

HEAVY DUTY VEHICLES EMISSION POLLUTION CONTROL IN CHINA

Likunsheng Beijing EPB

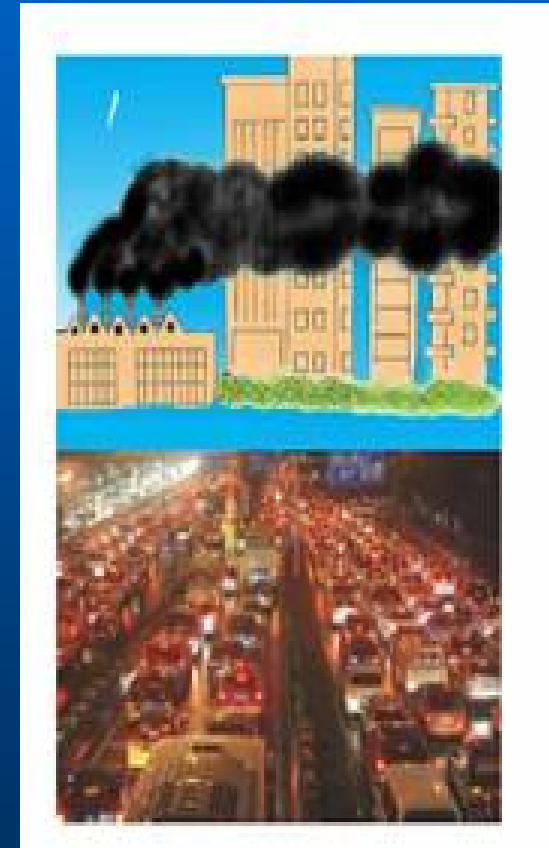
Mar. 2015

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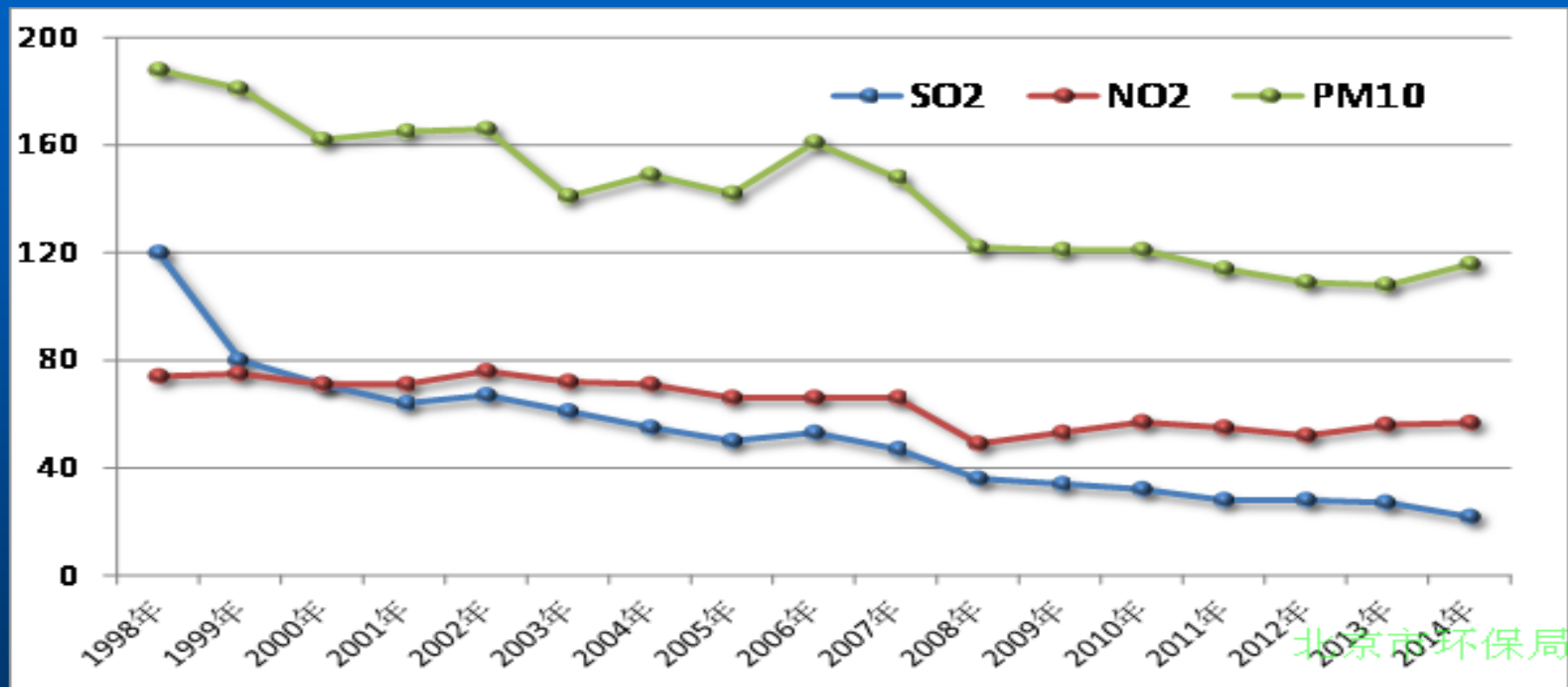
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1. Basic Information of Atmosphere in Beijing

- From 1970's to 1990's
focus on PM & coal burning
- The end of 1990's
highlight of vehicle pollution
- Beginning of the new century
typical combined pollution
- Control process
TSP \longrightarrow PM10 \longrightarrow PM2.5



Concentration of SO₂, NO₂ and PM₁₀ in Beijing

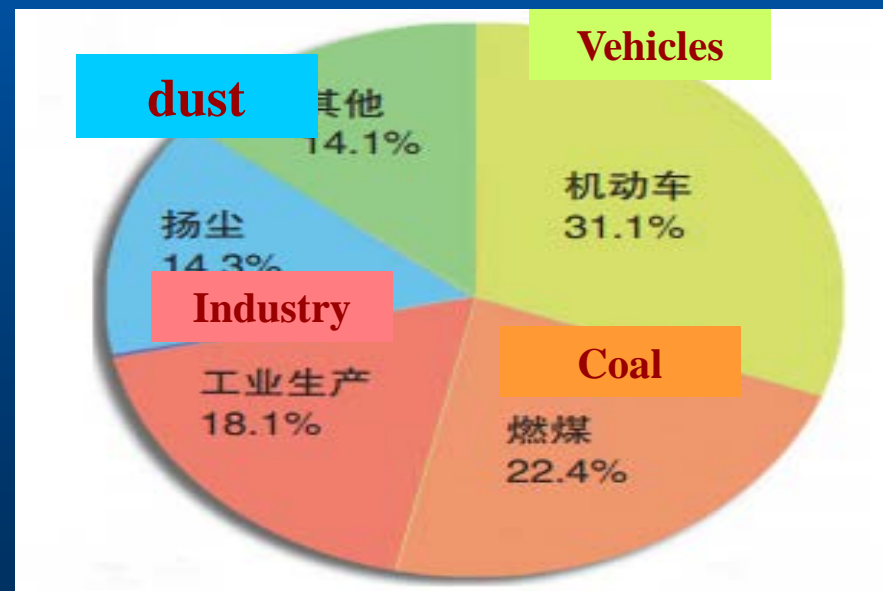


- Decline of SO₂ is most obvious, up to 82%
- Decline rate of NO₂ and PM₁₀ achieved 23% and 38%

