



6. 燃料的监督检查和达标管理方案

提高油品标准能减少燃料燃烧时产生的污染物，但更重要的是，清洁燃料可以令先进的排放控制装置在车辆上得以使用。只有车辆排放与燃料标准的制定相配套，且车辆和油品同时满足标准要求，车辆才能达到最佳的排放性能。

要确保零售站点销售的燃料能满足所有规定的规格，设计并有效实施油品达标管理方案十分重要。油品达标管理方案对使用先进的排放控制技术更为关键，因为这些先进的装置会被不合格的油品破坏（例如高硫燃料）。

不过，中国地域宽广，而且燃料供应商和零售商有很大诱因将违法油品以较低的价格出售给在乎价格的消费者，在中国推行有效的油品达标管理方案具有一定的挑战。本章将评估美国和日本在推进车用燃料质量方面的经验，并将从中学习经验，为中国实施有效的燃料品质管理方案提供一些建议。

6.1 美国环保局（EPA）的油品达标管理方案概述

EPA设立了一个综合性的油品达标管理方案，包含了燃料登记注册、油品监督检查、油品质量测试和报告机制以及违规处罚措施。大多数油品监督检查项目都是由EPA出资支持的；EPA只要求石化企业出资支持一个监督检查项目，来确保新配方汽油能满足各新配方汽油控制区设定的年度平均标准要求。石化企业还出资支持另外一项审查柴油硫含量的自愿性质量保障调查来证明已有确定的防范措施保证油品达标的要求，具体细节会在本章稍后进行论述。《清洁空气法》211节规定如果燃料及燃料添加剂有可能危及公众健康或财产或损伤排放控制装置或系统，EPA有权禁止其生产和销售。《清洁空气法》1990年修订案中增加了对燃料燃烧后排放物的减排要求，并授权EPA管理非道路机械用油品。

EPA的达标管理方案将证明达标的责任主要放在炼油企业、进口商和其它燃料运输和经销商身上，通过登记注册、油品分析和报告的方式来证明油品达标。EPA通过指定中立实验室进行抽样和检测来确保企业的达标证明真实公正，由第三方对企业的报告进行审核，并有目的或随机地对炼油厂、燃料进口设施、中转油库和加油站进行检查。具体内容将在下面的章节中具体论述。

管理对象

油品达标管理的对象包括燃料输送分配系统中的所有参与者，包括炼油企业、进口商、分配商、运输商、含氧剂添加企业、零售商和大批采购的消费者（拥有分油泵的车队运营商）。

EPA的实施方法

EPA建立达标管理方案是为了确保从炼厂出厂的燃料和进口的燃料都能满足各项法定要求或规定的每加仑限值或年均限值要求。下面的表6.1中列出了对汽柴油的要求（每加仑或年均）。EPA还设置了一些附加要求来确保炼厂下游的燃料品质（每加仑为基础）。各项实施措施将在下面的章节中进行简单论述。



6. Fuel inspection and compliance programs

Fuel modifications can reduce pollutant emissions from fuel combustion and, more importantly, enable the use of advanced emission control devices. The best vehicle emission performance can only be achieved if both vehicles and fuels meet standards that are designed to complement each other in reducing vehicular emissions.

Effectively design and implement a fuel compliance program is important to ensure that fuels sold at the retail stations meet all the mandated specifications. A fuel compliance program becomes more critical with the use of advanced emission control devices that can be damaged by fuel not conforming to specifications (e.g., high sulfur fuel).

However, it has been challenging to establish an effective fuel compliance program in China, with its expansive territory and with fuel suppliers and retailers having high incentives to sell cheaper illegal fuel to their price cautious customers. This chapter reviews the experiences of US and Japan in enforcing motor fuel quality, and lessons learned from these two countries are used to inform recommendations for the establishment of an effective fuel quality enforcement program in China.

6.1 Overview of US EPA's fuel compliance program

EPA manages a comprehensive fuel compliance program that combines fuel registration, extensive fuel inspections, fuel quality testing and reporting system, and stiff noncompliance penalties. Most of the fuel inspection programs are funded by EPA; industry is required to fund one program that assures reformulated gasoline compliance for annual average standards is met separately for each reformulated gasoline control area. Another voluntary quality assurance survey program for diesel fuel sulfur compliance is also funded by industry consortium as an alternative defense that will be discussed in more detail later in this chapter. Section 211 of the Clean Air Act (CAA) gives EPA the authority to prohibit the manufacture or sales of fuel and fuel additives if they may reasonably be anticipated to endanger the public health or welfare or impairs emission control device or system. The 1990 CAA amendments added provisions to mandate that fuel combustion result in fewer emissions and expanded EPA's authority to include fuels used in non-road vehicles.

EPA's compliance program places the onus of proof largely on refiners, importers and other fuel handlers to demonstrate compliance through registration, fuel analysis and reporting. EPA assures the authenticity and probity of industry's proof of compliance by mandating independent lab sampling and testing, third party auditing of industry reports, and by conducting targeted and random audits at refineries, import facilities, truck loading terminals and retail stations. Key elements of the program are discussed in more details in the following sections.

Regulated parties

The fuel compliance program targets all parties in the distribution system, including refiners, importers, distributors, carriers, oxygenate blenders, retailers, and wholesale-purchaser-consumers (fleet operators with their own dispensing pumps).

EPA enforcement approach

EPA's compliance program was established to assure that fuel leaving the refinery gate or that is imported meets all requirements or prohibition on a per-gallon and on an annual average basis. Table 6.1 below shows the per-gallon and average fuel requirements for gasoline and diesel fuel. Additional measures are established to assure that quality of fuel is maintained downstream of the refinery on a per-gallon basis. Each of the enforcement measures is briefly discussed in the following sections.

表 6.1: 汽柴油的特性要求

特性要求	新配方汽油 (RFG) ⁶⁶		其它汽油	
	每加仑	年平均	每加仑	年平均
铅	不得检出	-	不得检出	-
硫, ppm, 最大值	80	30	80	30
蒸气压 (夏季 RVP)	约7.0 psi (48 kPa)	-	7.8-9 psi (54-62 kPa)	-
芳香烃	25%	-	25%	-
苯	1.3%(体积分数)	0.95%(体积分数)	-	-
其它重金属物质 (例 如: 锰)	不得检出	-	-	-
RFG和倾弃 ⁶⁷	减少挥发性有机化合物 (VOCs) 和空气有毒物质 25-30% (相比1990年的汽油 质量)	减少VOCs和空气有毒物质 25-30% (相比1990年的汽油 质量)	-	油品清洁度不得 低于1990年汽油 质量
移动源空气有毒物质 (MSAT 1)		进一步减少有毒物质平均量	-	进一步减少有毒 物质平均量
移动源空气有毒物 (MSAT 2)	苯: 1.3 % (体积分数)	平均0.62% (体积分数)	没有上限, 但在使用信用额 度之前, 炼厂/进口商的年 平均值不得超过1.3%(体积 分数)	0.62 体积.% 平均

柴油(机动车和非道路)

特性要求	每加仑
硫	15 ppm
十六烷指数 最小值	40
或芳香烃 最大值	35%

66 Reformulated gasoline (RFG)是一种配方更清洁的汽油燃料, 被要求用于臭氧不达标的特定区域。

67 《清洁空气法》第211节规定了氮氧化物 (NOx) 限值, 要求基准车辆使用非新配方汽油时NOx排放水平不得超过基准车辆使用1990年基准汽油的排放水平。实施低硫汽油 (均值每加仑30ppm, 上限80ppm) 保障了排放满足原有的NOx标准, 自此后EPA没有再执行NOx标准。从2011年起, EPA将开始淘汰有毒物质标准, 代之以苯标准 (年均值0.62体积百分比)。

Table 6.1: Per gallon and average standards and performance requirements for gasoline and diesel

PROPERTY OR PERFORMANCE REQUIREMENT	REFORMULATED GASOLINE (RFG) ⁶⁶		OTHER GASOLINE	
	PER GALLON	AVERAGE	PER GALLON	AVERAGE
Lead	Non-detectable	-	Non-detectable	-
Sulfur, ppm, max	80	30	80	30
Volatility (summer RVP)	Approximately 7.0 psi (48 kPa)	-	7.8-9 psi (54-62 kPa)	-
Aromatics	25%	-	25%	-
Benzene	1.3 vol.%	0.95 vol.%	-	-
Other heavy metals (e.g., manganese)	Non-detectable	-	-	-
RFG and anti-dumping ⁶⁷	Reduce VOCs and air toxics by 25-30% (compared with 1990 gasoline quality)	Reduce VOCs and air toxics by 25-30% (compared with 1990 gasoline quality)	-	Fuel not dirtier than 1990 gasoline quality
Mobile Source Air Toxics (MSAT 1)	-	Further reduces average toxics	-	Further reduces average toxics
(MSAT 2)	Benzene: 1.3 vol%	0.62 vol.% on average	No cap but refinery/ importer annual average cannot exceed 1.3 vol.% before use of credits	0.62 vol.% average

Diesel (Motor vehicle and non-road)

PROPERTY REQUIREMENT	PER GALLON
Sulfur	15 ppm
Cetane index, min	40
Or Aromatics, max	35%

⁶⁶ RFG is a cleaner burning gasoline blend required in certain regions that do not meet air quality standards for ozone.

⁶⁷ Sec. 211 of the "Clean Air Act" specifies a backstop limit on NOx, requiring that NOx emissions from a baseline vehicle using non-RFG shall not exceed the level from the baseline vehicle using the baseline gasoline in 1990. EPA no longer enforces the NOx standard, since compliance with the low sulfur levels in gasoline (30 ppm average and 80 ppm per-gallon cap) assures compliance with the old NOx standards. Starting 2011, EPA will begin to phase out the toxics standards as well. These will be replaced by a benzene standard (annual average of 0.62 volume percent).

