Source Apportionment of Tehran's Air Pollution by Emissions Inventory

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Aug. 2012

Introduction

- Preview
- Air Pollution in Megacity of Tehran
- Needs for this research

Materials and Methods

- Emission Estimation

  - Stationary Sources
  - Vehicular Sources

  - Fuel Consumption
  - Emission Factor
  - Calculations and Estimation

Materials and Methods

- Stationary Sources

1. Residential Units
2. Industries
3. Small Industrial Units
4. Power Stations
5. Refinery
6. Agricultural Lands
7. Public Locations
8. Police Stations

Materials and Methods

- Stationary Sources
- Fuel Consumption

1. Gasoline
2. Diesel
3. Fuel oil
4. Liquid gas
5. Natural gas
6. Solid fuel

Materials and Methods

- Stationary Sources
- Emission Factor

Example:

Sector	Fuel	unit	Emission Factors				
			SPM	HC	CO	NOx	SO_2
Industry	Gas	g/L	1.44	10.48	272.34	5.80	1.30
	Diesel	g/L	2.38	0.34	0.56	6.15	3.20
	Gasoline	g/L	2.50	0.35	0.50	6.32	12.94
	Furnace oil	g/L	2.72	0.37	0.49	7.11	51.49
	Liquid gas	g/Kg	0.40	0.10	0.35	2.61	3.06
	Natural gas	g/m3	0.25	0.04	0.29	3.00	0.04
	Solid fuel	g/Kg	2.34	0.00	5.37	7.90	18.65

Data is provided by: Air Quality Control Company (DOE and JICA study team)

Materials and Methods

- Stationary Sources
- Calculations and Estimation

Example: NOx Emission in Residential Units

	Diesel	Gasoline	Natural Gas	Liquid Gas	Sum.
Fuel Consumption (m^3/yr)	249442	591168	6410000	86003	-
NO_x Emission Factor (kg/m^3)	2.31	2.73	2.05	1.81	-
NO_x Emission (ton/yr)	576	1617	13150	156	15499

Data is provided by: Air Quality Control Company (DOE and JICA study team)

Materials and Methods

- Vehicular Sources

1. Personal Light duty vehicles
2. Pick ups
3. Taxis (LDV)
4. Minibuses
5. Buses (Public & Private)
6. Motorcycles
7. Trucks

Materials and Methods

- Fuel Consumption
- Emission Factor

Example: LDVs' Emission Factors

Speed	Street Slant	THC	PM_{10}	CO	NO_x	SO_2
Average speed 20 km/hr	Horizontal	6,980	464	107,461	2,108	15
	uphill	11,173	2,319	302,911	5,792	21
	downhill	6,968	464	92,931	2,087	13
Average speed 40 km.hr	Horizontal	4,001	359	100,048	1,981	12
	uphill	5,329	1,796	123,880	5,346	17
	downhill	3,650	359	73,333	1,188	9
Average speed 60 km.hr	Horizontal	2,883	289	49,996	1,772	9
	uphill	3,683	1,444	57,904	5,579	13
	downhill	1,903	289	22,534	885	7
Average speed 80 km.hr	Horizontal	2,471	332	44,541	2,256	11
	uphill	3,137	1,662	46,767	5,538	15
	downhill	1,744	332	33,407	1,127	7

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Materials and Methods

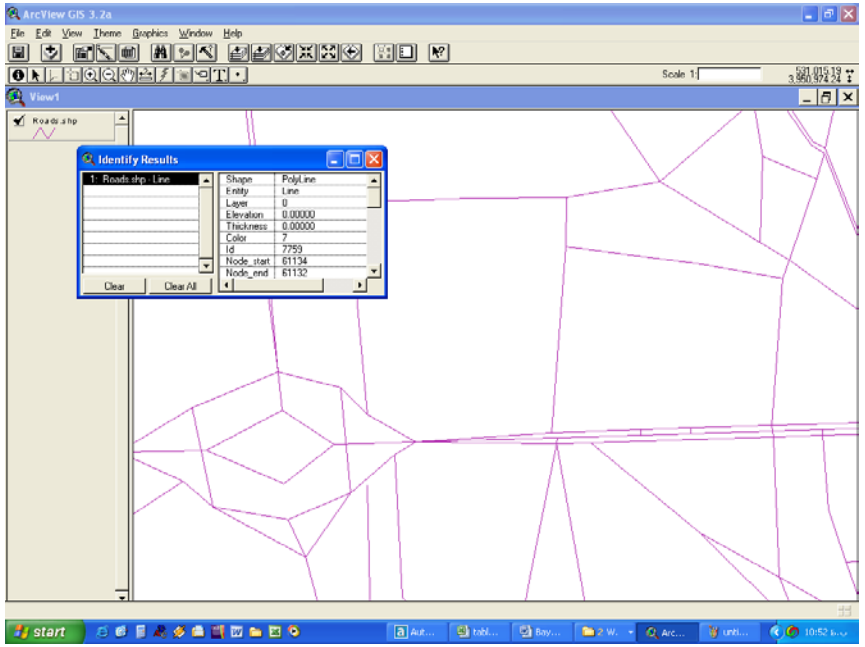
- Vehicular Sources
- Calculations and Estimation

Use of GIS in Vehicular Emission estimation as a computer-based tool for mapping and analyzing the data of the total kilometres travelled by the average speed for every type of vehicle in Tehran's roads

Materials and Methods

- Vehicular Sources
- Calculations and Estimation

Use of Arc GIS to combine the data of travels and emission factors in a spatial data base to determine the contribution of the regions in emitting each pollution.



Materials and Methods

- Vehicular Sources
- Calculations and Estimation

Example:

Path No.	Length (m)	Status	Annual Passing	Average Speed (km/hr)
7378	214.54	Horizontal	376287	38.5

Emission Factors: $EF_{SO2\text{-}20}$=10 mg/Km & $EF_{SO2\text{-}40}$=7 mg/Km

$$Eyear = N \times \frac{L}{1000} \times \frac{(40 - V_{ave}) \times EF_{20} + (V_{ave} - 20) \times EF_{40}}{40 - 20} \times \frac{1}{1000}$$

$$Eyear = 376287 \times \frac{214.54}{1000} \times \frac{(40 - 38.5) \times 7 + (38.5 - 20) \times 10}{40 - 20} \times \frac{1}{1000}$$

$$Eyear = 789 \text{ Kg/year}$$

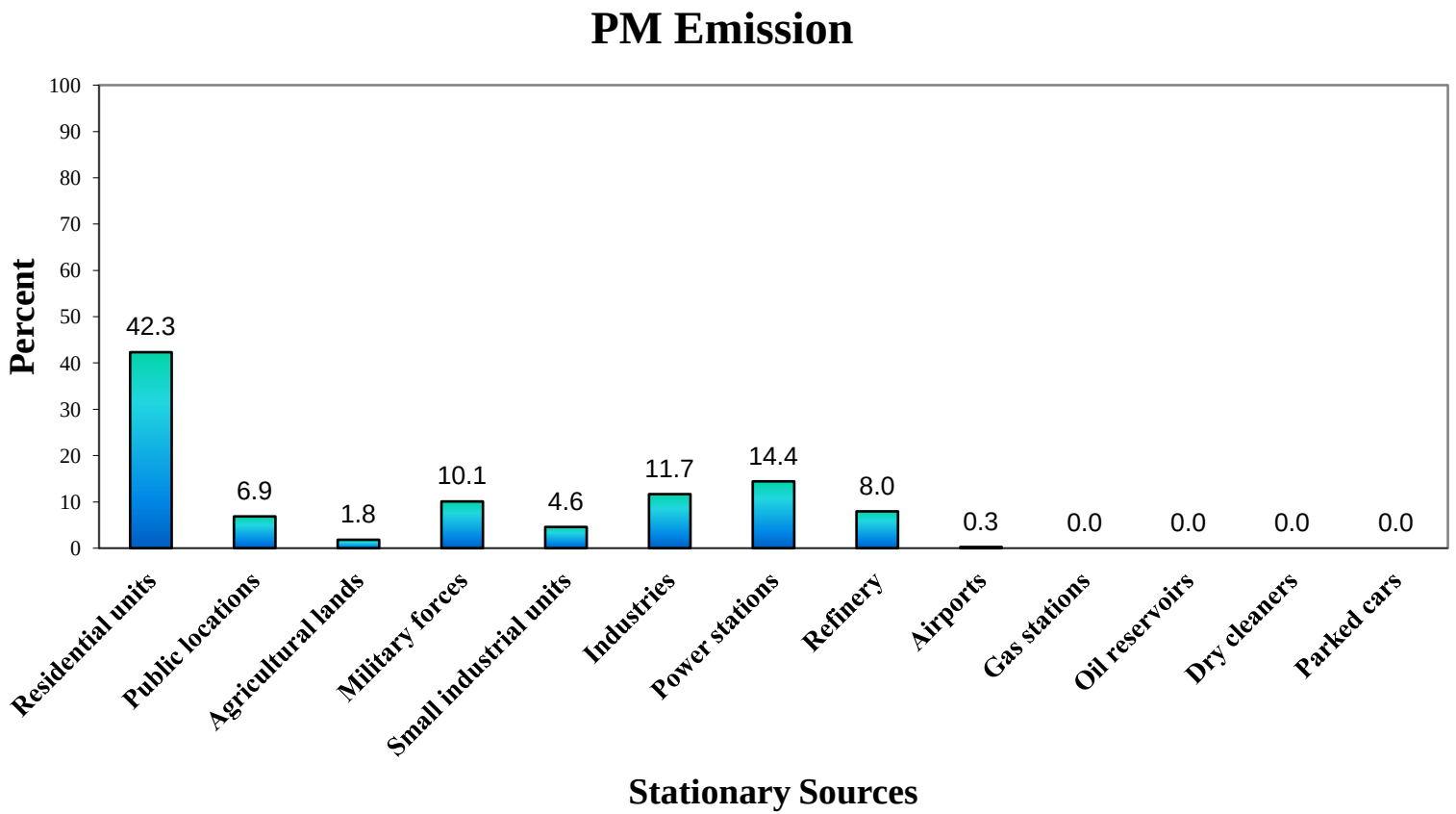
Results and Discussion

- Source Apportionment
  - Stationary Sources
  - Vehicular Sources
  - Temporal Changes
  - Spatial Changes