Percentage of PM2.5 Concentration in Beijing

- Concentration of PM2.5 drop 4% in 2014 compare with 2013
- Average concentration of PM2.5 was $85.9 \mu\text{g}/\text{M}^3$ in 2014

other



Challenge of Improve Air Pollution

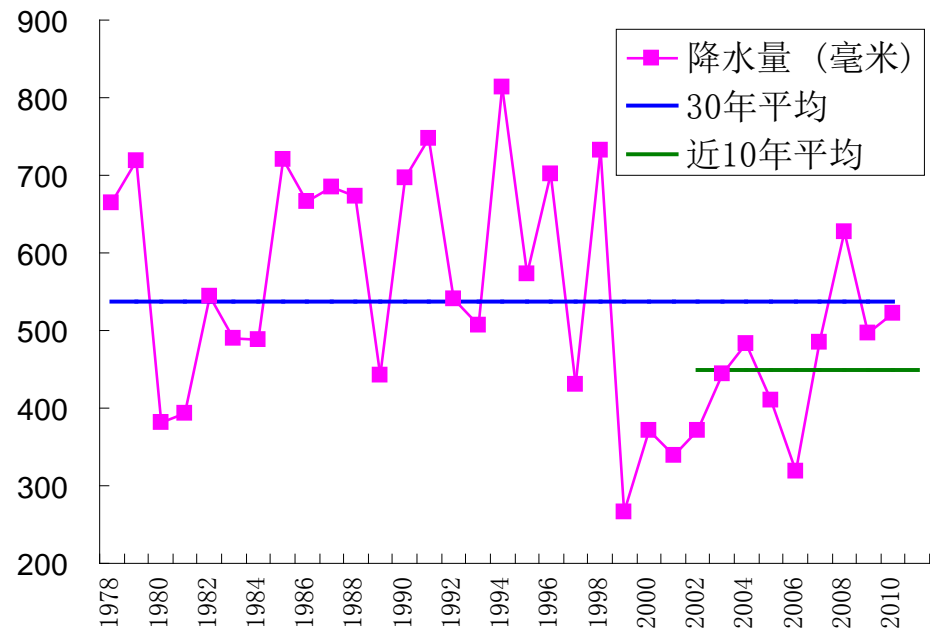
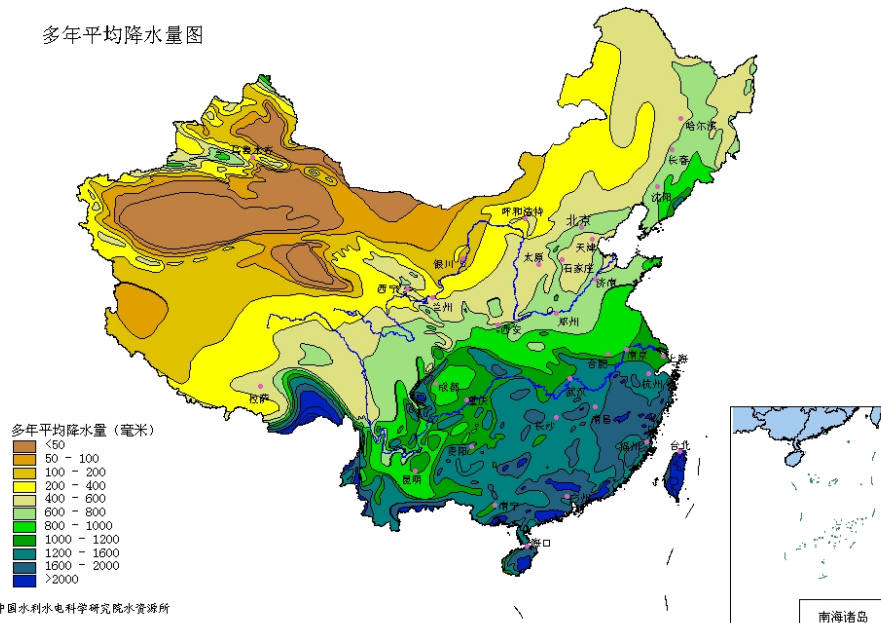
- **Geography of Beijing**

