

环境保护部机动车排污监控中心
国际清洁交通委员会

重型车达标管理国际研讨会

Vehicle Emission Control Center, Ministry of Environmental Protection, China
and
The International Council on Clean Transportation

Heavy-duty Vehicle Emissions Compliance Workshop
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加州重型车排放控制管理方案

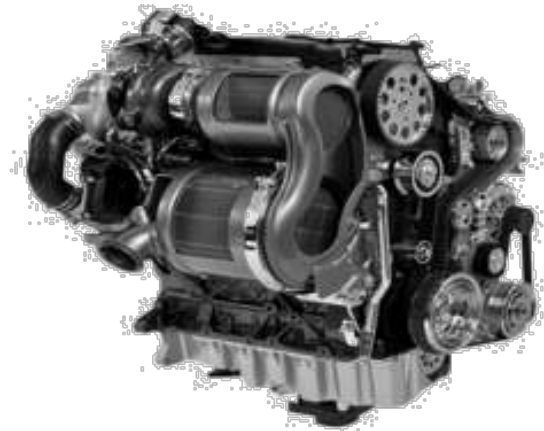
California's Heavy-duty Vehicle Emission Control Program

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重型车排放控制的三个关键政策导向

Three key policy drivers for HDV emission control



- 区域空气质量- 需要减少排放从而满足臭氧和颗粒物环境空气质量标准
- 1998年将柴油车颗粒物认定为致癌物-需要减低暴露于柴油车尾气排放的风险
- 全球气候变化-为了实现2030到2050年的气候目标，需要减少温室气体
- Regional air quality - need to reduce emissions for attainment of ozone and PM ambient air quality standards
- 1998 identification of diesel PM as a carcinogen - need to mitigate risk of exposure to diesel exhaust
- Global climate change - need to reduce greenhouse emissions for achieving 2030 and 2050 climate goals

Evolution of California's programs

加州政策的演变

1980s: 重点是乘用车 1980s: Focus on Passenger Vehicles	1990s: 重点是卡车、更清洁的乘用车和非道路发动机 1990s: Focus on Trucks, Cleaner Passenger Vehicles, Off-Road Engines	2000s: 重点是老旧车辆和新一代乘用车 2000s: Focus on Legacy Fleets and Next Generation Passenger Vehicles
尾气排放标准 Tail pipe standards	重型柴油车标准 Heavy-duty diesel truck standards	港口和船舶机械 Ports and freight handling equipment
烟度检测 Smog Check	清洁柴油燃料 Clean diesel fuels	对卡车和巴士进行改造/置换 Retrofit/replace trucks and buses
车载诊断系统 OBD	低排放车辆、清洁燃料和新配方汽油 Low-emission vehicles and clean fuels and reformulated gas	电动混合动力和插电式混合动力 Low-emission vehicles and clean fuels and reformulated gas
柴油燃料规格 Diesel fuel specifications	小型非道路设备 Small off-road equipment	海洋船舶 Marine vessels
	其他产品 Consumer products	非道路设备改造/置换 Retrofit/replace off-road equipment

以往获得成功的关键

Keys to Past Success

- 清晰明确的管理政策
 - 更加清洁的传统和替代燃料
 - 不断加严的新车排放标准
 - 可行的技术解决方案
 - 先进的后处理技术
 - 改善发动机燃烧
 - 对现有老旧车辆的策略
 - 在用车控制管理方案
 - 政府投入的财税刺激
 - 严格的执行和达标管理
- Clear and direct policy
 - Cleaner burning conventional and alternative fuels
 - Increasingly stringent new emissions standards
 - Available technological solutions
 - Advanced aftertreatment technologies
 - Improved engine combustion
 - Strategy for existing legacy fleet
 - In-use control programs
 - Public investment in monetary incentives
 - Strict enforcement and compliance