- Conclusion
  - Determinant Emission sources

Results and Discussion

- Source Apportionment
  - Stationary Sources



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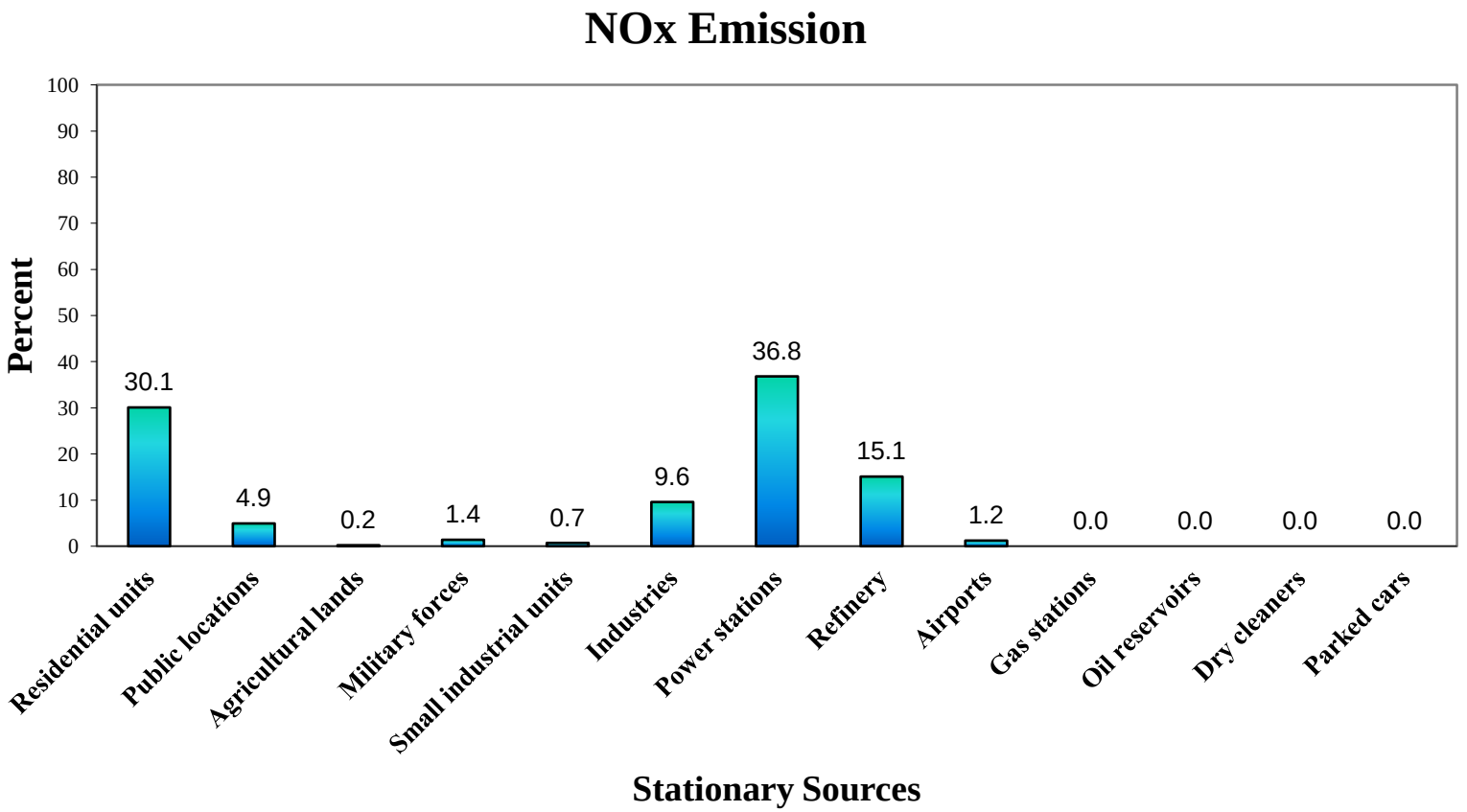

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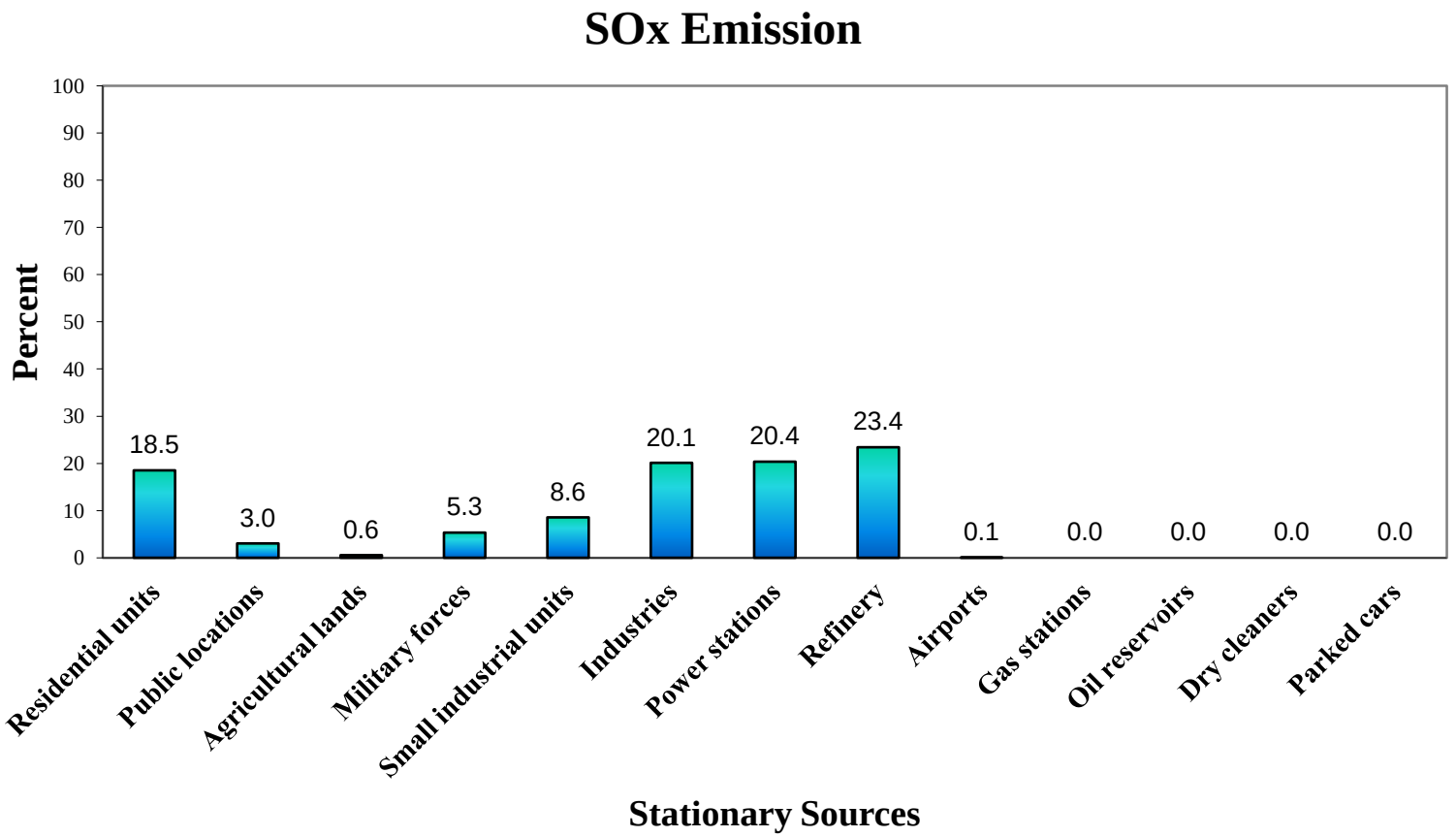