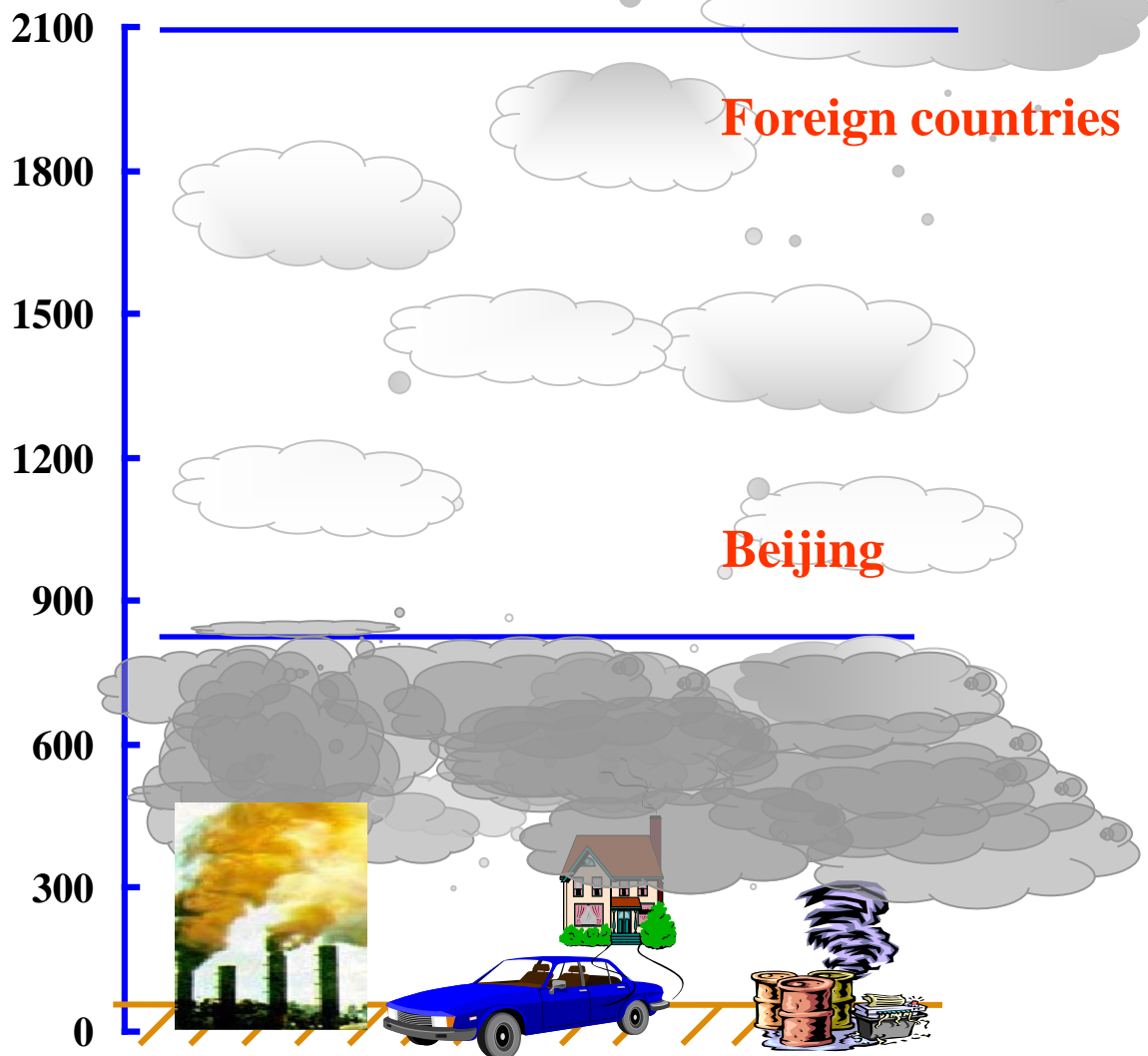
Surrounded by mountains, not conducive to the dispersion of pollutants.



- Location: 40 degrees north latitude
- Low precipitation: below average 450mm for recently a decade

