

***Further Challenge in Automobile and Fuel Technologies
For Better Air Quality***

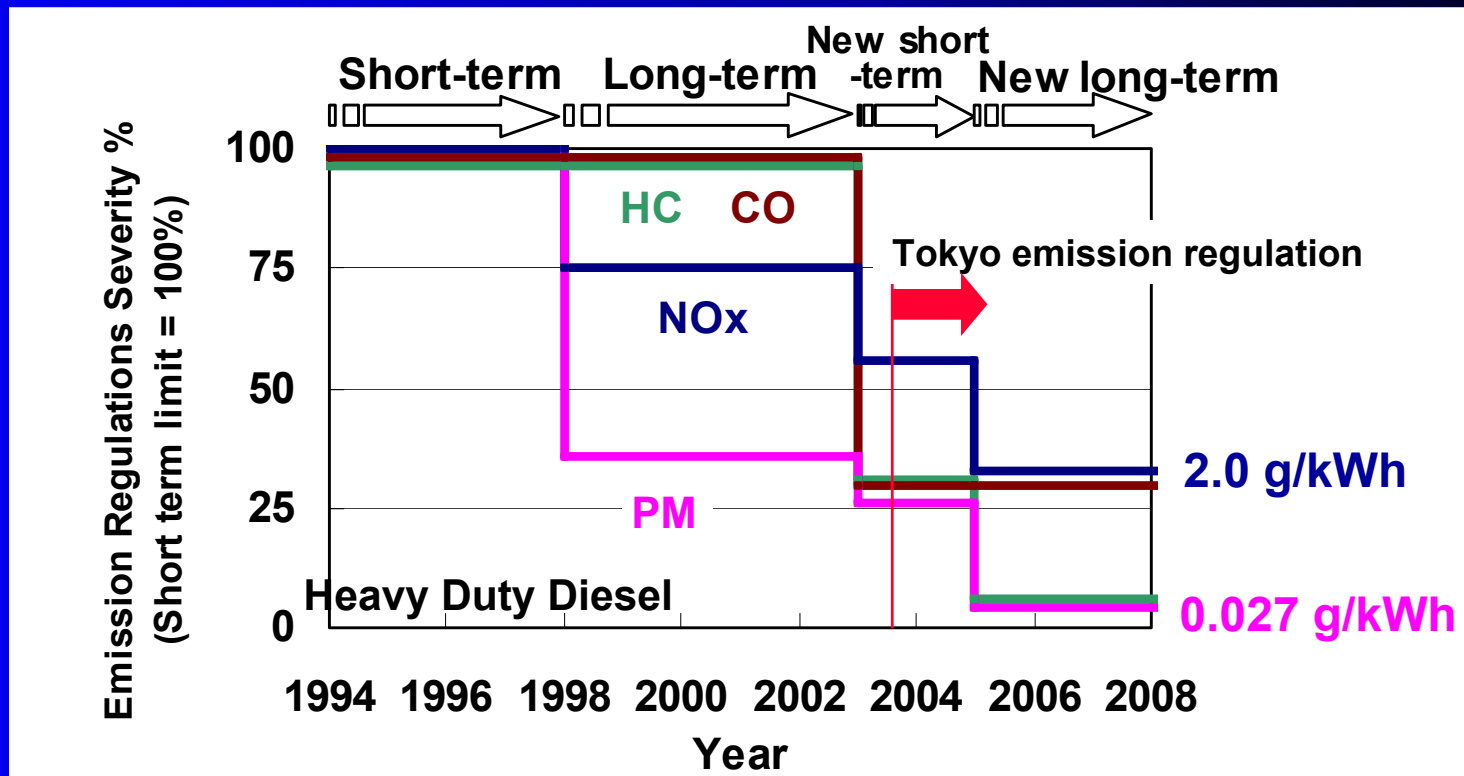
**Status of Fuels and Lubricants for
Diesel Engines in Japan**

