5. 车辆达标管理和实施方案

只有车辆在日常使用中的排放真正降下来，新车排放标准才能起到保护空气质量的作用。要全面实现新车标准的环境和健康收益承诺，必须推行有效的车辆达标管理和实施方案，从而确保新车和在用车的排放被有效控制。

本章归纳了中美两国车辆达标管理和实施方案的关键点。美国环保局（EPA）的车辆达标管理和实施方案是当今世界最全面的车辆达标管理和实施方案之一，本章将通过对比中美的现行措施，为改进中国当前的方案提出一些建议。

5.1 国际最佳实践经验：EPA的车辆达标管理和实施方案

美国的车辆实施方案是目前全世界最全面且影响最深远的车辆达标管理和实施方案。不过，在1970年《清洁空气法》刚刚通过的时候，美国的车辆达标管理和实施方案也仅仅只涵盖新车认证。多年来，管理方案不断成熟完善，从最初侧重于确保样车和新车达标发展，到现在重点强调在用车测试的方案，确保车辆在整个使用周期满足排放标准要求。

由于美国早年实施了强力有效的认证方案和选择性达标审核（Selective Enforcement Audit, SEA）方案，EPA现行的车辆达标管理工作可以把更多的资源用于在用车测试管理。上述两项方案杜绝了认证结果报告中的舞弊现象，并迫使生产企业出资大量测试其生产的新车以确保生产一致性。这就使EPA可以将更多的资源用于在用车测试，确保发动机和排放控制装置在车辆的使用周期内的耐久性并保证排放得以有效控制。近年来便携式排放测量系统（PEMS）的研发实现了在用车排放测量的突破，使在用车排放测量，特别是针对重型车和非道路机械设备排放的测量，变得可行。

下面我们将分几部分讨论轻型车、重型车、非道路机械及摩托车的达标管理和实施方案。其中一节内容专门总结检验与维护（I/M）方案和先进经验。美国管理实施方案的效果和成本也将予以介绍。

轻型车达标管理方案：

轻型车新车达标管理和实施方案包括：1）生产前认证；2）一致性测试；3）选择性达标审核（SEA）；4）由EPA执行的在用车监督检查；5）生产企业执行的在用车验证检测（in-use verification testing program, IUVP)；6）召回；7）保修和缺陷报告。各部分在车辆使用周期内如何实施，详见图5.1。

生产前认证测试：

根据《清洁空气法》206节规定，所有在美国销售的发动机及车辆都要求在进入市场前进行达标认证以得到认证证书。通过认证证明该发动机或车辆符合所有相关排放和燃料经济性要求。测试结果结合劣化系数之后与排放标准进行比较，然后判定是否通过[47]。

47 劣化系数是生产前认证、选择性达标审核和生产一致性测试中的基本组成部分，选择性达标审核和生产一致性将在本章后文中进行讨论。EPA通过耐久性验证管理来判定劣化系数。EPA要求每家生产企业设计一个耐久性实验方案，预测其生产的车辆在使用过程中的劣化情况。多数生产企业对排放控制元件采用台架加速老化程序来判定劣化系数。生产企业出资进行的在用车验证检测 (IUVP) 为劣化系数的判定提供了有价值的数据，本章稍后会具体讨论。如果在用车测试反映出更大的劣化系数，生产企业就必须修改他们的劣化系数判定程序。

5. Vehicle compliance and enforcement program

New vehicle emission standards can only serve to protect air quality if vehicular emissions are actually reduced when the vehicles are in normal use. To fully deliver the promise of environmental and health benefits from new vehicle standards, an effective vehicle compliance and enforcement program has to be in place to ensure emissions of new and in-use vehicles are effectively controlled.

This chapter summarizes the key elements of the vehicle compliance and enforcement program in the US and China. By comparing the current China program with the US EPA program, which is one of the most comprehensive vehicle enforcement programs in the world, this chapter offers some recommendations for enhancing China's current program.

5.1 International best practice overview: US EPA's vehicle compliance and enforcement program

The US vehicle compliance program is by far the most comprehensive and far-reaching compliance program in the world. But looking back to when the "Clean Air Act" was passed in 1970, the US vehicle compliance program only covered new vehicle certification. Over the years, the program has grown and evolved from one that focused mainly on ensuring prototype and new production vehicles comply with standards, to the current program that places strong emphasis on in-use testing to ensure compliance of emissions standard over the vehicle useful life.

EPA was able to shift more resources to in-use vehicle testing programs because of the strong enforcement presence established in early years through its vigorous certification program and the Selective Enforcement Audit (SEA) program. These two programs deterred fraudulent reporting of certification results and compelled manufacturers to extensively test new vehicles at their own costs to ensure production conformity. This allowed EPA to shift its resources to in-use testing to ensure engines and emission control devices are durable and emissions are effectively control over the useful life of vehicles. The development of the portable emissions measurement system (PEMS), a recent breakthrough of instrumentation for on-road/in-use emission measurement, makes in-use emission testing feasible, particularly for heavy-duty vehicles and non-road engines.

The following sections review the compliance program for light-duty vehicles, heavy-duty and non-road engines and motorcycles. A section is devoted to a summary of inspection and maintenance programs and best practices. Results and costs of the US compliance and enforcement program are also presented.

Light-duty vehicles (LDVs) compliance program:

The new vehicle compliance and enforcement program for LDVs consists of: 1) Pre-production certification, 2) Confirmatory testing, 3) Selective enforcement audit (SEA), 4) In-use surveillance performed by EPA, 5) In-use verification testing performed by manufacturer, 6) Recall, and 7) Warranties and defect reporting. How these elements are implemented over a vehicle's life is illustrated in Figure 5.1.

Pre-production certification testing:

Under CAA Section 206, all engines and vehicles sold in the US are required to be covered by a certificate of conformity before they can enter the market. The certification demonstrates that the engine or vehicle conforms with all applicable emissions and fuel economy requirements. A deterioration factor is applied to the test results before comparing to the emission standards and determining pass and fail[47].

47 The deterioration factor is an essential part of testing for pre-production certification, as well as for selective enforcement audits and conformity of production discussed in later part of this chapter. EPA has adopted a durability demonstration regulation on how to determine deterioration factors. Each manufacturer is required to design a durability process that predicts the in-use deterioration of the vehicles it produces. Most manufacturers determine deterioration factors using accelerated bench aging procedures for emission control components. The manufacturer-funded in-use testing program (In-use Verification Testing Program) discussed later in this chapter provides valuable data to validate manufacturers' procedures for determining deterioration factors. If in-use testing shows larger deterioration factors, the manufacturer must revise their procedures for determining deterioration factors.

由生产企业进行生产前认证测试，用于支持其达标认证的申请，通常在核发认证证书前进行[48]。生产企业可以组建自己的设备进行测试，也可以承包给独立的实验室。测试结果经过劣化系数调整之后，必须记录在认证申请材料中，以证明可以达标。生产企业对想要进行认证的全部“测试组别”都要进行认证测试。

“测试组别”或“发动机系族”是进行排放达标认证时的基本分类单元，是指一组设计和排放特性相似的车辆或发动机。对轻型和重型车而言，这些特性包括发动机排量、汽缸数、汽缸排列和燃烧室排列（直列或V型排列）以及适用于相同的排放标准。制造商应选择测试组别中排放和排放劣化最高的车型配置作为测试用车（即最差车型）。在美国，所选出来的车型配置被称为排放数据车[49]。

生产企业通过EPA的“VERIFY”计算机系统上传认证申请，申请在系统内会被自动核实。部分申请则需要人工审核。2007年，EPA向车辆及发动机制造商颁发了3500多份达标认证证书。

48 美国的认证测试包括以下试验程序：联邦测试程序（Federal Test Procedure, FTP）、高速公路燃料经济性试验、US06（高速/加速工况）、SC03（空调测试工况）、冷启动一氧化碳（在华氏20度条件下运行FTP工况）、蒸发排放、车载油气回收（Onboard refueling vapor recovery, ORVR）和汽车运作中的蒸发排放试验。

49 测试组别的详细定义请参见《美国联邦管理法规》40 CFR 86.1822-01 及 40 CFR 86.1827-01。

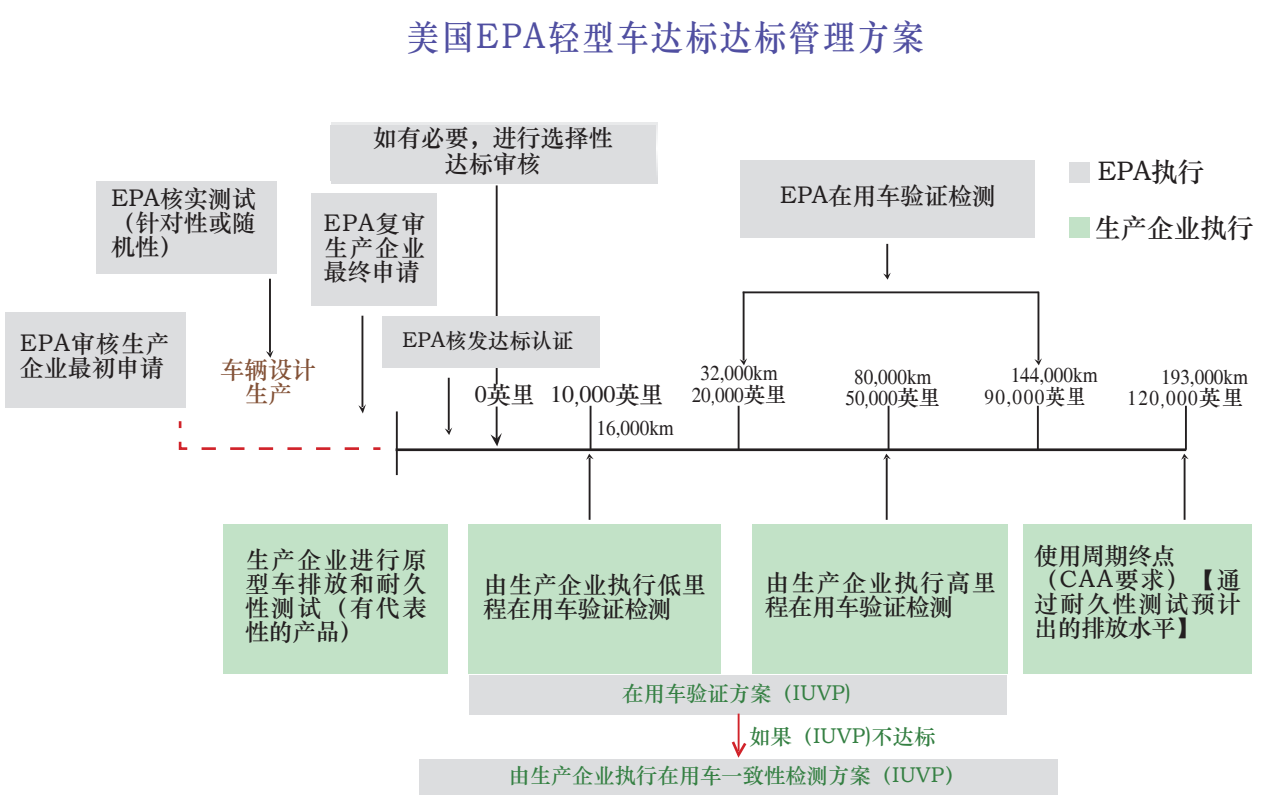
Pre-production certification testing is conducted by manufacturers to support their applications for a certificate of conformity and is usually performed before a certificate is issued[48]. A manufacturer can establish its own testing facility to conduct the test or contract the services of independent laboratories. Test results, adjusted with deterioration factors, must be recorded in the certification applications to demonstrate compliance. Manufacturers must perform certification testing for all the "test groups" that they choose to certify.

A test group or engine family is a basic classification unit used for demonstrating compliance with vehicle emissions requirements. It is a group of vehicles or engines having similar design and emission characteristics. For light- and heavy-duty vehicles, these characteristics include engine displacement, cylinder number, arrangement of cylinders and combustion chambers (in-line vs. v-shaped), and subject to the same type of emission standards. The manufacturer should select the vehicle configuration within the test group that is expected to generate the highest level of emission and emission deterioration as the test vehicle (the worst-case configuration). The selected configuration is called the emission data vehicle in the US[49].

Manufacturers submit certification applications through EPA's computer system called VERIFY, which automatically validate all applications. Manual auditing is performed for some applications. EPA issued over 3,500 certificates for conformity to vehicle and engine manufacturers in 2007.

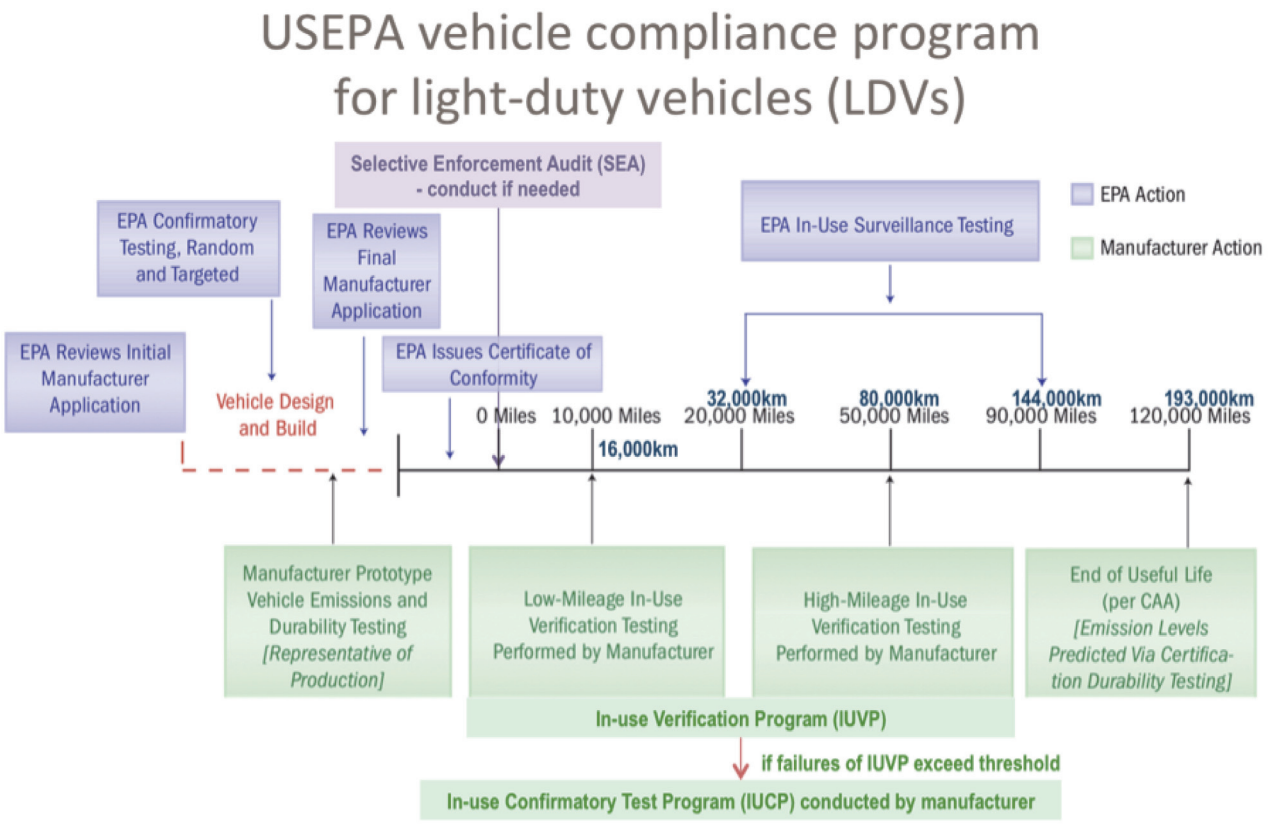
48 Certification testing in the US comprises the following test procedures: federal test procedure (FTP), highway fuel economy test, US06 (high speed/ acceleration cycle), SC03 (air conditioning test cycle), cold CO (FTP conducted at 20 deg F), evaporative emissions, Onboard Refueling Vapor Recovery (ORVR), and running loss emissions test.