油品和油品添加剂登记注册

EPA要求炼油企业和进口商在美国市场销售任何车用燃料和燃料添加剂前，须向EPA登记注册这些产品。进行登记注册要求提交燃料或燃料添加剂的化学性质描述和技术、市场和健康相关信息，如该产品的实际使用用途。EPA可能还会要求产品在延长注册有效期或新产品注册时进行健康影响测试。

EPA通过登记注册信息，使用复合模型（complex model）对燃料或添加剂的燃烧和蒸发排放进行评估⁶⁸并找出其排放物可能带来公共健康风险的产物。如果任何燃料或燃料添加剂可能危害公众健康或损坏排放控制装置，EPA可以拒绝这些产品的注册或取消其已有的注册。

根据《清洁空气法》的要求，要在所有汽油中加入清净剂以减少发动机和油品供应系统沉积物的累积，清净剂也必须通过EPA认证。认证程序包括：

- 1) 和其它添加剂一样在EPA进行登记注册，登记注册中应包括添加剂的组分和最小推荐浓度。在没有告知EPA的情况下，不得降低最小推荐浓度。
- 2) 向EPA提交清净剂样本。
- 3) 提交清净剂认证函。认证函必须由认证方的法定代表人签署。

在收到认证函后，EPA会审核认证资料，分析提交的清净剂样本，或对添加剂进行验证测试，并可能在必要时取消某项认证。

另外，EPA要求清净剂生产企业将最小推荐浓度准确地告知购买其清净剂以满足EPA要求的各家炼油企业⁶⁹。

油品测试和达标报告

EPA要求炼油企业和进口商分析生产或进口的每批次⁷⁰燃料的油品特性指标（根据油品种类）⁷¹。炼油企业和进口商要保存所有测试记录并封存测试样本。油品特性要上报EPA，根据特定的达标方案⁷²，按季度或按年度报告。另外，炼油企业和进口商均须向EPA提交年度报告以供存档，报告中应包括每批次的测试结果和相关特性指标，以示能够满足基于每加仑和年平均标准的要求。EPA会有选择地审核部分年度和季度报告并检查实验室记录是否与之一致。EPA还会审核实验室和审核试验方法以及质量保障程序等。

企业支付费用的独立实验室测试

除了对各批次油品进行自检，EPA还要求炼油企业和进口商雇佣独立的实验室进行新配方汽油和特定进口汽油的抽样及测试。独立实验室的测试报告要提交给EPA，以供EPA与认证管理对象提交的报告进行对比。所有的实验室报告都需要由该实验室的高级管理人员签发，一旦发现报告作假，EPA可对签署人提出刑事诉讼。

68 复合模型基于下列参数估算燃料NO_x、有毒物质和挥发性有机化合物的排放量：烯烃、芳香烃、硫、苯、氧含量、馏程（E200和E300）以及雷氏蒸汽压（RVP）。

69 详见《联邦管理法规》（40 CFR）86.161部分的清净剂认证方案。

70 在柴油燃料管理方案中，根据40CFR 80.502(d)的定义，一批次是保管权交给另一方的燃料的数量。一批次汽油则是指同性质的混合物。80.2节(gg)段。

71 柴油的硫含量、芳香烃和十六烷值指数；汽油的硫含量、芳香烃、苯、铅、夏季蒸汽压、馏程、烯烃；其它用来证明符合新配方汽油或传统汽油反倾弃要求的油品特性指标。

72 例如，炼油企业和进口商被要求提交所生产或进口的每批次油品的质量报告来证明产品能够达到对每加仑油品的要求。为证明符合新配方汽油和反倾弃要求，要求炼油企业和进口商每季度和每年提交报告。年度报告要求证明满足苯、挥发性有机化合物和空气有毒物质要求以及对每加仑汽油的硫含量限值和平均限值。

Fuel and fuel additive registration

Refiners and importers are required to register with EPA any motor vehicle fuel and fuel additive prior to marketing in the US. Registration requires submission of the chemical description of the fuel or fuel additive as well as technical, marketing and health-related information, such as the in-use purpose of their product. EPA might also require testing for possible health effects for a product to maintain its registration or for a new product to be registered.

EPA uses the registration information to assess the likely combustion and evaporative emissions using the complex model⁶⁸ and identify products whose emissions might pose unreasonable risks to public health. EPA can deny new registration or repeal existing registration of any fuel or fuel additive that may endanger public health or impair emission control devices.

Detergent additives, which are required under the CAA to be added to all gasoline to reduce accumulation of deposits in engines and fuel supply system, have to be certified with EPA. The certification process includes:

- 1) Registration with EPA like other additives, and the registration should include the additive's composition and the minimum recommended additive concentration. The recommended concentration cannot be lowered without first notifying EPA.
- 2) Submitting a sample of the detergent additive to EPA
- 3) Submitting a certification letter for the detergent additive package. The letter must be signed by a person legally authorized to represent the certifying party.

After receiving the certification letter, EPA may review the certification data, analyze the submitted detergent additive sample, or subject the additive package to confirmatory testing, and may disqualify a certification where appropriate.

In addition, the detergent additive manufacturers are required to accurately communicate the minimum recommended concentration to each fuel manufacturer who purchases the detergents for compliance with EPA's requirement⁶⁹.

Fuel testing and compliance reporting

EPA requires refiners and importers to analyze the properties of every⁷⁰ batch of fuel produced or imported for fuel properties associated with that kind of fuel⁷¹. Refiners and importers have to maintain all testing records and retain test samples. Fuel properties are reported to EPA on a quarterly or annual basis depending on the design of the particular compliance program⁷². In addition, annual reports are filed with EPA summarizing test results of every batch and the associated properties to show compliance with the per-gallon and average standards. EPA selectively audits the annual and quarterly reports, and lab records to check if they are internally consistent. EPA also audits the laboratories and the laboratory methods, quality assurance procedures, etc.

Industry-paid independent lab testing

In addition to conducting self-testing of every batch of fuel, EPA requires refiners and importers to hire independent labs to sample and test reformulated gasoline and certain imported gasoline. Independent lab test reports are submitted to EPA for comparison with the reports submitted by the regulated parties.

68 The complex model estimates NOx, toxics and VOC emission performance of fuels based on the following parameters: olefin, aromatics, sulfur, benzene, oxygen, distillations (E200 and E300) and RVP.

69 See 40 CFR Part 86.161 for more details about the detergent additive certification program.

70 In the diesel fuel program, by definition (40 CFR 80.502(d)), a batch is a volume of fuel whose custody has been transferred to another party. A batch of gasoline is defined as a homogeneous mixture. Section 80.2 (gg).

71 Sulfur content, aromatics and cetane number for diesel; sulfur, aromatics, benzene, lead, summer RVP distillation, olefin for gasoline, and other fuel properties that demonstrate compliance with the reformulated gasoline or conventional gasoline anti-dumping requirements.

72 For instance, refiners and importers are required to submit fuel quality report for every batch of fuel produced or imported to show that all per-gallon requirements are met. To demonstrate compliance with the RFG and anti-dumping requirements, refiners or importers are required to submit reports every quarter and annually. Annual reports are required for demonstrating compliance with the benzene, VOCs and air toxics requirements, and the average and per-gallon maximum gasoline sulfur limits.

企业支付费用对炼油企业报告和实验室记录进行独立审核

EPA同时要求炼油企业和进口商雇佣独立的注册会计师事务所或内部的注册审计师来审核所有油品测试结果、报告和炼油企业或进口商的其他信息。

推定责任和企业支付费用的市场调查

根据EPA的管理规定，如发现炼油企业、进口商、分配商、运输商、分销商、零售商或大批量购买的消费者销售或使用没有达到硫含量标准要求的车用柴油或没有达到苯、硫、挥发物、有毒物质和铅含量规定的汽油，这些机构均须承担责任。这就意味着一旦发现违规现象，不达标燃料的所有者，以及分配系统上游的所有人员机构都将被推定要为此负责，除非他们可证明已有确定的防范措施。炼油企业或零售商（其商标出现在加油站）可以实施下游质量保障方案来确保达标，并在被控诉要负上推定责任时可以作为辩护的其中一项理据⁷³。这些企业还需要提供其他辩护理据，包括未能达标产品与上游生产过程及产品品质无因果关系。

为满足超低硫柴油的抽样和测试要求以作为推定责任的辩护理据，石化企业出资进行柴油油品调查。在调查中，石化企业雇佣的调查人员会利用统计学方法定期从不同地区的零售站点抽样，然后根据柴油硫含量要求对样本进行测试。

EPA审核和检查

除了审核企业提交的报告并要求企业雇佣独立的实验室进行油品测试及独立的审核机构对测试结果的真实性和公正性予以审核，EPA还会随机和有针对性地检查被怀疑生产不达标油品的炼油企业。EPA每年还会检查一小部分独立实验室，确保企业与测试实验室之间的紧密联系不会影响实验室的独立性和报告的准确性。

不达标处罚

《清洁空气法》设定了每天不超过37,500美元⁷⁴（或256,000人民币）的民事罚款并要求企业上缴违规带来的经济收益或资金节约。实际的罚款金额由EPA在考虑经济效益、商业规模和违规程度（是否造成了明显的排放上升）后进行裁定。尽管不经常进行最高额的罚款，EPA还是会对严重违规的企业实施重罚。例如在1985年，EPA对Decker Coal公司处以266,000美元（180万人民币）的罚款，理由是该公司给37辆标明使用无铅汽油的车辆加注含铅汽油⁷⁵。2008年EPA对售卖未通过登记注册添加剂的Biofriendly公司罚款125万美元（875万人民币）⁷⁶。另外，EPA如果发现炼油企业、进口商和独立实验室伪造测试结果或协助作假可以对他们提出控诉。

73 实例详见40 C.F.R. 80.613(d)。

74 根据40 CFR 19部分，由于通货膨胀，上调了《清洁空气法》规定的25,000美元的民事罚款上限。

75 美联社，1985年，油品违规罚款搜索，Spokane Chronicle。

76 EPA，2008年，Biofriendly公司清洁空气解决方案，EPA网站<http://www.epa.gov/compliance/resources/cases/civil/caa/biofriendlycorp.html> (2010年4月29日查阅)。

77 例如1998年，为炼油企业和进口商提供测试和检查服务的Saybolt公司，因向EPA提交作假的炼油企业和进口商实验室测试检查报告，共计被罚款490万美元（3300万人民币）。

All laboratories reports have to be signed by senior management of the lab, and EPA could file criminal charges against the signatory if reports are found to be falsified.

Industry-paid independent auditing of refinery reports and lab records

Refiners and importers are required to hire independent certified public accounting firms or certified internal auditor to audit all fuel test results, volume reports and other information of the refiners or importers.

Presumptive liability and industry-funded field surveys

EPA rules place liability on refiners, importers, distributors, carriers, resellers, retail and wholesale purchase-consumers if they sell or use motor vehicle diesel fuel that does not meet the sulfur standards or if they sell or use gasoline that does not comply with the benzene, sulfur, volatility, toxics and lead contamination regulations. This means that when a violation is found, the party in possession of the non-conforming fuel, as well as all parties upstream in the fuel distribution system are presumed liable unless they establish an affirmative defense. Refiners and importers whose brands appear at retail outlets may implement downstream quality assurance program to ensure compliance and to establish one element of their defense against presumptive liability⁷³. Other elements must be established, including lack of causation.

As a means of meeting the sampling and testing defense element for ULSD, industry funds A fuel survey program. Under this program, industry-paid surveyors take statistically representative samples regularly from retail stations and test them against the diesel fuel sulfur requirements.