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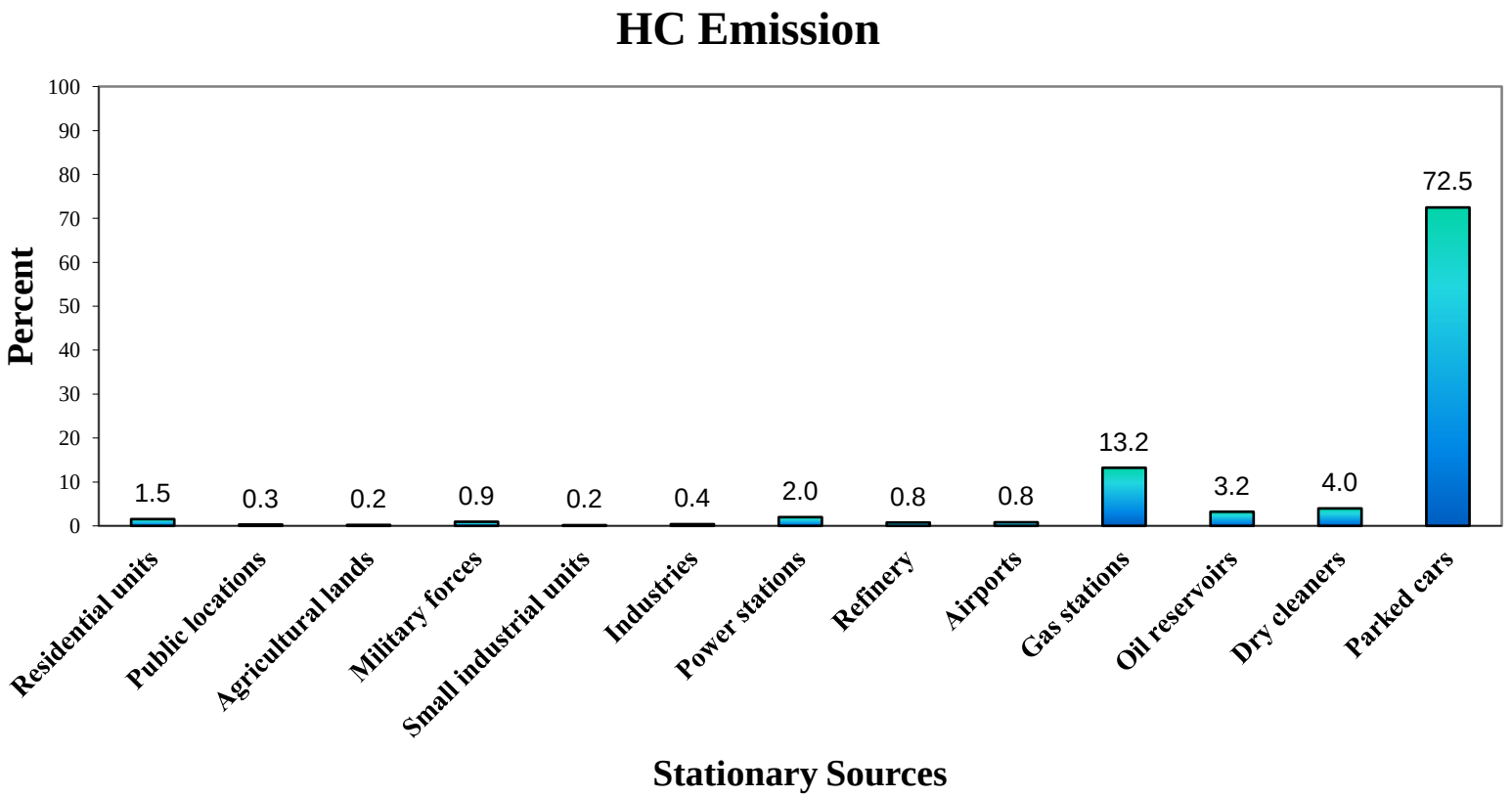

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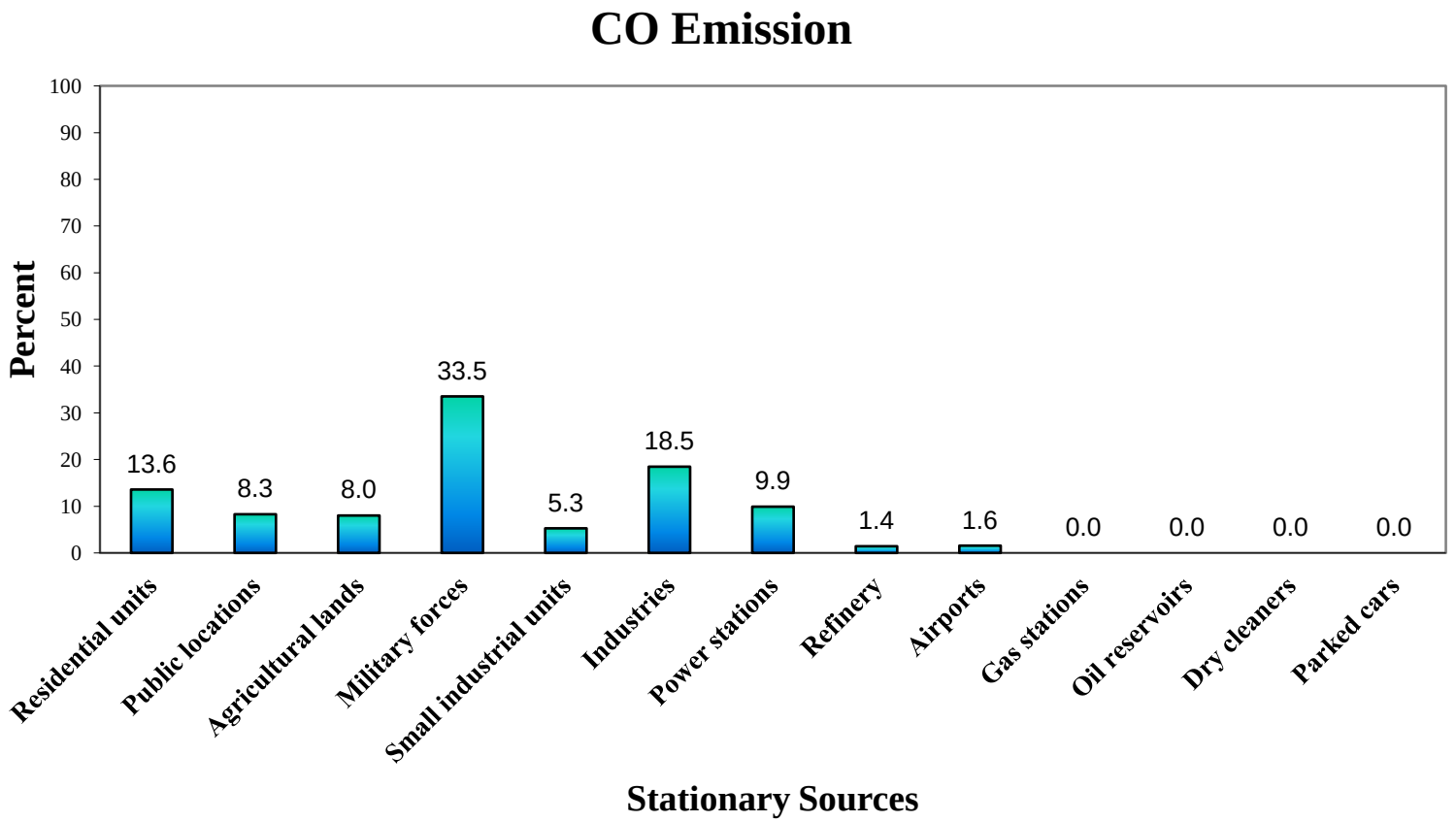

Results and Discussion

- Source Apportionment
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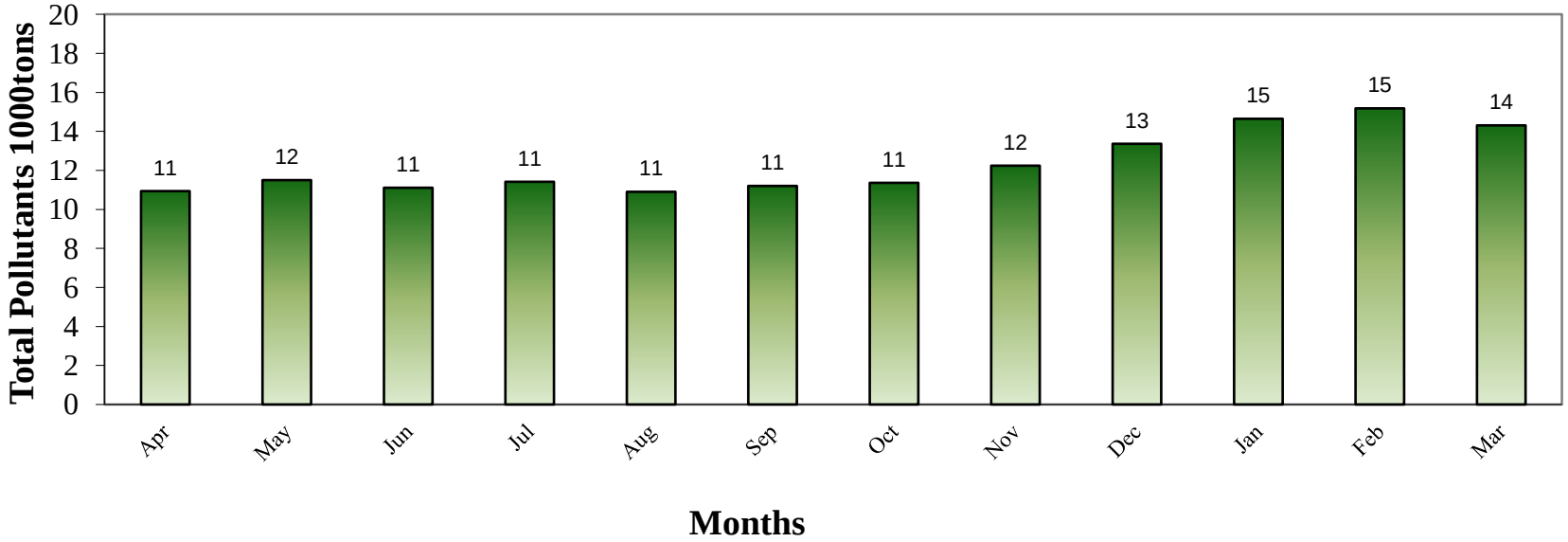
  - Temporal Changes