49 For more details about test group determination, see US Code of Federal Regulations 40 CFR 86.1822-01 and 40 CFR 86.1827-01.



来源：EPA2007年车辆和发动机达标情况报告，2008年10月

图 5.1: EPA轻型车达标管理和实施方案



Source: EPA. 2007 Progress Report-Vehicle and Engine Compliance Activities. Oct., 2008.

Figure 5.1: US EPA Vehicle Compliance program for light-duty vehicles

核实测试:

核实测试是EPA进行的有针对性的或随机的测试来确认认证测试中报告的排放和燃料经济性试验结果。近年来，EPA在所有测试组别中挑选了大约15%进行核实测试，其中2/3（占全部测试组别的10%）是随机挑选的，另外1/3（占全部测试组别的5%）是有针对性的进行测试。所有轻型车的核实试验都由EPA位于安娜堡（Ann Arbor）的实验室执行。

有针对性的一致性测试的主要对象是使用新技术或新设计的车型，其它的测试对象则是被认为可能存在排放问题的车型，包括在认证时排放水平非常接近标准上限（处于排放限值边缘）的车型。

制造商会被邀请观察测试的执行情况。每辆测试车有两次通过机会，如果第一次测试没有通过，将进行第二次测试。制造商可以选择在第一次测试失败后对车辆进行检查，确定车辆的问题（如是否存在错误零件或管路断开）。如果制造商能够证明测试无效，则车辆可以被重新测试。如果车辆两次测试均未通过，将不能获得认证。此时，制造商可以选择放弃认证或进行调整之后（重新标定）重新申请认证。

选择性达标审核 (SEA):

SEA开始于上世纪70年代中期，当时EPA发现一些制造商会偶尔生产出不达标的车辆类型，尽管进行认证的样车是达标的。SEA的目的就是找出制造商提供的样车不能作代表性产品的情况。

通过SEA方案，EPA可以要求制造商测试从生产线终端抽取的车辆，并由制造商支付费用，预先不予通知。SEA能在早期给EPA提供机会评估在核实认证下生产的车辆是否确实与认证样车规格一致，以及制造商是否留出充分的达标空间，确保其批量生产的发动机和排放控制设备能够在应用劣化系数后达到标准要求。

SEA的设计前提是没有必要对所有流水线上的车辆进行固定比例的测试，相比之下，把精力集中在疑问较大的车型上，也能取得同样的信息且对企业来说成本较低。在选择测试对象时，EPA会采纳多渠道的信息，包括制造商以往的达标率、达标水平、认证数据、I/M数据、技术评估和缺陷报告等。

根据EPA的要求，SEA测试可以使用制造商的实验设备按照EPA的测试要求进行，或在任何一家EPA指定的实验室进行。如果某车型没能通过SEA测试，EPA有权吊销或暂停该车型的认证资格，这将限制该车型的销售，直至制造商证明该车型能够达标。

审核失败带来的处罚对制造商来说影响非常严重，如关停不达标车型的生产线，所以许多制造商自SEA方案实施后开始定期测试他们的车辆。在本方案实施后不久，制造商测试的车辆数量已远远超过EPA审核测试的数量（超出100倍以上）。到上世纪80年代中期，不能通过审核的轻型车生产线已经非常少了，具体轻型车辆不能通过SEA的也很少见，因此EPA决定将轻型车SEA员工换去执行重型车SEA工作和在用车测试（召回）项目[50]。

EPA已经很多年没有执行轻型车SEA审核了，但是一旦发现日常生产线测试有可疑之处，如报告作假或测试程序不当等，EPA依然保留有执行SEA审核的权力。

50 与 Chuck Freed的谈话。

Confirmatory testing:

Confirmatory tests are targeted and random tests performed by EPA to validate the emission and fuel economy testing results reported in certification testing. In recent years, EPA selected about 15% of all test groups for confirmatory test; two-third of the selected test groups (10% of all test groups) are randomly selected and the remaining one-third (5% of all test groups) are targeted testing. All LDV confirmatory tests are conducted at EPA's Ann Arbor laboratory.

The majority of vehicles targeted for confirmatory test are those models that use new technology or new design. Others are targeted due to potential emission concerns, including models with certified emission levels very close to the standards (small emission margin).

Manufacturers are invited to observe how the tests are performed. Every test vehicle has two attempts to pass, if the vehicle failed the first test, the vehicle is tested a second time. The manufacturer can also choose to inspect the test vehicle after it failed the first test to determine what went wrong (e.g., if the failure is due to wrong parts, or disconnected hose). If the manufacturer can demonstrate that it was an invalid test, the vehicle can be retested. If a vehicle fails two valid tests, no certificate will be issued. The manufacturer can choose either not to pursue certification, or make changes (recalibration) and then resubmit a new application.

Selective enforcement audit (SEA):

The SEA program came about in the mid-1970s when EPA found that manufacturers were occasionally producing classes of new vehicles that did not comply with standards, even though the certified prototypes meet the standards. The SEA is aimed at identifying cases where prototype vehicles supplied by manufacturers are not representative of production.

Through the SEA program, EPA can require manufacturers to test vehicles pulled off from the end of the assembly line, at the manufacturer's expense, without prior notice. SEA offers EPA an early opportunity to assess whether the vehicles produced under the certificate of conformity are actually built adhering to the specifications of the prototype, and if manufacturers allow sufficient compliance margins such that in mass production the engine and emissions control equipment function effectively to comply with standards after deterioration factors are applied.

The SEA was designed based on the premise that testing a fixed percentage of all assembly line vehicles is not necessary; rather, a program that focuses on potentially suspect classes could achieve the same information at lower cost to the industry. To pick the target test groups for the audits, EPA uses information from many different sources, including compliance history with a manufacturer, compliance margin, certification data, I/M data, technology reviews, and defect reports.

The SEA can be performed at the manufacturer facility following EPA's requirements, or at any testing lab EPA chooses. If a model fails SEA testing, EPA has the power to revoke or suspend certification, which will restrict sales of the model, until the manufacturer can demonstrate conformity with the standards.

Because the penalties of failing the audits, like halting the assembly line of a failed vehicle class, were disruptive to the manufacturers, many manufacturers began routinely testing their vehicles. Soon after the program started, manufacturers tested far more (100 times more) vehicles than the number of vehicles audited by EPA. By mid 1980s, failed LDV audits became rare, and even failed individual vehicles in the SEA were infrequent, and EPA decided to shifted LDV SEA staff resources to heavy-duty SEA efforts and the in-use testing (recall) program[50] .

EPA has not conducted any SEA for LDVs in many years but the agency reserves the authority to conduct SEA if a problem is suspected with routine production line testing, such as reporting fraud or improper testing procedures.

50 Communications with Chuck Freed.

在用车监督检查和召回测试方案：

EPA实施的在用车监督检查和召回测试方案主要针对可能存在排放相关问题的车型（通常为测试组别）或出于其它原因抽取的车辆群体。选择车型的主要依据是：1）生产企业的缺陷报告；2）各州实施I/M的数据；3）生产企业服务记录；4）认证测试结果（EPA更多的是测试认证时存在问题的车型）；5）配备新技术或新发动机车型；6）销售量；7）在用车验证检测未通过车型；8）随机；9）其它EPA认为适当的原因。

所有被选车辆都在安娜堡实验室进行测试（除非EPA另行指定其他场地），采用与认证相同的测试程序和燃料（标准燃料）。车辆被抽到进行在用车测试时会通知生产企业，并邀请他们参观测试过程和测试前的车辆维护保养过程，这样一来，他们就可以信任测试完成的质量。

在监督检查过程中，EPA会从密西根东南部（安娜堡实验室附近）招募三至五辆车龄在两年或三年的车。项目承包人员会根据EPA选出的测试车辆组别，分别联系车主。车主会获得小额的奖金（每天约20美元）和一辆代步车（或每天50美元代替代步车）。EPA确保车辆会被合理保养和使用，如有必要会在测试前进行保养。所进行维修养护是根据测试方案要求而定。如果更换任何部件，会向参与者提供清单。

如果在监督检查测试中发现一定数量测试车辆不达标，EPA将会与生产企业进行商讨，寻求可接受的解决方案，如自愿召回、生产企业修理服务或延长保修。EPA很少会采用强制召回手段，但保留使用该手段作为最终解决方案的权力。

2007年共计测试了142辆车，代表47个测试组别。其中9辆车（代表5个测试组别）未通过在用车测试，不过只有一个测试组别反映出大范围不达标，引致EPA的进一步调查[51]。

如果监督检查结果表明某一车型可能存在多车次在使用周期内排放超标的情况，且生产企业拒绝自愿补救该问题，则测试将进入核实检查阶段。如果这一阶段的测试证实了该车型存在大量不达标的现象，将导致EPA下令召回。生产企业可以在任何时候实施自愿召回以避免上述情况发生。EPA也会同生产企业协商补救方法来避免实施下令召回。然而，根据《清洁空气法》207节（C）款之规定，如果无法达成一致的自愿解决方案，EPA有权下令召回。

核实测试的车辆选择和测试过程比监督检查测试要严格的多，因为要证明这些车辆在正常保养和使用情况下无法达标。通常，EPA会从问题车型中随机选出10辆进行测试，车主必须正常保养和使用测试车辆。EPA将评估核实测试的结果并判断不通过率是否反映出大规模的不达标现象。这主要取决于不通过车辆的数量和排放超标量。没有规定具体多少车辆不通过就要实施下令召回。通常，如果抽样中有两辆以上的车不合格，EPA就可能采取进一步行动。在EPA发布官方结论之前，生产企业有机会自愿采取相应行动[52]。

EPA从2000年开始实施新达标保障方案（CAP2000），其中将在用车核实阶段改为下面将要介绍的在用车一致性检测方案（IUCP）。

51 EPA，2008年，车辆与发动机达标行动，10月， EPA-420-R-08-011. (http://www.epa.gov/otaq/about/420r08011.pdf, 2009年11月10日查阅)。

52 与EPA交流（2010年4月8日）哈里森•丹，2006年，《美国的在用车符合性管理》发表于机动车污染控制国际研讨会，北京，中国。

In-use surveillance and recall testing program:

Performed by EPA, the in-use surveillance and recall testing program targets vehicle classes (usually test groups) that are suspected of having emission-related problems, or are simply populations that are chosen to be sampled for other reasons. Vehicle classes could be selected based on: 1) manufacturer defect reports, 2) information from state I/M programs, 3) manufacturer service bulletins, 4) certification test results (EPA more likely tests vehicle models that have had problems in certification), 5) newer technology or engine, 6) sales volume, 7) IUVP failures, 8) random, or 9) any other reason EPA deems appropriate.

All selected vehicles are tested at the Ann Arbor laboratory (unless designated by EPA), following the same test procedures and fuels (standard fuels) used in certification. Manufacturers are contacted if their vehicles are picked for in-use testing, and they are invited to watch the tests being performed and maintenance being performed on the vehicles, so they have confidence of the quality of the tests.

At the surveillance phase, EPA typically recruits three to five vehicles that are two or three years old from Southeastern Michigan (in proximity to the Ann Arbor lab). EPA's contractor contacts vehicle owners of each of the test group selected by EPA for testing. The owners are given small monetary awards (about US$20 per day) and a loaner car (or US$50 per day in lieu of a loaner car). EPA ensures that the cars have been properly maintained and used, and if needed performs required maintenance before testing. The maintenance performed depends on program requirements. Participants are given a list of any parts that are replaced.

If a number of failures were identified in the surveillance testing, EPA will discuss these with the manufacturer to find out some acceptable resolutions, such as voluntary recall, field fix, or extended warranty. EPA rarely uses forced recall and reserves to use it as a last resort.

In 2007, a total of 142 vehicles were tested, representing 47 test groups. Nine vehicles (representing five test groups) failed the in-use tests, but only one test group showed the extent of failure that resulted in further EPA investigation[51].

The testing enters the confirmatory phase if the surveillance results indicate that a substantial number of vehicles in the class may exceed emission standards within the useful life, and if the manufacturer declines to voluntarily remedy the problem at that time. This step could lead to an EPA-ordered recall if the testing confirms the likelihood of a substantial number of vehicles failing within the class. The manufacturer can voluntarily recall the vehicles at any time to avoid this process. EPA will work with manufacturers to agree on appropriate remedies to avoid an ordered recall. However, EPA has the authority under Section 207(c) of the "Clean Air" Act to order a recall if voluntary measures are not agreed upon.

