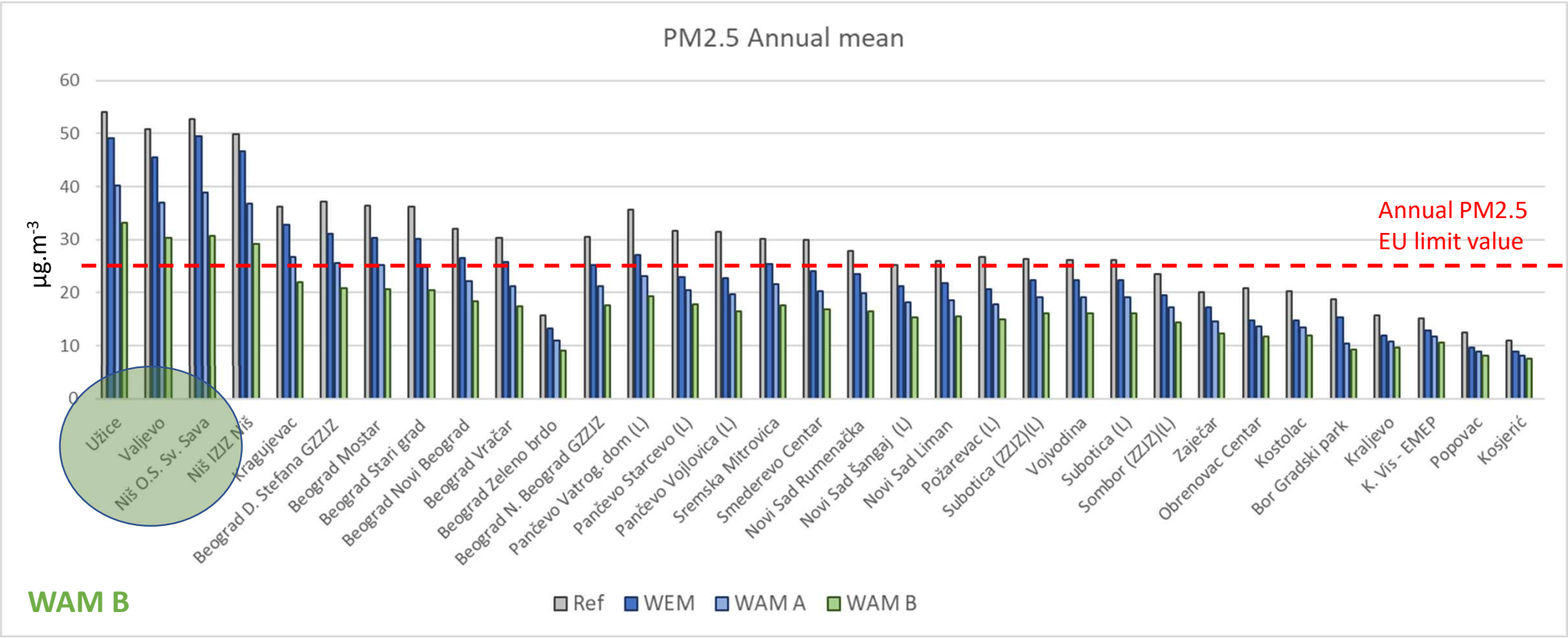
PM2.5 - LV on ANNUAL mean concentrations (25 µg.m^{-3})



PM2.5 - LV on ANNUAL mean concentrations (25 µg.m^{-3})