EPA field audits and inspection

Besides auditing industry's self-reports and requiring industry to arrange for independent lab testing and independent auditing to verify the authenticity and probity of test results, EPA inspects refineries both randomly and also those that are suspected of producing non-conforming fuels. It also audits a small number of independent labs every year to ensure that close ties between the testing labs are maintaining appropriate independence and correctly reporting results.

Non-compliance penalty

The CAA sets a maximum civil penalty of USD 37,500⁷⁴ (or 256,000 RMB) per day per occurrence plus the amount of economic benefit or savings resulted from such violation. The actual penalties are determined by EPA based on various considerations including economic benefits, business size, and the gravity of violation (whether it results in significant increases in emissions). While the maximum fines are seldom assessed, EPA has levied heavy fines for severe violation. For instance, in 1985, EPA imposed fines of USD 266,000 (1.8 million RMB) against Decker Coal Co. for using leaded gasoline in 37 vehicles marked for unleaded fuel only⁷⁵. In 2008, EPA assessed a penalty of USD 1.25 million (8.75 million RMB) against Biofriendly Corporation for failing to register an additive⁷⁶. In addition, EPA can file criminal charges against refiners, importers and independent labs should they be found to have falsified or assisted in falsifying test results⁷⁷.

73 See 40 C.F.R. 80.613(d), for instance.

74 Per 40 CFR Part 19, the civil penalties are adjusted for inflation from the \$25,000 cap on civil penalties when the CAA was enacted.

75 Associated Press. 1985. Fuel violation fines sought. Spokane Chronicle.

76 EPA. 2008. Biofriendly Corporation Clean Air Settlement. EPA website. <http://www.epa.gov/compliance/resources/cases/civil/caa/biofriendlycorp.html> (accessed April 29, 2010)

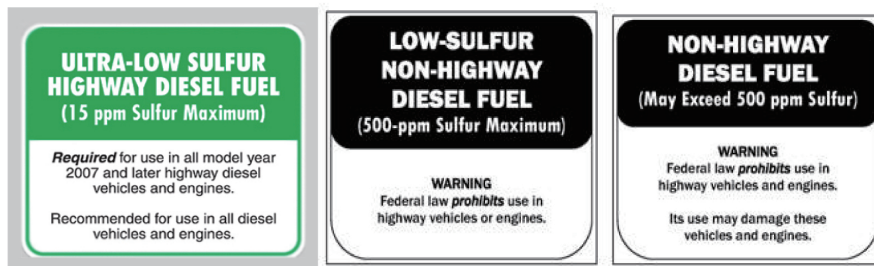
77 For instance, in 1998, Saybolt Inc., which performed testing and inspection services for refiners and importers, was fined a total of USD 4.9 million (33 million RMB) for submitting false statements to EPA about results of lab testing performed for refiners and importers.

其它政府机构的实施成果

美国对车用燃料征收燃油税，但是非道路燃料是豁免的。为保证税收，美国联邦税务局和一些州政府设立了自己的油品实施方案，确保非道路燃料不会被有意用于道路车辆。

达标的弹性机制

为了让企业利用最具成本效益的途径达标，EPA引入了一些弹性管理措施。在此介绍两大主要弹性措施。



标志内容为：

<p>超低硫公路用柴油 (最高 15ppm 硫含量)</p> <p>要求所有 2007 车型年或以后公路柴油车辆或发动机使用。 建议所有柴油车辆或发动机使用。</p>	<p>低硫非公路用柴油 (最高 500ppm 硫含量)</p> <p>警告 联邦法例禁止于公路柴油车辆或发动机使用。</p>	<p>低硫非公路用柴油 (可超过 500ppm 硫含量)</p> <p>警告 联邦法例禁止于公路柴油车辆或发动机使用。 使用这类柴油可损害车辆和发动机。</p>
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图 6.1: 油泵上粘贴的标志，注明硫含量和使用范围

平均、存储和贸易体系

平均、存储和贸易体系或称Average, Banking and Trading (ABT) 体系允许在不损伤环境的前提下在规定的达标期限内弹性达标。例如，在EPA的降硫方案中，假设一家炼油企业在一定时期内，超额完成达标，该炼油企业就可以储存信用额度在这一年晚些时候使用，当炼油企业进行设备升级或设备维修时，或在另一家炼油厂生产了硫含量稍高的车用油品时，炼油企业依然可以在整个达标周期内实现达标，通常达标周期为一年。尽管如此，燃料不得超过每加仑上限。信用额度只能用于平均值达标，不能用于每加仑上限达标。

EPA允许被管理对象产品的部分油品特性在年度平均基础上满足要求。表6.1总结了美国的油品指标和特性要求，以及哪些要求可以根据每加仑或年平均基础来满足。

指定分发和跟踪Designate and track

EPA允许道路和非道路柴油在2010年以前执行不同的硫含量要求，两种柴油可在同一系统中分发和运输，只要经手人按季度提交电子报告，列出他们所接收的柴油燃料种类（道路或非道路）并说明转手给了何人。因此，指定分发和跟踪方案使炼油企业和进口商能够最大程度的利用现有的燃料分发系统，同时允许EPA跟踪燃料的分发确保没有人违法将非道路柴油作为道路柴油销售。为方便管理，所有非道路柴油要在油库被染成红色，这样管理人员可以在下游检测时将燃料倒入白色的桶里，通过观察颜色来判定达标情况（又称白桶测试）。另外，要求加油站在油泵上粘贴标签，标明燃料的硫含量和使用范围（见图6.1）。一旦所有燃料都实施了15ppm的超低硫标准，对EPA来说，通过指定分发和跟踪来区分道路和非道路油品将不再重要。

Enforcement efforts of other government agencies

Motor vehicle fuels are subject to fuel tax, but non-road fuels are exempted. For tax purposes, Internal Revenue Service (IRS) and some state governments established their own enforcement programs to ensure non-road fuels are not intentionally used for onroad purposes.

Compliance flexibility

In order for the industry to meet the standards in the most cost-effective way, EPA has introduced a number of flexibility measures. The two major flexibility measures are discussed below.



Figure 6.1: Labels posted at fuel pumps stating diesel sulfur content and intended use

Averaging, banking and trading systems

Averaging, Banking and Trading systems or ABT systems allow flexibility in meeting the standard over a specific compliance period without hurting the environment. For example, in EPA's gasoline sulfur reduction programs, suppose a refinery over complies with the standard for a period of time; that refinery can bank credits for use at a later time of the year, when refinery units are being upgraded or are down for repairs, or at a different refinery, to make motor fuel with slightly higher levels of sulfur so that the refinery can meet the standard over the entire compliance period, typically a year. Nevertheless, the per-gallon caps cannot be exceeded. Credits can only be applied to meet the average, not the cap (i.e., the per-gallon requirements).

EPA allows regulated parties to meet some requirements on an annual average basis. Table 6.1 summarizes the US fuel property and performance requirements that can be met on a per-gallon and on an average basis.

Designate and track

EPA allows onroad and non-road diesels that are subject to different sulfur content requirements before 2010, to be distributed and transported through the same system, as long as all handlers file quarterly electronic reports listing what type of diesel fuel they received (non-road or onroad), and to whom it was delivered. The Designate and Track program hence enables refiners and importers to maximize utilization of the existing fuel distribution system while allowing EPA to track fuel distribution to ensure no party illegally represents off-road diesel as on-road. To facilitate enforcement, all non-road diesels have to be dyed red at the terminal so enforcement staff could determine compliance by place fuel in a white bucket and observe the color (so called white bucket test). Also, retail stations are required to put labels on the fuel pumps to identify the fuel sulfur level and the intended use of the fuel (see Figure 6.1). Designate and track is not important to EPA for distinguishing highway and non-road fuel once all fuels are subject to the ULSD 15-ppm sulfur standard.

控制汽油加油过程中的蒸发排放

汽油运输和存储过程中的油气排放是挥发性有机化合物（VOCs）和有毒物质（如苯）的污染源，美国已经采用了控制装置来控制和回收燃料运输和分发阶段和车辆在加油站加油时的蒸发排放。

在燃料运输和分发阶段（例如：储油罐、储配站、批发油库、加油站和油罐车）回收蒸发排放的设备被指定为一阶段控制（Stage I control）。为满足环境空气质量标准，很多州在他们的州级实施方案（SIP）⁷⁸中要求实施一阶段控制。

要控制加油过程中的油气，可以在加油站安装设备，捕集加油过程中排放的油气，并将它们回收至地下储油罐，这一过程为二阶段控制（Stage II control）。另一种选择是在车上安装一个碳罐来捕集油气，又称车载油气回收系统（ORVR）。

根据EPA1994年发布的ORVR管理方案和《清洁空气法》的规定，所有乘用车和轻型卡车须安装ORVR，重型车和卡车（额定车辆最大总质量（GVWR）大于8500磅）可不安装ORVR。在臭氧不达标的地区，《清洁空气法》要求安装二阶段油气回收系统，直至ORVR在在用车上全面使用，并且该地区可以在不实施二阶段控制的情况下满足空气质量要求。

从2000年开始，所有乘用车被要求安装ORVR。从2006年起，所有轻型卡车（包括多功能车（SUV）、微型货车和GVWR不大于8500磅的小型卡车）被要求安装ORVR。2006年，EPA判定ORVR已经广泛应用，并且让臭氧不达标地区，除了部分地处臭氧运输区的地区（美国东北部的一些州）外，无须再按《清洁空气法》的要求实施二阶段控制。

比起二阶段控制，ORVR更有优势，因为ORVR系统安装在车上，比改造全州的加油站更具成本效益。现在，美国还有7个州要求在全州实施二阶段控制，有21个州要求在部分地区实施二阶段控制（通常是臭氧不达标区）以满足环境空气质量要求⁷⁹。

实施方案的效果和成本

EPA的实施方案是成功的：每年只有不到1%的被审核的企业（机构）被发现违反燃料质量要求⁸⁰。方案的成功主要归功于以下因素：

不达标处罚：如前文中提到的，油品达标方案重罚违规者，包括炼油企业、进口商或测试实验室。若发现有大型企业违规或发现任何企业有严重违规行为，EPA会征收数额可观的罚款（上百万美元）。一旦发现实验室对测试结果作假，会提起刑事控诉。因此，尽管EPA很少执行37,500美元/每天的最高限度民事罚款，高额罚款的可能性还是起到了威慑作用，迫使燃料生产商、进口商和经营者更努力的确保达标。

推定责任制：推定责任制鼓励配送体系的所有有关人员都努力确保其接收的燃料质量，阻止在燃料分发运输过程中混入非法燃料。由企业支付费用的零售燃料质量调查帮助确保了整个配送体系的达标，减轻了EPA的管理负担。

78 州级实施方案（SIP）是不能达到国家环境空气质量标准的州在指定期限内实施的具体控制措施，以实现达标。

79 要求执行二阶段控制的地区，详见<http://www.ansdistributing.com/content/6546/StateStagell.pdf>。

80 与EPA管理人员的谈话（2010年2月）。

Controlling evaporative emissions from gasoline refueling

Gasoline vapors emitted during transportation and storage of gasoline is a source of VOCs and toxics (like benzene), and control devices have been developed to contain and recover vapors at the early phases of marketing and when vehicles are being refueled at the service stations.