Recruitment and testing in confirmatory testing are much more rigorous than in surveillance testing because vehicles must be shown to fail when properly maintained and used. Usually, ten randomly selected vehicles from within the class in question are tested, and the test vehicles must have been properly maintained and used. EPA will review the results of the confirmatory testing and make a determination whether the failure rate indicates a substantial number are failing. This will depend on the number of failures and the margins of failure. There is no set number of failures that can trigger the ordered recall process. Generally, if more than two of the vehicles in the sample fail, there is risk of further action. The manufacturer will have the opportunity to take voluntary action prior to EPA issuing an official finding[52].

In the New Compliance Assurance Program (CAP2000) adopted by EPA in 2000, the in-use conformity phase becomes the in-use confirmatory testing (IUCP) program discussed below.

51 EPA. 2008. Vehicle and Engine Compliance Activity. October. EPA-420-R-08-011. (http://www.epa.gov/otaq/about/420r08011.pdf, accessed Nov 10, 2009)

52 Communications with EPA (April 8, 2010); Harrison, Dan. 2006. In-use Vehicle Compliance Management in the United States. Presentation at Vehicle Pollution Control International Workshop. Beijing, China.

在用车验证检测方案(In-use verification testing program (IUVP)):

IUVP检测[53]由生产企业执行，设计用于测试低里程（1万英里或1.6万公里）和高里程（5万英里或8万公里）的在用车排放情况。每个测试组别抽出1-5辆车参加测试，在2007年汽车企业约进行了2000次测试。无论低里程还是高里程，如果测试抽样中有50%的测试车未能通过测试且平均排放水平超过标准限值1.3倍，生产企业就必须自动执行在用车核实检测方案（In-use confirmatory test program (IUCP)）。在IUCP方案下，车辆的选择和测试方法更为严格（同上文核实阶段的在用车测试方案），若无法通过IUCP，将导致召回。

EPA要求生产企业上报IUVP检测数据。大量的在用车数据能使EPA发现未来几年车辆技术设计中可能的问题，特别是排放控制装置在日常行驶工况下的劣化情况，并可以重点关注存在高排放隐患的车型。IUVP数据还可以用于评估和更新生产企业设定的劣化系数和测定劣化系数的过程。

召回：

《清洁空气法》授权EPA，如经认定车辆或发动机在正常保养和使用状态下仍有一部分无法达标，可以要求生产企业召回该组别的车辆或发动机并支付所有召回所需的费用。

当某一测试组别不能通过在用车监督检查测试的核实阶段 (IUCP) 时，EPA可以要求实施召回。EPA还可以根据IUCP数据，提出召回要求。生产企业通常愿意在提供数据时实施自愿召回。如果生产企业拒绝召回，EPA可以依照管理程序下令召回。

EPA还会调查与排放相关的车辆（技术或设计）缺陷，并判定生产企业是否要修复这些缺陷。通常，EPA会在采取措施前先与生产企业联系，而生产企业通常也会发布自愿召回。有时候，EPA也会实施监督检查或核实检测，收集在用车不达标证据，或者生产企业自己进行检测和调查并实施自愿召回。大多数情况下，生产企业会主动召回，不需要EPA进行干预。

有些召回行为只涉及某一车型中一小部分存在缺陷的车辆，并且车辆存在的故障很明显车主能很容易发现并自主进行维修。这种情况通常称为“车主自主行为（self-campaigning）”。如果这种缺陷已经导致了排放问题，并且这个问题还可能在排放部件保修期以外发生，生产企业可以延长保修期，书面告知车主车辆可能存在的问题并告知他们延长保修的期限和里程数。EPA将这种召回视为厂商自愿服务行为，并鼓励生产企业通过这种方式维修部分存在问题的车辆。

保修和缺陷报告:

《清洁空气法》规定生产企业须提供特定排放控制部件的保修（包括轻型车、重型车和非道路机械）。这一保修要求是要保护车主，使其不必支付由于设计缺陷、材料质量和生产做工原因造成排放超标所需的相关维修。

保修有两种形式：性能保修和设计及缺陷保修。性能保修是指对车辆进行维修或调整，保证车辆在按照生产厂商的要求正常保养和正常使用的情况下，可以在2年/2.4万英里内通过经批准的各地方规定的排放测试（类似I/M）。主要排放控制部件，如催化转化器、电控单元和车载诊断装置，保修期为8年或8万英里。设计和缺陷保修是指对排放相关部件进行维修，该部件由于原材料缺陷或生产做工问题在保修期内发生故障。

53 小型生产企业无需执行IUVP。

In-use verification testing program (IUVP):

Performed by manufacturers, the IUVP[53] is designed to test emissions of low-mileage (10,000 miles or 16,000km) and high-mileage (50,000 miles or 80,000km) in-use vehicles. One to five vehicles per test group are tested, and about 2,000 tests industry-wide were performed in 2007. If 50% of tested vehicles of the test group sample at either the low or high mileage test point fail and the average emission levels are greater than 1.3 times the standard limits, manufacturer must automatically conduct an In-use confirmatory test program (IUCP). In the IUCP, test vehicles are selected and tested in a more rigorous manner (same as the confirmatory phases of in-use testing described above) and failure of the IUCP could lead to recall.

Manufacturers are required to report all IUVP data to EPA. The large sample of in-use data allow EPA to identify potential design issues for future mode years, particularly on deterioration of emissions control devices under real life driving conditions, and focus attention to potentially high emission vehicles. The IUVP data is also used to assess and update the manufacturers deterioration factors and procedures used to determine deterioration factors.

Recalls:

The CAA authorizes EPA to require a manufacturer to recall a group of vehicles or engine at its own cost if it has been determined that a substantial number of vehicles from that group do not meet the standards even if they have been properly maintained and used.

EPA could require a recall when a test group fails the confirmatory phase of the in-use surveillance test. EPA could also require a recall based on the IUCP data. Manufacturers typically prefer to launch voluntary recall when they are presented with the data. If a manufacturer refuses to recall, EPA can follow established regulatory procedures that could result in an ordered recall.

EPA also investigates emission-related defects to determine if manufactures should remedy them. EPA usually contacts manufacturers prior to initiating action, and manufacturers generally issue voluntary recalls as a result. Sometimes EPA will conduct surveillance and/or confirmatory testing to establish evidence of failure in use, or the manufacturer may conduct its own testing and investigations that may result in voluntary recalls. Most of the time, manufacturers issue voluntary recalls without direct EPA intervention.

Some recall campaigns involve defects that occur in a small number of vehicles within a class, and the malfunction is very evident to the vehicle owner such that they seek repair. These are usually termed "self-campaigning". If these defects result in emissions failures, and can occur outside of the warranty period for the emission-related component, manufacturers can conduct a warranty extension campaign where letters are sent to owners to notify them of the potential failure and tell them that the repair will be covered for a certain time and mileage. EPA deems these recalls to be voluntary service campaigns, and encourages manufacturers to conduct these when it is not appropriate to fix vehicles that do not have the problem.

Warranty and defect reporting:

The CAA requires manufacturers to warranty certain emission control components on vehicles (including LDVs, HDVs and non-road engines). The warranties protect vehicle owners from the cost of repairs for emission-related failures resulting from defects in design, materials, and workmanship that cause the vehicle or engine to exceed emission standards.

There are two types of warranties: Performance Warranty and Design and Defect Warranty. The Performance Warranty covers any repair or adjustment which is necessary to make your vehicle pass an approved, locally-required emissions test (like an I/M) during the first 2 years/24,000 miles of vehicle use as long as the vehicle has been properly maintained according to the manufacturer's specifications and has not been misused. Specified major emission control components, like catalytic converters, electronic control units, and onboard diagnostic devices, are covered for the first 8 years or 80,000 miles. The design and defect warranty covers repair of emission related parts that become defective because of a defect in materials or workmanship during the warranty period.

53 Small volume manufacturers are exempt from conducting IUVP.

所有排放控制系统的保修期和排放相关部件的保修期为2年或2.4万英里，特定主要排放控制部件为车辆使用的最初8年或8万英里[54]。

在正常保养和使用发动机的情况下，如果同一车型年的车辆中有25辆以上都存在特定的排放部件相关的缺陷，EPA则要求生产企业追踪调查这些缺陷问题并向EPA提交缺陷报告。缺陷报告中必须估测装有缺陷零件的车辆比例并进行缺陷排放影响评估。如果对排放有明显影响，哪怕系族中仅有1%的车有同样的缺陷，EPA也可以要求进行召回。

重型车和非道路机械达标管理和实施方案

重型车和非道路机械达标管理和实施方案的关键因素包括：1）生产前认证；2）核实测试；3）选择性达标审核（SEA）；4）生产企业执行的生产线检测； 5）由EPA和生产企业执行的在用车（机）检测；6）保修和缺陷报告。各部分在车辆使用周期内如何实施，详见图5.2。

生产前认证测试：

与轻型车方案类似，EPA要求所有重型车生产企业测试新重型发动机或经过修改的重型发动机，证明发动机能够达标并将测试结果纳入向EPA提交的认证申请当中。

重型发动机认证主要基于发动机测试，而并非在底盘测功机上进行整车试验。和轻型车的原理相仿，选择发动机系族（类似于测试组别）中排放水平最高的发动机进行测试。将测试结果结合劣化系数，然后判定是否达标。车辆特性也会在认证时作为参考。

核实测试：

核实测试是由EPA在安娜堡实验室或在承包商和生产企业的实验室进行的有针对性的或随机的测试。EPA选择针对性测试用的发动机会考虑多项因素，包括：1）制造商的以往的达标率；2）发动机达标水平；3）新技术应用；4）EPA掌握的其它关于某发动机系族的信息。

没有通过核实测试的重型或非道路发动机是不能获得EPA认证证书的。如果一台发动机的排放低于标准，但在一致性认证中，该发动机的测试结果超过了最初申报的系族的平均、预存和交易（Averaging, Banking, and Trading, ABT）排放限值，那么发动机生产企业则需要根据EPA的测试结果修改原来的系族排放限值（Family Emission Limit, FEL）。

EPA从2006年起开始对非道路发动机执行核实测试，并且已经将测试范围扩展到其它非道路设备，如近期纳入的园艺设备（如剪草机）。

在经过认证的676款2007车型年的重型和陆上非道路发动机（通常称为农用或建筑机械发动机）中，EPA检测了其中的11款。2007年，EPA的重心集中在非道路发动机的核实测试上，所以在那一年中没有核实检测任何一款道路用重型发动机。

生产企业执行的生产线检测：

要求小型点燃式、大型点燃式、船舶和火车发动机生产企业定期测试刚下线的发动机，证明销售的发动机和认证测试样机一样能有效控制排放。

目前，对非道路发动机的检测主要是由企业执行生产线检测，因为一旦发动机被安装到相应设备上，再想取下来进行检测十分困难且成本较高。至于便携式排放测量系统（PEMS）进行非道路设备在用检测，目前尚没有如重型车那样具体的PEMS检测要求。

54 更多信息详见EPA简报《1995年之后轿车和卡车的排放保修》。(http://www.epa.gov/oms/consumer/warr95fs.txt, 2010年3月26日查阅)。

The warranty period for all emission control and emission related parts is the first 2 years or 24,000 miles of vehicle use, and for specified major emission control components is the first 8 years or 80,000 miles of vehicle use[54].

EPA requires manufacturers to monitor identified defects in emission control systems of properly maintained and used engines and submit defect reports to EPA whenever there are 25 or more vehicles within the same model year are found to have a particular emission-related defects. The defect reports must estimate the proportion of vehicles that contain a defective part and estimate the impact of the defect on emissions. A recall can be initiated if as little as 1% of an engine family has the same defective part and the defect has a significant impact on emissions.

Heavy-duty and non-road engine compliance program

The key elements of the heavy-duty (HD) and non-road engine enforcement and compliance program include: 1) Pre-production certification, 2) Confirmatory testing, 3) Selective enforcement audit, 4) Manufacturer production line testing, 5) In-use testing performed by EPA and manufacturers, 6) Warranties and defect reporting. Figure 5.2 illustrates how the various elements are implemented during the vehicle's useful life.

Pre-production certification testing:

Similar to the LDV program, all HD engine manufacturers are required to test new or modified HD engine to demonstrate compliance and submit testing results as part of the certification application to EPA prior to production.

HD engine certification is based primarily on engine testing as opposed to chassis dynamometer testing of the entire vehicle. Similar to the rationale applied to LDVs, certification tests are performed on an engine that represents the highest emission level of an engine family (similar to test group). Deterioration factors are applied to the testing results before comparing test data with applicable standards and determining compliance. The vehicle characteristics are included in the certification by reference.

Confirmatory testing:

Targeted and random confirmatory tests are performed by EPA at the Ann Arbor lab or at contractor's or manufacturer laboratories. Engines are selected for targeted confirmatory tests based on various criteria including: 1) compliance history with a manufacturer; 2) compliance margin of the engine; 3) use of new technologies; 4) other information the agency might have regarding an engine family.

EPA will not issue a certificate of confirmation to any heavy-duty or non-road engine that fails the confirmatory tests. An engine with emission levels below the standard but with a confirmatory test result that is higher than the Averaging, Banking, and Trading (ABT) Family Emission Limit (FEL) originally submitted in the certification application would need to replace the original FEL with the EPA test results.

EPA started performing conformity testing for non-road engines in 2006, and has expanded the test to other non-road engine categories, like lawn and garden equipment recently.

Among the 676 heavy-duty land-based non-road engines (typically called agricultural and construction engine) certified in MY2007, EPA tested 11 of them. EPA's primary focus in 2007 was on non-road engines, and it did not test any onroad heavy-duty engines that year.

Manufacturer production line testing:

Manufacturers of small spark-ignited, large spark -ignited, marine and locomotive engines are required to routinely test engines as they leave the assembly line to demonstrate that emissions from engines sold are controlled as effectively as the prototype engines tested for certification.

Manufacturer production line testing is now used primarily for non-road engines because once an engine is installed into equipment it is difficult and costly to take it out for testing. Also in-use testing requirements for non-road equipment using portable emission measurement system (PEMS) has not been as well developed as for HDVs.

54 For more information, see EPA Environmental Fact Sheet – Emissions Warranties for 1995 and newer cars and trucks. (http://www.epa.gov/oms/consumer/warr95fs.txt, accessed March 26, 2010).