多年平均降水量图

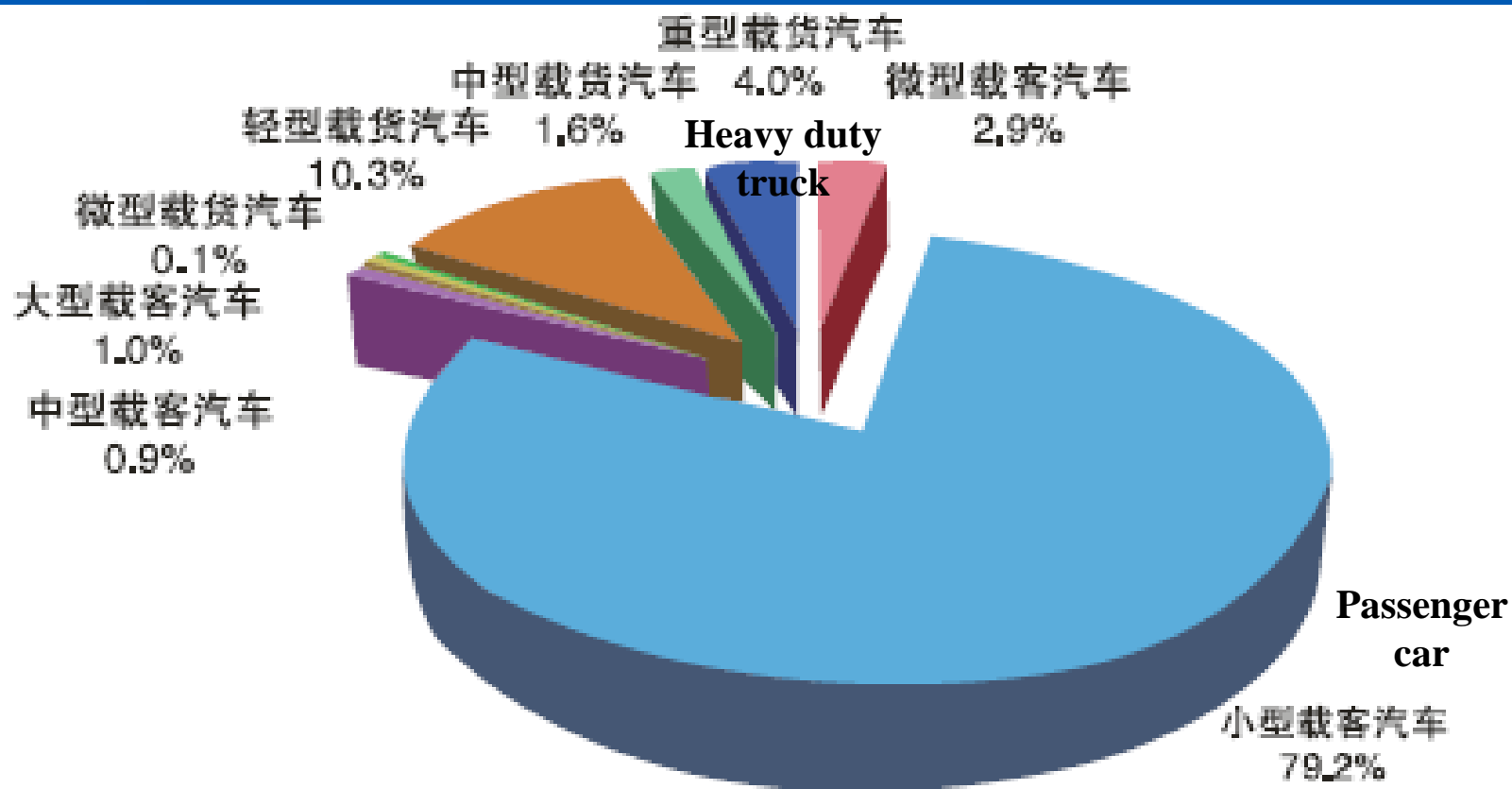




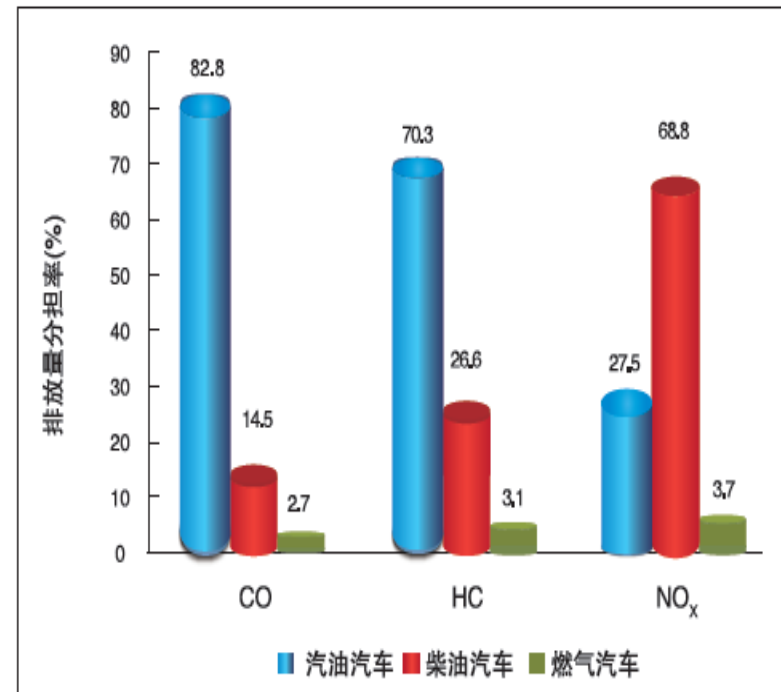
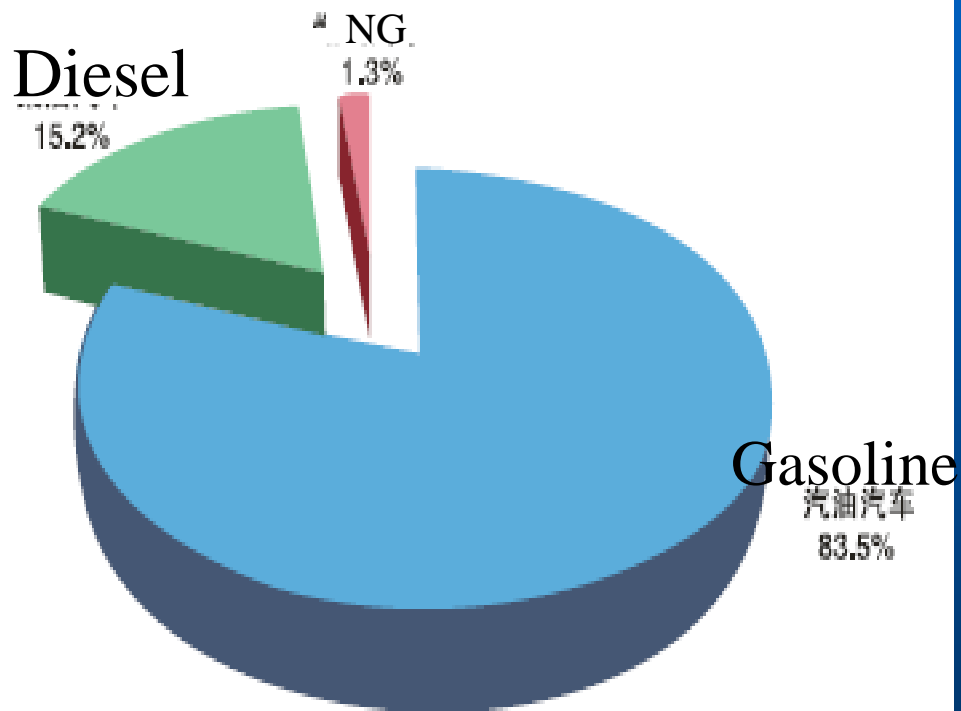
● The height of mixing layer is about 1,200m in Beijing. It's more easier to form a “gray cap”

2. Review of Heavy Duty Vehicles Emission Control in China

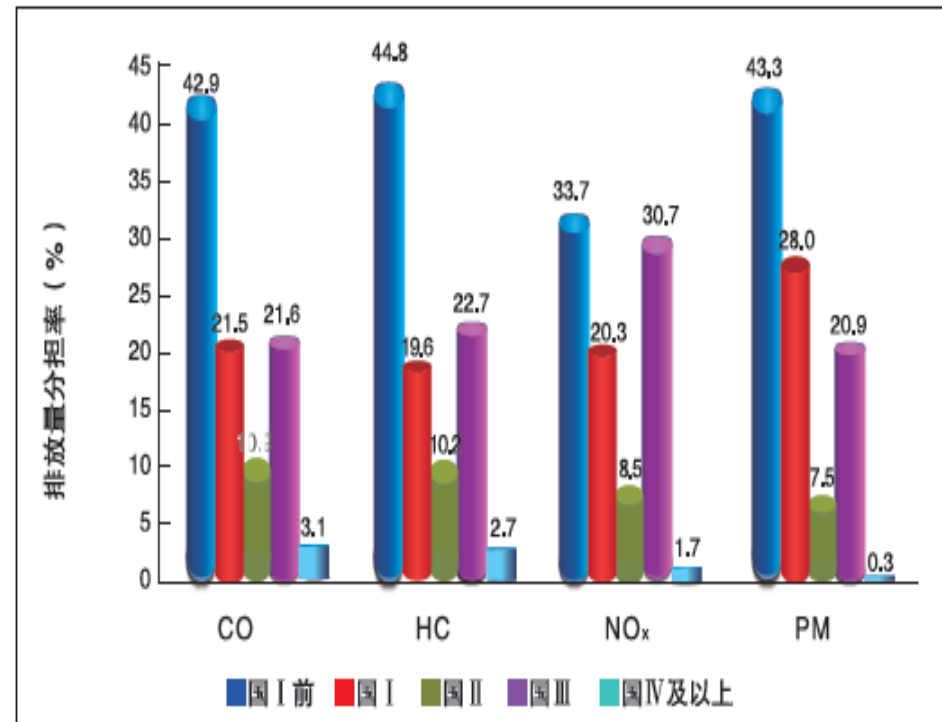
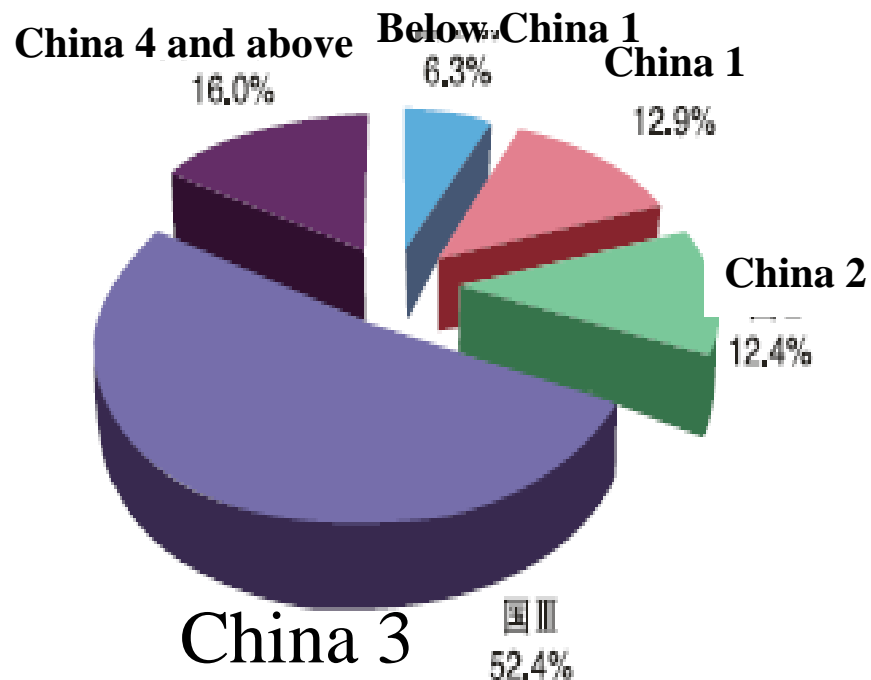
- Above 231.6 million vehicle in China.