Equipment for recovering evaporative emissions during early phases of gasoline marketing and distribution (e.g., storage tanks, bulk plants, bulk terminals, storage tanks at service stations and fuel trucks) are designated as Stage I controls. To meet the ambient air quality standards, many states require Stage I controls in their State Implementation Plans (SIP)⁷⁸.

To capture vapors during refueling, equipment can be installed at the service stations capturing vapors released during the refueling process and circulating them back to the underground storage tanks, so called Stage II controls. Alternatively, vapors could be captured through the use of a carbon canister installed on vehicles, so called onboard refueling vapor recovery (ORVR) system.

Under EPA's ORVR rule promulgated in 1994 and the CAA, ORVRs are required for all passenger cars and light trucks but ORVRs are not required for heavy-duty vehicles and trucks (those over 8,500 pounds gross vehicle weight rating (GVWR)). Worse ozone nonattainment areas, under the CAA, are required to use Stage II vapor recovery system, until ORVR have been widely implemented throughout the in-use vehicle fleet, and those areas can satisfy air quality requirements without Stage II controls.

Since 2000, all passenger cars are required to have ORVRs, and since 2006, all light trucks (including SUVs, minivans and pickups through 8,500 pounds GVWR) are required to have ORVRs. In 2006, EPA determined that ORVRs are in widespread use and relieved the worse ozone nonattainment areas, except for those in the ozone transport region (a group of states in the northeast of the US), from the CAA requirement to implement Stage II control(s).

ORVRs are preferred to Stage II controls because ORVR systems on vehicles are more cost-effective than converting all service stations across the nation. At present, seven states require the use of Stage II controls statewide and 21 states require Stage II controls in some areas of the state (usually the nonattainment areas) to achieve ambient air quality requirements⁷⁹.

Results and costs of the enforcement program

EPA's enforcement program has been successful: Less than 1% of facilities audited are found in violation with fuel quality requirements every year⁸⁰. Below are the major factors attributing to the success of the program:

Non-compliance penalty: As mentioned previously, the fuel compliance program has aggressively pursued violators, including refineries, importers or testing laboratories. Substantial fines (millions of dollars) were imposed on big companies or when severe violations were found, and criminal charges have been filed against laboratories found to have falsified test results. Therefore, even though the maximum civil penalty of USD 37,500 per day per occurrence is seldom assessed, the possibility of being subjected to a hefty fine creates a deterrent effect forcing fuel producers, importers and handlers to more diligently ensure compliance.

Presumptive liability: The presumptive liability provisions encourage all parties along the distribution chain to undertake efforts to assure quality of fuel they received, and deter dropping of illegal fuel during fuel distribution. The industry-paid surveys for verifying retail fuel quality help to assure compliance along the chain and lessen the regulatory burden on EPA.

78 State Implementation Plans (SIPs) detail the control measures a state that is in non-attainment of National Ambient Air Quality Standards is undertaking to reach compliance within a given time period.

79 For a summary of states and areas requiring Stage II control system, see <http://www.ansdistributing.com/content/6546/StateStageII.pdf>.

80 Communications with EPA enforcement staff (Feb 2010).

独立的测试和审核：EPA要求由独立实验室测试每批燃料并由独立机构审核石化企业内部和独立实验室的测试结果，这让炼油企业或进口商很难在向EPA提交数据时作假。

EPA实施方案的运行成本

EPA每年要支付超过100万美元给负责燃料抽样和测试的承包机构，还要加上20名EPA全职工作人员，包括律师、工程师和检查人员。这些成本不包括企业实施的确保RFG和超低硫柴油达标的调查开支。EPA燃料达标管理方案的经费来源于国会划拨给EPA的预算。EPA不得使用任何罚款所得：所有罚款要收归美国国库。

6.2 日本的油品达标管理方案概述

日本从1996年4月起废止了进口石油产品的禁令，允许进口的成品油在国内销售。随着燃料来源于更多的企业和不同的地区，需要给予更加严格的燃料质量控制来确保石油产品的稳定供应及确保进口或国内炼制的燃料的质量能够满足所有必要要求。这促成了《汽油和其它燃料质量控制法》（《油品质量控制法》）的颁布。这部法律规定由经济产业省（METI）负责实施市售汽柴油和煤油的质量管理。

日本的油品质量管理实施方案⁸¹

基于环境和安全考虑，《油品质量控制法》强制规定了10种汽油指标和3种柴油指标规格（详见表6.2中的黑体字参数）。《油品质量控制法》还规定了一系列标准规范，包括对汽柴油燃料的所有强制性要求和附加的推荐性要求（见表6.2）。

81 有关日本石油质量管理资料参考：全国石油协会演讲文稿. 2006. 《日本车用燃料质量管理体系》(Quality control system of on vehicle fuel in Japan) http://www.pecj.or.jp/japanese/overseas/koria/2006_2nd_oiltech/02_Quality_control_system.pdf. 2010年2月10日查阅; Keiko Hirota. 2008. 《欧盟、美国和日本的燃料监督》(Fuel Quality Monitoring {FQM} in EU, US and Japan).发表于印度-日本自动车研究所 2008 圆桌会议(Indo-JARI Roundtable 2008). <http://petrofed.winwinhosting.net/upload/17-18Mar09/>. 2010年2月10日查阅。

Independent testing and auditing: The EPA requirements of independent lab testing of every batch of fuels and independent auditing of in-house and lab test results make it difficult for refineries or importers to cheat by submitting falsified data to EPA.

Costs for running EPA's enforcement program

The EPA contractor for conducting field sampling and testing costs over one million US dollars, plus over 20 EPA full time staff that include lawyers, engineers and inspectors. This cost does not take into account the cost to the industry of the two field survey consortiums to ensure compliance with RFG and ULSD requirements. Budget of the fuel compliance program comes from EPA's budget appropriated by the Congress. EPA is not able to use any fees or money from the penalties assessed; all fines go to the U.S. treasury.

6.2 Overview of Japan's fuel compliance program

Japan dropped the ban on petroleum product imports in April 1996, allowing imported refined petroleum products to be sold in the country. With fuels offered by more companies and coming from different regions, there is a need for imposing stricter fuel quality control to ensure a stable supply of petroleum products and quality of fuel imported or refined domestically meet all necessary requirements. This led to the promulgation of the Law on the "Quality Control of Gasoline and Other Fuels" ("Fuel Quality Control Law"), which puts the Ministry of Economy, Trade and Industry (METI) in charge of enforcing quality of gasoline, diesel and kerosene sold on the market.

Japan's fuel quality enforcement approach⁸¹

Based on environmental and safety considerations, the "Fuel Quality Control Law" establishes mandatory specification for ten gasoline properties and three diesel properties (see properties in bold in Table 6.2). The "Fuel Quality Control Law" also specifies a set of Standard Specification that include all mandatory requirements and additional recommended requirements for gasoline and diesel fuels (see Table 6.2).

⁸¹ Reference materials regarding Japan's fuel quality management system can be found at: Presentation by the National Petroleum Association. 2006. Quality control system of on vehicle fuel in Japan. http://www.pecj.or.jp/japanese/overseas/koria/2006_2nd_oiltech/02_Quality_control_system.pdf. Accessed on Feb. 10, 2010; Keiko Hirota. 2008. Fuel Quality Monitoring (FQM) in EU, US and Japan. Presentation at Indo-JARI Roundtable 2008. http://petrofed.winwinhosting.net/upload/17-18Mar09/Hirota_slI%20.pdf. Accessed on Feb. 10, 2010.

表6.2: 《油品质量控制法》— 强制规定和标准规范

汽油			柴油		
		特性	标准		
标准规格	强制规格	铅	不得检出	十六烷指数	45 最小值
		硫含量	10 ppm	硫含量	10 ppm
		甲基叔丁基醚 MTBE	7% 体积, 最大值	馏程, T90%	360°C 最大值
		苯	1% 体积, 最大值	脂肪酸甲酯FAME *	0.1 质量% 最大值
		煤油	4% 体积, 最大值	甘油三酯 *	0.01 质量% 最大值
		甲醇	不得检出	闪点	45°C 最小值
		胶质	5 毫克/100 毫升, 最大值	倾点	根据地区和月份
		颜色	橙色	冷滤点	根据地区和月份
		氧含量	1.3% 质量% 最大值	残炭 **	0.1 质量% 最大值
		乙醇	3% 体积% 最大值	运动粘度 (30°C)	1.7 平方毫米/秒 最小值
		辛烷值	常规: 89 最小值. 优质: 96 最小值		
		密度	0.783 克/立方厘米最大值		
		馏程	T10/T50/T90		
		铜片腐蚀 50°C	1 最大值		
		雷氏蒸气压RVP	44-78千帕 (千克/立方厘米)		
		氧化安定性	240分钟 最小值		

来源: 日本石油联盟, 2009年, 《2009年日本石油工业》

注: 上表中列出的所有属性都包含在标准规格当中: 其中黑体字为强制规格。

* 此规格适用于没有在日本以外添加FAME的柴油燃料。强制标准允许的FAME添加上限为0.5 %。在这种情况下, 附加标准包括:

甘油三酯: 不大于0.01质量%; 甲醇: 不大于0.01质量%; 酸度值: 不超过0.13 mgKOH/g; 甲酸+乙酸+丙酸: 不大于0.003质量%; 酸稳定性: 不超过0.12 mgKOH/g。

** 残炭为10%蒸余物残炭中成分。

油品进口商和炼油企业的质量保障义务

《油品质量控制法》要求炼油企业和进口商在分配和销售之前测试燃料的质量, 确保他们提供的石油产品达到所有强制要求。如果在加油站发现他们提供的不达标产品, 炼油企业和进口商将与加油站共同承担责任。这就推动了石化行业定期检测配送体系中的油品。

Table 6.2: The Fuel Quality Control Law – mandatory and standard specifications

		GASOLINE		DIESEL			
		PROPERTY	STANDARD	PROPERTY	STANDARD		
Standard specifications	Mandatory Specifications	Lead	Non-detectable	Cetane Index	45 min.	Mandatory	Standard specifications
		Sulfur content	10 ppm	Sulfur	10 ppm		
		MTBE	7% vol. max.	Distillation, T90%	360°C max.		
		Benzene	1% vol. max.	FAME *	0.1 mass% max.		
		Kerosene	4% vol. max.	Triglyceride *	0.01 mass% max.		
		Methanol	Non-detectable	Flash point	45°C min.		
		Washed gum	5 mg/100 ml. max.	Pour point	Depends on regions and month		
		Color	Orange	Cold Filter Plugging Point (CFPP)	Depends on regions and month		
		Oxygen content	1.3% mass% max.	Carbon residue **	0.1 mass% max.		
		Ethanol	3% vol% max.	Kinematic viscosity @30 °C	1.7 mm ² /s min.		
		Octane	Regular: 89 min. Premium: 96 min.				
		Density	0.783 g/cm ³ max.				
		Distill	T10/T50/T90				
		Copper corrosion @50 °C	1 max.				
		RVP	44-78kPa (kgf/cm ²)				
		Oxidation stability	240min min.				