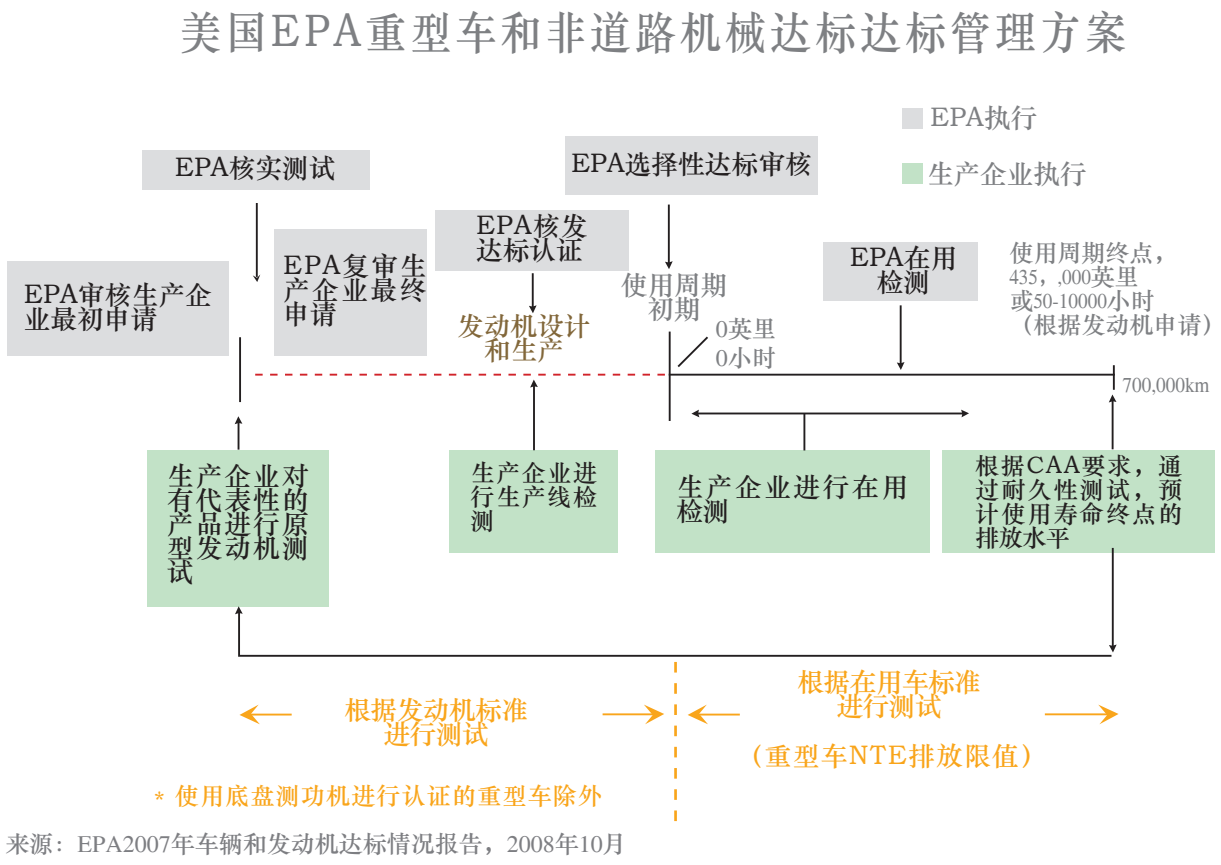
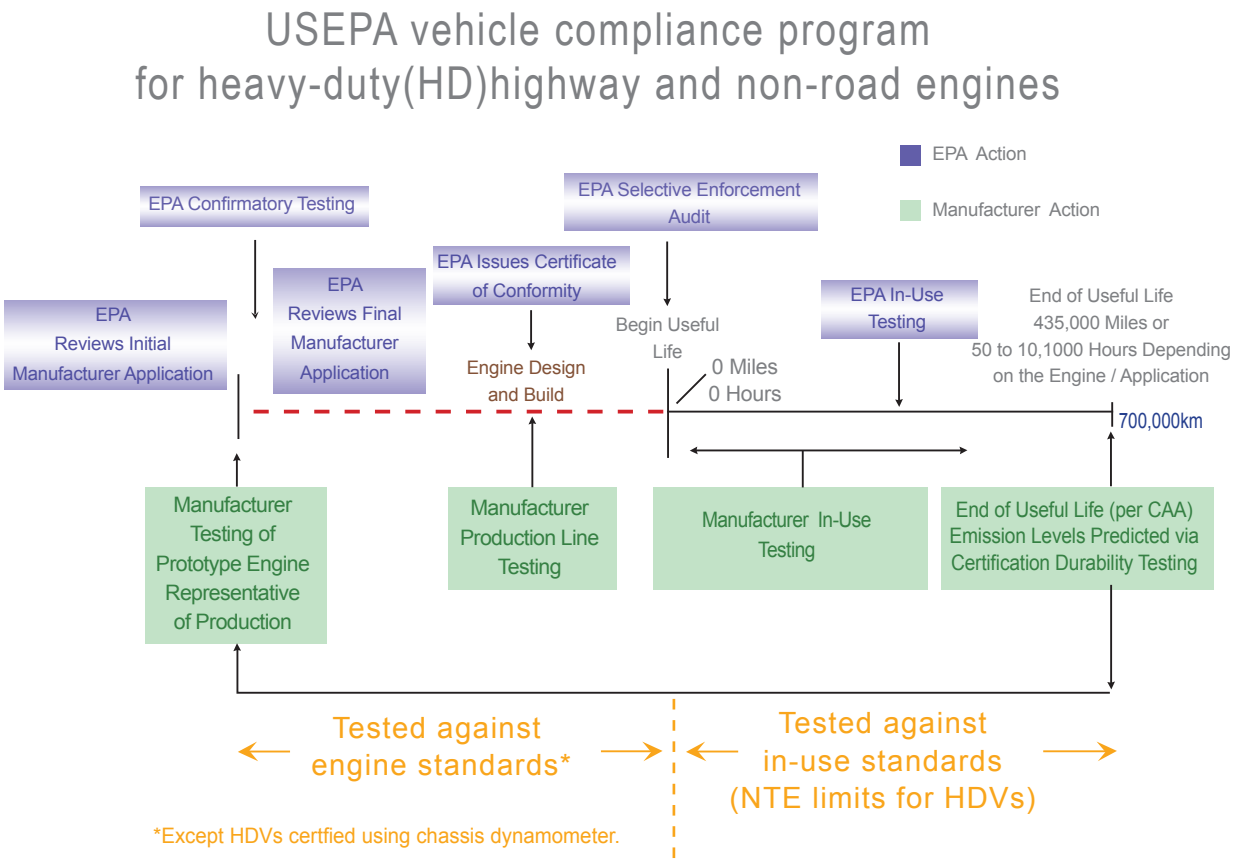


图5.2: EPA重型高速和非道路发动机达标管理和实施方案



Source: EPA.2007 Progress Report-Vehicle and Engine Compliance Activities.Oct., 2008

Figure 5.2: US EPA compliance program for HD highway and non-road engines

选择性达标审核 (Selective Enforcement Audit, SEA):

EPA计划对非道路机械实施SEA审核。SEA对非道路机械起到的作用比对轻型车起到的作用更大，因为非道路机械是通过发动机测试来验证是否达标的，在发动机安装到设备上之前判定其是否达标更为方便。

如果某一测试组别中有非道路发动机不能通过SEA审核，则生产企业需要找出并解决问题，直至发动机通过测试。如果整个发动机系族都不能通过，EPA有权采取进一步行动，如勒令生产企业停止生产。

由EPA和生产企业执行的在用车（发动机）检测:

传统实验室进行重型发动机和非道路发动机检测时采用的是特定的测试工况，要求将发动机从车辆或设备上拆下。因此，实施重型车和非道路在用测试既昂贵又复杂。此外，重型车和非道路机械的运行环境既多样也复杂（负载、速度），不能在有限的测试工况中充分表现出来。实验室在特定测试工况下执行的检测无法确保车辆和机械设备在实际使用中能够达到相应排放标准规定的范围。长期以来，一直需要更加有效的方法来测定重型车和非道路机械的日常使用排放（在用车/机排放）。由于便携式排放测量系统（PEMS）的开发和要求使用PEMS系统的检测规定的不可超过排放上限的出台（Not-To-Exceed (NTE) emission limit），EPA现在能够监督和验证重型车和非道路机械在日常运行中的达标情况了。

EPA与加州空气资源局（CARB）和柴油发动机生产企业共同合作，在2005年出台了重型卡车及巴士在用车检测方案。在本方案中，EPA、CARB和生产企业使用PEMS系统测量重型发动机使用过程中的排放并以是否能满足NTE标准要求来判定达标与否[55]。

EPA的在用检测都是在安娜堡（Ann Arbor）实验室和位于马里兰州阿伯丁(Aberdeen)的国防部检测实验室进行的。2007年，EPA使用PEMS系统总共测试了54辆卡车和72台非道路设备。对重型车而言，绝大部分在用测试主要由生产企业进行，这是重型车在用测试规定[56]中的一部分。 根据规定，生产企业要对其生产的发动机进行在用测试，证明其能够满足NTE限值要求，即FTP标准的1.25或1.5倍。EPA指定厂商每年测试不超过其生产发动机系族（engine family）总数的25%，但只有年产量超过1500台的发动机系族才需要测试。由于在用测试方法差异较大，EPA发起了一项综合性研发示范项目，来认定更准确的PEMS测试差额。

EPA从2005年和2006年开始推行气态污染物在用测试强制试点方案，在2007和2008年又对颗粒物推行了相同方案。从2007年开始，全面实施气态污染物在用车测试方案。

即使在在用车（机）测试中超过了NTE排放上限，也不一定就表明生产企业违反或达不到相关标准，因为EPA容许企业在达标要求上有一定的弹性。EPA会根据具体情况决定是否采取进步一措施，不过到目前为止还没有采取过有关行动。

摩托车

摩托车的达标管理和实施方案与轻型车方案非常接近。包括认证、核实测试、选择性达标审核、生产线检测、保修及缺陷报告。

检验与维修保养（I/M）管理方案

I/M方案的主要目的是找出高排放车辆并对这些车辆进行维修。在美国，《清洁空气法》要求空气质量不达标（不能满足国家环境空气质量 (NAAQS) 标准的区域）的州或地区实施I/M管理方案。臭氧问题严重的特定地区，必须实施更加严格的强化I/M方案。

各州I/M方案的执行力度各不相同。因此本文总结了优秀I/M方案的必要构成因素，而不是对美国所有的I/M制度详加介绍，具体内容详见表5.1。

55 NTE要求在发动机扭矩曲线下设置一个区域，发动机在此区域内运作时相关污染物排放量不得超过规定值。

56 详见40 CFR 第9部分及第86部分，EPA，2008年，新车的空气污染物排放控制：重型柴油发动机及车辆的在用测试。最终条款及修订内容。EPA420-F-08-011 (http://www.epa.gov/otaq/regs/hd-hwy/inuse/420f08011.htm, 2010年3月26日查阅)。

Selective Enforcement Audit (SEA):

EPA is planning to expand the use of SEA for testing non-road engines. SEA is a more useful tool for non-road engines than for LDVs because compliance with non-road new engine standards is verified by engine testing, and it's much easier to assess compliance of an engine before it is installed into equipment.

If a non-road engine of a test group failed an SEA, the manufacturer needs to identify and correct the problems until the engine can pass. If the entire engine family fails, EPA can pursue follow-up actions, such as forcing the manufacturer to stop production.

In-use testing by EPA and manufacturers:

Traditional laboratory testing for HD and non-road engines over a specific test cycle requires the engine be removed from the vehicle or equipment. This makes it prohibitively expensive and cumbersome to conduct in-use testing for HD and non-road engines. In addition, HD and non-road engines operate in a wide range of conditions (load, speed) that cannot be fully represented in limited test cycles. Laboratory testing following a specific test cycle cannot ensure that emissions from these vehicles and pieces of equipment are within the range of the applicable standards during normal operation. There has been a long-standing need for more accurate measurement of HD and non-road engine emissions under real life operation (in-use emissions). The development of the portable emissions measurement systems (PEMS) and the incorporation of testing requirement of using these systems (the Not-to-Exceed limits, NTE) make it possible for EPA to monitor and verify compliance of the HD and non-road engines during normal operation.

Collaborating with the California Air Resources Board (CARB) and diesel engine manufacturers, EPA launched the in-use testing program for HD trucks and buses in 2005. In this program, EPA, CARB and manufacturers measure in-use emissions of HD engines using PEMS, and compliance is determined against the NTE standards[55].

EPA in-use testing is conducted at the Ann Arbor lab and at the Department of Defense testing lab at Aberdeen in Maryland. In 2007, EPA tested 54 truck models and 72 non-road equipment using PEMS. For HDVs, the majority of in-use tests are conducted by manufacturers as part of the requirements of the HD in-use testing rule [56]. Manufacturers are required under the rule to conduct in-use testing to demonstrate compliance with the NTE limits, which is generally 1.25 or 1.5 times the applicable FTP standards. EPA will designate no more than 25% of a manufacturer's engine families with production volume greater than 1,500 engines for in-use testing by any given manufacturer every year. Because of the wider variations of the in-use testing measurements, EPA initiated a comprehensive research, development and demonstration program designed to identify new accuracy measurement margins for PEMS.

EPA established a mandatory pilot in-use testing program for gaseous pollutants in 2005 and 2006, and for PM pollutants on 2007 and 2008. The program became fully enforceable for gaseous pollutants starting in 2007.

Exceedences of the NTE limit during in-use testing do not necessarily represent a violation or noncompliance because of the flexibility given to manufacturers to comply with the standards. EPA will make the decision on follow-up action on a case-by-case basis, and no action has been taken to date.

Motorcycles

The compliance and enforcement program for motorcycles is very similar to the light-duty vehicle program. It includes certification, confirmatory testing, selective enforcement audits, production line testing, and warranties and defect reporting.

Inspection and Maintenance (I/M) programs

The main goal of an I/M program is to identify gross polluters—vehicles that produce excess emissions—and get those vehicles repaired. In the US, the CAA demands a state that has areas not meeting the national ambient air quality standards (NAAQS nonattainment areas) must implement a mandatory I/M program. For areas designated as serious or worse for ozone pollution have to implement a more stringent inspection program called enhanced I/M.