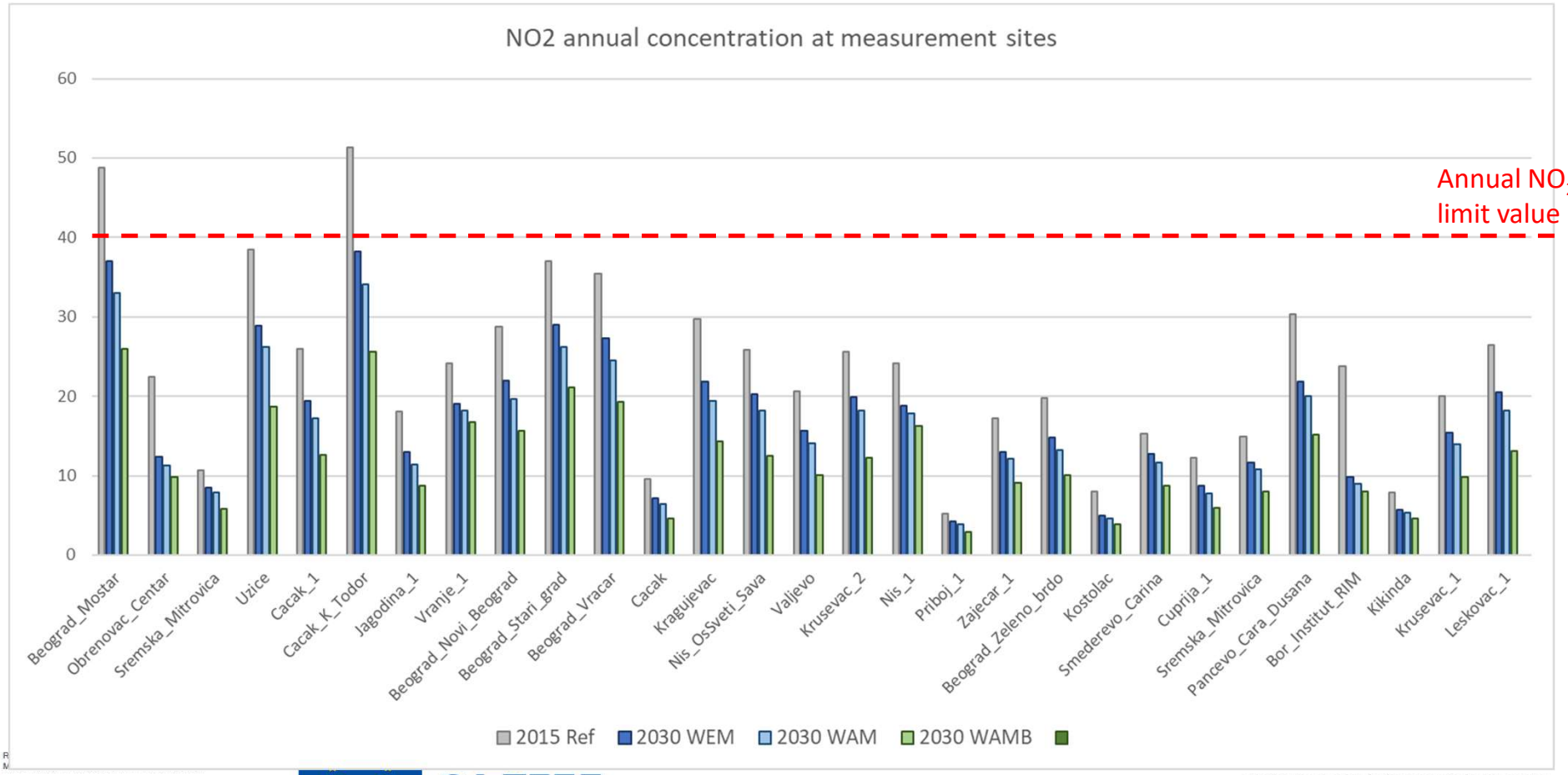


PM2.5 - LV on ANNUAL mean concentrations (25 µg.m^{-3})

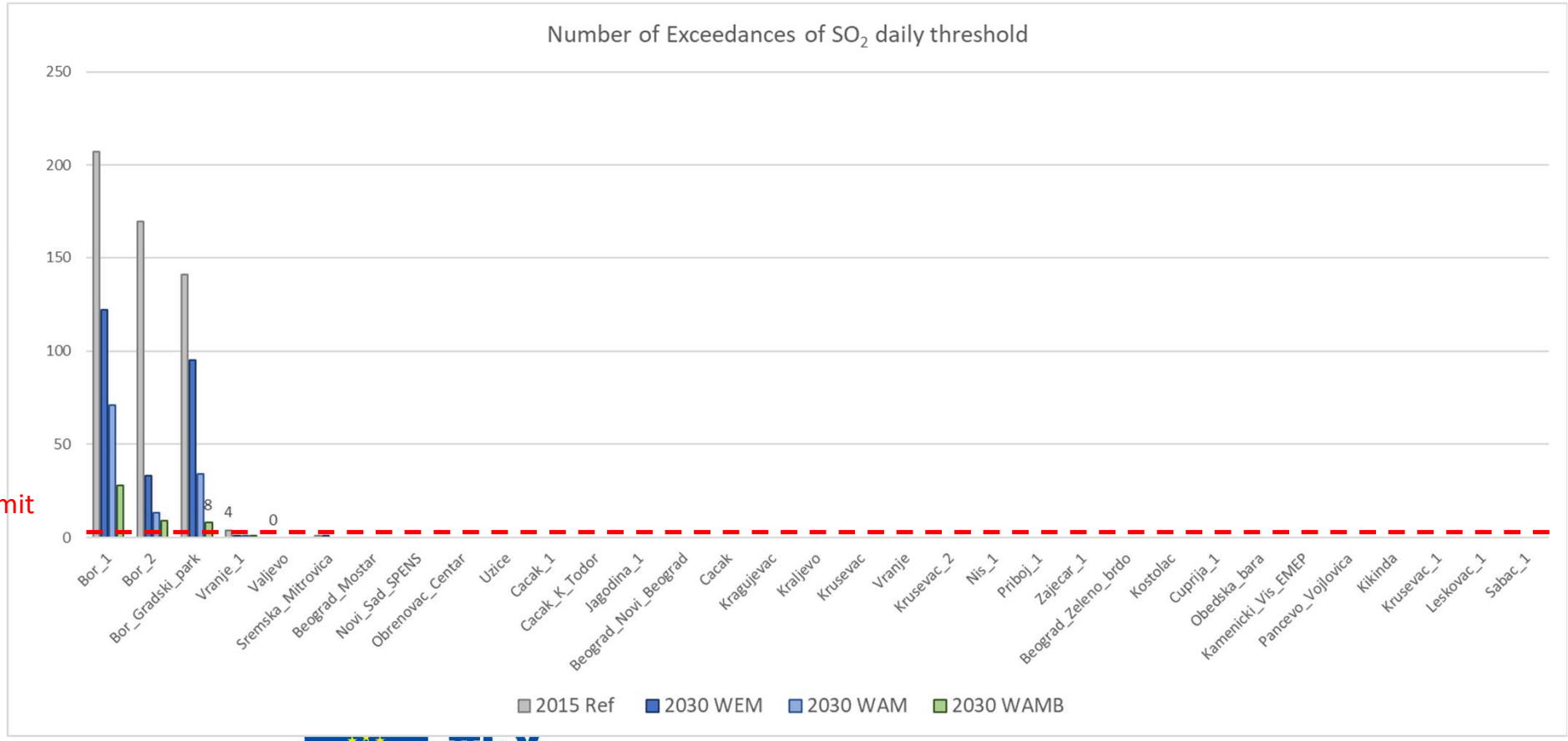


WAM B

NO2 - LV on ANNUAL mean concentrations (40 µg.m^{-3})