Source: Petroleum Association of Japan. 2009. Petroleum Industry in Japan 2009.

Note: All properties listed above are included in the standard specifications; items in bold are mandatory specifications.

* This specification is applicable to diesel fuels without international blending of FAME (Fatty Acid Methyl Ester). Mandatory standards allow FAME upper blending limit of 0.5 max%. In such a case, additional standards include:

Triglyceride: 0.01 mass% max.; Methanol: 0.01 mass% max.; Acid Value: 0.13 mgKOH/g max.; Formic Acid+Acetic Acid+Propionic Acid: 0.003 mass% max.; Acid Stability: 0.12 mgKOH/g max.

** CCR, from 10% distillation residue.

Quality assurance obligations of fuel importers and refiners

The "Fuel Quality Control Law" requires refineries and importers to test the quality of fuel prior to distribution and sale to ensure that the petroleum products they offer meet all the mandatory requirements. Refiners and importers share the responsibility should non-conforming fuel be found at any retail station they supply fuel to. This prompts the industry to regularly test fuel along the distribution chain.

汽油零售站登记注册和测试要求

所有出售汽油的加油站都必须在METI进行登记注册。《油品质量控制法》也规定加油站每隔10天要测试所出售的燃料是否满足表6.2中的强制要求。加油站可以委托METI授权的4家实验室中的任意一家来执行油品测试。

如果零售站可以证明1) 其产品拥有确定的分发渠道；且2) 有一家分销商与之共同承担产品质量保障责任，则可以向METI申请豁免频繁的测试要求（每10天一次的油品测试），只需要每年进行一次油品测试。

METI的实施方案

METI每年进行大量的油品抽样和测试。METI与全国石油协会(NPA)——一家独立的公立机构——签订合同，由其负责每年从全国45,000多家加油站逐个采集测试油品样本⁸²。

NPA在日本拥有9家测试实验室，每家实验室负责所在地区的油品测试。NPA每年会在不预先通知的情况下从每家加油站购买一次或两次燃料样本，每次分别购买优质汽油、普通汽油、柴油和煤油各1升。买回的燃料样本会接受分析，看是否满足强制规格和标准规格。不达标的样本会被送往质量测试实验室，该实验室为NPA的9家实验室提供技术支持，样本在这里接受进一步分析。测试结果会被快速提交至METI和经济产业政策局(Economic and Industry Bureau, EIB)。METI和EIB会与警方和消防厅合作，突击检查出售不合格油品的加油站并可能采取惩罚行动（下令整顿或暂停营业）。2009年，NPA共采集和测试了超过29,000个汽油样本和超过54,000个柴油样本。

消费者信息：标准质量标志

为鼓励消费者选择高品质的燃料，所有出售满足所有标准规格（包括强制规格和推荐规格）的燃料的零售站都可以展示由EIB发放的标准质量标志(SQ标志)。

不达标处罚

若METI发现炼油企业、进口商或加油站出售不能达到强制规格的燃料将予以严惩，包括最高100万日元（7.6万人民币）的罚款及或最长1年监禁。METI还有权因分配销售不达标油品而中止炼油企业、进口商或加油站的商业经营权最长6个月并公布不达标商户名单。如果拥有标准质量标志的零售站被发现出售不符合标准规格的燃料，METI将收回标准质量标志。

管理行动抵制违法将重油混入柴油

出于保护环境和税收的目的，日本的税务部门和一些地方政府，包括东京市在内，已经采取了有力的措施，打击违法向柴油中混合重油。根据东京环境保护研究院2000年进行的一项研究，使用掺有50%重油的非法柴油，将造成颗粒物排放增加15%，氮氧化物排放增加7%，有毒物质排放也会增加（如苯和甲苯）。

从2000年起，东京市政府联合其它地方政府发起了“根除违法柴油”运动，包括严厉打击违法柴油生产基地、组织宣传教育活动和实施路边检查。在日本出售的柴油和重油中添加了一种化学香豆素(coumarin)指示剂。税务机构和地方政府可以通过检测在路边检查的柴油样品中香豆素指示剂的浓度轻松判断是否违法添加了重油。

日本实施方案的效果和成本

来自汽车企业的油品质量监测数据显示，日本市场销售的柴油自2007年起已经能够达到10ppm硫含量限值(见图6.2)。

每年METI向NPA支付1570万美元（1.06亿人民币）用于油品质量测试⁸³。这还不包括METI员工的工作时间成本和其他用来实施燃料质量管理方案和进行零售站突击检查的资源成本。

82 更多资料可以在全国石油协会网站找到：<http://www.sekiyu.or.jp/qualitycontrol/index.html> (日文网站)。

83 与京都环境局自动车公害政策部联系(2010年2月19日)。

Gasoline retail station registration and testing requirements

All retail stations selling gasoline must register with the METI. The "Fuel Quality Control Law" also stipulates retail stations test the fuels they sell against the compulsory requirements listed in Table 6.2 once every ten days. Retail stations may commission any one of four laboratories accredited by the METI for fuel testing.

If a retail station can show that it has 1) a clear distribution channel and 2) a distributor who is jointly responsible for ensuring product quality, it can apply to METI to be exempted from the frequent testing requirement (test fuel once every 10 days), and only need to test fuel once a year.

METI enforcement programs

METI conducts massive fuel sampling and testing every year—METI contracts the National Petroleum Association (NPA), an independent public corporation, to collect and test fuel samples at least once a year from every single one of the 45,000 plus retail stations in the country⁸².

NPA owns nine testing labs around the country, and each lab is responsible for fuel testing in its region. NPA purchases one liter each of premium gasoline, gasoline, diesel and kerosene once or twice every year from each one of the retail stations without prior notice. Fuels purchased are analyzed against the mandatory and standard specifications. Non-conforming samples will then be sent to the Quality Testing Laboratories, which provides technical support to NPA's nine testing labs, for further analysis. Results are sent immediately to METI and the Economic and Industry Bureau (EIB). The METI and EIB, in collaboration with the Police and Fire Department, then conduct surprise inspections at retail stations selling off-spec fuels and regulatory actions (ordering improvements or suspension of operation) can be taken. Over 29,000 gasoline samples and over 54,000 diesel samples were collected and tested by NPA in 2009.

Consumer information: Standard Quality (SQ) Mark

To enable and encourage consumers to choose high-quality fuels, any retail station selling fuels that meet all the Standard Specifications (including all the mandatory and recommended specifications) can display a Standard Quality (SQ) logo issued by the EIB.

Non-compliance penalty

Refineries, importers or retailers found guilty of selling fuels that fail to meet all the mandatory specifications are subject to heavy punishment, including a fine of up to ¥1,000,000 (76,000 RMB) and/or up to 1 year of imprisonment. METI also has the authority to suspend any business for up to 6 months for distributing/selling non-conforming fuels and publicize the name of the non-compliant business to the public. METI will revoke the SQ logo if a retail station that displays a SQ logo is found selling fuel not meeting the Standard Specifications.

Regulatory actions against illegal mix of diesel fuel with heavy oil

Tax authorities and some local governments in Japan, including Tokyo, have also taken aggressive action against illegal use of mixed diesel and heavy oil for environmental and tax purposes. According to a 2000 study by Tokyo Research Institute for Environmental Protection, using illegal diesel fuel with 50% heavy oil content results in 15% high PM, 7% higher NOx emissions, and higher toxic emissions (such as benzene and toluene).

Since 2000, the Tokyo Metropolitan Government together with other local governments launched an Illicit Diesel Fuel Eradication Campaign, including cracking down on illegal diesel manufacturing bases, launching education campaigns, and conducting roadside inspections. A chemical marker coumarin is added to diesel and heavy oil sold in Japan. Tax authorities and local government can easily determine if heavy oil is illegally added by testing the concentration of coumarin in the fuel samples collected from roadside inspections.