The stringency of the I/M programs implemented in different states varies widely. For the purpose of this study, a summary of the essential elements of a good I/M program is presented in Table 5.1, as opposed to reviewing the status of I/M programs in the US.

55 The NTE requirements establish an area or zone under the torque curve of an engine where emissions must not exceed a specified value for any of the regulated pollutants.

56 See 40 CFR Parts 9 and 86. EPA. 2008. Control of Emissions of Air Pollution from New Motor Vehicles: In-use Testing for Heavy-duty Diesel Engines and Vehicles. Final Rule, and the amendment of this rule EPA420-F-08-011 (http://www.epa.gov/otaq/regs/hd-hwy/inuse/420f08011.htm, accessed March 26, 2010).

表5.1: 优秀I/M方案的特征[57]

基本要素	最佳实践方案	优势
I/M 设计	统一实施的I/M体系，检验与维修保养分离的运行机制	-方便政府监管检测场 -大量车辆到每个检测场进行检测有可能降低测试成本
	由政府进行监管，但具体实施可以由私人企业承包	私人企业技术水平可能比政府机构更高
制度/ 行政管理设置	力争获得高级政策制订者的支持和建立足够的机构能力以便管理	获得充足的财政和资源支持，确保方案的实施不会由于贪污腐化现象和质量控制力度不足等问题而受到影响。
	建立合理的收费制度，由受影响车主支付I/M方案所需的费用（包括审核和监管费用，道边检测等）	确保有充足的资金
	在方案设计初期，要与有关部委或部门（国家级和地方级的）充分沟通	确保有关机构认可各自的职责并对方案认同及负责
	将I/M制度与登记注册数据挂钩，如无法提供检测证明，将不予登记注册	大力鼓励车主将车辆送检
	建立详细数据管理系统用于传输所有检测数据	使得监管机构可以收集数据来完善实施方案，如果检测设备能够自动将测试数据上传至数据库，能够有效防止数据篡改现象。
技术问题	实施更加严格的新车标准的同时，加严在用排放标准	不断提高I/M方案的实施效果

57 迈克尔•沃尔什(Michael Walsh)，2005年，《机动车检查与维修保养:国际经验》。

Table 5.1: Features of a good I/M program[57]

ELEMENTS	BEST PRACTICE	ADVANTAGES
I/M design	Centralized I/M system where inspection are separated from maintenance function	- Easier facility oversight by the government - Potentially lower cost per test if large number of vehicles are tested in each facility
	Government should regulate but actual enforcement could be contracted out to private companies	Private companies might have better expertise than the government
Institutional/ administrative set up	Solicit support by senior decision makers and the institutional capacity to manage and regulate the system	Adequate funding and resources would be allocated to ensure the program is not plagued by corruption and poor quality control
	Develop an adequate fee structure in which affected vehicle owners pay the full costs of the I/M programs (including costs for auditing and overseeing the program, road-side testing, etc.)	Ensure sufficient funding
	Initiate full dialogue with all appropriate ministries or departments (national and local) at the early stage of design	Assure all key stakeholders agree with their respective role and have ownership of the program
	Link I/M with registration data so that failure to present proof of inspection leads to denial of registration	Strong inducement to encourage vehicle owners sending vehicles for inspection
	Include a detailed data management system to enable transmittal of all test data	Allows oversight agencies to collect data for enhancing the enforcement program, and minimize chances of falsifying data if testing device automatically input testing data into the database
Technical issues	Tighten in-use emission standards for new vehicles in tandem with adoption of more stringent new vehicle standards	Continuous improvement of I/M program effectiveness

57 Walsh, Michael. 2005. "Motor Vehicle Inspection and Maintenance: The World Experience".

	确保根据不同车类不同的里程累积或排放控制系统耐久性，订立不同的检测周期	确保里程累积高/使用周期长的运营车，如出租车，能适时进行检测并合理维修保养
I/M的公众参与水平	使公众了解成功的I/M方案所能带来的健康收益	确保公众接受并鼓励公众参与I/M检测
	制订I/M执行标准，对执行情况不佳的站点予以处罚	保证I/M的执行质量是获得公众支持的关键
质量保障–审核	确保审核贯穿整个方案设计并纳入收费机制	树立I/M机制的威信度和实施效力
	设定合理的检测费，为私人检测机构提供足够的利润，进行必要设备的维护、置换和升级	保证测试过程的执行质量
道边检测方案	采用道边检测或遥感补充I/M方案的实施	查出利用临时检修通过I/M要求的高排放车辆
重视维修保养	保证修理行业有充足设备且知道如何正确维修车辆	实现I/M方案承诺的减排效果
	在加严I/M要求时，要给修理行业充裕的时间来作足准备，维修不达标车辆	确保车辆得到适当维修并减少排放
	建立维修行业与I/M管理方之间的沟通	解决因相关维修需求而产生的争端

在美国，I/M方案中会利用车载诊断系统（OBD）技术的州会向EPA提供OBD数据。EPA每两个月会与各州的相关人员联系，定期交换问题车辆信息。EPA会调查问题，与生产企业一起研究解决方案并告知各州如何处理实施I/M方案时查出的问题车型。

	Assure frequency of inspections varies for vehicles with differing mileage accumulation rates and with more or less durable emission control systems	Ensure that high mileage/usage commercial vehicles, like taxi cabs, are adequately inspected and properly maintained
Public participation in I/M	Raise public awareness on health benefits that can be resulted from a successful I/M program	Ensure public acceptance and encourage participation in I/M inspection
	Develop performance standards for I/M and penalize poorly performing stations	Guarantee quality of the I/M program is key to assure public support
Quality assurance – Audit	Ensure audits are fully built into the overall program design and accounted for in the fee structure	Establish credibility and effectiveness of the I/M systems
	Set test fees at a reasonable level that will allow private operators to make a sufficient profit to maintain, replace and upgrade equipment as required	Assure good quality testing is performed
Roadside Testing program	Complement I/M with roadside testing or remote sensing	Catch gross emitters that use temporary fixes to pass I/M requirements
Pay attention to maintenance	Ensure service industry have sufficient equipment and knowhow to properly repair vehicles	Realize the emission reductions promise of the I/M program
	Give sufficient lead-time to allow the service industry equip itself to repair failing vehicle when tightening I/M requirements	Ensures that failed vehicles are properly repaired and emissions are reduced
	Establish communications between the repair industry and the I/M managers	Resolve disputes over the appropriate repairs needed.

In the US, states with I/M programs that incorporate OBD technology provide OBD data to EPA. EPA holds bi-monthly stakeholder calls with the states to give both EPA and the states a regular opportunity to share information on problematic vehicles. EPA will research issues, work with manufacturers on resolution and use the calls to report back and give guidance on how states should deal with problem vehicle models identified in conducting their I/M programs.

EPA鼓励各州在I/M测试中使用OBD。OBD数据能够帮助查找出问题车型。事实证明，较新的车（1996年或之后的）上所装的OBD系统的错误代码在检测高排放车辆方面至少和I/M检测一样可靠或更好。 另外，OBD数据还能协助加快I/M检测流程，并协助找出故障从而进行维修，降低维修成本。

美国管理实施方案的效果和成本

在EPA实施其管理方案初期，核实测试和SEA成功的起到了很好的保障实施作用。不能通过实施测试和SEA的严重后果有效遏制了认证结果造假并迫使生产企业自己出钱进行大量测试来保证生产一致性。随着新车不达标现象越来越少，新车不再是EPA关心的重点，EPA就可以将更多的精力和资源转移到在用车测试方案上，从而保障车辆（及排放控制装置）在使用周期足够耐用并保持良好运行状态。

尽管车辆管理方案已经十分成熟完善，生产前认证依然会出现问题——2007年，18%的测试车辆未能通过FTP工况的核实测试。这突出了核实测试作为保证样车原型的设计可以满足标准的重要性。

实施召回的高昂成本起到了明显的威慑作用，鼓励生产企业提高车辆和排放控制装置的耐久性，确保在实际使用过程中达标。

在上世纪70年代末80年代初，刚刚开始实施召回方案时，EPA一年要召回30-40%的轿车和轻型卡车，现在EPA每年会召回5-10%的车辆[58]。

2008年，有超过100万辆新车和在用车被召回进行直接维修（约占当年1320万新车销售量的7.5%），另有210万辆车在自愿维修行动中被召回（出现问题后车主可以去维修）[59]。

从2007年起对重型车实施气态排放物在用车测试要求，颗粒物在用测试目前还处于试点阶段。EPA对要求实施后第一年内的气态排放物测试数据进行了分析，尚没有发现不达标情况[60]。

实施车辆管理方案的资源配置：

轻型车达标管理工作组有7名全职员工（FTE）和4名合约制员工。这4名合约制员工是高级环境雇员方案下的部分成员，均为退休工程师。每年，轻型车达标管理项目还要花费约100万美元，用于签订承包商，承担在用车监管、缺陷报告、自愿召回跟踪和收取认证费的工作。

58 查克•弗雷德(Chuck Freed)，2006年，《在用车排放耐久性测试--召回》，SAE-中国的口头报告。

59 2008年，导致召回的问题包括：发动机控制模块、OBD、PCV集油器和通风管道、燃料管路、车底隔热板、催化转化器、传动控制模块等。更多信息，详见EPA，2009年，《轻型车和轻型卡车2008年排放相关召回及自愿检修情况汇总》EPA420-B-09-016。

60 与EPA的谈话内容(2010年4月8日)。

EPA encourages states to adopt the use of OBD in I/M testing. The OBD data are useful for identifying problematic models. In fact, trouble codes set by the OBD system in newer (1996 or newer) vehicles have been shown to be as reliable, if not more so, than the I/M test in detecting gross emitters. Also, OBD data can help speed up I/M testing process, and can help mechanics identify problems and fix them, reducing repair costs.

Results and costs of US's enforcement program

In early years of EPA's compliance program, the conformity tests and SEA were successful in establishing strong enforcement presence. The adverse consequences of failing confirmatory tests and SEA effectively deterred fraudulent reporting of certification results and forced manufacturers to conduct large number of tests at their own costs to ensure production conformity. As new vehicle non-compliance became less of a concern, EPA was able to shift resources to in-use testing programs that ensure vehicles (and emission control devices) are designed to be durable enough to function well throughout the useful life of the vehicles.

While the vehicle compliance program is a well-developed and mature program, pre-production mistakes can still happen—18% of confirmatory tests failed over the FTP cycle in 2007. This highlights the importance of confirmatory tests to make sure prototypes are designed to meet the standards.

The high cost for initiating a recall has a significant deterrent effect, encouraging manufacturers to improve durability of vehicles and emission control devices to ensure compliance in actual use.

In the late 1970s and early 1980s, when the recall program began, EPA recalled 30-40% of cars and light trucks produced in any given year; today, EPA recalls 5% to 10% of vehicles produced in any given year[58].

In 2008, over 1 million new and in-use vehicles were recalled for immediate correction (about 7.5% of the 13.2 million new vehicles sold that year) and 2.1 million were recalled for voluntary service campaigns (owners bring in vehicles when the problem is evident) [59].

In-use testing requirements for HDVs started in 2007 for gaseous pollutants, while PM testing is still in the pilot stage. Analysis of gaseous data from the first enforceable year of manufacturer testing has not revealed any noncompliance issues[60].

Resources for running the vehicle enforcement program:

There are seven full-time-equivalent (FTE) staff and an additional four grantees on the light-duty vehicle compliance team. The four grantees are part of the senior environmental employment program and are typically retired engineers. The light-duty vehicle compliance program also spends about $1 million per year on contractor support for the in-use surveillance program, defect report and voluntary recall tracking, and certification fees.

58 Freed, C. 2006. In-use emission durability testing—recall. Presentation at SAE-China.

59 Problems leading to the recalls in 2008 included: engine control module, OBD, PCV oil trap and ventilation hose, fuel line tubes, underbody heat shield, catalytic converter, powertrain control module, etc. For more details, see EPA. 2009. 2008 Annual Summary of Emission-related Recall and Voluntary Service Campaigns Performed on Light-duty Vehicles and Light-duty Trucks. EPA420-B-09-016.

60 Communications with EPA (April 8, 2010).

5.2 中国车辆达标管理和实施方案概况

《大气污染防治法》中要求“机动车船向大气排放污染物不得超过规定的排放标准”，规定“任何单位和个人不得制造、销售或者进口污染物排放超过规定排放标准的机动车船”，而且“在用机动车不符合制造当时的在用机动车污染物排放标准的，不得上路行驶”。《大气污染防治法》 还声明，“制造、销售或者进口超过污染物排放标准的机动车船的，由依法行使监督管理权的部门责令停止违法行为，没收违法所得，可以并处违法所得一倍以下的罚款；对无法达到规定的污染物排放标准的机动车船，没收销毁”。但是在本法规中却没有明确指出由哪个部门负责实施上述管理。

根据轻型车、重型车、摩托车和非道路及农用车排放标准，车辆或发动机生产企业必须将样车送至委托检测实验室进行型式核准测试（相当于美国的认证测试）。

《大气污染防治法》规定，省、自治区和直辖市级环保局有权委托经公安部门认可的车辆检测中心执行I/M检测。如果发现在未授权检测场进行检测，或发现I/M检测场有作弊行为，管理部门应制止这种违法行为，要求其立即改正并处以不超过5万元人民币的罚款。对于严重违规行为，可以取消检测机构的I/M检测资格。

《大气污染防治法》目前正处于修订阶段。环保部建议在法律中明确授权环保部负责实施新车排放标准，并有权召回不达标车辆。

中国的车辆管理方法

中国的车辆达标管理方案主要包括三部分：1）新车型式核准；2）生产一致性（conformity of production, COP）和在用性检查（in-use compliance）；3）I/M方案。环保部的管理重点主要放在新车型式核准和COP上，各省和自治区环保局负责管理各地的I/M方案。

新车型式核准

环保部在全国委托了23家实验室进行排放试验，其中18家从事轻型车、重型车及发动机、农用车和非道路机械试验，5家从事摩托车排放测试。这些实验室主要进行型式核准测试，也有一些同时进行生产一致性检测[61]。

这些实验室是经过环保部科技标准司核准的，该司每年会对实验室进行一次检查，进行实验室能力评估并决定是否延长认证有效期。在前去检查前，会提前1-2天通知实验室，由环保部官员、VECC的工作人员和其它委托实验室的专家共同实施检查。

型式核准报告要提交至VECC进行审核，不过到目前为止，提交的所有报告都是通过的，也就是说，环保部/VECC不要求实验室提供未通过认证要求的车辆或发动机的相关报告/数据。因此，环保部/VECC并没有接收认证测试失败的信息和数据。目前，型式核准报告被驳回的都是由于一些很小很表面的问题，比如生产企业提供的申请材料不正确。

61 参见VECC网站委托实验室名单 (http://www.vecc-mep.org.cn/news/newslist.jsp)。

5.2 Overview of China's vehicle compliance and enforcement programs

The "Air Pollution Prevention and Control Law" requires that emissions from all motor vehicles and vessels must not exceed the regulated limits, prohibits any entity from producing, selling and importing vehicles that do not comply with emissions standards, and it prohibits in-use vehicles that fail to meet in-use emission standards from operating on the road. The law also states that for entities producing, selling or importing nonconforming vehicles, the regulatory agency shall stop noncompliant activities, confiscate all nonconforming vehicles, and could levy a fine equivalent to the economic benefits from confiscated products; all non-conforming vehicles and vessels can be confiscated and destroyed[61]. The law, however, does not clearly specify which government agencies are responsible for enforcing these provisions.