SO2 - LV on DAILY mean concentrations (not more than 3 exceedances of the 120 µg.m^{-3} threshold)



SO_2 EU limit value

Cities with exceedances of EU LV : SUMMARY

	2015 Ref	2030 - WEM	2030 - WAM A	2030 - WAM B
Užice	PM10 & PM2.5	PM10 & PM2.5	PM10 & PM2.5	PM10 & PM2.5
Valjevo	PM10 & PM2.5	PM10 & PM2.5	PM10 & PM2.5	PM10 & PM2.5
Niš	PM10 & PM2.5	PM10 & PM2.5	PM10 & PM2.5	PM10 & PM2.5
Kragujevac	PM10 & PM2.5	PM10 & PM2.5	PM10 & PM2.5	PM10
Beograd	PM10 & PM2.5 & NO2	PM10 & PM2.5	PM10 & PM2.5	PM10
Pančevo	PM10 & PM2.5	PM10 & PM2.5	PM10	
Novi Sad	PM10 & PM2.5	PM10	PM10	
Sremska Mitrovica	PM10 & PM2.5	PM10 & PM2.5	PM10	
Smederevo	PM10 & PM2.5	PM10	PM10	
Vojvodina	PM10 & PM2.5	PM10	PM10	
Subotica	PM10 & PM2.5	PM10	PM10	
Požarevac	PM10 & PM2.5	PM10 & PM2.5		
Sombor	PM10 & PM2.5	PM10 & PM2.5		
Obrenovac	PM10			
Kostolac	PM10			
Zaječar	PM10			
Vranje	SO2			
Bor	SO2	SO2	SO2	SO2
Cacak	NO2			

03

Construction of a WAMC scenario that avoid LV exceedances

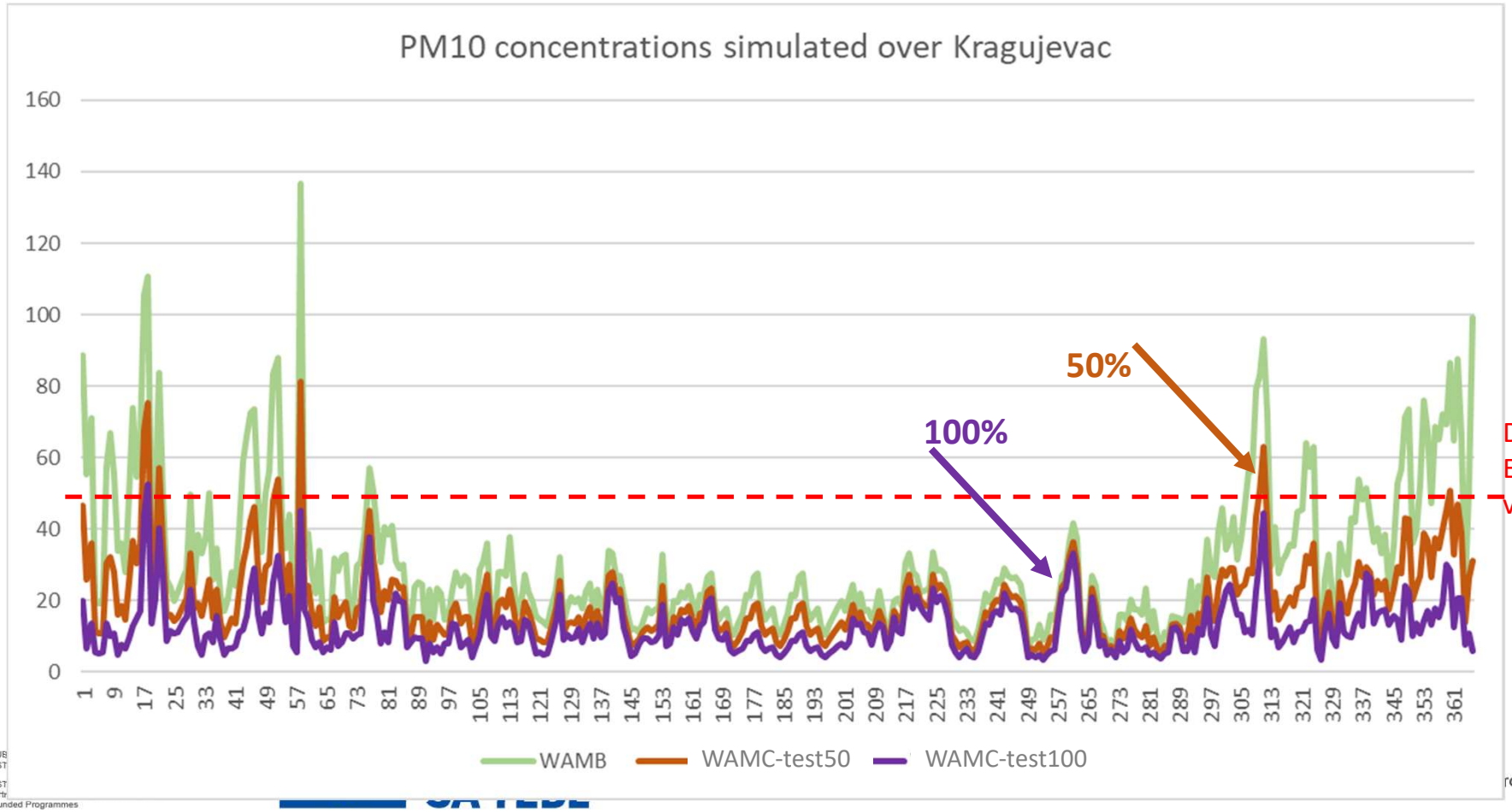
WAMC: « inverse modelling » to estimate emissions reduction from pollutant concentration simulation

Some cities are still in exceedances with the WAMB scenario for particles and SO2. In WAM B in all cities, domestic heating remains the largest source of PM10 and PM2.5 in 2030.