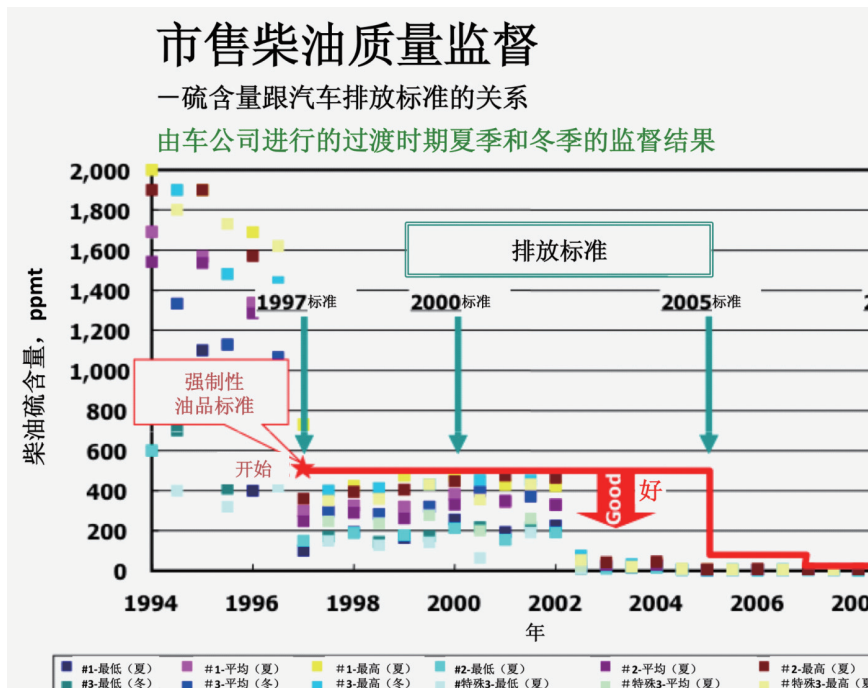
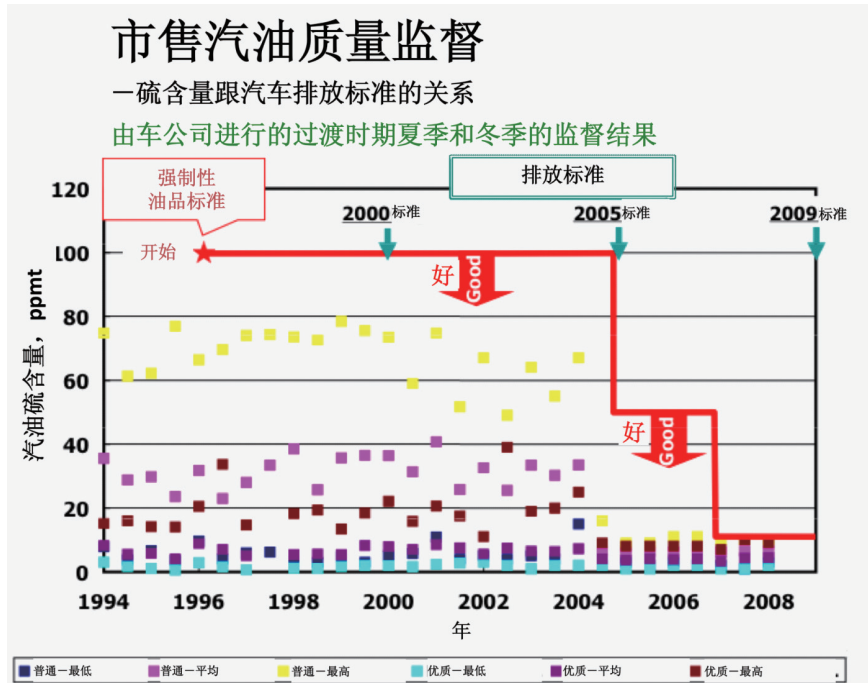
Results and Cost of Japan's enforcement program

Fuel quality monitoring data from the auto industry suggest that diesel and gasoline sold in Japan has met the 10-ppm sulfur limit since 2007 (see Figure 6.2).

METI pays NPA USD 15.7 million (106 million RMB) every year for fuel quality testing⁸³. This does not include the expenses for METI's staff time and other resources for managing the fuel quality enforcement program and conducting surprise inspections at retail stations.

82 More information could be found at the NPA website: <http://www.sekiyu.or.jp/qualitycontrol/index.html> (in Japanese)

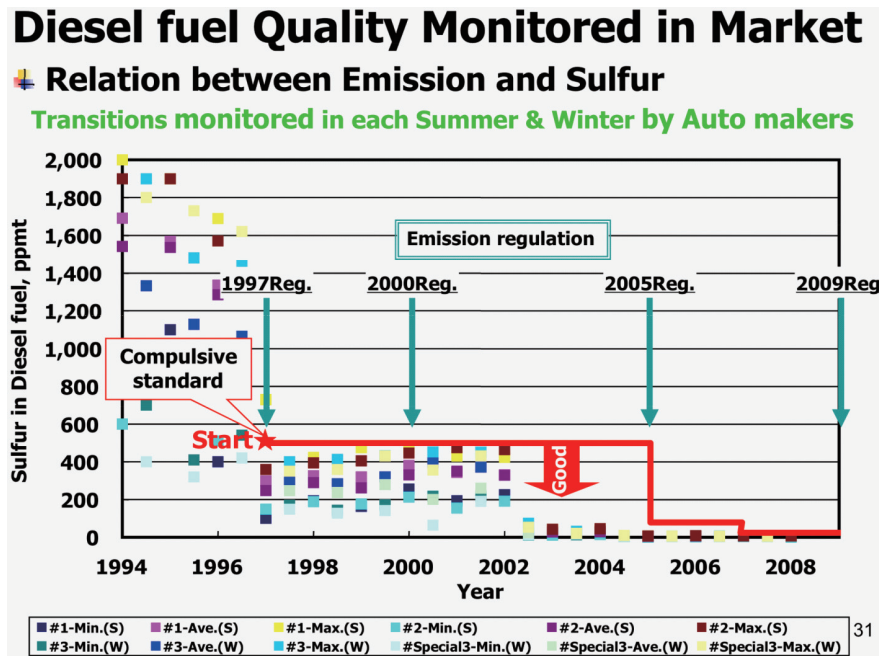
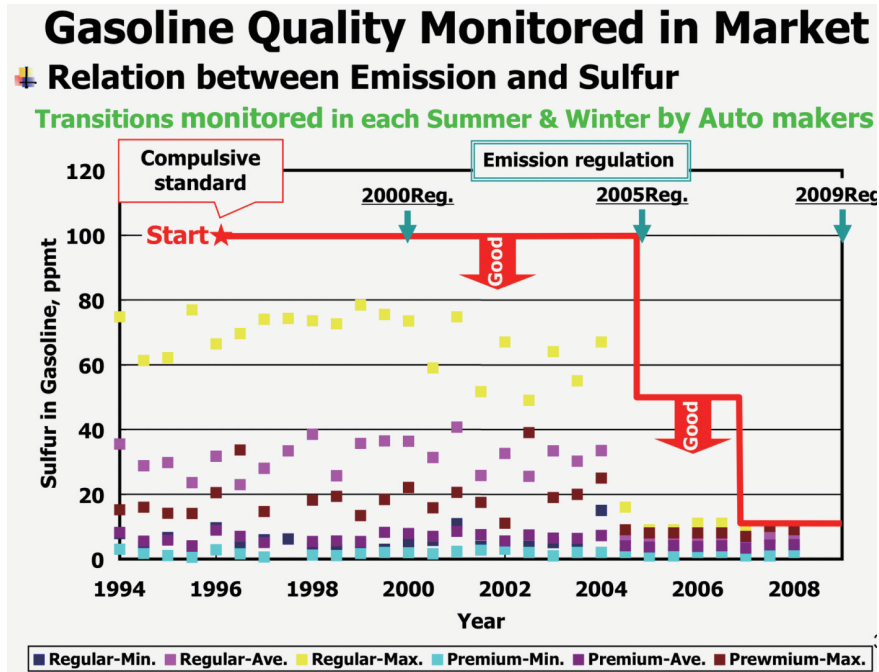
83 Communications with Automotive Pollution Control Division of the Bureau of Environment of the Tokyo Metropolitan Government (Feb. 19, 2010).



摘自Mitsuru Osawa, 2009年, 《控制日本市场油品质量的方法》, 发表于日本汽车制造商协会, 燃料和润滑油小组委员会, 中国圆桌会议。2月。

www.jari.or.jp/resource/pdf/china_2009/Session4-2_E.pdf

图6.2: 日本的汽柴油硫含量



Extracted from Mitsuru Osawa. 2009. "Measures of Maintaining Market Fuel Quality" in Japan, Presentation at the China Round Table 2009. Fuels and Lubricants Subcommittee. Japan Automobile Manufacturers Association. February.

www.jari.or.jp/resource/pdf/china_2009/Session4-2_E.pdf

Figure 6.2: Gasoline and Diesel Fuel Sulfur Content in Japan

6.3 中国的油品达标管理方案概述

油品质量管理实施方案

在本次的评估中，很难通过公开的资料找到详细说明各个部委在保障中国油品质量方面的具体地位和责任。在下文中总结了我们从相关的油品管理法规、《大气污染防治法》和与中方合作团队沟通后得出的见解。这些结论可能不能全面的反映出中国油品达标管理的全部内容。

《大气污染防治法》禁止生产、进口和销售含铅汽油并授权环保部实施此项禁令。《大气污染防治法》中还鼓励生产和使用优质油品，并支持减少燃料中的有毒物质，以对空气质量的影响减至最低⁸⁴。但是，《大气污染防治法》中没有阐述控制或管理影响机动车排放的其它燃料特性的责任。

通过与中国环境科学研究院的交流，我们了解到燃料生产终端的油品质量归国家质量监督检验检疫总局（以下简称质检总局）管理，但是在全国各地管理力度和效果差异很大。我们从VECC了解到，加油站的油品质量由各地质检部门下属的质量技术监督司（处）负责监测。

根据中国石化行业标准SH 0164-92,《石油产品包装、贮运及交货验收规则》，关于保障运输和交货验收过程中的燃料品质的规定如下：

- 在燃料出售给加油站之前，依靠燃料销售商保障油品达标。
 - 发货单位根据适用标准对石油产品进行测试并认证产品质量。
 - 收货单位有权进行随机抽样核查产品质量。
- 中石化的石油化工科学研究院作为仲裁机构，仲裁购买方与销售方就产品质量问题产生的争议。
- 加油站出售的燃料的质量由各地的工商部门或质量技术监督部门负责监管。
 - 城市政府可以对零售站进行随机抽样。
 - 油品特性检测主要包括：
 - 汽油:** 硫、苯、锰、胶质、芳烃、烯烃、蒸气压；
 - 柴油:** 硫、闪点、馏程、酸度等。
- 不同的城市，根据其实际情况，会实施不同的测试，然后将结果在管理机构网站上发布。

84 《大气污染防治法》第4章第34款。

6.3 Overview of China's fuel compliance program

Fuel quality enforcement approach

During this assessment public documentation detailing the role and responsibilities of various ministries responsible for assuring quality of fuel in China has been difficult to obtain. Below summarizes what is understood from reviewing fuel-relevant regulations and the Air Pollution Prevention and Control Law as well as communications with the team's Chinese partners. This may not reflect the full extent of activities related to fuel compliance in China.

The "Air Pollution Prevention and Control Law" bans the production, import and sale of leaded gasoline and authorizes MEP to enforce the ban. The law also encourages the production and use of good quality fuels and supports measures for reducing toxics in fuel to minimize impacts on air quality⁸⁴. However, there is no mention of control or regulatory responsibility for other fuel characteristics that affect motor vehicle emissions.

According to communications with CRAES, fuel quality at the oil terminals is managed by the General Administration of Quality Supervision, Inspection and Quarantine (AQSIQ), but the enforcement efforts and their effect vary considerably across the country. Quality of fuel sold at the retail stations, according to VECC, is monitored by the local Quality Technology Supervision Bureaus under AQSIQ in provinces and municipalities.