According to the emissions standards for light- and heavy-duty vehicles, motorcycles, non-road and agricultural vehicles, engine and/or vehicle manufacturers must submit vehicle prototypes to accredited testing laboratories for type approval testing (comparable to the certification testing in the US).

Under the "Air Pollution Prevention and Control Law", provincial- and municipality-level environmental protection authorities have the responsibility to entrust vehicle test centers that have been accredited by the Public Security Bureau to conduct inspection and maintenance (I/M) testing. If I/M tests are found to be conducted at unauthorized facilities, or if I/M facilities are found conducting fraudulent testing, the regulatory agency shall stop those illegal activities, demand remediation and levy a fine no more than 50,000 RMB. In the case of serious violation, the certificate for conducting I/M tests could be revoked.

The "Air Pollution Prevention and Control Law" is currently being revised, MEP recommends the law provide the ministry broad authority to enforce new vehicle emission standards, including the authority to recall nonconforming vehicles.

China vehicle enforcement approach

China's vehicle enforcement and compliance program consists of three main elements: 1) new vehicle type approval, 2) conformity of production (COP), and 3) I/M programs. MEP's compliance effort mainly focuses on new vehicle type approval and COP, and provincial and municipal environmental protection bureaus (EPBs) are charged with managing local I/M programs.

New vehicle type approval

MEP has entrusted 23 laboratories nationwide to conduct emissions testing of which 18 labs conduct testing for LDVs, HD vehicles and engines, agricultural vehicles and non-road engines and five labs conduct motorcycle emissions testing. These labs are mainly used for type approval testing, but some also conduct testing for conformity of production.

The labs are certified by MEP's Department of Science, Technology and Standards, which inspects the labs once a year to assess the labs' testing capabilities and decides if certification should be renewed. The labs are given one to two days of advance notice before each inspection, and the inspections are conducted by MEP staff, staff from the Vehicle Emission Control Center (VECC) and a team of experts recruited from other accredited labs.

Type approval reports are submitted to the VECC for review, but all reports submitted to date are passing reports, meaning that laboratories are not required to provide any report / data on vehicles or engines tested that do not pass the certification requirements. Therefore MEP/VECC do not receive information and data on the failed certification tests. The only rejection of type approval reports that has occurred to date are for very minor and obvious problems, such as a manufacturer not providing the correct application materials.

61 See website of VECC for list of accredited laboratories (http://www.vecc-mep.org.cn/news/newslist.jsp).

2008年，总计有10248种车型和发动机型被测试并通过型式核准检测。其中半数以上（8101种或57%）是重型发动机车型，约1/4（3474种或24%）是轻型车车型，2275种（16%）是摩托车和轻便摩托车，16种（1%）是重型发动机，另有348种（2.4%）是未指定用于轻型或重型车的发动机。每个月VECC会在自己的网站上发布通过环保部型式核准测试的车辆名单。

生产一致性

每年，环保部委托VECC组织一些随机COP检查。COP检查的结果会总结上报环保部。进行COP检测时，有时会从生产线终端选取测试车辆，有时会从市场上购买车辆进行测试。

环保部会评估VECC提交的COP报告，根据不达标车辆和企业的具体情况，设定一个期限，要求企业在规定时间内实现生产线达标并以暂停接受型式核准申请作为违规处罚。根据环保部关于加强生产一致性监督管理的公告（2005年1号函），如果某级别测试组别的发动机在整改后依然不能满足标准要求，环保部可以撤销其型式核准证书。由于《大气污染防治法》中没有明确由哪个部门征收罚款，故通常不进行罚款。

2008年，VECC对11家车辆生产企业的13个车型（包括轻型车和重型车）进行了随机COP检测。在这13款车型当中，有两款因其实际量产的部件配件与核准申请报告不符被直接判定为不达标。在接受检查的11家生产企业中，有3家的生产线检测设备质量没有达到要求。

环保部除了进行COP检查外，还要求车辆和发动机生产企业每季度向VECC提交COP保证报告。环保部要求轻型和重型车生产企业至少每发动机系族测试组别随机抽测3台样车（机），非道路和农用车企业至少随机抽测1台样车（机）。对于轻型或重型车，如果测试样车（机）的各项污染物排放全都低于标准限值，或三台样车（机）的统计量均能低于限值要求，则该发动机系族/测试组别的COP达标[62]。 对于非道路和农用车，如果第一台样车（机）合格就算通过COP检查；如第一台样车（机）不合格，企业可追加测试一定数量的样车（机），如所测样车的所有排放物的统计平均值都低于标准，则该发动机系族测试组别COP合格。

在用符合性检测和召回

目前环保局要求企业申报在用符合性计划和年报，但由于国内大部分地区还没有售卖与排放标准相配的燃料，环保局并未在全国进行在用符合性抽查，不过在北京已经有了针对乘用车的在用检测方案。2009年3月北京市环保局开始执行随机抽检，抽检累计行驶里程不超过10万公里的国III和国IV乘用车。目前已有60辆车接受了检测。另外，北京市环保局在2010年6月3日发布了要求生产企业进行在用车测试，主要针对在北京每年销售超过500辆的车型或发动机型。

北京市环保局进行的在用车检测方案暴露出了在用车存在的一些问题，例如，某些车辆只装有一个催化器来取代型式核准时指定的两个催化器。不过目前北京的在用车检测结果还在分析过程中，尚不清楚北京市环保局会采取怎样的措施来应对生产违规车型的生产企业。

62 COP测试具体要求详见车辆排放标准。 非道路和农用车是至少一台合格就算通过，轻型车和重型车都必须抽检3台，3台全部合格或统计量合格才算通过。

A total of 10,248 vehicle and engine models were tested and passed type approval testing in 2008. Over half of them (8,101 models, or 57%) are heavy-duty engines models, about one-fourth (3,474 models, or 24%) are light-duty vehicle models, 2,275 (16%) are motorcycle and moped models, 16 (1%) are heavy-duty engines, and 348 (2.4%) are engines not specified for light- or heavy-duty uses. Every month, VECC issues on its website a list of vehicles that have passed type approval testing.

Conformity of production

Every year MEP commissions VECC to conduct a number of random COP tests. Results of the COP tests are summarized in a report submitted to the MEP. Some of the COP tests are conducted by selecting and testing vehicles right off the end of the assembly line and some are performed on vehicles purchased on the market.

MEP reviews the annual COP report submitted by VECC and, based on the specific circumstances of the non-conforming vehicles and enterprises, issues a deadline for bringing the production line into compliance and temporarily suspends accepting type approval application as punishment for non-compliance. According to the MEP's notice on strengthening COP supervision (2005 Notice no.1), if an engine class/test group still cannot meet the standards after remedial actions are taken, MEP could revoke the type approval certificate. Fines are not usually issued because it is unclear from the "Air Pollution Prevention and Control Law" which ministry has the authority to impose fines.

In 2008, VECC conducted random COP testing at 11 auto manufacturers, and mass products of 13 vehicle models were inspected (including both LDV and HDV). Of the 13 models, two were directly judged as out of compliance because essential parts/accessories used in mass production were inconsistent with those reported in the certification application. Of the 11 manufacturing facilities inspected, the quality of inspection equipment of three production lines did not meet the requirements.

In addition to COP tests conducted by MEP, vehicle and engine manufacturers are required to submit COP assurance report to VECC on a quarterly basis. To demonstrate COP compliance, LDV and HDV manufacturers are required to randomly select and test at least three vehicles of each engine test family/test group, and manufacturers of non-road engines and agricultural vehicles have to randomly select and test at least one engine/vehicle. For LDVs and HDVs, an engine family/test group are COP compliant if emissions of every regulated pollutants from all samples tested are lower than the standards, or the average emission level of all pollutants of the samples tested are statistically lower than the limits. For non-road and rural vehicles, if emissions of the first sample tested are lower than the limits for all pollutants, the engine model/test group is COP compliant, otherwise, the manufacturer could chose to test more samples, and the engine model/test group passes the COP test if the average emission levels are statistically lower than the limits for all the pollutants[62].

In-use compliance testing and recall

Currently, MEP requires vehicle manufacturers to summit in-use compliance plan and annual report, but because of the lack of supply of compatible fuel, MEP has not selected and verified any of the in-use compliance plans and report. However, the city of Beijing has started an in-use testing program focused on passenger vehicles. In March 2009, the Beijing Environmental Protection Bureau (BEPB) launched a random in-use testing program for China III and IV passenger vehicles with cumulated mileage of no more than 100,000 km. So far 60 vehicles have been tested. In addition to the in-use testing conducted by BEPB, BEPB released a notice on in-use testing on June 3rd, 2010, requiring manufacturers to conduct in-use testing of any engine/vehicle model sold more than 500 units/year in Beijing.

The in-use testing program conducted by Beijing EPB has identified some problems with in-use vehicles, for example, some vehicles have only one catalyst instead of the two catalysts specified in the type approval. But the Beijing in-use testing results are still being analyzed. It is unclear what follow-up actions BEPB will undertake against manufacturers producing non-conforming models.

62 Details of the requirements for conducting COP tests are laid out in vehicle emission standards.

清华大学和其它一些科研院所也都进行了遥感和PEMS在用车排放测量研究。通过PEMS测试，显示出北京出租车在达到耐久性要求的里程之前氮氧化物排放超标，另外清华大学用PEMS在北京、深圳和西安进行了轻型和重型卡车排放测试，结果显示国III重型卡车的氮氧化物排放量明显高于国II重型卡车。PEMS研究结果总结如下。

表 5.2: 中国在用车测试结果汇总

研究机构	测试车辆	结论
中国环境科学研究院[1]	22辆国I、国II或国III北京出租车	▪ 在累计行驶里程达到6.5万公里以上时，部分车辆氮氧化物排放高 (>0.3克/公里) ▪ 在累计行驶里程28万公里上时，部分车辆碳氢化合物排放高 (>0.4克/公里) ▪ 三元催化器失效是导致排放升高的潜在原因
清华大学[2]	在北京、深圳和西安选取70辆重型卡车(国 I, II, III)和29辆轻型卡车 (国 0, 1, 2, 3)	▪ 国III重型卡车的氮氧化物排放明显高于国II重型卡车，大约处于欧I排放水平

来源：1.与中国环境科学研究院胡京南博士联系(2009)；2.与清华大学姚志良博士联系(2009).

I/M 方案

依照《大气污染防治法》，I/M方案由省级（含自治区和直辖市）环保局实施，维修保养机构则由各省的交管部门负责授权。

环保部制定了有负载和无负载I/M测试程序并规定了无负载测试的排放限值。环保部要求采用无负载测试的地方政府采用环保部定的I/M测试程序和限值；环保部推荐空气污染严重的地区采用有负载I/M测试，而地方环保部门需要根据各地的情况设定排放限值。环保部在2010年12月发布了《关于印发〈机动车环保检验机构管理规定〉的通知》，“通知”规定机动车环保检验机构每年须向市级环保局提交年度报告。然后由市级环保局向省级环保局提交环检机构日常监督管理年度报告，再由省环保局向环保部提交这些报告[63]。

《大气污染防治法》规定禁止排放不达标的车辆（新车或在用车）上路行驶。因此，许多地方政府将I/M方案与黄绿标方案相结合以便获得公众的配合——只有拥有黄绿标的车辆才能进行登记注册（标志方案将在第七章具体讨论）。环保部于2009年7月发布了《关于印发〈机动车环保检验机构管理规定〉的通知》，“通知”要求省、市环保局自2009年10月开始对所有车辆（包括农用车和摩托车）核发全国性的统一排放标志[64]。

63 参看环保部关于印发 《机动车环保检验机构管理规定》的通知，环发〔2009〕145号 (http://www.mep.gov.cn/gkml/hbb/bwj/201004/t20100407_187894.htm，2010年8月11日查看)。

64 参看环保部关于印发《机动车环保检验合格标志管理规定》的通知，环发〔2009〕87号。
（http://www.njhb.gov.cn/art/2010/1/4/art_465_16723.html，2010年8月11日查看）。

Tsinghua University and other academic institutions also have conducted remote sensing and PEMS research to measure emissions from existing vehicles. PEMS testing of Beijing taxis showed high NOx emissions before reaching durability mileage, and PEMS testing of light- and heavy-duty trucks in Beijing, Shenzhen and Xi'an showed that China III heavy-duty trucks emitting significantly more NOx than China II ones. Results of the PEMS studies are summarized below.

Table 5.2: Summary of in-use testing results in China

RESEARCH INSTITUTE	VEHICLE TESTED	FINDINGS
CRAES[1]	22 China I, II or III taxis in Beijing	Some vehicles showed high NOx emissions (>0.3g/km) with over 65,000 km mileage Some showed high HC emissions (>0.4g/km) with over 280,000km mileage Failure of three-way catalytic converters is a potential cause of high emissions
Tsinghua University[2]	70 HD trucks (China I, II, III) and 29 LD trucks (China 0, 1, 2, 3) in Beijing, Shenzhen and Xi'an	China III HD trucks emit significantly more NOx than China II HD trucks, about the same level as Euro I

Sources:

1.Communications with Hu, Jingnan at Chinese Research Academy of Environmental Science, 2009.