October 9-10, 2002

**JCAPII Oil WG
Shuzo Nemoto**

Exhaust emission regulations in Japan

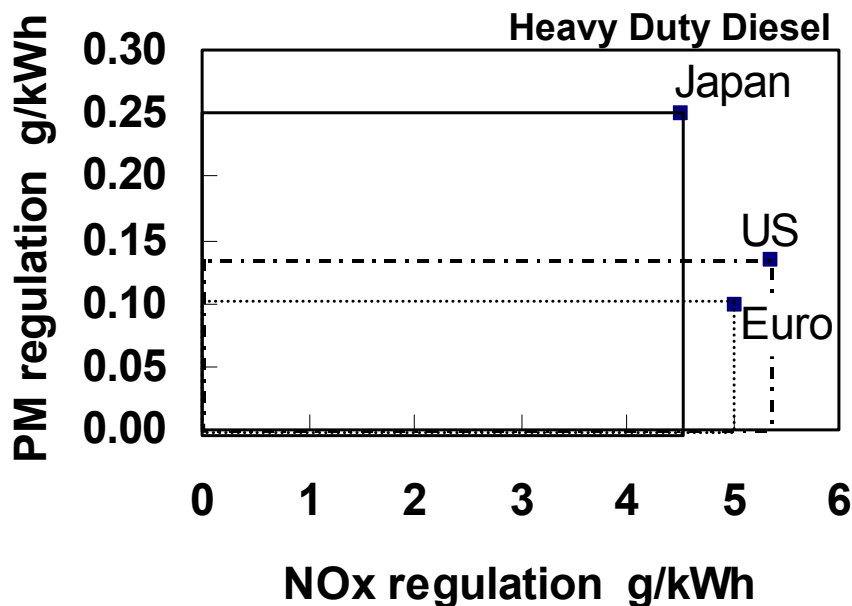
- During the past decade, exhaust emission regulations in Japan have become gradually severe .
- In 2005, new long-term regulation will come into effect. PM emissions of HD diesel will be largely reduced, along with emission measurement change to a new transient mode.



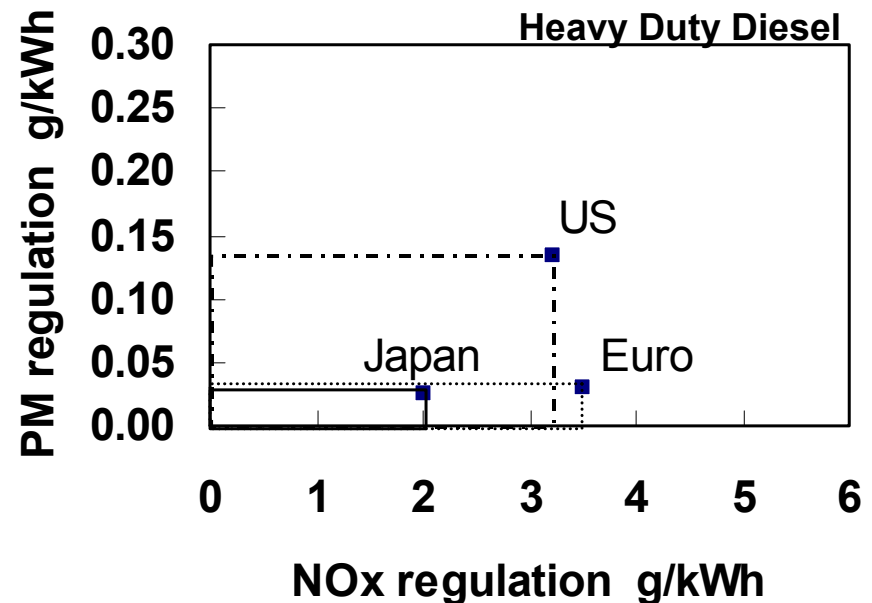
Comparison of future emission regulations in Japan, US and Europe

- Although current Japanese regulations are more relaxed in PM than US and Europe, however, it will be the most stringent regulations in the world in 2005 when new long-term regulations is implemented.

Current('02)



Future('05)