According to Part 7 of the People's Republic of China petroleum refining industry standard SH 0164-92, "Rules for Storage, Transport, and Delivery Acceptance of Petroleum Products," regulation for guaranteeing petroleum product quality during transport and delivery acceptance stipulates that:

- Before fuels are sold to retail stations, rely on fuel sellers to ensure fuel comply with the standards.
 - The party delivering petroleum tests the product against applicable standards and certifies product quality.
 - The buyer has the right to take random samples to verify product quality.
- Sinopec's Research Institute of Petroleum Processing (RIPP) acts as the arbiter when disputes arises on product quality between fuel buyers and sellers.
- Quality of fuel sold at retail stations is supervised and managed by the local Industry and Commerce Bureau or the Quality Technology Supervision Bureau.
 - City governments can take random samples at retail stations.
 - The major fuel properties to be tested should include:
 - Gasoline:** sulfur, benzene, manganese, existent gum, aromatics, olefins, vapor pressure;
 - Diesel:** sulfur, flash point, distillation range, acidity, etc.
 - Different cities, according to actual conditions, perform different testing, then report the results on the bureau website.

⁸⁴ Chapter 4, Article 34 of the "Air Pollution Prevention and Control Law".

中国油品管理实施方案的效果和成本

尽管我们未能找到对全国油品质量进行评估的报告或研究，但近期在中国不同地区进行的一些油品调查和车辆排放研究，表明油品规格超标并非罕见现象，显现出实施管理的不足。在此，总结了从油品调查和车辆测试中得到的发现，以及应对方案。

- 北京市质量技术监督局进行的2006和2007年油品质量调查表明95%以上的燃料样本能够达标，最普遍的不达标指标是硫含量。一些汽油样本被发现含有MMT。北京市质监局责令不达标的加油站立即停止销售不达标油品，并要求地方质检部门调查和处罚相关责任方。

- 深圳市质量技术监督局2008年秋实施的随机燃料检查结果显示，汽柴油的达标率分别为94%和97%。质监局对不达标企业提出了整改期限，要求改正问题并停止让不达标油品流入市场。

- 云南省产品质量监督检验研究院执行的燃料品质检查结果表明接受测试的785个精制油品、润滑油和机动车刹车油产品抽样中，只有81%符合标准。大多数不达标产品都不是来自中石油和中石化这两家最大的炼油企业，且都是在小型社区服务站发现的。

- 2008年7月由VECC出资，委托通标标准技术服务有限公司（SGS）进行了全国性的燃料质量调查，结果表明6%的柴油样本硫含量超过2000ppm限值，13%的汽油样本含有甲醇，13%的汽油未达到蒸气压标准，另外2%的汽油未能达到苯含量的要求。由于实施本次测试是出于研究目的，对未达标企业没有采取应对措施。

- 2008年中国环境科学研究院对中国北方地区的油品质量进行了研究，结果表明7.5%的柴油样本硫含量超过2000ppm的规定限值，12%的汽油样本硫含量在500ppm以上，超过当时的硫含量限值⁸⁵。

- 中国环境科学研究院对北京的在用出租车进行了测试，结果表明催化转化器上有大量锰沉积，说明所使用的汽油可能锰含量较高。

实施达标管理的成本和资源

在中国环境科学研究院有5名工作人员，VECC有2名工作人员负责燃料和燃料添加剂的质量。目前没有掌握地方质检部门油品监管人员数量的信息。

85 张克松等人，2010年《中国北方汽柴油燃料硫含量》《能源政策》38期6号。

Results and costs of China's fuel enforcement program

Although reports or studies assessing the quality of fuel nationwide were not available, recent fuel surveys and vehicle emissions studies conducted in various areas in China found that fuels exceeding specification are not uncommon, an indication of a lack of enforcement. Summarized below are findings from fuel surveys and vehicle testing, as well as follow-up actions if any were taken.

- Fuel surveys conducted by Beijing Quality Technology Supervision Bureau in 2006 and 2007 showed that over 95% of fuel samples meet the standards, with the most common item out of compliance being high sulfur content. Some gasoline samples were found to contain MMT. The Beijing Quality Technology Supervision Bureau ordered the non-conforming retail stations to stop selling non-compliant fuel immediately and requested the Quality Technology Supervision Bureaus in related counties to investigate and penalize responsible parties.
- Random fuel inspection results conducted by Shenzhen Quality Technology Supervision Bureau in the fall of 2008 showed that gasoline and diesel were, respectively, 94% and 97% in compliance. The bureau imposed a deadline for out-of-compliance enterprises to correct the problems and stop nonconforming fuels from entering the market.
- Fuel quality inspection conducted by Yunnan Provincial Institute of Product Quality Supervision and Inspection found that only 81% of the 785 samples of refined oil, lubricants, and motor vehicle brake fluid tested comply with the standards. Most of the out-of-compliance products were not from PetroChina and Sinopec, the two largest oil companies, but were found in small community service stations.
- A nation-wide fuel quality survey funded by VECC and conducted by a private company SGS in July 2008 shows that 6% of diesel samples exceeded 2,000 ppm sulfur limits, 13% of gasoline samples contained methanol and 13% and 2% of gasoline did not meet the vapor pressure and benzene requirements respectively. No follow-up action was taken as the tests were performed for research purposes.
- A fuel quality study conducted by CRAES across northern China in 2008 showed that sulfur content of 7.5% of the diesel samples was above 2,000 ppm, the required limit, and 12% of gasoline samples contain over 500 ppm sulfur, the sulfur limit then in effect⁸⁵.
- Testing of in-use taxis in Beijing conducted by CRAES showed high level of manganese deposit in the catalytic converter, implying that gasoline used might have high manganese content.

Costs and resources for running the compliance program

There are five staff in CRAES and two staff in VECC whose duties are related to quality of fuel and fuel additives. Data regarding the number of staff in local Quality Technology Supervision Bureau involved in fuel inspections are not available.

85 Zhang, K., et al. 2010. Sulfur content of gasoline and diesel fuels in northern China. *Energy Policy*, Vol. 38, number 6.

6.4 中国方案与国际最佳实践经验的对比及中国发展道路上的障碍

环保部缺少管理与排放相关的油品质量的法律权力

《清洁空气法》明确授权EPA管理油品和实施油品质量标准，从而实现清洁空气这一核心目标。《清洁空气法》还规定了对不达标行为的最高罚款限额，EPA在发现违规行为时可以进行罚款。法律依据授权EPA建立了一套综合性的油品达标管理方案，对整个配送体系施加了推定责任制，从而迫使石化企业与整个配送体系的参与企业进行测试，并保存记录以证明自己的无责。法律还允许EPA对不达标行为实施高额罚款。推定责任制和罚款权是方案成果的两个关键。

日本的情况也类似，《油品质量控制法》授权METI管理油品质量和对违规者实施处罚（罚款、停业和监禁）。

中国目前的法律和管理规定基本上将燃料质量视为产品质量问题，而没有全面的考虑其对空气质量的影响。除了对汽油中的铅和有毒物质的规定，《大气污染防治法》中没有涉及油品对车辆排放的影响。因此，除了铅、有毒物质和清净剂，环保部没有管理燃料质量的法律依据，也无法采取任何措施来应对会造成车辆高排放的不合格燃料销售行为。

燃料分发过程的质量监督和油品追踪力度不足削弱了实施效果

美国EPA建立的综合性方案得以确保油品质量，很大程度是依靠石化企业与配送体系有关企业出资进行的测试和分析，以及独立的实验室测试和审核。通过推定责任，使生产、分配和销售环节中的所有人在从炼油厂到加油站的每一阶段都积极地监测燃料品质。

在日本也推行类似的要求，炼油企业和进口商要对下游零售点发现的违规行为负责，导致炼油企业和进口商在整个配送体系实施测试，检查燃料质量。

在中国，保障燃料质量的责任落在质检总局、地方质检部门和石化企业的身上。从我们收集的资料看来，似乎是质检总局负责上游燃料质量监督（炼厂、油库），地方质检部门负责加油站的油品检查，但是除了购买者和销售者，没有明确的部门负责运送分发过程中的燃料质量。

缺少配送体系中的燃料质量监管造成在加油站发现不达标油品时，很难分离和查明问题的源头（例如在燃料分发过程中混入违法燃料）。油品调查结果清楚的表明在现有的实施方案中只要求加油站停止销售不达标燃料，而没有追溯和惩罚真正令燃料未能达标的始作俑者，是不足以杜绝不符合规格的燃料品流入市场的。

环保部需要实质的资源和明确的权力来改善中国的油品管理实施方案

美国和日本的经验表明，需要来自管理部门（EPA和METI）和企业的实质资源，用于油品分析、保存记录和审核，从而确保配送体系的燃品质量。

6.4 Comparison of China's program and international best practices and barriers to progress in China

MEP lacks the legal authority to enforce emission-related fuel standards

The CAA gives clear authority to EPA to regulate fuels and enforce fuel quality standards to meet the overarching goal of attaining clean air. The law also specifies a maximum non-compliance penalty, which EPA can assess when violations are found. The legal basis provided by the law empowers EPA to establish a comprehensive fuel compliance program that imposes presumptive liability on the entire distribution chain, thereby forcing the industry to bear the burden of testing and record keeping proving innocence. It also allows EPA to levy hefty, punitive fines in cases of noncompliance. The presumptive liability provision and the power to impose substantial fines are two keys of the program's success.

Similarly, the "Fuel Quality Control Law" in Japan grants the METI the authority to regulate fuel quality and assess punitive measures (fines, suspension of operation and imprisonment) against violators.

The current Chinese law and regulation treats fuel quality largely as a product quality issue, and does not fully account for its impact on air quality. Except for the provision on lead and toxics in gasoline, there is no mention in the "Air Pollution Prevention and Control Law" of fuel-related impacts on vehicle emissions. MEP, as a result, does not have the legal basis to regulate fuel quality other than lead, toxics and detergents, and cannot take any action against entities selling off-spec fuels that results in high vehicular emissions.

Poor quality monitoring and tracking along the distribution chain weakens the enforcement efforts

US EPA established a comprehensive program that relies substantially on industry-funded testing and analysis, and independent lab testing and auditing to verify and assure fuel quality. Subjecting all parties along the chain of production, distribution and sales with presumptive liability forces all parties, including refineries and importers, fuel handlers and distributors, and retail stations to diligently monitor fuel quality at every stage from the refineries to the retail stations.

Similar requirements were put in place in Japan, where refiners and importers are liable to any violations found at the downstream retail stations, leading refiners and importers to conduct tests to check fuel quality along the fuel distribution chain.

In China, the responsibilities for assuring fuel quality fall onto AQSIQ, local Quality Technology Supervision Bureaus, and the industry. It appears that AQSIQ is responsible for monitoring fuel quality upstream (refineries, fuel terminals) and the local quality bureaus are in charge of fuel inspection at retail stations, but it is not clear who, if any party, takes charge of assuring fuel quality during distribution other than the buyers and sellers.