2.Communications with Yao Zhiliang at Tsinghua University. 2009.

I/M program

Under the "Air Pollution Prevention and Control Law", I/M programs are managed by provincial- and municipality-level environmental protection bureaus (EPBs), and maintenance and repair centers are managed by the provincial transportation management authorities.

MEP establishes test procedures for loaded and unloaded I/M tests, and specifies emission limits for unloaded tests. Local governments are required to adopt the MEP I/M test procedures and limits (if unloaded test is used); regions suffering from severe air pollution are recommended to use the loaded test for I/M testing, and the local EPBs need to set the emissions limits according to the local situation. A MEP notice released in December 2010 mandates each I/M testing facility to submit to city EPBs an annual work report with a description of the test facility and emission problems identified. City EPBs will then prepare and submit an I/M inspection and management report to provincial EPBs for transmission to MEP[63].

The "Air Pollution Prevention and Control Law" bans vehicles not meeting emission standards (new or in-use) from operating on the road. As a result, many local governments combine the I/M program with the yellow/green sticker program to get public's cooperation—vehicles can only register if there is a yellow/green emission stickers on the vehicle (more detailed discussion of the labeling program can be found in Chapter 7). MEP announced a nationwide label program in July 2009, requiring all provincial and municipal EPBs that have established emission sticker programs to verify and issue vehicle emissions stickers (including rural vehicles and motorcycles) according to a unified format and categorization specified by MEP starting from October 2009[64].

63 See MEP's notice on the regulation for managing I/M testing facilities. MEP notice [2009] No. 145. (http://www.mep.gov.cn/gkml/hbb/bwj/201004/t20100407_187894.htm, accessed Aug 10, 2010).

64 See MEP's notice on the regulation for managing vehicle environmental labels. MEP notice [2009] No. 87. (http://www.njhb.gov.cn/art/2010/1/4/art_465_16723.html, accessed Aug 10, 2010).

目前，已经有345个地方环保局推行了I/M管理方案，其中50个地区采用有负载测试（ASM或IM240）。VECC推测全国约有10-15%的车辆无法一次通过I/M检测，但目前没有具体每年有多少车参检的数据。

中国管理实施方案的效果和成本

从目前执行的小规模的在用车测试结果可以了解到有一些在路上行驶的车辆并不是按照认证规格来生产制造的（缺少催化器），这些车耐久性差（还未超出耐久性里程范围就发生排放超标现象），或污染物排放量超过预期排放量（国III卡车比国II的排放还高）。还有一些非官方的证据显示部分车辆在设计时有两个传感器，一个用于监测发动机排放，另一个用于监测后处理装置排放，而在实际生产中只装有一个传感器用于监测发动机排放。

导致上述问题的原因可能包括：低劣的车辆设计（没有在型式核准中明确指出）、企业未遵守生产一致性规定、现行达标管理方案中没有指出和修正非工况覆盖点的排放，或排放控制装置耐久性问题。要找出并控制住这些问题的源头需要进一步逐一调查，并且有些情况可能源自于多个复杂交错的原因，致无法查明问题的最终源头。无论怎样，这些结果清楚的指出环保部目前针对新车认证和COP所采取的行动还不够充分和有效，不足以保证所有生产的车辆如标准中规定的那样切实达到预期的排放要求。

实施车辆管理方案的资源配置

在环保部/VECC有15名工作人员全职或兼职负责认证（型式核准）和COP工作。

5.3 中国方案与国际最佳实践对比以及中国发展过程中的障碍

政治 / 政策问题

《清洁空气法》授权EPA管理所有向大气中排放污染物的发动机和车辆，并要求生产企业自费召回和维修即使在正常保养和使用条件下，在实际使用中不能达到标准要求的车辆和发动机。

《大气污染防治法》没有明确授予任何部委召回不达标车辆的权力。这限制了环保部实施新车认证和COP的力度（详见表5.2）。《大气法》也没有明确指出由哪个部门来对不达标车辆和行为进行罚款。另外，《大气污染防治法》允许省级和自治区环保局随机挑选车辆进行在用车测试（如进行道边测试），但却没有明确赋予环保部这项权力。由于在执行在用车测试，对生产不达标车辆的生产企业进行罚款或要求生产企业召回不达标车辆方面缺乏明确的法律授权，环保部对车辆达标管理的执法力度很弱，阻止不达标车辆生产的手段也很有限。环保部已经提出了《大气污染防治法》修订意见，要求《大气污染防治法》授于环保部实施车辆召回的权力。

技术能力和检测能力

EPA自身具有良好的技术人员和检测设备及能力来有效实施车辆排放标准：

位于安娜堡的国家车辆与燃料排放实验室成立于1971年，有约400名员工，负责执行车辆和发动机的核实检测和在用测试。环保局还利用位于马里兰州奥伯丁地区的国防部检测中心来进行重型车和非道路发动机的在用测试。

Currently 345 local EPBs have established I/M programs, 50 of them conduct loaded tests (ASM or IM240). VECC suspects that nationwide, about 10-15% of vehicles did not pass the first I/M inspection, but there is no data on how many vehicles are being tested every year.

Results and costs of China's enforcement program

Results from the small number of in-use testing conducted to date suggest that there are vehicles on the road that were not built as certified (missing catalysts), with poor durability (emissions exceeding standards before reaching durability mileage), or emit more pollutants than they are supposed to be (China III trucks emitting more than those meeting China II). There are also some anecdotal evidences suggesting that some vehicles designed to have two sensors, one for monitoring engine out emissions and another for monitoring post-treatment emissions, are produced with only one sensor installed to monitor engine out emissions.

These problems could be due to poor vehicle design (not identified during type approval), conformity of production non-compliance, off-cycle emissions that were not identified and corrected through the existing enforcement and compliance program, or durability of emissions control devices. Pinning down the source of the problem will require further case-by-case investigations, and in some cases that might not even be possible because of confounding factors. Nevertheless, these findings clearly indicates MEP's existing activities to enforce new vehicle certification and COP requirements are not sufficient nor effective in guaranteeing vehicles produced actually meet the emissions requirement they are supposed to meet.

Resources for running the vehicle enforcement program

There are 15 staff in MEP/VECC working full-time or part-time on certification (type approval) and COP.

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

Political / policy issues

The CAA authorizes EPA to regulate all engines and vehicles that emit pollutants to the atmosphere and to require manufacturers to, at the manufacturers' cost, recall and fix any vehicle and engine not meeting the standards in actual use even though they are properly maintained and used.

The "Air Pollution Prevention and Control Law" does not explicitly confer the authority to recall vehicles that do not meet emission standards to any ministry. This limits MEP's enforcement efforts to focus on new vehicle certification and COP (see Table 5.2). The law also does not clearly specify which ministry has the authority to impose fines when noncompliant vehicles or processes are found. Further, the "Air Pollution Prevention and Control Law" allows provincial and municipal level EPBs to randomly select vehicles for in-use testing (like conducting road-side tests), but does not explicitly grant MEP such authority. Lacking clear authority to conduct in-use testing, to assess penalty on manufacturers producing non-conforming vehicles or to require manufacturers to recall non-compliant vehicles, MEP has weak enforcement power and limited means to deter production of sub-standard vehicles. MEP has recommended a revision of the "Air Pollution Prevention and Control Law" to provide MEP the authority to conduct vehicle recall.

Technical capacity and testing capability

EPA has established good in-house technical capacity and testing capability to effectively enforce vehicle emission standards:

With about 400 staff, the National Vehicle and Fuel Emission Laboratory in Ann Arbor was established in 1971 to perform conformity testing and in-use testing of vehicles and engines. The agency also uses the Department of Defense Aberdeen Test Center in Maryland to conduct in-use testing of HDVs and non-road engines.

EPA的达标与创新战略处共有7名全职员工，4名合约制员工以及一个外部委托团队来支持轻型车排放标准的实施。这还不包括负责重型车和非道路机械设备标准实施的工作人员。

环保部则恰恰相反，其自身的技术人员、检测设备和能力非常有限。目前在环保部和VECC共有15名工作人员全职和兼职负责型式核准和COP工作，负责审核车厂委托进行型式核准测试实验室所提交的检测报告和检查认证实验室，环保部/VECC缺乏有丰富检测经验的技术人员，且没有独立的检测机构（甚至没有在执行认证测试时要求使用的标准燃料）。型式核准试验缺乏有效的监管，但COP抽查时，对检测全过程采取严格的监督，数据可靠公正。技术人员和检测设备、能力的不足严重影响环保部查处认证或导致量产过程中的作弊现象。环保部／VECC正在与厦门市政府合作建立一间独立的检测实验室，将于2010年冬季开始使用。环保部可以利用这样的独立实验室来执行核实测试或其它必要的排放测试。拥有新的检测实验室将是加强环保部检测能力的第一步。

表5.3.: 中美车辆检测和达标管理资源配置情况

国家和机构	中国环保部/VECC		美国EPA	
	员工	合约服务	员工	合约服务 (每年)
车辆检测和达标管理的资源配置情况	15名 (认证和COP)	——	7名全职员工 4名合约制员工	每年680万人民币以上

财政资源

相比以上列出的EPA的人员和实验室资源，环保部在车辆管理方面的财政资源投入也难以应对新车生产量。环保部在机动车管理方面的预算在未来几年内不会增加，这就意味着要集中力量开展回报最高的行动来加强车辆管理, 并从管理对象那里设法获得新的财政支持。

EPA's Compliance and Innovative Strategies Division has seven full-time-equivalent staff, four grantees and a team of outside contractor for the light vehicle division to enforce the vehicle emissions standards. This does not include staff responsible for heavy-duty and non-road engine and vehicle enforcement.

MEP, on the contrary, has very limited in-house technical capacity and testing capability. While there are 15 staff in MEP and VECC working part-time and full-time on type approval and COP, to verify and audit type approval testing reports supplied by laboratories contracted by the industry and inspect certified labs, MEP/VECC lacks staff with extensive expertise on testing and do not have access to independent testing facilities (not even the standard fuels needed to perform certification testing). Right now, there is not sufficient oversight on the type approval process, but when conducting random checks for COP compliance, MEP closely moinitors the entire process to ensure the data collected are fair and reliable. The limited technical capacity and testing capability severely impede MEP's efforts to identify cheating during certification or mass production. MEP/VECC is collaborating with the Xiamen city government to establish an independent testing laboratory that will open in the summer of 2010. MEP can use as an independent laboratory to conduct confirmatory tests or other tests as needed. Access to the new testing laboratory will be a first step of enhancing MEP's testing capability.

Table 5.3: Resources for conducting vehicle inspection and compliance in China and US

COUNTRY AND AGENCY	CHINA MEP/VECC		US EPA	
	STAFF	CONTRACTOR SERVICES	STAFF	CONTRACTOR SERVICES (PER YEAR)
Resources for conducting vehicle inspection and compliance	15 (certification and COP)	——	7 full-time-equivalent staff, 4 grantees	Over 6.8 million RMB per year

Financial resources

Compared to the size of enforcement staff and laboratory resources that EPA has at disposal, resources MEP spent on vehicle enforcement program are substantially smaller for an equivalent new vehicle production volume. MEP's budget for vehicle enforcement is not expected to increase in the near future, meaning that any enhancement of the program would have to focus on enforcement activities with the highest return and be associated with innovative fundraising from regulated parties.

表5.4: 中美车辆达标管理和实施方案对比

交通部门				生产前		生产中		生产后
				认证	核实测试	生产线测试	选择性达标审核/生产一致性	在用车召回
道路	轻型 (LD)	乘用车、皮卡、SUV	中国	✓			✓ 13款轻型和重型车进行测试	
			美国	✓	✓ 15%进行测试			-EPA测试150辆车，生产企业测试2000辆车
		摩托车	中国	✓			✓	
			美国	✓				
	重型 (HD)	卡车和巴士	中国	✓			✓13款轻型和重型车进行测试	
			美国	✓				- EPA测试54款车型，生产企业最多测试发动机系族的25%
非道路	花园、农用、建筑用设备、火车和船舶		中国	✓				
			美国	✓	✓ EPA 测试 15台发动机	✓ EPA测试 72 台发动机		✓

Table 5.4: Comparison of the vehicle compliance and enforcement program in China and the US

INDUSTRY SECTOR				PRE-PRODUCTION		PRODUCTION			POST-PRODUCTION
				CERTIFI-CATION	CONFIRMATORY TESTING	PRODUCTION LINE TESTING	SELECTIVE ENFORCEMENT AUDIT/CONFORMITY OF PRODUCTION		IN-USE/RECALL
On-road	Light-duty (LD)	Cars, pickup trucks & SUVs	China	✓			✓ 13 LD & HD models tested		
			US	✓	✓ 15% tested				✓ EPA tested 150 vehicles; manufacturers tested 2000
		Motor-cycles	China	✓			✓		
			US	✓					
	Heavy-duty (HD)	Trucks & buses	China	✓			✓ 13 LD & HD models tested		
			US	✓					✓ EPA tested 54 models; mfrs tested up to 25% of engine families
Non-road	Garden, farm, construction equipment, locomotive and marine vessels		China	✓					
			US	✓	✓ EPA tested 15 engines	✓ EPA tested 72 engines			✓

5.4 建议

有限的在用车测试结果和一些非官方证据显示中国存在生产和使用不达标车辆的情况，并且现有的管理方案不能有效阻止不达标车辆的生产和销售。与美国的车辆达标管理方案相比，很明显中国方案在一些重点领域有待提高。扩大授权范围和额外的资金是实现这一目标的关键，应尽快予以落实。同时，环保部应评估现有方案，找出成本效益最佳的改善途径，提高自身技术能力和检测能力，配备充足的人员建立实施在用车检测方案。在用符合性和强制检测是成熟车辆管理实施方案的奠基石。实施有效的在用车检测方案（以生产企业自检为主，环保部给予支持）应当是环保部的长期目标。

环保部已经采取了一些措施来应对以上部分需求，包括与美国EPA合作开展在用车召回培训，与厦门市政府合作建立新的检测实验室。对环保部建立强效车辆管理方案的具体建议如下：