Pollutants emitted by stationary sources in various months



Results and Discussion

- Source Apportionment
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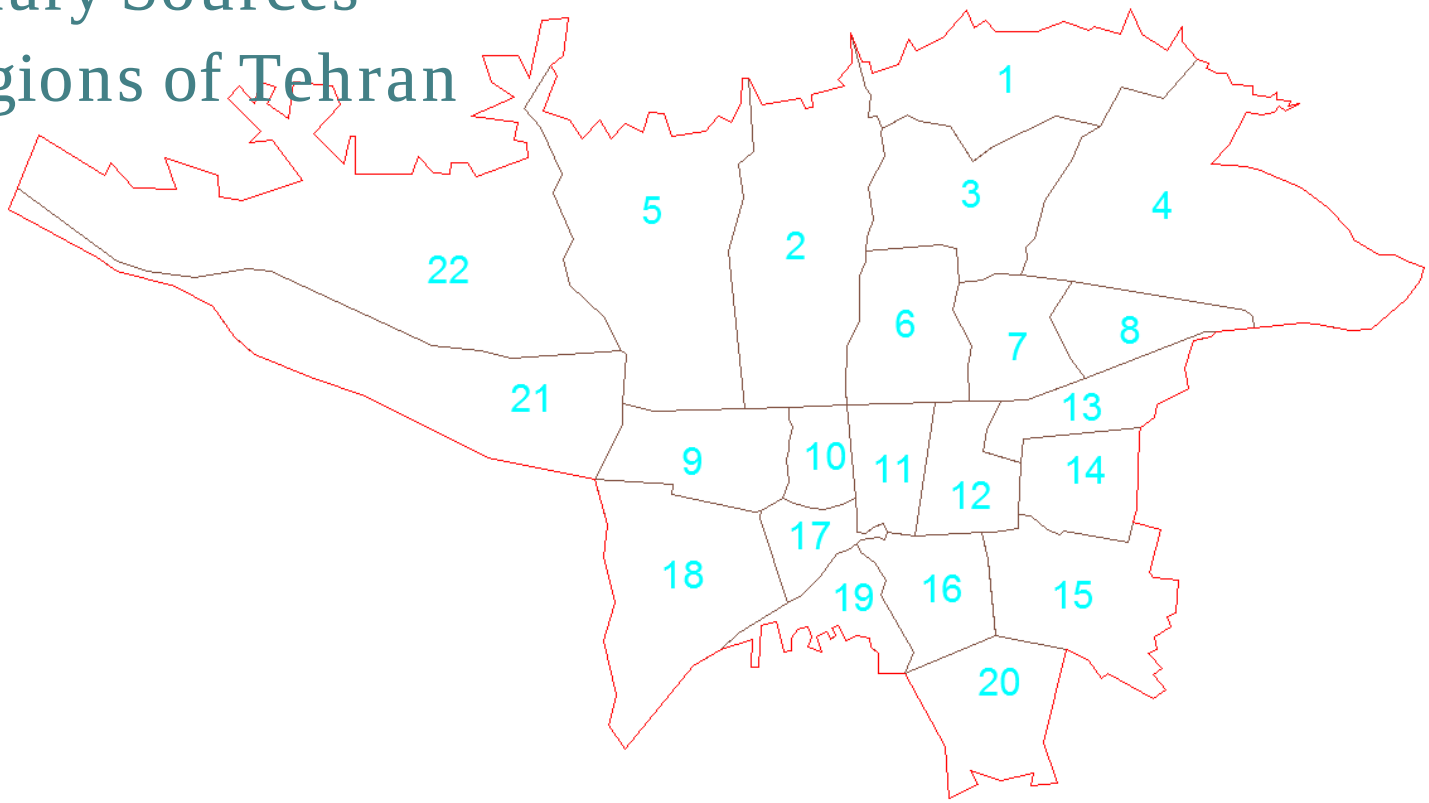
  - The regions of Tehran



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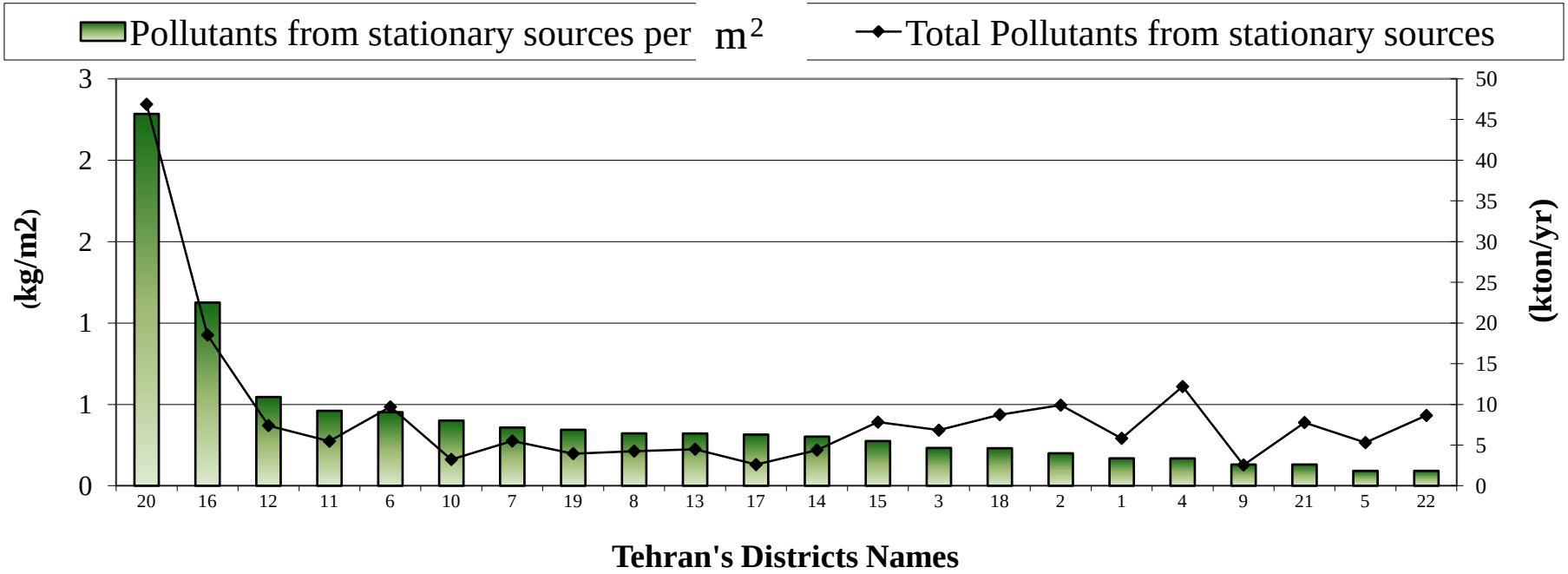

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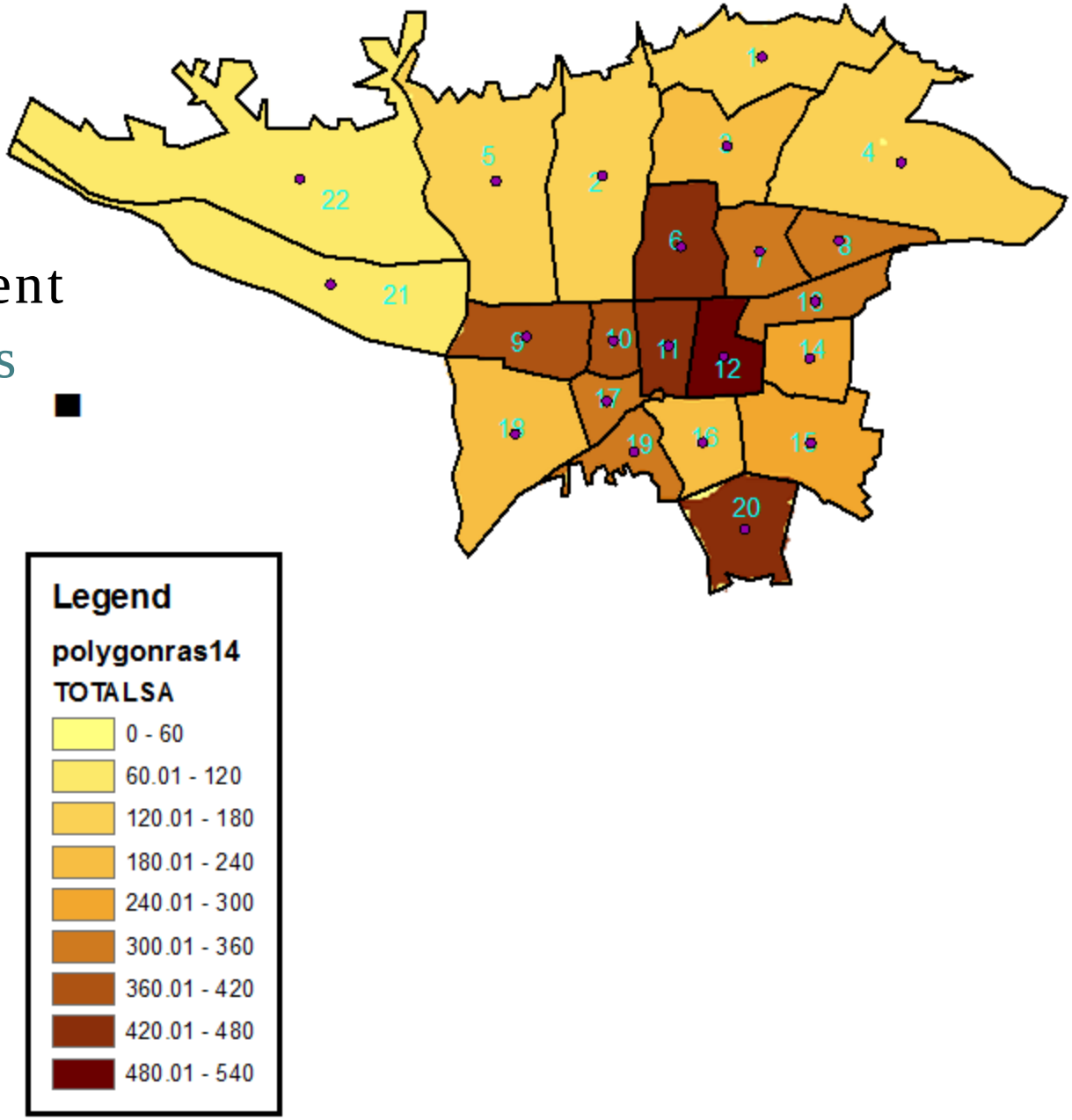