We decided to conduce an “inverse modelling” study: to choose emission reductions that would avoid LV exceedances based on concentrations obtain in each cities for specific test simulations.
2 test simulations have been conducted with the CHIMERE model based on hypothetical emission reductions on domestic heating :

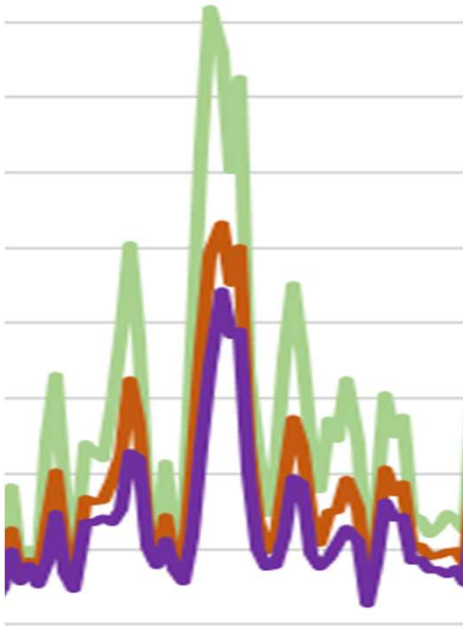
Reduction (compared to WAMB)	Reduction on domestic heating emissions	Reduction on Field burning of agricultural waste
WAMC – test50	50%	100%
WAMC – test100	100%	100%

WAMC: test simulations – Example of Kragujevac

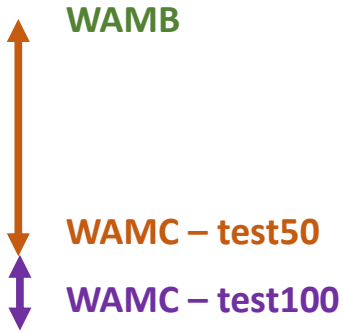


WAMC: « inverse modelling » – Calculation of the needed emission reduction

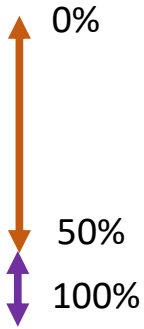
Based on the assumption that the relationship between emission and concentration reductions is linear between WAMB and WAMC-test50 and between WAMC-test50 and WAMC-test100; PM10 daily time series can be re-constructed for any reduction in emissions

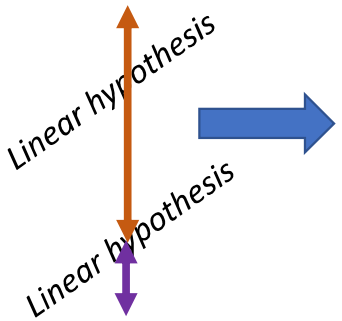


PM10 hourly concentration



Emissions reduction compared to WAMB





Construction of the PM10 daily concentration associated with a reduction of X% of residential heating emissions

Calculation of the X% of emission reduction of residential heating allowing to avoid LV exceedances

WAMC: Which emission reductions are needed to avoid LV exceedances

Based on the test simulations, needed emission reductions have been calculated for each cities still showing particles exceedances with the WAMB scenario. For SO_2, the relation between emissions and concentrations is more straight forward and a linear relation emission/concentration has been taken to calculate this reduction.

