Supply of Sulfur Free Gasoline and Diesel Fuel

In response to the air pollution issue that has arisen as a result of rapid motorization since the 1970s, the oil industry has been striving to respond to the needs of society by actively engaging in measures to reduce the environmental impact of gasoline and diesel fuel. In January 2005, we began supplying sulfur free (sulfur content of 10ppm or less) gasoline and diesel fuel.

Reducing the Environmental Impact of Gasoline

The Japanese oil industry has been striving to reduce benzen content, vapor pressure and sulfur content, in order to reduce the environmental impact of gasoline.

• Reducing Benzene Content

Since January 2000, the benzene content in gasoline, which is considered possibly harmful to humans, has been reduced from 5% to 1%.

• Reducing Vapor Pressure

In order to reduce vaporized gas which can be a cause of photochemical smog, since 2001, the vapor pressure for gas during only the summer season has been reduced from less than 78kPa to less than 72kPa. The gasoline with less than 65kPa has been voluntarily produced in 2005.

• Reducing Sulfur Content

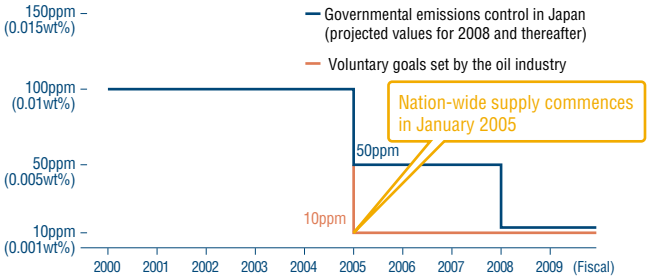
Low sulfur content of gasoline reduced pollutants in the air and also plays a role in maximizing the performance of emissions cleaning systems in automobiles. The oil industry has repeatedly implemented measures to reduce the sulfur content of gasoline.
We began supplying sulfur free gasoline (with sulfur content of 10ppm or less) in January 2005.

Reducing the Environmental Impact of Diesel Fuel (Reduction of Sulfur Content)

The oil industry, in response to the changes in emissions regulations, has utilized state-of-the-art technologies in an effort to reduce the sulfur content of diesel fuel. In April 2003, we supplied diesel fuel with a sulfur content of 50ppm, and we were able to begin supplying sulfur free diesel fuel (with sulfur content of 10ppm or less) by January 2005.

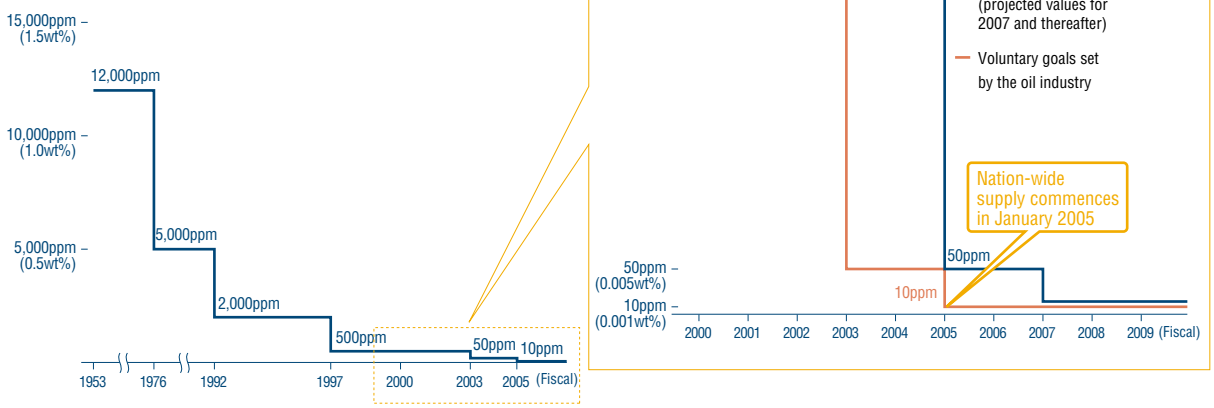
Current Status and Future Projection concerning the Sulfur Content in Gasoline

Source: The Petroleum Association of Japan



Current Status and Future projection concerning the Sulfur Content in Diesel Fuel