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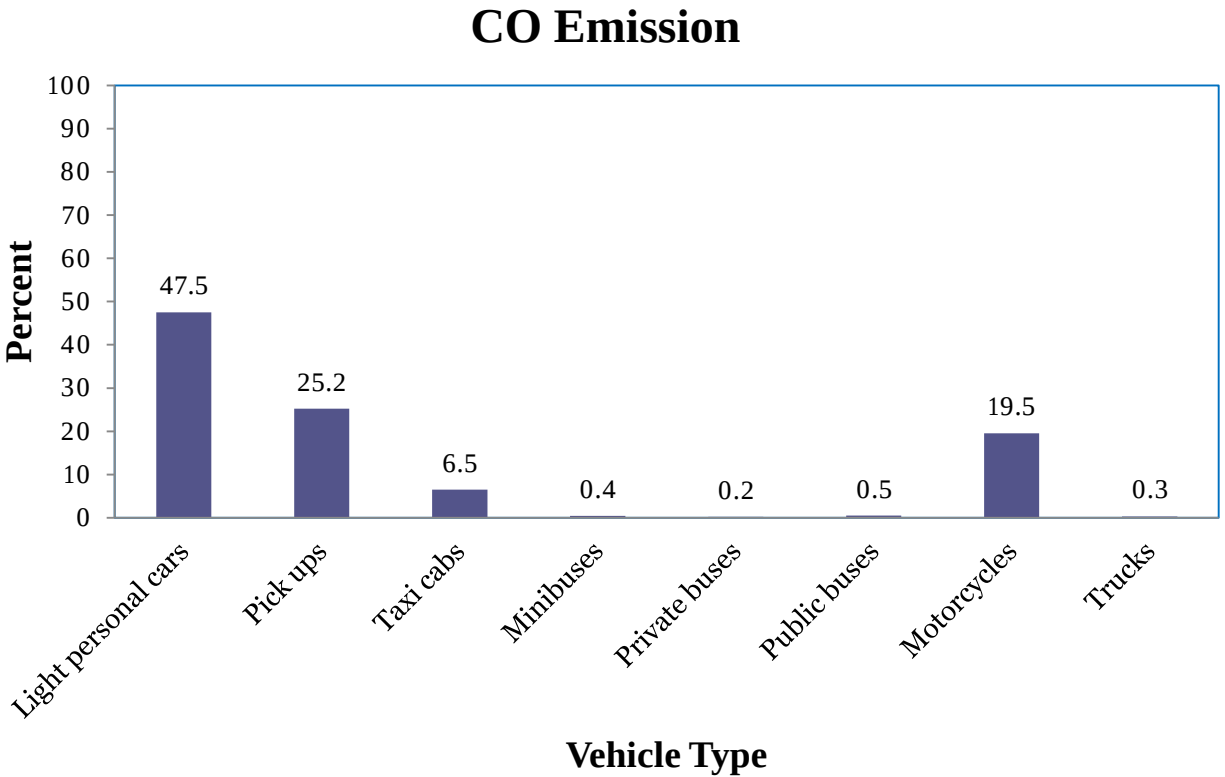

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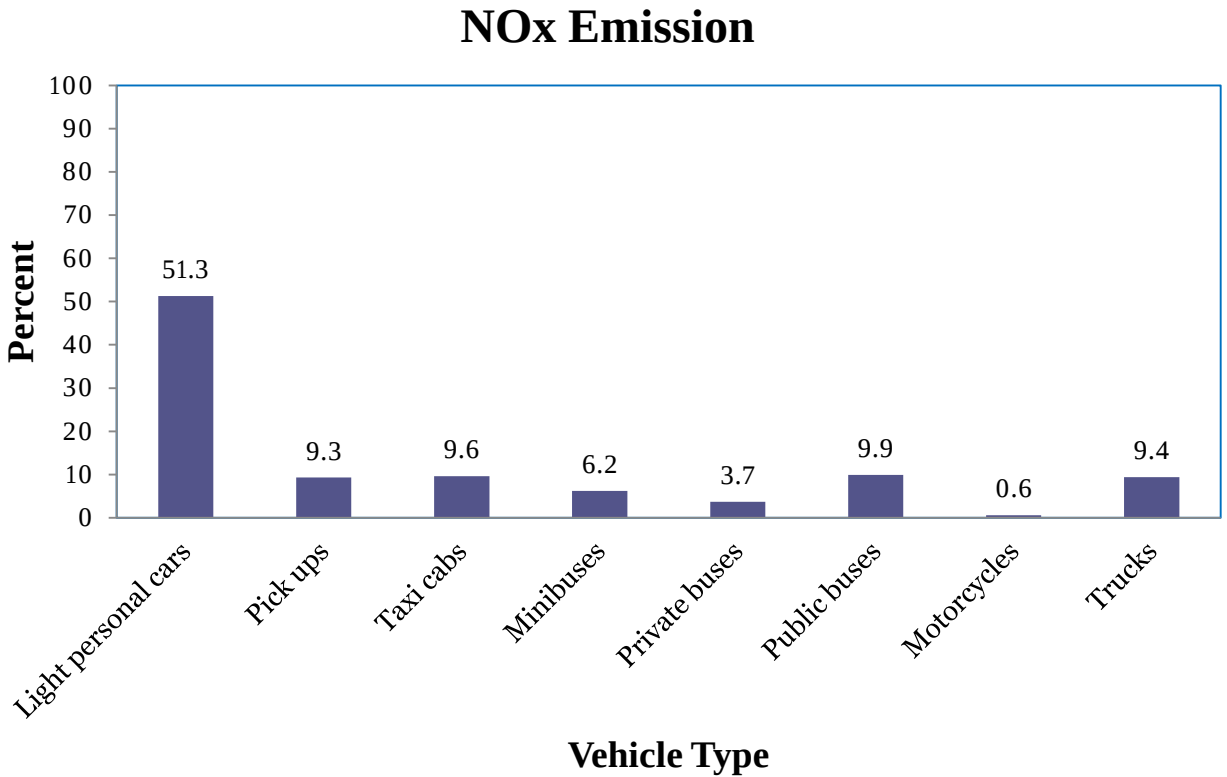

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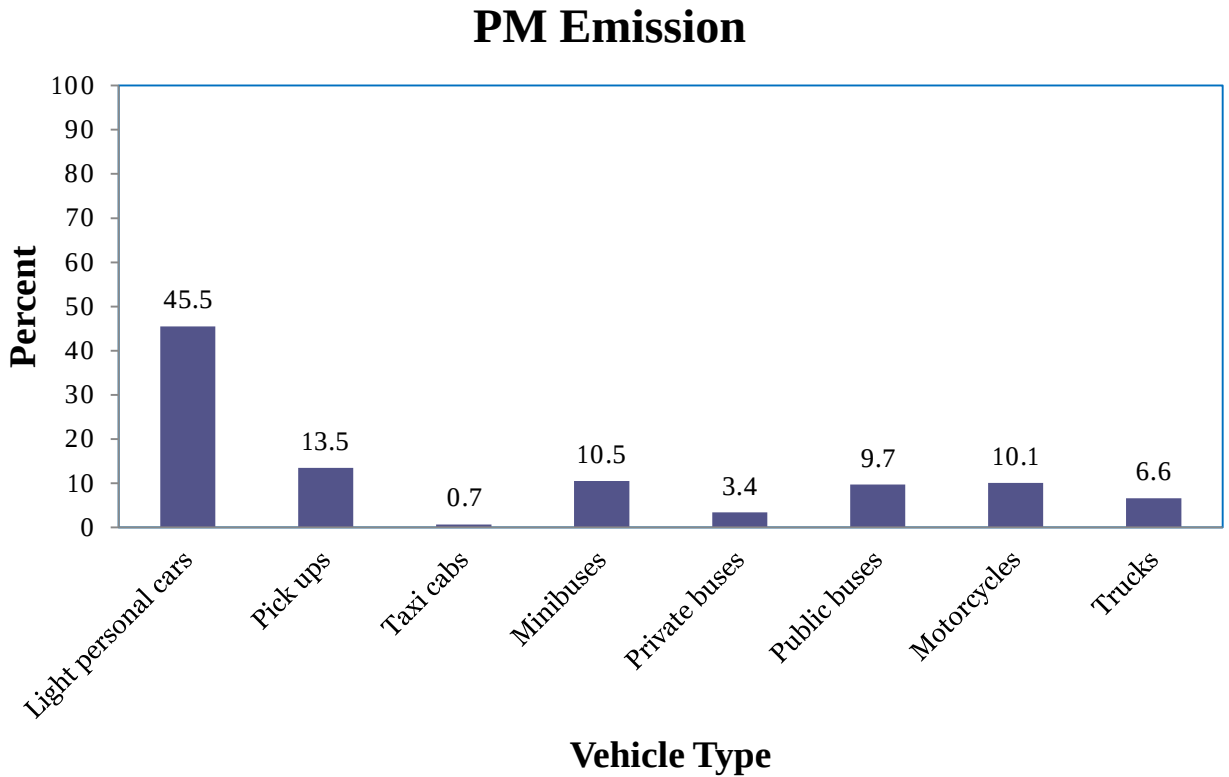