Vehicle emission by fuel type



Vehicle emissions by emission standard



Phase out yellow label vehicles

- Phase out 6million yellow label vehicles in 2014
- Basically eliminate yellow label vehicles in key regions by the end of 2015
- Basically eliminate yellow label vehicles in key China by the end of 2017



绿色环保标志



黄色环保标志

Stringent emission standard

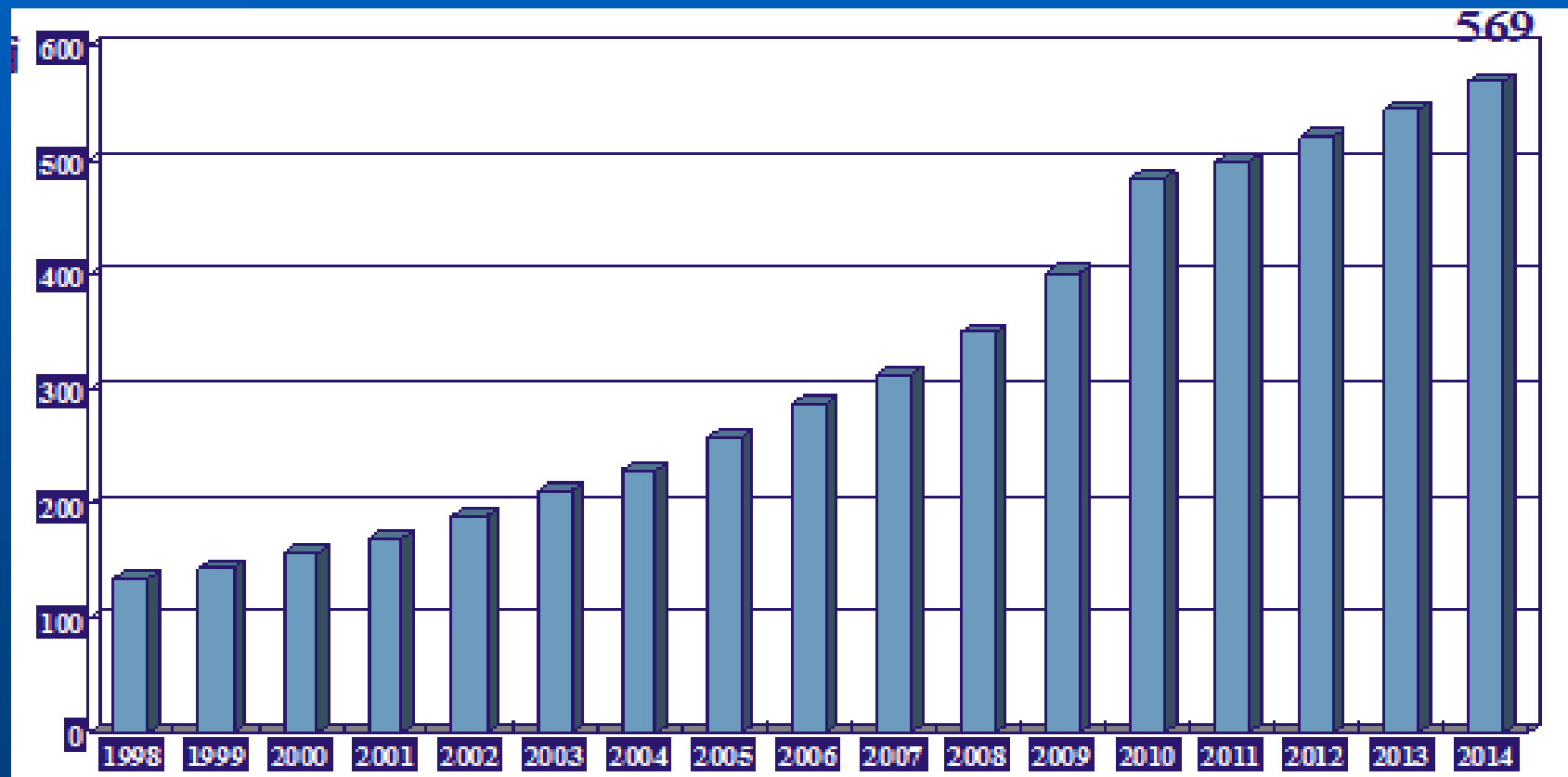
年份		2006	2007	2008	2009	2010	2011	2012	2013	
车型										
轻型汽车	柴油车	国Ⅱ			国Ⅲ					
	汽油车	国Ⅱ			国Ⅲ			国Ⅳ		
	气体燃料车	国Ⅱ			国Ⅲ			国Ⅳ		
重型汽车	柴油车	国Ⅱ			国Ⅲ					国Ⅳ
	汽油车	国Ⅱ				国Ⅲ				国Ⅳ
	气体燃料车	国Ⅱ			国Ⅲ		国Ⅳ		国Ⅴ	
摩托车	两轮和轻便摩托车	国Ⅱ				国Ⅲ				
	三轮摩托车	国Ⅱ					国Ⅲ			
低速汽车		无控制要求	国Ⅰ	国Ⅱ						
非道路	柴油发动机	无控制要求			国Ⅰ		国Ⅱ			
移动机械	小型汽油发动机	无控制要求							国Ⅰ	