- *争取通过修订《大气污染防治法》给予环保部明确授权对生产企业进行在用车测试和对不达标行为予以处罚（包括车辆召回）：*有效的在用车管理实施方案能够从实质上确保车辆在使用寿命周期满足所有相关排放标准的要求。根据美国EPA的经验，不达标的高额处罚，无论是召回的成本或暂停未通过SEA的车型的生产和销售带来的经济损失，都是成功地实施方案的关键因素。高额的经济处罚还是推动生产企业提高产品质量、改善新车设计和不断提高车辆及排放控制装置耐久性的重要助推因素。因此，环保部应争取尽早获得授权，要求生产企业执行在用车测试并征收罚款。一旦环保部获得了车辆召回权，接下来应该重新审阅与召回有关的法律法规并作出必要修订，确保不会与环保部的新权力产生冲突。例如，环保部已经对2004年颁布的《汽车缺陷产品召回管理规定》进行修订并发表征求意见，现正在研究已收到的意见。

- *建立在用车测试和召回方案：*如果只有有限的启动资金，可以将方案的最初的重点放在分析从生产企业、研究机构和I/M实施中获得在用车数据上，通过分析这些数据来确认少数高排放车型，要求对这些车型进行在用符合性测试并要求生产企业在必要时实施召回。

- *从对车主征收的排放收费/车辆税或通过提高对车辆/发动机生产企业的认证申请收费来获得更多的资金：*如果没有额外的资金，要环保部持续改进车辆管理方案会很困难，因此增加资金储备是环保部近期的重要任务。目前，生产企业向检测实验室支付认证测试服务费用，但是环保部没有收取任何费用来支付达标管理成本（审核认证符合性报告、执行实验室检查、COP检测或在用车测试）。美国的《清洁空气法》允许EPA向生产企业收费以填补管理方案的实施开销[65]。这样做的理论依据是EPA的达标管理支出是为了保障在美国销售的车辆能够满足所有法律规定的相关要求。环保部可以考虑使用同样的理论依据征收认证费或排放费税来支付车辆管理方案的实施成本。

65 《清洁空气法》和《联邦管理条例40 》86.905-93中规定，EPA可以向生产企业合理收费，用以支付机动车和发动机达标管理方案的实施成本(详见Reitz, R. W的论述，2001年，空气污染控制法：达标与实施，环境法学会 p285)。这样EPA就可以向生产企业收取认证费，来支付实施SEA和在用车达标检测的费用，因以上两部分也属于达标管理方案范畴。

5.4 Recommendations

Results of limited in-use testing and anecdotal evidence suggest that sub-standard vehicles are produced and used in China and that the existing enforcement programs have not been sufficient in deterring production and sales of non-conforming vehicles. Compared to the US vehicle enforcement and compliance program, the China program clearly needs enhancements in several key areas. Expanded authority and additional funding will be critical to achieve this goal and should be pursued as early as possible. In the meantime, MEP should review its current programs, find cost effective ways to improve them, enhance its technical capacity and testing capability, and prepare its staff for the establishment an in-use testing program. In-use compliance and enforcement testing is the cornerstone of mature vehicle enforcement programs. Establishing an effective in-use testing program (conducted mainly by manufacturers and supported by MEP) should be the ministry's long-term goal.

MEP is already taking steps in the right direction to address some of these needs, including collaborating on training programs with US EPA on in-use recall, and working with the Xiamen city government to establish a new testing laboratory. A more detailed discussion of the overall recommendations to MEP for the establishment a strong vehicle enforcement program follows:

▪ *Seek modifications to the "Air Pollution Prevention and Control Law" to give MEP clear authority to require manufacturers to conduct in-use testing and impose penalties for non-compliance (including the authority to recall vehicles):* An effective in-use enforcement program is essential to ensure vehicles meet all applicable emission standards throughout their useful life. Large non-compliance penalties, either from the costs for recall or from the costs of stopping production and sale of models that fail a SEA, are a key element of a successful enforcement program, as evidenced by the US experience. Large penalties are also a key driver forcing manufacturers to improve production quality and design of new vehicles and continuously enhance durability of vehicles and emission control devices. Therefore MEP should, as early as possible, seek the authority to require manufacturers to conduct in-use testing and to impose punitive penalty. When MEP is granted the authority to recall vehicles, a follow-up step would be to review, and revise as necessary, all existing recall-related laws or regulations to ensure no conflict with MEP's new authority. For instance, MEP has just revised and released the "Defective Automotive Products Recall Management Regulation" issued in 2004 for public comments and is now reviewing all the submitted comments.

▪ *Establish an in-use testing and recall program:* If only limited initial funding is available, the program should focus initially on analyzing in-use data provided by manufacturers, research institutes and I/M programs to identify the small number of high polluting models for in-use compliance testing, and request manufacturers to recall if appropriate.

▪ *Raise funds from emissions fee/vehicle taxes on vehicle owners or increased certification application fees for vehicle/engine manufacturers:* It would be difficult for MEP to substantially upgrade its vehicle enforcement program without additional funding, so raising funds would be an important near term task. Right now, manufacturers pay a fee for certification testing to the testing labs for the services they perform, but no fee is paid to MEP to cover the cost of the compliance program (auditing compliance reports, conducting lab inspection, COP testing, or in-use testing). In the US, the "Clean Air Act grants" EPA the ability to recoup costs for its enforcement program by imposing a fee on manufacturers[65]. The rationale is that the costs of EPA's compliance efforts are incurred to ensure that vehicles sold in the US meet all the necessary requirements under the law. MEP could consider using a similar rationale to collect certification fees or set emissions fees/taxes to cover the cost of running the vehicle enforcement programs.

65 Under the CAA and the regulation 40 CFR 86.905-93, EPA can recoup the reasonable costs of running the motor vehicle and engine compliance program from manufacturers (see discussion in Reitz, R. W. 2001. "Air Pollution Control Law": Compliance and Enforcement. The Environmental Law Institute. p. 285). EPA therefore could impose a post-certification fee on manufacturers to cover the costs for conducting SEA and in-use compliance testing as they are considered part of the compliance program.

▪ *环保部要争取获得授权，让他可以要求车辆和发动机生产企业按照环保部的设定要求执行在用车测试，并将原始数据结果提供给环保部，以便数据可能用于达标管理方案当中：*充足及优质的在用车数据对环保部十分重要，可以借此发现不达标问题的源头并适当修订管理方案以应对这些挑战。中国车辆年产量超过1300万辆但环保部目前的技术能力还十分有限，因此环保部不可能自己执行在用车测试来获得大量有关数据。环保部应利用汽车企业的资源收集在用车测试数据，而环保部自身的人员资源应去执行更有针对性的在用车测试，监察汽车企业的在用车数据收集过程。环保部应通过修订《大气污染防治法》来获得授权，让其可以要求生产企业支付在用车测试费用。

环保部在寻求更多的资源来提高自身的技术水平的同时，还应开始筹备为在用车测试和召回方案培训和配备自己的团队：

▪ *通过与EPA和其它机构合作开展培训，增强内部人员的召回业务和管理水平：*由于目前还没有权限，环保部没有执行召回的经验。环保部正在与EPA合作开展关于召回管理的培训项目，将在2010年底或2011年初进行。这样的培训项目将协助环保部开始着手策划和制订适合中国特殊需求的召回方案。

随着环保部已经在着手提升自己的权威地位和增加实施在用车测试的资源，现行管理方案中存在的一些明显不足有待在近期内以较低成本妥善解决：

▪ *提高环保部的技术能力和检测能力，确保良好地执行认证测试和企业出资实施的COP检测：*一些非官方的证据表明当前的管理实施方案不能有效遏制企业生产不达标车辆。在近期，增加在改善认证实施方案和COP检测方面的资源投入可能是环保部最具有成本效益的选择。例如，在认证测试中，应要求实验单位把无论是通过、失败或测试无效的数据都报告给VECC。另外，环保部应建设自主检测能力，在厦门建立实验室就是朝正确方向迈出的第一步。这些改进对一个切实有效的方案而言是不可或缺的。提高环保部的实施力度，结合罚款权，将能阻止生产企业制造排放大幅超标的新车。提高环保部的检测能力对实施召回方案也很重要，生产企业是愿意召回或是向环保部质疑召回的要求都取决于环保部的测试质量水平。

▪ *在主要城市制订良好的I/M实施方案作为查找和消除高排放车辆的途径之一，并提供宏观层面的数据，协助环保部更有效发现高排放车型来进行在用符合性检测：*环保部可以制订一套I/M最佳实施方案，经济条件较好或机动车排放问题严重的主要城市的环保局可以通过此方案来逐步提高他们现有的I/M方案。I/M方案的效果只有在高排放车辆接受维修或置换以后才能显现出来，环保部应考虑创立一项基金来负担高排放车辆的维修或报废费用，或许可以作为目前国家报废方案的一个延展。

▪ *利用研究机构如高校和其他研究院的技术专长：*环保部应充分利用已完成的或正在进行的研究机构的研究工作来有针对性地制定工作目标，实现对管理方案的升级改善。一些研究机构，如清华大学、北京理工大学和中国环境科学研究院都使用PEMS测量过在用车排放，这些研究结果现在和今后都具有重大价值，能够协助环保部发现问题（高排放车型或高排放车辆潜在的缺陷），并引导环保部将资源投入到更有效的领域。

▪ *寻找其它方法强制生产企业遵守排放标准 (例如通过“点名曝光”活动，公开不达标车型或生产企业)：*随着中国汽车市场竞争日趋激烈，车辆生产企业，特别是乘用车企业越发意识到品牌的价值。环保部可以考虑公开查出的违反标准的生产企业或车型作为对其违规的处罚。

从长期措施而言，一旦更多的经费有所保障，环保部应当考虑下列内容：

▪ *首先增大对在用车测试的投入，覆盖大量高排放车型：*当不需要再和现在一样重点考虑新车达标问题的时候，可以将资源逐步从新车认证和COP方面转向在用符合性管理。

▪ *确定长期的资金来源，支持车辆达标管理成果：*如本章所述，过去10年中车辆保有量的急剧增长需要不断改进车辆管理实施方案来应对大量的车辆排放问题。中国机动车市场还将持续增长。寻找长期稳定的资金来源来改善和扩展排放控制工作，应对不断上升的实施管理需求，对环保部来说十分关键。

▪ *Seek authority MEP to require vehicle and engine manufacturers to carry out in-use testing of vehicles and engines using protocols established by MEP and to provide the raw data results to MEP for possible use in its compliance program:* Sufficient, good quality in-use data are essential for MEP to identify the roots of the non-compliance problems and to be capable to tailor improvements of the enforcement program to address those challenges. With China's annual vehicle production exceeding 13 million units and MEP having severely limited technical capacity, it will be impossible for MEP to conduct in-use testing to obtain sufficient representative data. MEP should leverage the industry's resources to collect in-use testing data, and use its staff resources to conduct more targeted in-use testing as well as to provide oversight to industry in-use data collection efforts. MEP should seek through the revision of the Air Pollution Prevention and Control Law the authority to require manufacturer-funded in-use testing.

While MEP pursues additional resources to enhance its own technical expertise, the ministry should start train and equip its team in preparation for setting up an in-use testing and recall program:

▪ *Increase in-house proficiency in recall program administration through MEP training collaborations with the EPA or other regulatory agencies:* Limited by the authority it currently possesses, MEP has no experience in conducting a recall program. MEP is coordinating a training program with EPA around the recall program that would be held in late 2010/early 2011. Training programs such as this one will help MEP start planning and developing a recall program that suits China's specific needs.

As progress is made to increase MEP's authority and resources to conduct in-use testing, there are significant gaps in the current program that can be remedied in the near term and cost effectively:

▪ *Increase MEP's technical capacity and testing capability to ensure certification tests and industry-funded COP testing are being done properly:* Anecdotal evidence shows that the current enforcement program has not successfully deterred production of sub-standard vehicles. In the near term, it might be most cost effective for MEP to increase resources on improving the enforcement of certification and COP testing. For instance, laboratories conducting certification testing should be required to report all certification test data to VECC – passing, failing, and voided tests. Also, MEP should establish its own testing capability and the establishment of the testing laboratory in Xiamen is a first step in the right direction. These improvements are essential for an effective program. Increasing MEP's enforcement presence, combined with MEP having the authority to impose fines, could prevent manufacturers from producing new vehicles with grossly excessive emissions. Establishing MEP's testing capacity is also essential for developing a recall program as manufacturers' acceptance of vehicle recalls – or likelihood to challenge–depends on the quality of MEP's testing.

▪ *Establish good I/M programs in major cities as a way to identify and eliminate gross emitters and provide macro level data to help MEP better target high-emission models for in-use compliance testing:* MEP could develop a set of I/M best practices that could be used to assist those major cities whose EPBs have better financial resources or major vehicle emission problems to gradually enhance their existing I/M programs. Since emissions reductions of I/M programs can only be realized if gross emitters are repaired or replaced, MEP should consider creating a fund to cover repairs or scrappage of gross emitters perhaps as an extension or variation of the existing national scrappage program.

▪ *Leverage technical expertise in existing research institutions such as universities and other research institutes:* The ministry should fully utilize research done or being conducted by research institutions to help target efforts in enhancing the compliance program. Research institutes such as Tsinghua University, Beijing Institute of Technology and CRAES have been using PEMs to examine in-use vehicle emissions, and those findings have been and will continue to be very valuable in helping MEP identify problems (models or vehicle types with excessive emissions or possible defects of high emitters), and direct its resources to areas where they could be more effective.

▪ *Pursue other measures to coerce manufacturers to comply with emissions standards (e.g., a "name and shame" campaign to publicize non-compliant models and/or manufacturers):* As the China auto market becomes increasingly competitive, vehicles manufacturers, especially those producing passenger vehicles, are increasingly aware of the brand values. MEP could consider ways to publicize manufacturers or models that are found to not be compliant with the standards, to complement non-compliance penalties.

In the longer-term, once additional funding is secured, MEP should consider the following:

▪ *Expand resources allocated to in-use testing should be expanded first to cover a larger number of high-polluting models:* When new vehicle compliance becomes less of a concern than it is today, resources could be gradually shifted away from new vehicle certification and COP to the in-use compliance program.

▪ *Identify a long-term sustained resource stream to finance vehicle compliance efforts:* The spiraling growth of vehicle population in the past decade or so demands substantial enhancements of the vehicle enforcement program to match the magnitude of the vehicular emission problems as discussed in this chapter. China's vehicle market is projected to see continued growth. It would be critical for MEP to seek long-term sustainable funding to improve and expand its emission control efforts to match the rising enforcement needs.