Technology for New long-term regulations

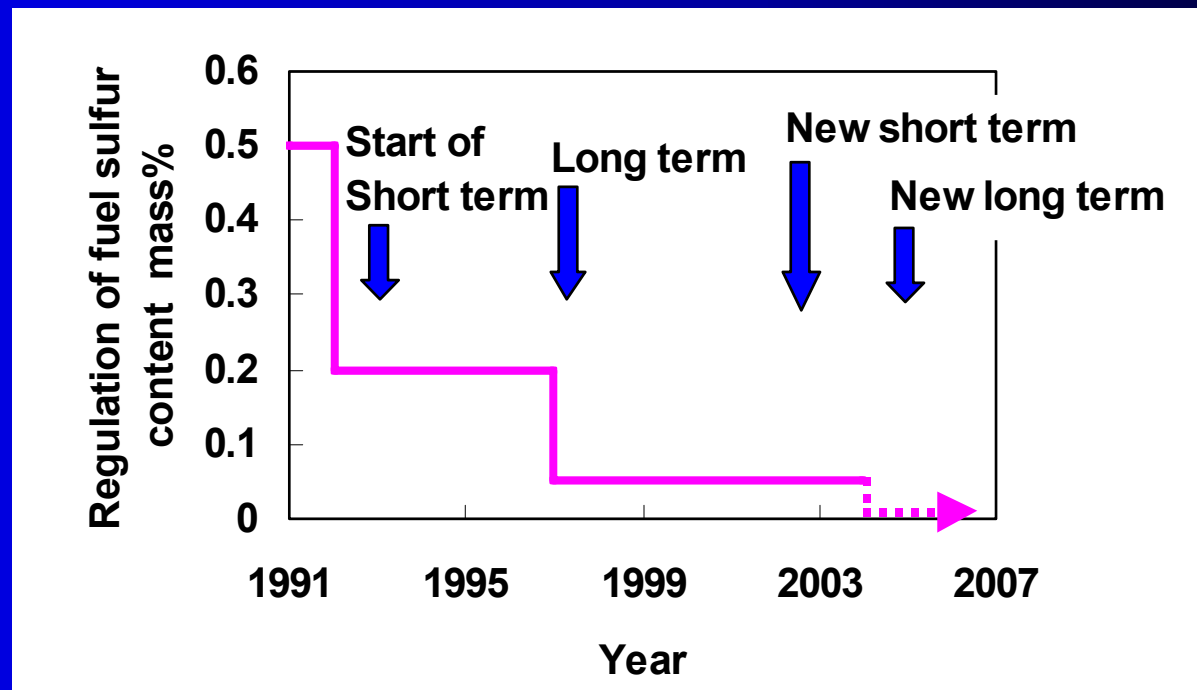
- **Heavy duty trucks and buses will be equipped with DPF traps to meet PM emission limits.**
- **NOx storage reduction (NSR) catalyst will also be equipped to meet NOx emission limits.**

	Engine technology	Aftertreatment device
PM	Common rail system + Electric control	Continuous regeneration- type DPF
NOx	Cooled EGR	NOx storage reduction catalyst, SCR

SCR: Selective Catalytic Reduction

Trend of sulfur content in fuel in Japan

- With more stringent emission regulations in the past decade, sulfur content in fuel has been decreased to 0.05 mass %, mainly for the purpose of preventing engines with EGR from corrosion.
- What is the appropriate sulfur level in fuel in the new long-term regulations?



Effect of fuel sulfur on CR-DPF and NSR catalyst

- In JCAP program, the effect of fuel properties including sulfur content on aftertreatment devices was studied.
- It was clarified that sulfur content has the most significant influence on aftertreatment devices.
 - As the sulfur content in fuel increases,
 - CR-DPF pressure drop was increased.
 - NOx emissions reduction by NSR catalyst was deteriorated.
- Detailed results will be presented by Mr. Kakegawa in tomorrow's session.

Status of sulfur content in fuel in Japan

- **Japanese government has decided to introduce 50ppm cap sulfur fuel until the end of 2004 for new long-term regulations to be implemented in 2005.**
- **Supply of 50ppm cap sulfur fuel for Tokyo Metropolis has already been launched.**
- **At the end of last month, Petroleum Association of Japan(PAJ) announced that they will supply 50ppm cap sulfur fuel almost all over the country from next April.**
- **Preliminary discussions were just started about the necessity of 10ppm cap sulfur fuel in the farther future.**
 - **Technical data will be investigated under JCAPII.**