Promote clean fuels

环保指标	车用柴油							普通柴油
	GB19147 国Ⅲ	GB19147 国Ⅳ	GB19147 国Ⅴ	北京	上海	广东	海南	GB252
硫含量 (ppm)	≤350	≤50	≤10	≤10	≤10	≤50	≤50	≤350
十六烷值	≥49	≥49	≥51	≥51	≥51	≥51	≥49	≥45
密度 (kg/m³)	810-850	810-850	810-850	800-845	800-845	820-845	810-850	报告
多环芳烃 (质量分数/%)	≤11	≤11	≤11	≤11	≤11	≤11	≤11	
润滑性、磨斑直 径 (μm)	≤460	≤460	≤460	≤460	≤460	≤460	≤460	
实施日期	2011.7.1	2015.1.1	2018.1.1	2012.5.31	2013.9.1	2010.6.1	2013.11.20	2013.7.1

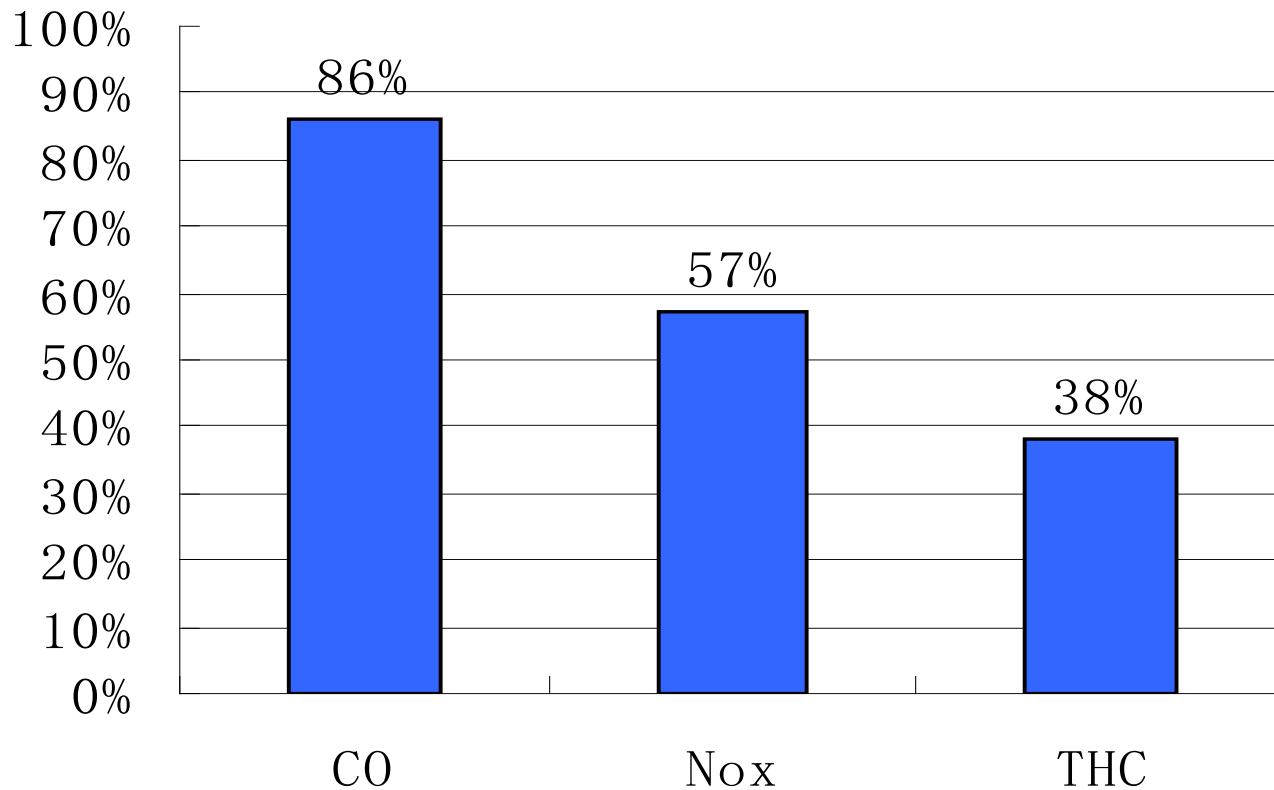
3. Review of Heavy Duty Vehicles Emission Control in Beijing

millions Vehicles Population in Beijing



annual growth rate as high as 15%

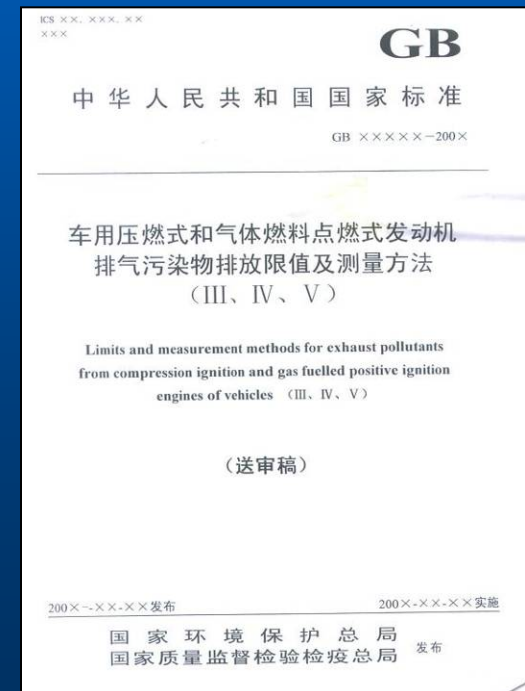
Proportion of Vehicles Emission pollutants in Beijing's ambient air



Emission Control of New Vehicles in Beijing

Beijing implements strict standards two years ahead of the national phase.

- CHINA 1 (equal Euro 1) in 1999
- CHINA 2 (equal Euro 2) in 2002
- CHINA 3 (equal Euro 3) in 2005
- CHINA 4 (equal Euro 4) in 2008
- CHINA 5 (equal Euro 5) in 2013

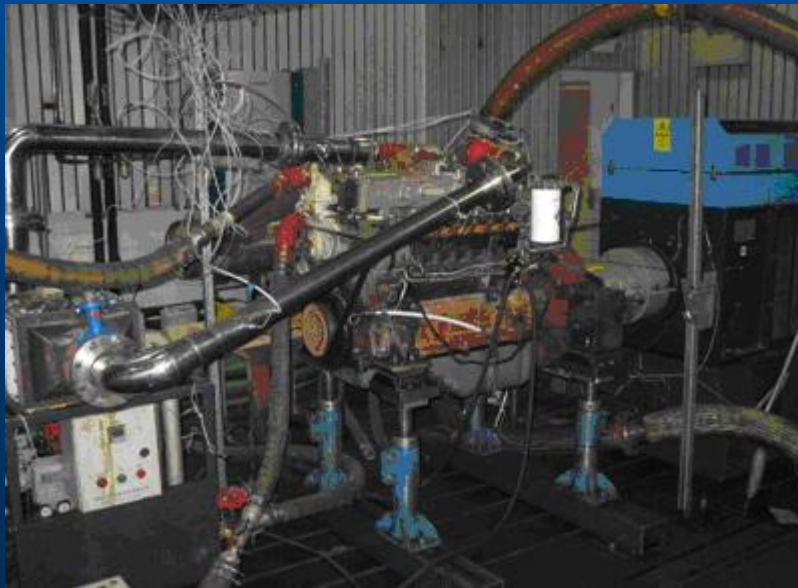


- Publish and implement local standard of Aqueous urea solution for euro 4 HD diesel vehicles
- Supply Adblue in gas stations, and HDV service stations