Source: The Petroleum Association of Japan



• Reducing Sulfur Content in Gasoline and Diesel Fuel

Cosmo Oil began supplying sulfur free (sulfur content of 10ppm or less) gasoline and diesel fuel in 2005. This was the result of our voluntarily moving forward the schedule for implementing restrictions which called for reducing the sulfur content to 10ppm or less by 2007 for diesel fuel and by 2008 for gasoline. Although the restriction that exited in Japan until now, that required the sulfur content in gasoline and diesel fuel to be 50ppm or lower, is a very stringent regulation standard internationally including for developing countries, we were able to reduce sulfur content to an even lower level (refer to diagram). Sulfur free gasoline and diesel fuel, if used with the newest, environmentally friendly automobiles, can not only reduce NOx and PM emissions, but can also be useful in improving the fuel consumption of automobiles. For this reason, we anticipate that these sulfur free fuels will also help to reduce CO_2, thereby serving as effective countermeasures to climate change as well.

In the Kyoto Protocol Achievement Plan, based on the condition that automobiles which run on sulfur free fuels by installing the direct fuel-injection lean burn technology will have increased, it is projected that CO_2 emissions will be reduced by 1.2 million tons in Japan, nationwide, by 2010.

■ International Comparisons of Restrictions on Sulfur Content

Source: The Petroleum Association of Japan

Since January, 10ppm or less for nationwide delivery (voluntary action)

		2004	2005	2006	2007	2008	2009	2010
Gasoline (regular)	Japan (till December 2004: approximately 35ppm)		50ppm or less			10ppm or less (scheduled)		
	EU (2004: 150ppm)		50ppm or less				10ppm or less	
	U.S. (2004: 300ppm)			80ppm or less				

Since January, 10ppm or less for nationwide delivery (voluntary action)

		2004	2005	2006	2007	2008	2009	2010
Diesel fuel	Japan (till December 2004: approximately 50ppm)		50ppm or less		10ppm or less (scheduled)			
	EU (2004: 350ppm)		50ppm or less				10ppm or less	
	U.S. (2004: 500ppm)			15ppm or less				

• Reducing Sulfur Content in Sulfur Free Gasoline

Two effects are anticipated from reducing the sulfur content in gasoline, below the stringent level of 10ppm or less that we have achieved.

One is the reduction of CO_2 emissions, as a result of improved fuel consumption by automobiles. Currently, the most promising technology for the purpose is the lean combustion engine, otherwise knows as the direct injection engine or the lean burn engine. New engines have a lean NOx catalyst in their exhaust gas treatment equipment. The performance of this catalyst declines with sulfur content, and therefore, it is necessary to have a gasoline that contains very little sulfur. In other words, without desulfurization of gasoline, the direct injection, lean burn engine that has superior fuel consumption could not be developed and commercialized.

The other effect is that through desulfurization, the durability of existing gas exhaust processing equipment for automobiles (3-way catalyst) would be improved, and emissions of nitrogen oxide (NOx), carbon monoxide (CO), and hydrocarbons (HC) would also be reduced.

Desulfurization of gasoline is not an issue that should be handled alone by the oil industry, but it is an issue in which the automobile industry also needs to be a part. This should be a part of a renewed effort in handling problems related to the global environment.

• Producing Sulfur Free Gasoline (Introduction of FCC Gasoline Desulfurization Unit)

In order to produce sulfur free gasoline, Cosmo Oil introduced new FCC gasoline desulfurization unit at its 3 refineries in Chiba, Yokkaichi, and Sakai.

Gasoline is generally produced by mixing several gasoline components. Of those, one of the components which has the highest sulfur content is FCC gasoline that comes from FCC (fluid catalytic cracking). For this reason, desulfurization of the FCC gasoline is the short-cut to reducing the sulfur content of gasoline.

The basic principle behind desulfurization is hydrodesulfurization which is the process of eliminating sulfur by making it bind with hydrogen, but at the same time, this process breaks down elements that have a high octane number. In order to avoid this reaction, the desulfurization unit that has been newly introduced utilizes a new technology that separates the fraction which has high sulfur content and low octane number from the fraction that has low sulfur content and high octane number, and then continues to desulfurize only the fraction that has high sulfur content and low octane number.