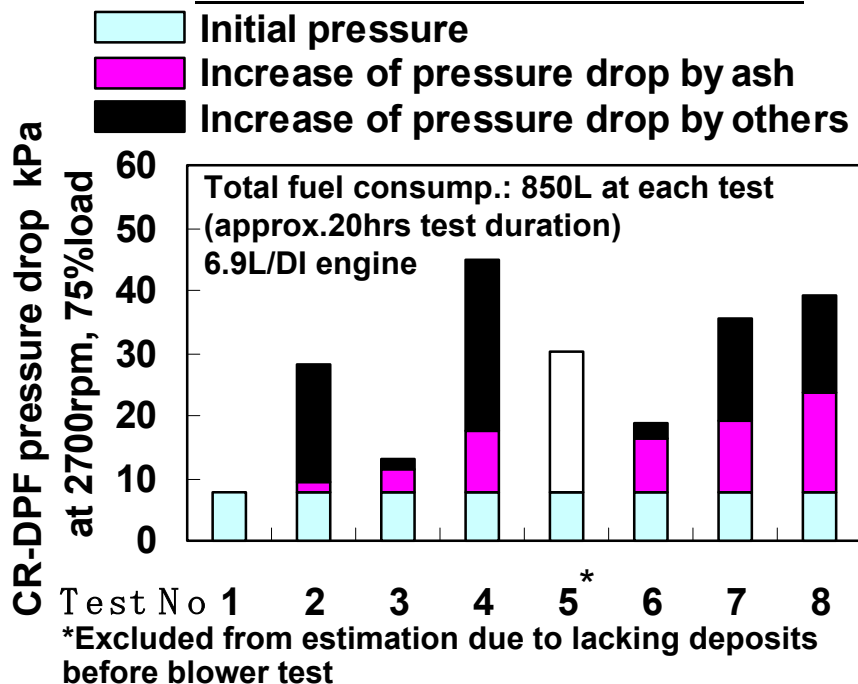
Effect of oil ash on CR-DPF clogging - an excerpt from JCAP data -

- The effect of oil ash on CR-DPF clogging was investigated by adding oil additives to fuels.
- This acceleration test revealed that oil ash increases pressure drop of CR-DPF.
- Actual mileage accumulation tests to confirm these results are currently carried out.

Metal content in test fuel

Test No.	Ca ppm	Mg ppm	Zn ppm	P ppm	Mo ppm	S ppm	Base Fuel
1	-	-	-	-	-	48	S=50ppm
2	-	70	40	33	20	96	S=0ppm
3	53	-	-	-	16	25	S=0ppm
4	65	62	34	30	-	126	S=50ppm
5	82	-	34	30	20	148	S=50ppm
6	65	67	-	-	-	15	S=0ppm
7	121	-	33	26	-	77	S=0ppm
8	130	60	-	-	18	88	S=50ppm

Acceleration test results



Status of lubricant in Japan

- **JASO DH-1 oil, which was commercialized in 2001, is becoming popular in Japanese HD oil market.**
- **However, its compatibility with DPF equipped engines is concerned due to high oil ash content.**
- **JAMA/PAJ Engine Oil Subcommittee is now discussing about post DH-1 oil standards(DX-2/3) to reduce the oil ash content to maintain DPF performance.**
- **Post DH-1 oil standards(DX-2/3) may also include upper limits for sulfur and phosphorus contents in oil.**
 - **It is expected that technical data will be investigated under JCAP11 from the next fiscal year.**

JAMA : Japan Automobile Manufacturers Association Inc.

PAJ : Petroleum Association of Japan

JASO: Japan Automobile Standards Organization

Summary

- **For new long-term emission regulations in Japan,**
 - **Sulfur content in fuel will be less than 50ppm by the end of 2004.**
 - **Lower ash lubricant standards will be introduced by April, 2005.**
- **Investigation of the necessity of 10ppm cap sulfur in fuel was just started.**
 - **Under this situation, it can be presumed that reduction of sulfur content in lubricant is a more important issue.**

JCAPII Oil Working Active Plan & Schedule

Active Plan	Schedule				
	2002	2003	2004	2005	2006
1) Research the influence of oil ash on CR-DPF clogging • Mileage accumulation dynamometer test • Analysis of ash content in emission gas before and after CR-DPF					
			→		
		→			
2) Investigate the adverse effect of oil components (S,P) on DeNO _x catalyst.					→

Mileage Accumulation Dynamometer Test

Test No.	Engine	Fuel Sulfur	Oil	Operating Condition
1	7L/DI	50 ppm	DH-1 equivalent oil \$.Ash = 1.7%)	Max. power point/600hr
2	7L/DI	50 ppm	Low ash oil A \$.Ash = 1.3%)	Max. power point/600hr
3	7L/DI	50 ppm	Low ash oil B \$.Ash = 0.9%)	Max. power point/600hr

Result of MAD test