PM10 and PM2.5

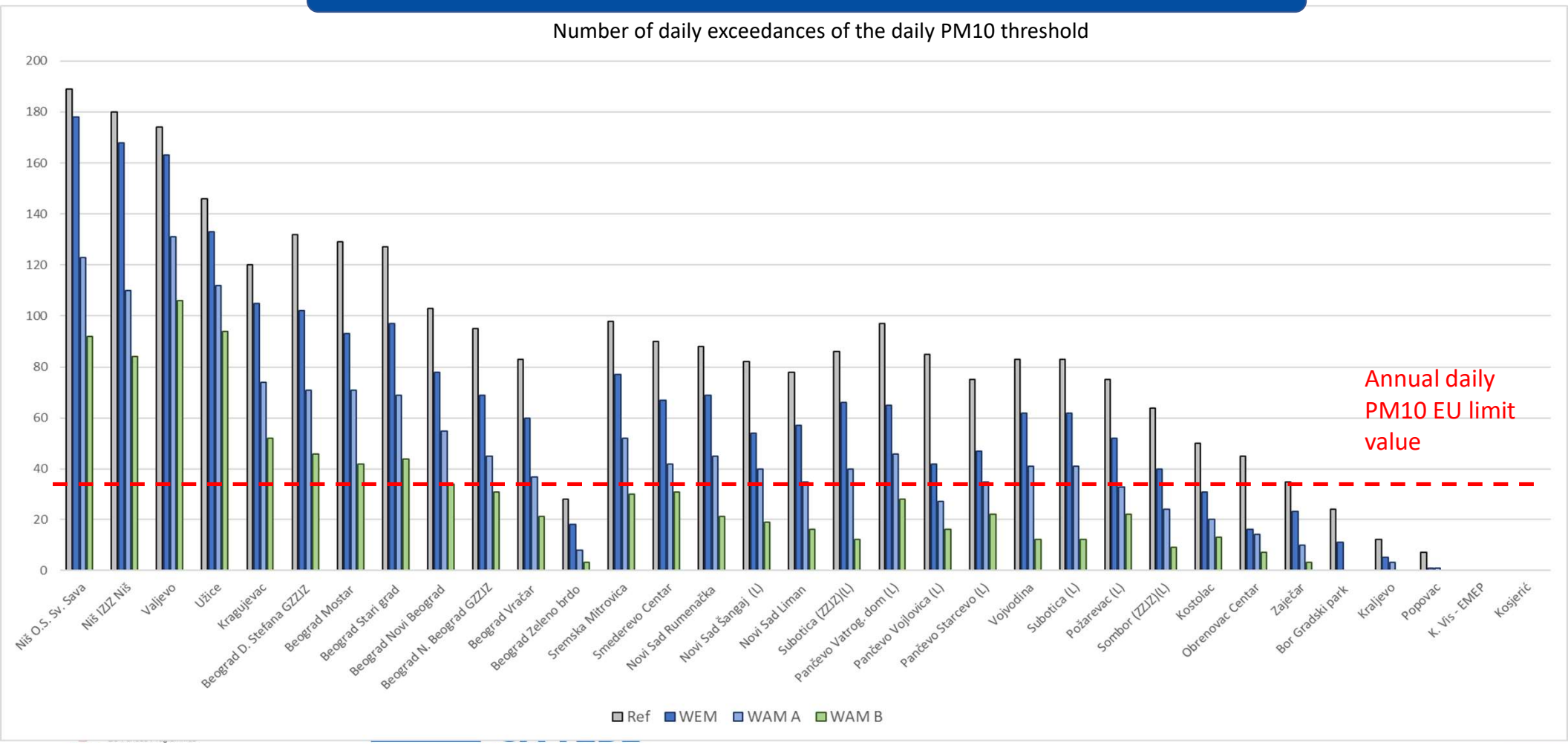
Cities	Needed reduction for domestic heating compared to WAMB
Uzice	65%
Valjevo	50%
Kragujevac	15%
Nis	50%
Beograd	20%

SO2

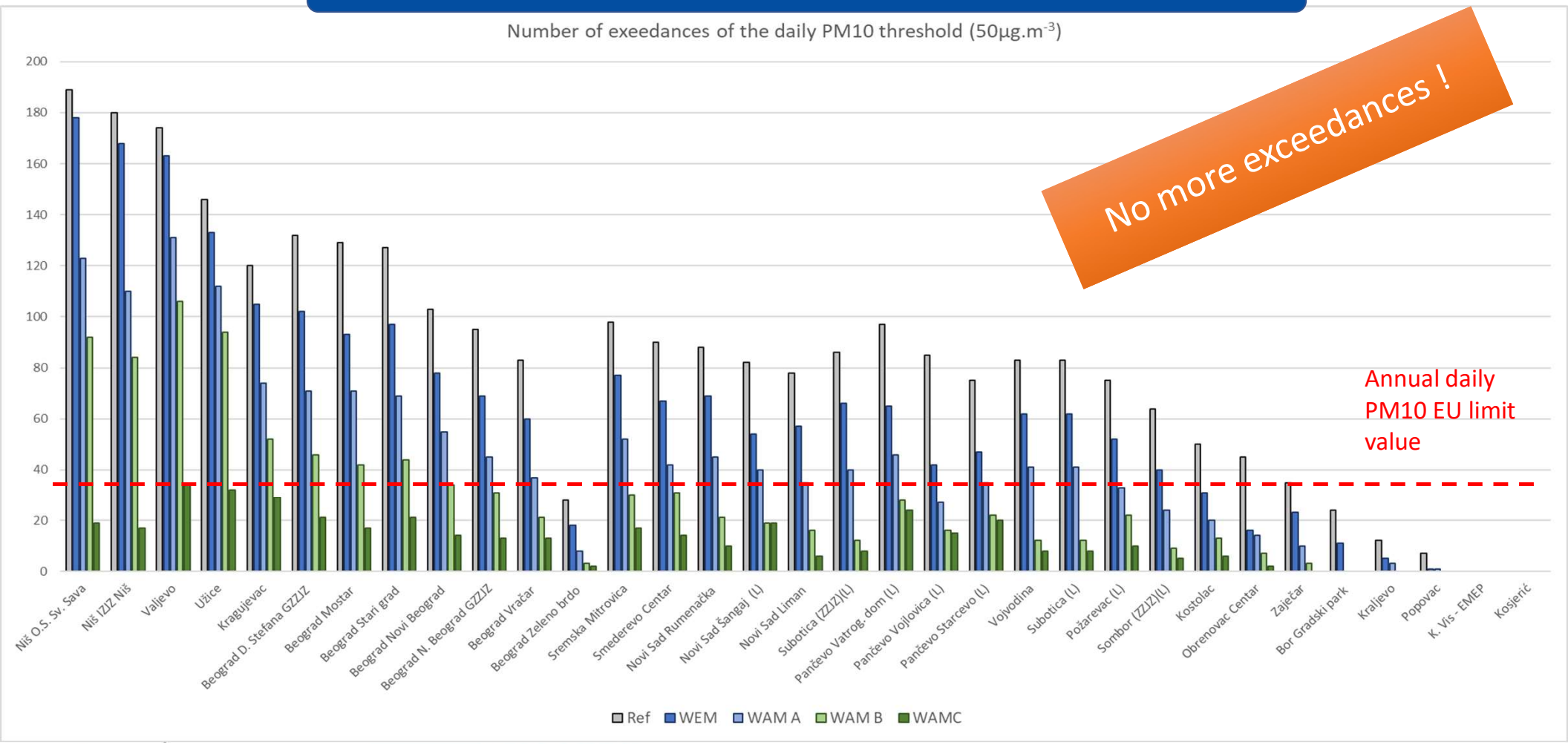
Cities	Needed reduction compared to WAMB
Bor	55% - 60%