A lack of fuel quality monitoring along the distribution chain makes it hard to isolate and identify the source of problems (such as dumping illegal fuel during fuel distribution) when non-conforming fuels are found at retail stations. Results from the fuel surveys clearly suggest that existing enforcement efforts, which only demand that service stations stop selling non-conforming fuels, but fail to track down and penalize the true culprit, are not sufficient to keep off-spec fuels off the market.

Substantial resources and clear authority are needed to improve China's enforcement program

The experience in the US and Japan show that substantial resources from both the regulatory agencies (EPA and METI) and the industry are needed for fuel analysis, record keeping, and audits to assure fuel quality along the distribution chain.

从资料上看，中国政府目前还没有实施全面和有系统的油品检查。一些私人公司，如SGS倒是在全国范围内执行了大规模的油品调查，但是服务和数据很昂贵。地方质检部门、环保部门和地方环保部（如北京市环保局）也实施过油品调查，但是这些调查都是零散的，并且只覆盖部分城市地区。

环保部要想建立一套与美国和日本方案一样严密的综合性实施方案，明显需要更多的资源（人员和资金）来进行燃料分析（自主或外包）和审核。同时环保部需要有明确的权力要求企业执行更多的油品测试，并将结果报告给环保部。

环保部在实施油品质量管理方面人员能力有限

EPA除了雇佣承包检测机构为其在全国范围内执行燃料测试和依靠企业执行的调查来监测燃料质量，在局里有25名以上的全职员工（包括一些科学家和检查人员）负责执行实验室和炼油企业审核，同时监督燃料测试承包机构采样和测试的设计与实施情况，以及监督由企业出资进行的新配方汽油和柴油燃料调查项目。这25名员工并不包括EPA负责燃料和燃料添加剂注册和报告部门的员工。

在中国，中国环境科学研究院拥有自己的测试实验室和5名职员来支持环保部和北京市环保局的油品测试和燃料标准制订，目前他们正在升级实验设备以便有能力测试国IV油品。在VECC也有两名职员全职负责燃料和清净剂的相关工作，但不包括燃料达标管理。相比中、美两国各类车辆的年度车用燃料消耗量，环保部在燃料工作方面可动用的人员比EPA要少得多。

表6.3:中美日实施油品监督和达标管理的资源配置

国家和机构	中国环保部/VECC/环科院		美国EPA		日本METI	
	员工	合约服务机构	员工	合约服务机构 (每年)	员工	合约服务机构(每年)
实施油品监督和达标管理的资源配置	7 (环科院5名, VECC2名)	不详	25+	每年680万人民币 以上	不详	每年1.08亿人民币

6.5 建议

为确保中国市场销售的燃料能够满足相应标准，从而使车辆运行正常并满足不断加严的排放标准，环保部需要拥有执行与排放有关的燃料参数标准和进行不达标罚款的权力。因为燃料的质量不容易观测、分辨，只有企业和环保部（或其合约机构）进行全面定期的燃料采样和测试并实施良好的报告和审核计划，才能确保油品达标。要承担这一新的职责，环保部需要筹措资金，建设自身的技术能力和专业水平。以下提出了一些建议来实现这些目标。

力争修订《大气污染防治法》赋予环保部管理与排放有关的燃料质量的权力： 如我们在油品和车辆标准章节中所提到的，保障优质燃料的供应，特别是低硫燃料，是国家实施更加严格的车辆标准并由此有效控制机动车排放的必要条件。油品调查结果表明中国市场中还在销售硫含量高于标准规定的不达标燃料。赋予环保部管理与排放相关的燃料规格的权力是对这些与排放相关的燃料规格实现有效控制的众多步骤中的第一步。

From materials reviewed, it seems that there is no systematic and comprehensive fuel inspection performed by the government in China. Private companies such as SGS conduct large-scale fuel surveys across the country, but the service and data are expensive. Local Quality Technology Supervision Bureaus, and MEP and local EPB (like Beijing EPB) also conduct fuel surveys, but those surveys occur only sporadically and cover only a few cities/regions.

For MEP to establish a comprehensive enforcement program comparable in rigor to the US and Japan programs, it needs significantly more resources (staff and funds) to perform fuel analysis (either in-house or contracted-out) and auditing, as well as clear regulatory authority to demand the industry to perform more fuel testing and report results to MEP.

MEP has limited staff capacity on fuel quality enforcement

While EPA hires contractors to conduct fuel testing across the country and relies on industry-conducted surveys to monitor fuel quality, the agency has 25+ full time staff (including some scientists and inspection staff) who conduct laboratory and refinery audits, as well as oversee the design and implementation of fuel sampling and testing conducted by its contractor and by the industry-sponsored RFG and diesel fuel survey programs. The 25 staff do not include the EPA division responsible for fuel registration and reporting.

In China, CRAES has its own testing laboratory and five staff supporting MEP and Beijing EPB on fuel testing and fuel standard setting, and it is upgrading its laboratory equipment to be capable of testing China IV fuels. There are also two colleagues at VECC working full-time on fuel- and detergent-related efforts but are not involved in fuel compliance. MEP has far fewer staff than EPA has at its disposal relative to each fleet's annual motor fuel consumption.

Table 6.3: Resources for conducting fuel inspection and compliance in China, US and Japan

COUNTRY AND AGENCY	CHINA MEP/VECC/CRAES		US EPA		JAPAN METI	
	STAFF	CONTRACTOR SERVICES	STAFF	CONTRACTOR SERVICES (PER YEAR)	STAFF	CONTRACTOR SERVICES (PER YEAR)
Resources for conducting fuel inspection and compliance	7 (5 at CRAES, 2 at VECC)	Not known	25+	Over 6.8 million RMB per year	Not known	106 million RMB per year

6.5 Recommendations

To ensure that fuels sold on the market in China meet the applicable standards, so that vehicles function well and meet increasingly stringent emissions standards, MEP needs to have the authority to enforce standards for emission-related fuel parameters and assess non-compliance fines. Because fuels are fungible, compliance can only be assured through extensive, routine fuel sampling and testing conducted by industry and MEP (or its contractors), as well as a good reporting and auditing scheme. To assume this new role, MEP would need to raise fund and establish its own technical capacity and expertise. The following provides specific recommendations to achieve these goals.

Seek to modify the "China Air Pollution Prevention and Control Law" to give MEP authority to regulate emission-related fuel quality: As discussed in the fuel and vehicle standard chapter, ensuring the supply of good quality fuel, particularly low sulfur fuel, is essential for the country to advance to more stringent vehicle standards and thereby to effectively control motor vehicle emissions. Fuel survey results suggest that non-compliant fuels with sulfur levels higher than the standards are sold on the Chinese market. Granting MEP the authority to regulate emission-related fuel specifications is the first of many steps to enable effective control of fuel characteristics that are most relevant to vehicle emissions.

赋予环保部这样的权力非常重要，因为这样环保部就有权要求石油行业测试并向环保部报告燃料质量分析结果，这样就允许环保部（或其合约机构）执行站点审核和检查加油站，并对发现的违规行为实施处罚。

*为建立监督和达标管理方案寻求资金：*对美国和日本的燃料质量管理实施方案的分析明确指出，就算是企业被要求定期进行油品测试并将结果报告至管理部门，油品管理部门同样需要可观的资金、人员来支持燃料测试承包机构和管理部门进行广泛的燃料质量检查。一旦环保部获得了管理与排放有关的燃料参数的权力，就需要资金来雇佣燃料测试承包机构实施燃料采样、测试、站点审核和加油站检查，并加强环保部内部的资质和技术能力建设，从而监督承包机构的工作，管理整个油品管理工作。环保部可考虑燃料税、车辆税、车辆登记注册费和或IM收费作为资金的来源。在争取获得授权，实施与排放相关的油品标准的同时，环保部应在近期内开始进行具体分析，判定以上提出这些潜在资金来源中哪些在法律上是可行的。

*与EPA或其它国家的管理机构合作，通过培训建设自身能力：*环保部的人员在EPA或其它地区的管理机构进行培训对环保部是有益的，可以更好地了解油品实施方案中技术方面的要求，同时可全面了解实施方案的管理。如之前所分析的，美国的燃料质量管理方案包含大量的企业报告和报告审核，以及有效地监督企业和EPA承包机构执行油品质量采样和测试。在设计管理方案和制定对企业报告及各类测试的要求时，不为管理部门和企业带来过多不必要的案头工作和油品测试要求，是保障管理方案成果的关键。与其它地区管理机构之间的培训班应在近期内开展，并定期举行（如每年或每半年一次）。

*力争修订《大气污染防治法》将油和车视为一个体系：*和我们在报告的其它章节中提出的建议一样，从根本上将燃料和车辆标准连成一体十分关键，只有这样才能有效推行最佳的汽车排放控制技术。

Giving MEP such authority is also important because it provides the ministry with the power it needs to demand that the oil industry test and report fuel quality analysis results to MEP, allow MEP (or its contractors) to conduct on-site audits and inspect retail stations, and impose punitive fines if violations are found.

Seek funding to establish fuel inspection and compliance program: Review of the fuel quality enforcement programs in the US and Japan pointed to the need for substantial funding to cover comprehensive fuel quality inspections conducted by contractors and the regulatory agencies, even when the industry is required to test fuel periodically and report results to the regulatory agency. When MEP is granted the authority to regulate emission-related fuel parameters, funding would be needed to hire contractors to conduct fuel sampling, testing, on-site audits, and retail station inspections and to enhance capacity and technical capability within MEP to oversee contractors' work as well as manage the program. Potential sources of funding are fuel taxes, vehicle taxes, vehicle registration fees and/or I/M fees. MEP should start in the near term to conduct detailed analysis to determine which of these options are legally feasible while the ministry seeks the authority to enforce emission-related fuel standards.

Build up in-house capacity through training workshops with the EPA or regulatory agencies in other countries: MEP would benefit from having its staff trained at the EPA or other regulatory agencies to better understand the technical aspects of the fuel enforcement program, as well as the overall program management. As reviewed earlier, the US fuel quality program involves substantial industry reporting and report auditing, as well as effective oversight of fuel quality sampling and testing conducted by the industry and EPA contractors. Designing and executing the reporting and testing part of the program so that the regulatory agency and the industry are not over-burdened with paperwork and fuel testing needs is critical to the program's success. The training workshops with other regulatory agencies should be set up in the near term, and could be hosted on a regular (e.g., annual or bi-annual) basis.

Seek revisions of the "China Air Pollution Prevention and Control Law" such that fuels and vehicles are treated as one system: As recommended in other chapters of this report, it is key that ultimately fuel and vehicle standards be set in tandem and be effectively enforced to enable the best emission control technologies.