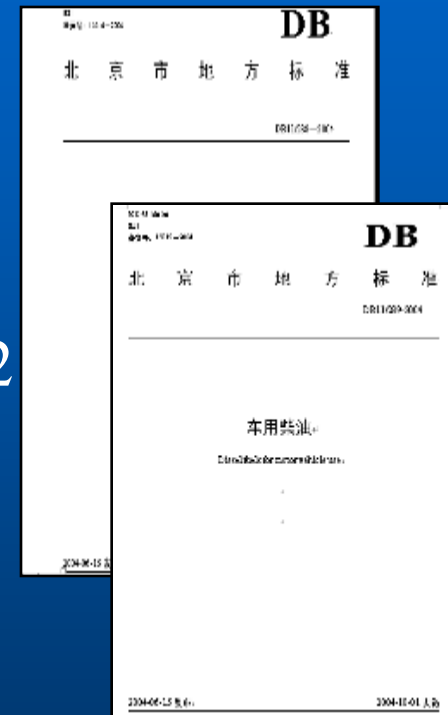
Emission test lab of Beijing EPB

- Conformity of Production and In-use Compliance test every year
- Test engine and whole vehicle emission in engine bench and PMES



Improvement of Fuel Quality in Beijing

- Implement euro2 local fuel standards in 2004
- Implement euro3 local fuel standards in 2005
- Implement euro4 local fuel standards in 2008
- Implement euro5 local fuel standards in May 2012
(Sulfur content is 10ppm in Petrol and diesel)



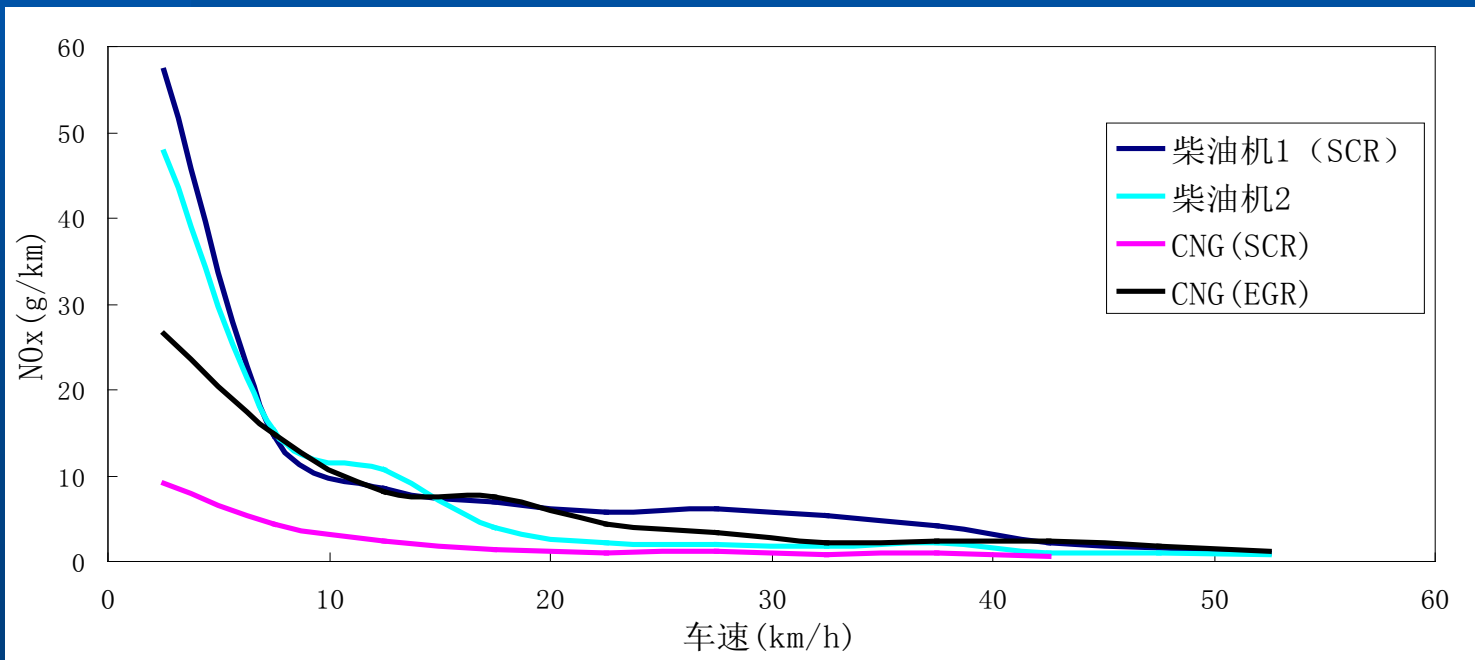
**Make all vehicles pollutants emission
reduced by 10% ~15%**

Diesel Fuel Standards in Beijing

item	Beijing Phase 2	Beijing Phase 3	Beijing Phase 4	Beijing Phase 5
sulfur ≤	500ppm	350ppm	50ppm	10ppm
Cetane ≥	49(5#0#-10#)	51 (5#0#-10#)		
	47 (-20#)	49 (-20#)		
	45 (-35#)	47 (-35#)		
aromatics ≤		11		
T95° C≤	365			
Density kg/m³	810-850(5# 0# -10#)	820-845(5# 0# -10#)		800-845 (5# 0# -10#)
	800-845(-20# - 35#)	800-840 (-20# -35#)		790-840 (-20# -35#)

Supplemental Engine's National Test Procedure Off-Cycle Emission Standard

- High “off-cycle” NO_x emissions in urban driving, because poor low temperature performance of SCR systems for China 4 and China 5.



- Release 2 local standards, that supplement an additional test cycle (WHTC) for HDV engines emissions testing, and a Portable Emissions Measurement System (PEMS) test for whole vehicle.