These reductions have been the starting point to elaborate WAMC scenario. A full CHIMERE simulation with this NEW WAM C scenario was run to confirm if LVs were respected.

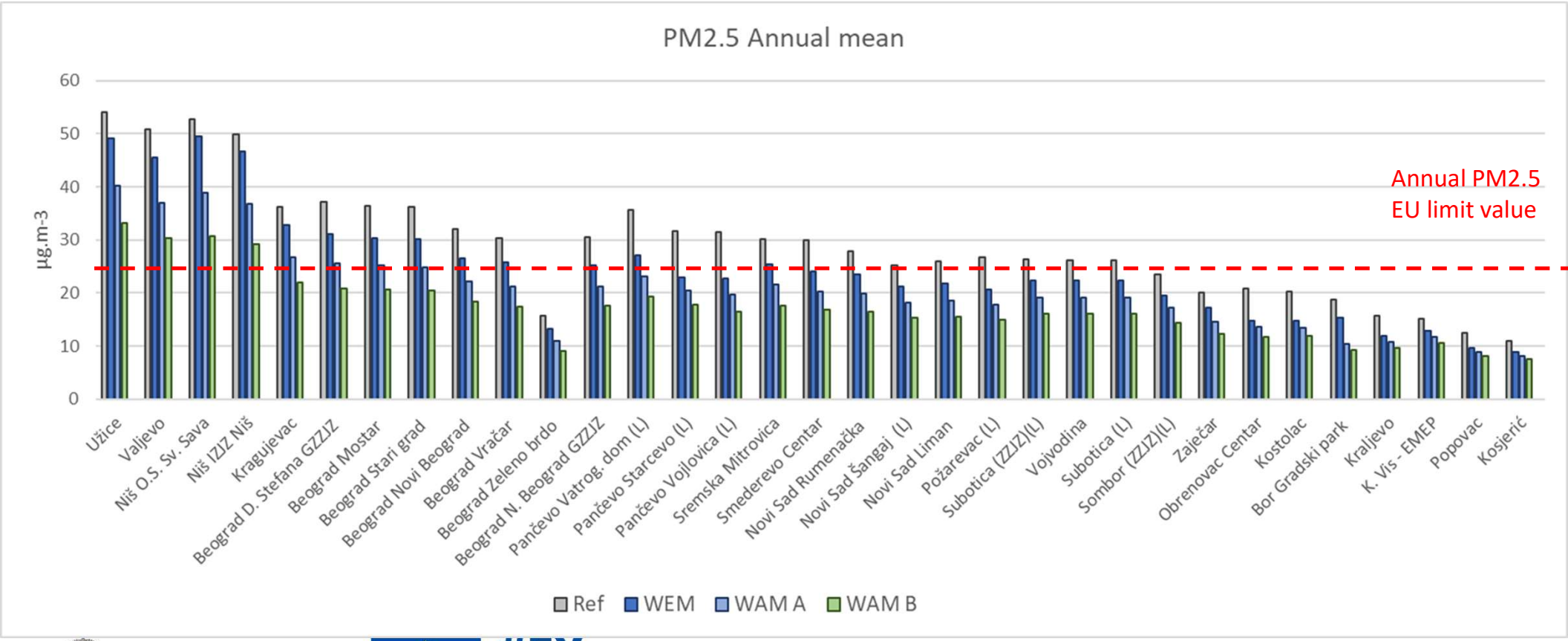
WAM C: annual LV on daily PM10 concentrations