重型车排放标准：在过去20年中减排幅度超过 90%

Heavy-Duty Emissions Standards: over 90% reduction in emissions in 20 years

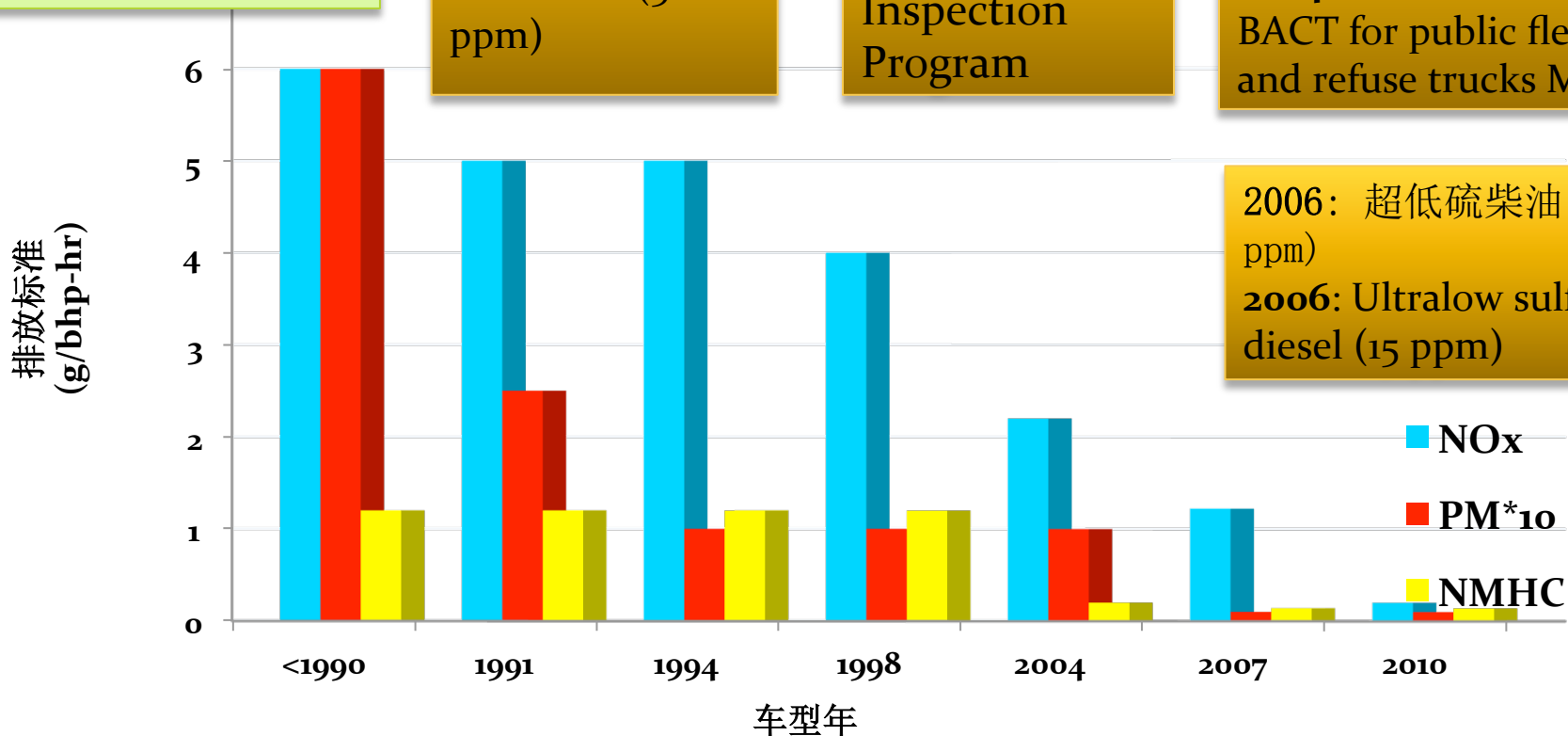
1973: 首次实施排放标准（颗粒物标准是1988年）
1973: First emission standard (1988 for PM)

1993: 低硫柴油燃料 (500 ppm)
1993: Low sulfur diesel fuel (500 ppm)

1998: 定期烟度检测方案
1998: Periodic Smoke Inspection Program

2004-2011: 对1960-2006车型年的公交车和垃圾车进行改造
2004-2011: Retrofits to BACT for public fleets and refuse trucks MY

2006: 超低硫柴油 (15 ppm)
2006: Ultralow sulfur diesel (15 ppm)