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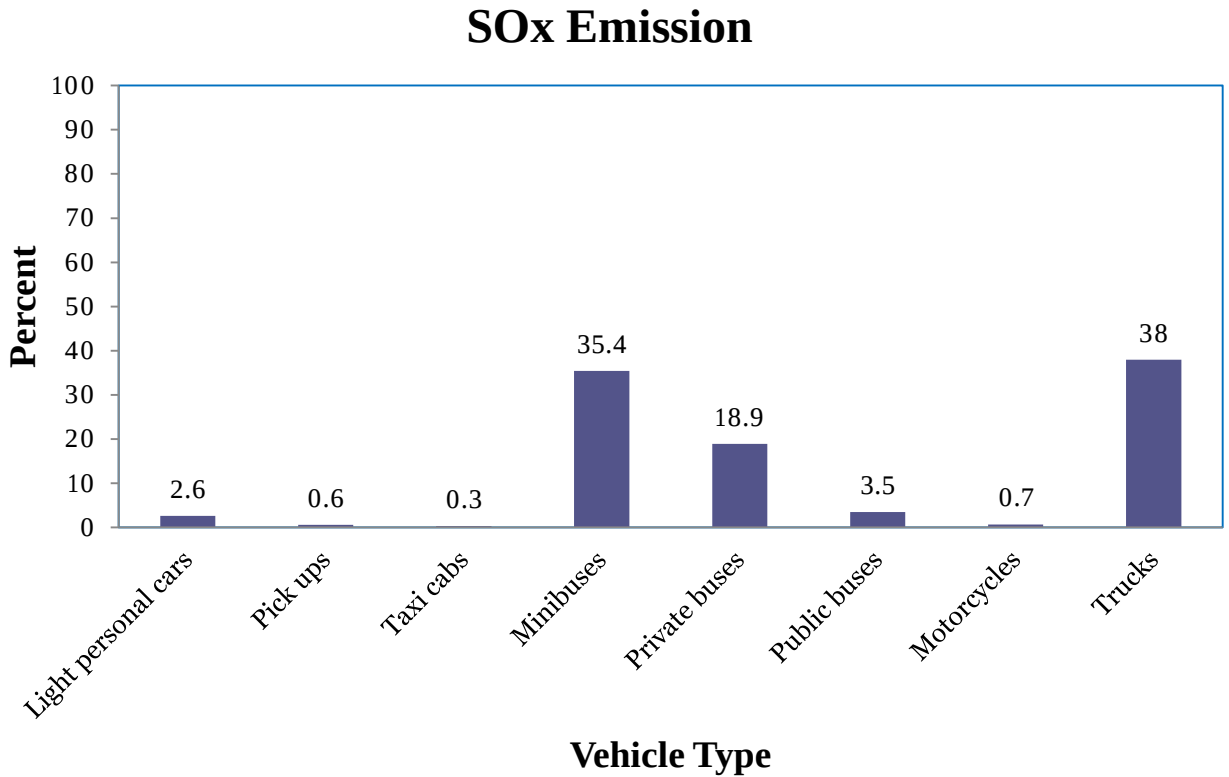

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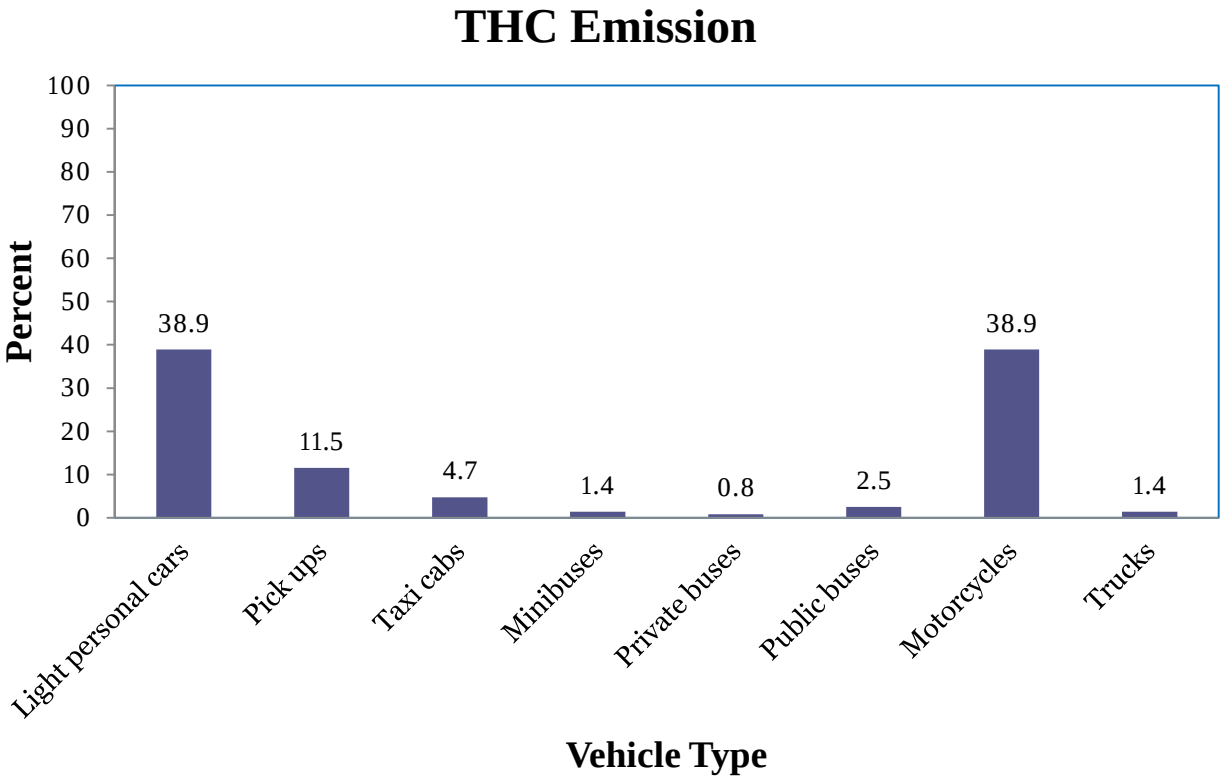

Results and Discussion

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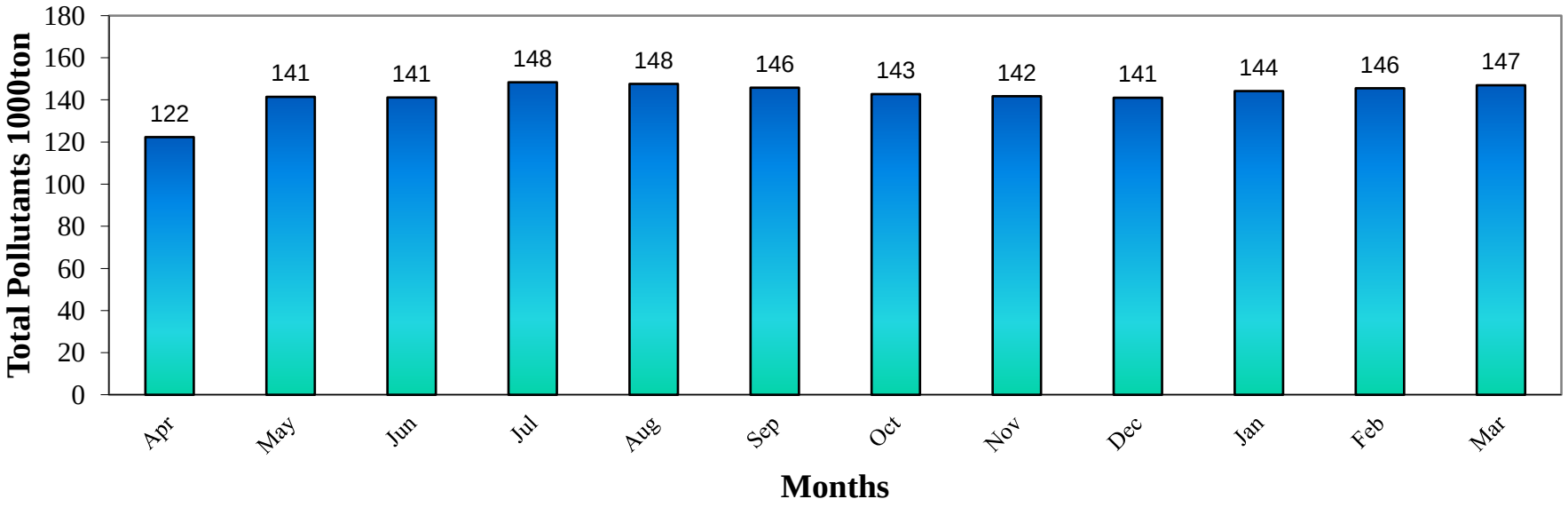
  - Temporal Changes