□ Limits and Measurement Methods for Exhaust Pollutants from Compression Ignition and Gas Fuelled Positive Ignition Engines of Vehicle (Bench Mode Methods)

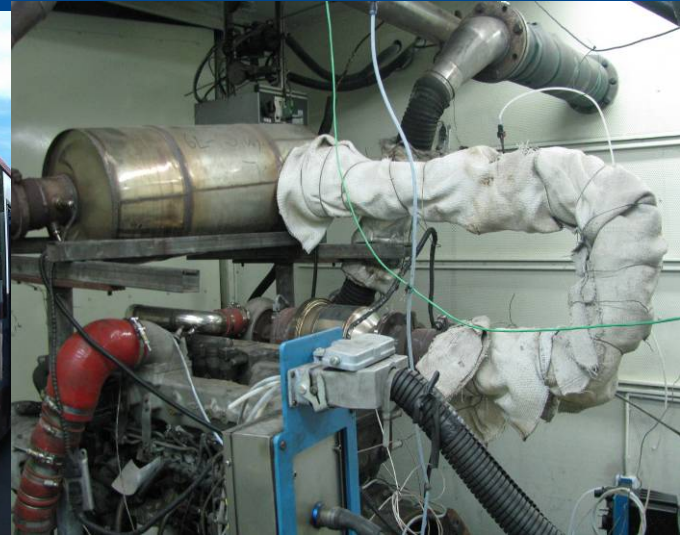
□ Limits and Measurement Method of Emissions from Heavy Duty Vehicle (PEMS Method)



- Every euro 4 and euro 5 new engine and HDV that registered in Beijing must meet local standards.

Phase	Limit of NOX (g/KW.h)		
	WHTC	PEMS	
		WWM (Work-based Window Method)	NTE (Not-To-Exceed)
IV	3.7	7	6
V	2.8	5	4

- About 8,000 euro 4 and euro 5 heavy diesel buses that were registered before local standards are retrofitted for meet local standard
- Organized engine manufactures to keep SCR warm up and calibrate ECU
- Reduce by 60% each bus NOx emission



Control of in Use Vehicles Emission

LUGDOWN method is used to test HDV in more than 100 dynamometer testing lines in 43 inspection stations



Establishment of Environmental Label System



- Yellow(<euro1 gasoline, <euro3 diesel), green(<euro5) and blue (euro 5) labels
- Use of electronic tags, embedded chips in 2009
- Functions: information storage and remote reading
- Vehicles without labels are illegal on the road



Inspection and Penalties

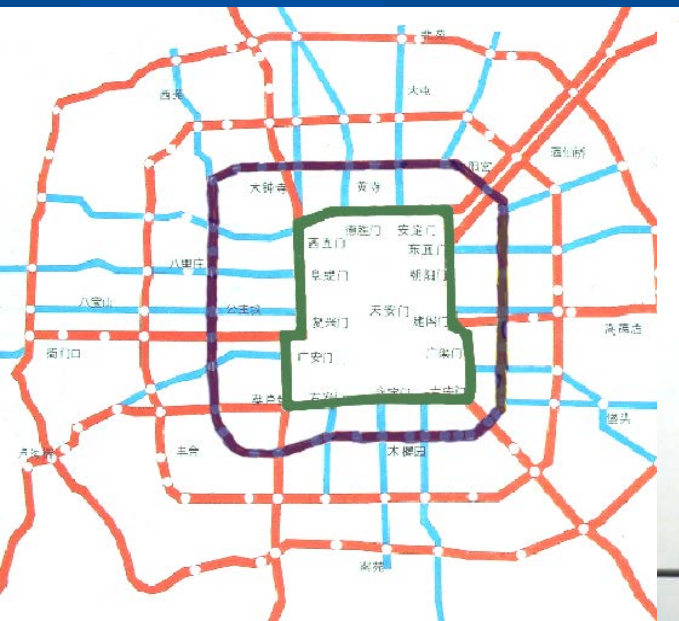
- Inspection site include a random roadside locations and a fleet stations and entrances of city

Items for Inspection	Penalty of inspection violation
Environmental label	\$35
Smoke emission testing	\$50-\$500
Emission control device and Record of Adblue injection	\$800-\$1500
OBD MIL and code	\$50



Traffic Restriction of Yellow Label Vehicles

- Traffic restriction of yellow label vehicles began in 2003
- Forbidden to run within the 5th ring road from Jan. 1st 2009
- Forbidden to run within the 6th ring road from Oct. 1st 2009



Phase out of Aged Vehicles by Financial Incentive

- Yellow label vehicles :
 - from 2009 to 2010
 - \$ 750
 - About 156,000 were retired or replaced
 - reduce 315 tons of emissions daily.



- Aged vehicles that served over 6 years (2011-2014)
 - Average \$ 800
 - Over 1.4 million were retired or replaced
 - reduce 300,000 tons of emissions per year
- Aged vehicles that served over 6 years (2015-)
 - aged vehicles must be retired
 - Average \$ 1,000
 - Focus on phase out HDV, up to \$ 6,500 (include national policy \$ 3,000)

Retrofit of Diesel Vehicles

More than 9000 heavy diesel vehicles, including buses, coaches, trucks, were retrofitted with DPF.



Off-road retrofit pilot program

- 25 off-roads are being retrofitted with DPF, include excavators, wheel loaders, compactors, etc.



Development of Electric and NG Vehicles

- Over 30,000 electric and NG vehicles in Beijing, include buses, garbage trucks, etc.
- Over 1,600 charging piles and charging stations have been constructed



Development of Public Transportation System

- 20,000 Buses
 - 90% meet euro 4 standard or above
 - New buses must meet euro5 standard since 2011
 - 3,000 Euro 5 LNG buses in 2103
- Pilot program of 1000 Euro 6 buses will be running in 2015



Revise and Implement New Local Law

- Implement The Regulations of Beijing Municipality on Atmospheric Pollution Prevention and Control from Mar 1, 2014
- Include 8 Chapters and 130 articles
- Chapter 5 is Prevention and Control of Emission from Motor Vehicles and Off-Road Mobile Machineries:
 - Duty of Production enterprises and sellers
 - Use and maintenance of vehicles
 - Fuels of vehicle
 - Inspections

4.The next steps

Research Beijing 6 emission standards

- Engine emission standard similar to Euro 6
- Add whole vehicle emission test
- Organize a fleet and engines to do verify test
- Will be implemented about 2017



Control of in Use Vehicles Emission in Regional Areas

- Set up Beijing and Surrounding Area Vehicles Emission Control Cooperation Office, which is composed of Beijing EPB and neighboring provinces' EPB.
- The emphasis of the Office are:
 - ▣ 20,000~30,000 heavy duty trucks that registered in neighboring provinces run into Beijing, and more than 80% emit excessive standards. They will be listed in “ smoke blacklist ” and fined by local EPB.
 - ▣ Inspection new vehicles in markets and conduct COP test in the regions





Thank your attentions