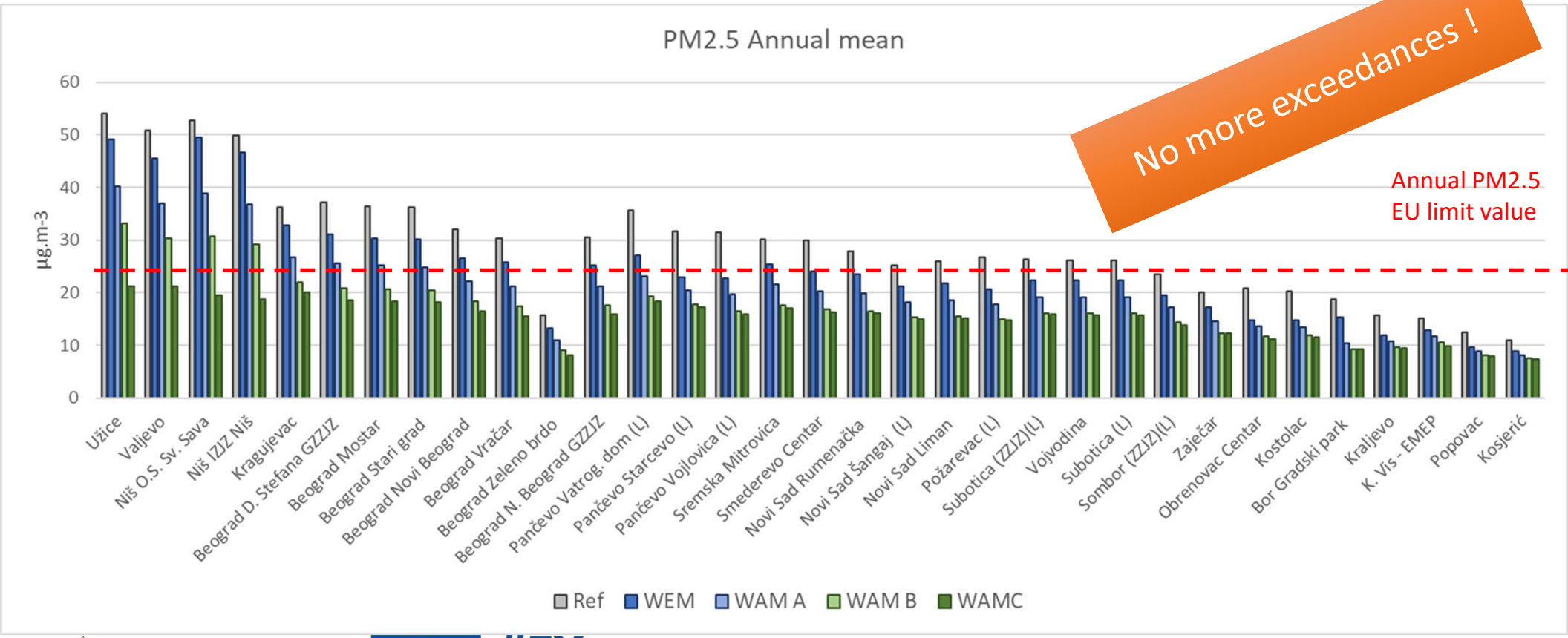
WAM C: annual LV on daily PM10 concentrations