Pollutants emitted by Vehicular sources in Tehran in various months



Results and Discussion

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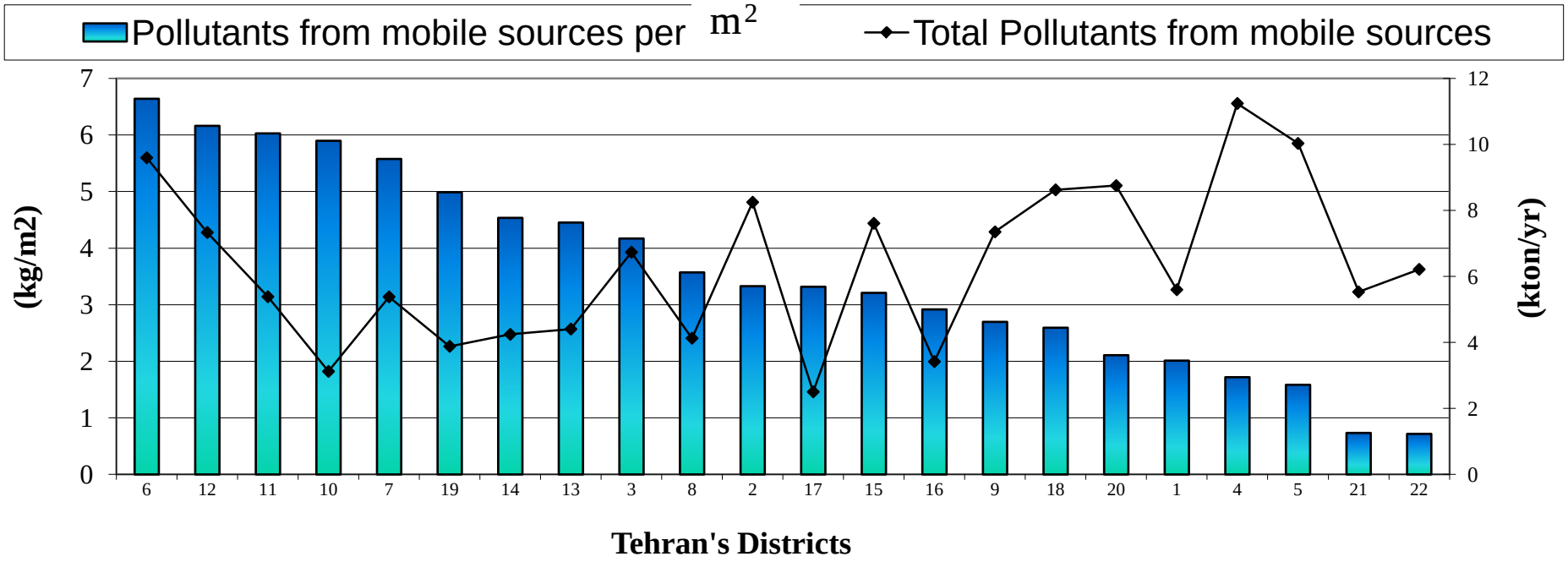
  - Vehicular Sources
  - Spatial Changes



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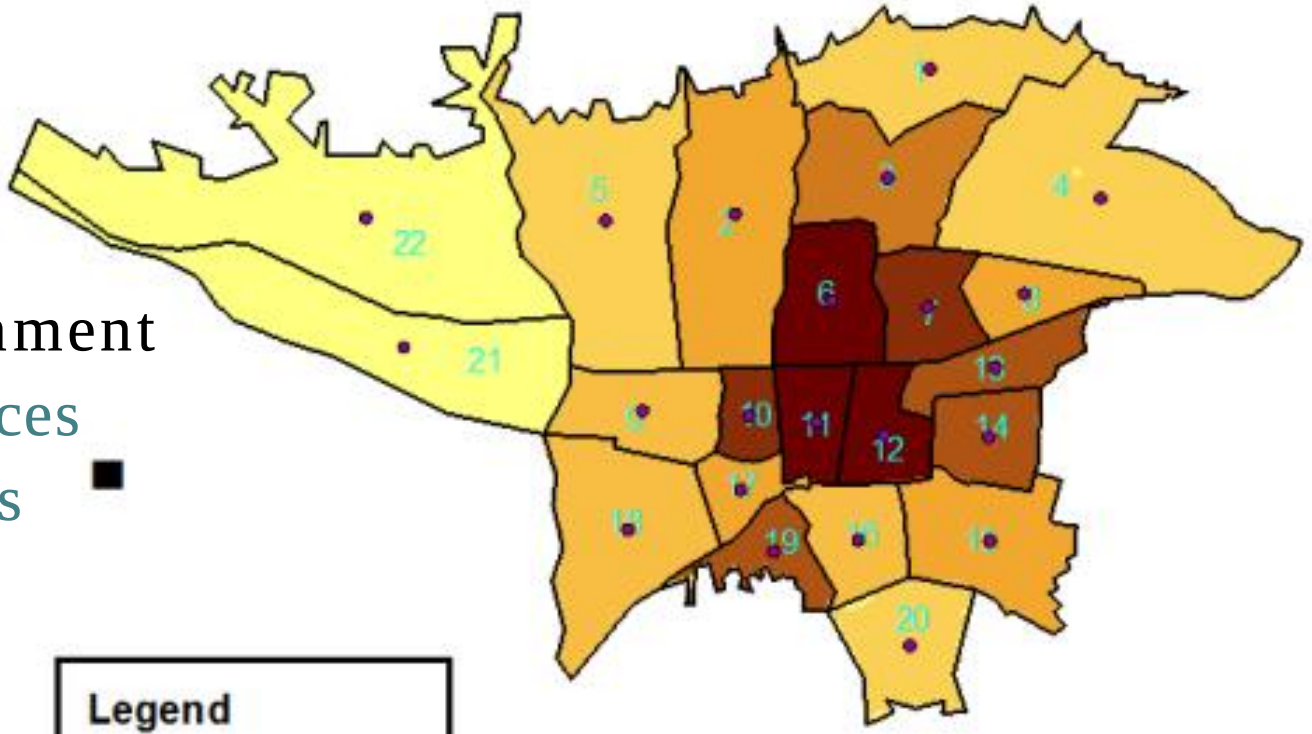
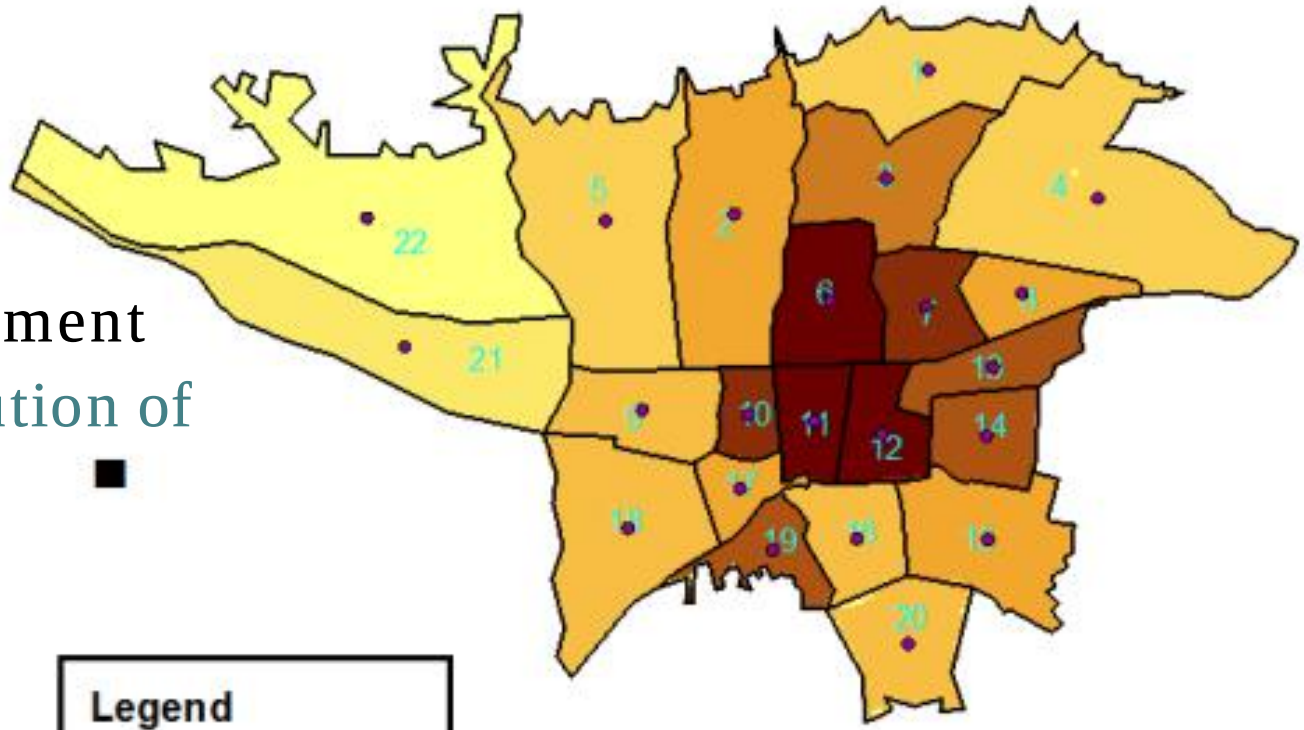