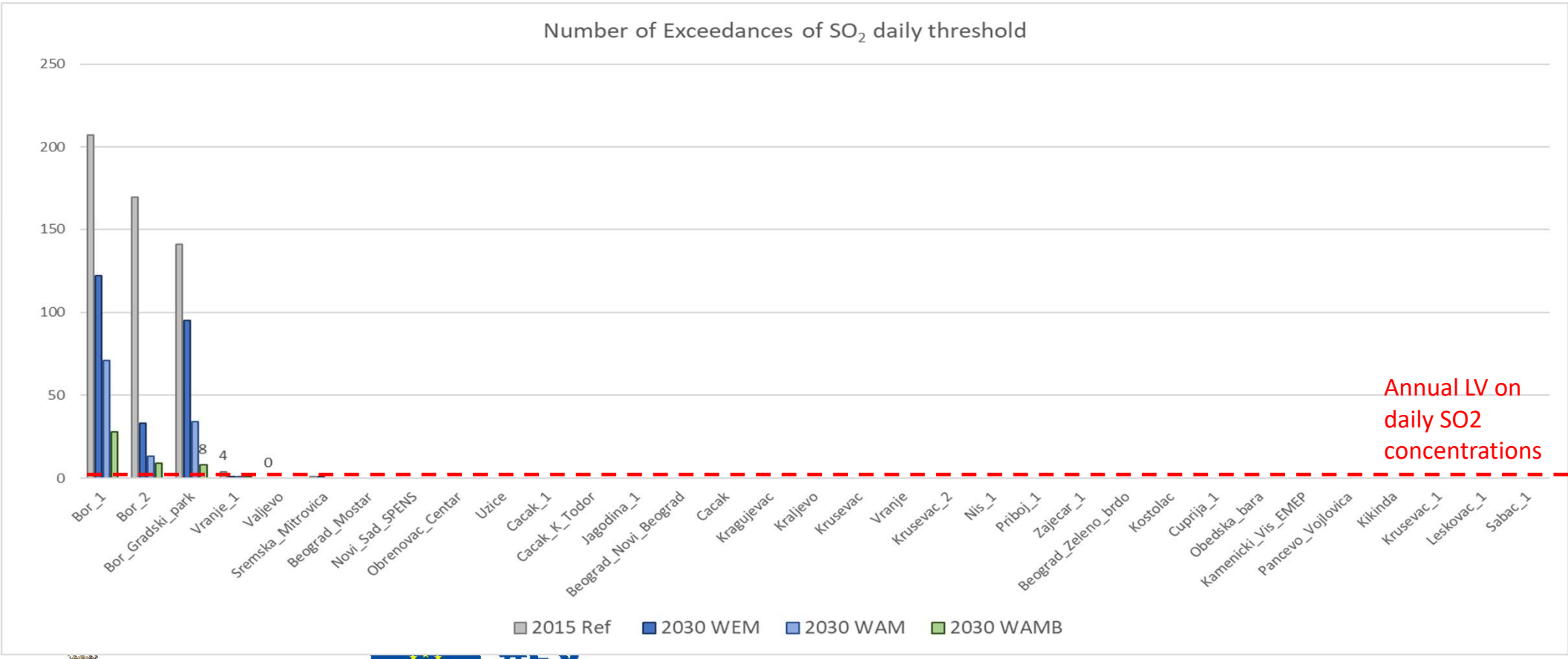
WAM C: annual LV on PM25 concentrations



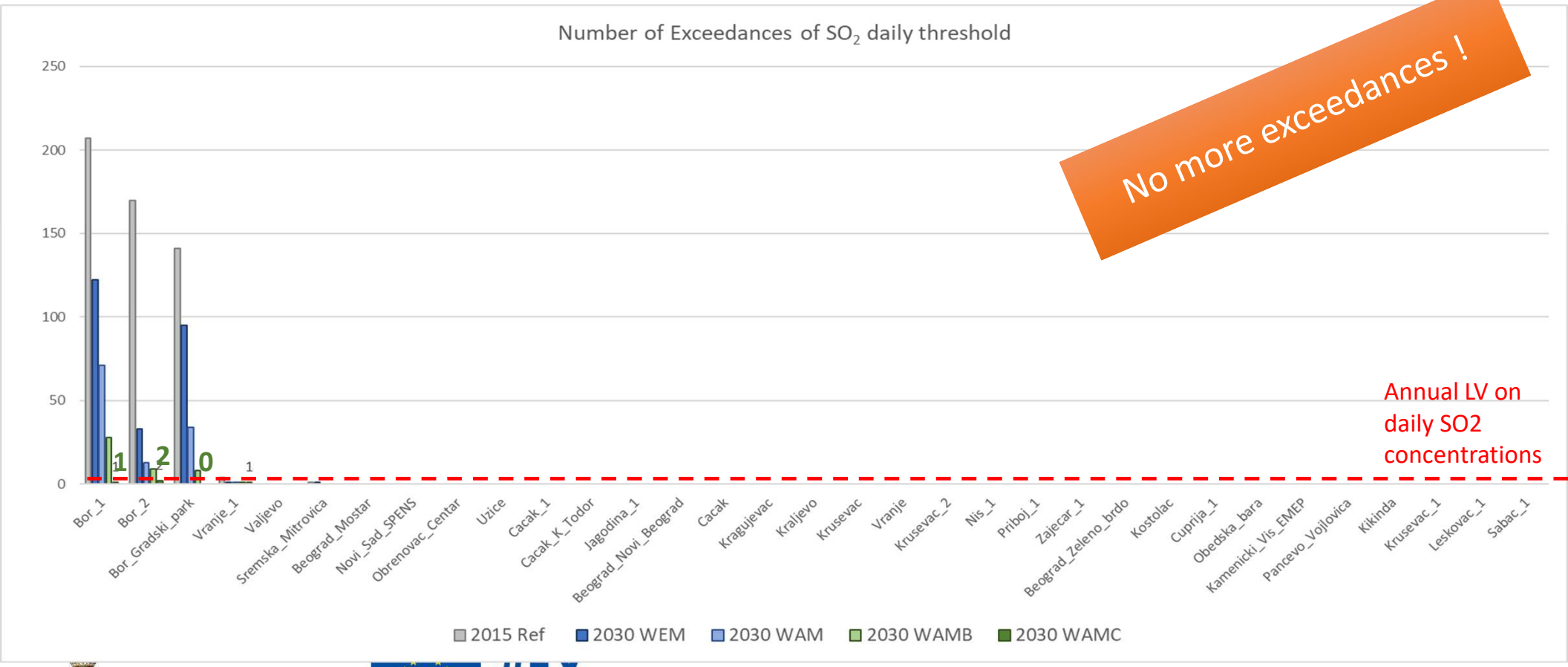
WAM C: annual LV on PM25 concentrations



WAM C: annual LV on SO2 concentrations



WAM C: annual LV on SO2 concentrations



04

Conclusion

Conclusion

	2015 Ref	2030 - WEM	2030 - WAM A	2030 - WAM B	2030 - WAM C
Užice	PM10 & PM2.5	PM10 & PM2.5	PM10 & PM2.5	PM10 & PM2.5	
Valjevo	PM10 & PM2.5	PM10 & PM2.5	PM10 & PM2.5	PM10 & PM2.5	
Niš	PM10 & PM2.5	PM10 & PM2.5	PM10 & PM2.5	PM10 & PM2.5	
Kragujevac	PM10 & PM2.5	PM10 & PM2.5	PM10 & PM2.5	PM10	
Beograd	PM10 & PM2.5 & NO2	PM10 & PM2.5	PM10 & PM2.5	PM10	
Pančevo	PM10 & PM2.5	PM10 & PM2.5	PM10		
Novi Sad	PM10 & PM2.5	PM10	PM10		
Sremska Mitrovica	PM10 & PM2.5	PM10 & PM2.5	PM10		
Smederevo	PM10 & PM2.5	PM10	PM10		
Vojvodina	PM10 & PM2.5	PM10	PM10		
Subotica	PM10 & PM2.5	PM10	PM10		
Požarevac	PM10 & PM2.5	PM10 & PM2.5			
Sombor	PM10 & PM2.5	PM10 & PM2.5			
Obrenovac	PM10				
Kostolac	PM10				
Zaječar	PM10				
Vranje	SO2				
Bor	SO2	SO2	SO2	SO2	
Cacak	NO2				

- Despite the halving of PM emissions in the WAM B scenario compared to the 2015 base year, LV exceedances are still simulated in some cities in Serbia. Furthermore, SO_2 reductions are not sufficient to eliminate exceedances in Bor.

- The WAM C scenario, based on locally adapted emissions reductions on domestic heating sector, phase out of agricultural waste burning and on stricter limit values for industrial plants in Bor, solves the remaining exceedance problems in Serbia, but requires considerable efforts in terms of emission reductions for the cities concerned.

Questions and assistance

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Thank you for your attention!