Results and Discussion

- Source Apportionment
  - Spatial Distribution of All Sources



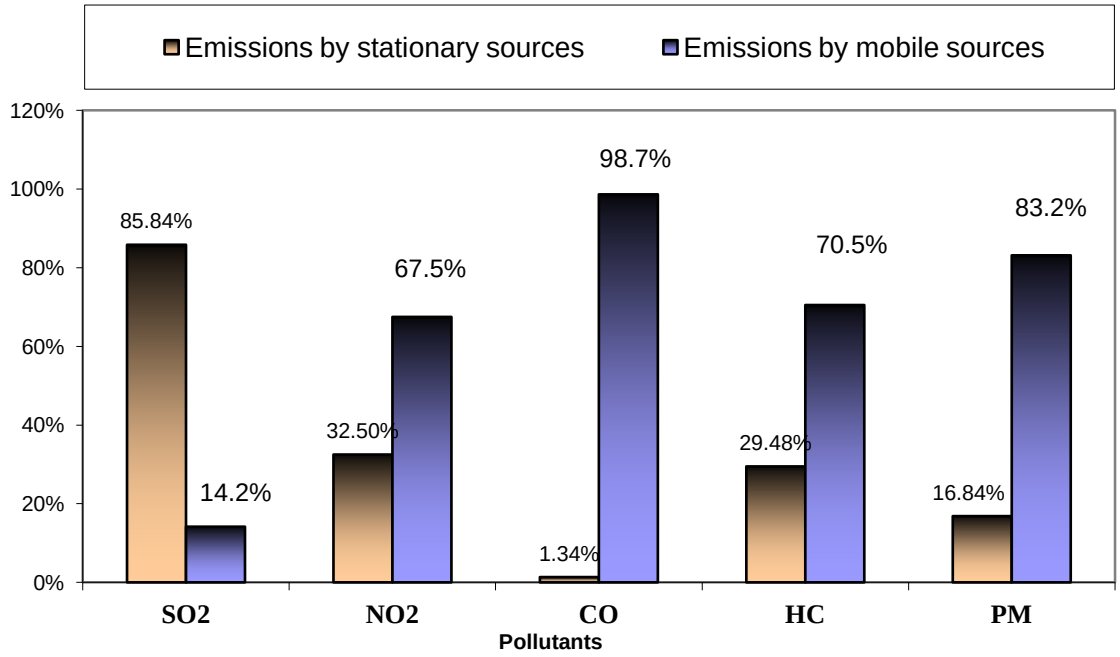
Results and Discussion

- Conclusion
  - Determinant Emission Sources

Sources	Pollutants (ton/year)					Total
	SO2	NOx	CO	HC	PM	
Stationary sources	48,456	51,532	19,328	64,807	7,874	191,997
Mobile sources	7,991	107,016	1,419,326	155,033	38,871	1,728,237
Total	56,447	158,548	1,438,654	219,840	46,745	1,920,234
Production % by stationary sources	85.8	32.5	1.3	29.5	16.8	10
Production % by mobile sources	14.2	67.5	98.7	70.5	83.2	90
share of the total pollutants	2.9	8.3	74.9	11.4	2.4	100

Results and Discussion

- Conclusion
  - Determinant Emission Sources



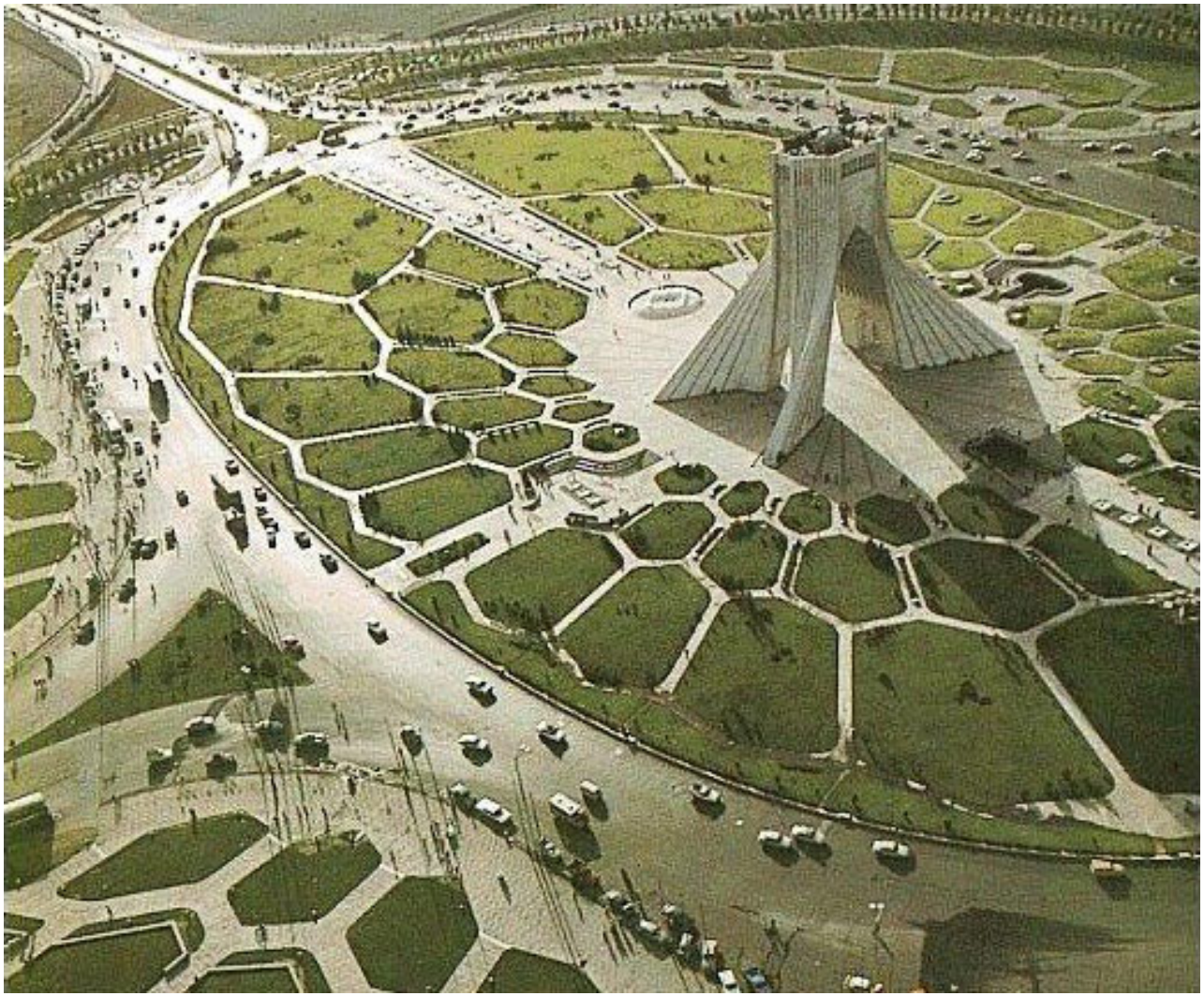
Results and Discussion

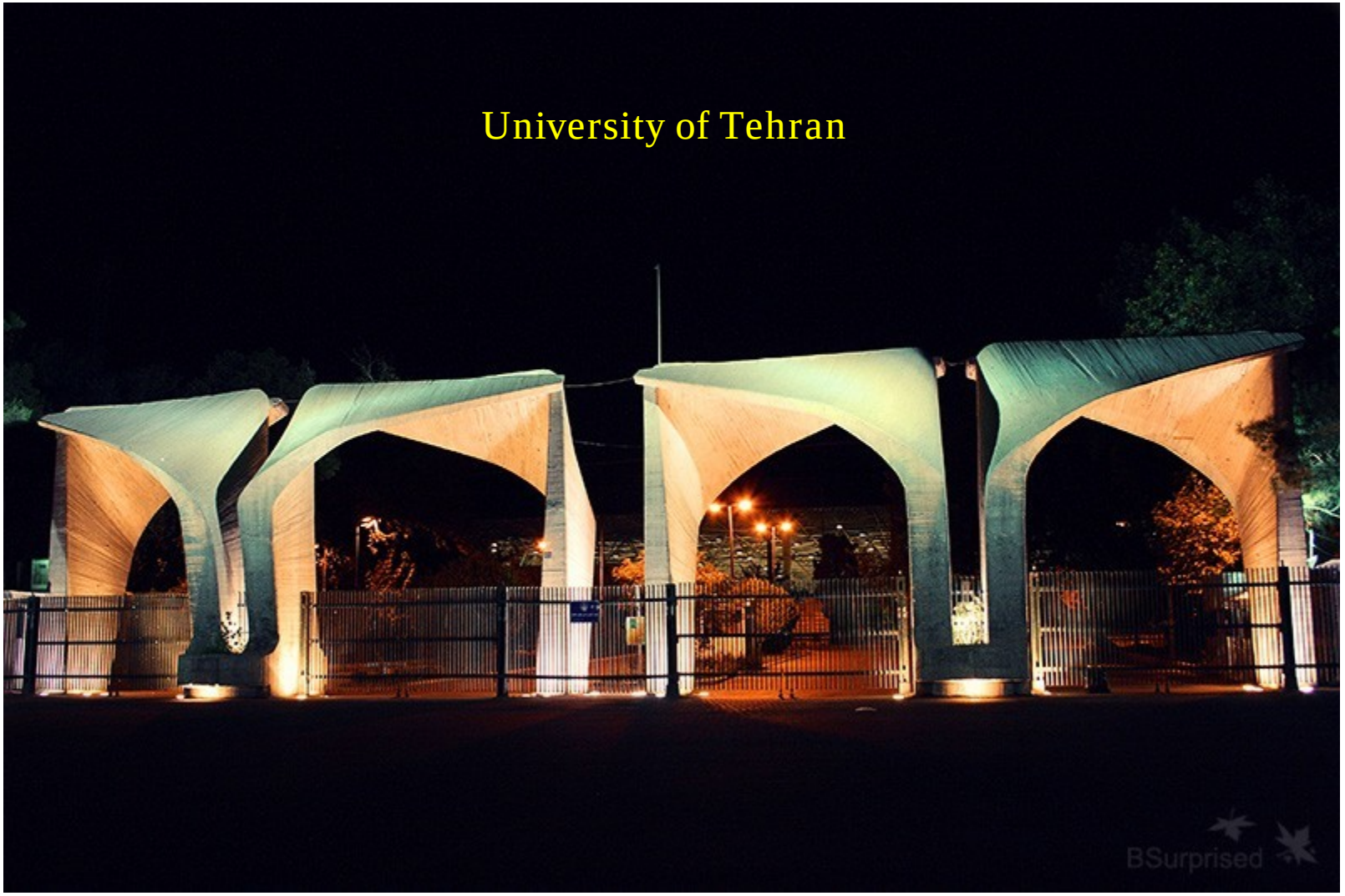
- Conclusion

Most of the total pollutants are emitted by the vehicles in city of Tehran

Thank you

Tehran at Night

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MEHR


بام جمشیدیه


Tehran View
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