美国在用车达标管理进程

Historical Perspective on In Use Compliance in the US

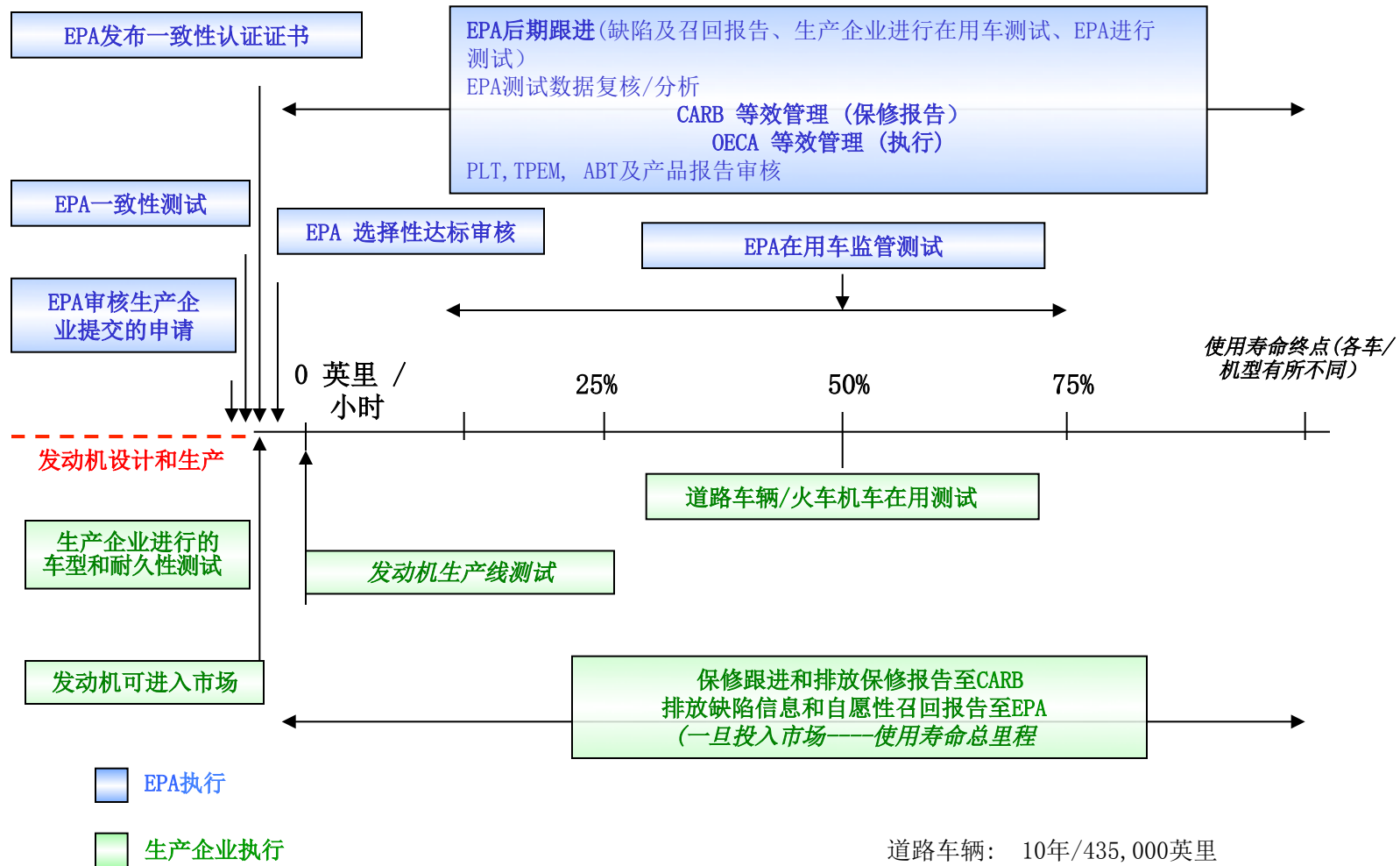
- 在开展在用车达标管理的最初15年中：
 - 1/3的车辆被召回
 - 大部分召回是EPA直接实施的
 - 排放标准不断加严
 - 各项技术处于开发初期
 - 耐久性/可靠性不佳
- 80年后后期以后：
 - 召回过大约10%的车辆
 - 现在大部分都是自愿性召回
 - 标准趋于稳定，技术也更完善（燃油喷射、反馈控制、三元催化、电控等）
 - 车辆更加可靠，OBD系统会提前预警
- First 15 years of in-use compliance:
 - 1/3 of the fleet recalled.
 - Most recalls result of direct EPA action.
 - Standards increasingly more stringent.
 - Technology in early development.
 - Durability/reliability was not good.
- Since the late 1980s:
 - Recalls approximately 10% of the fleet.
 - Mostly voluntary recall today.
 - Standards more stable, and technology more perfected (fuel injection, feedback control, three-way catalysts, electronic controls, ...)
 - Vehicles more reliable, and early warnings with OBD systems.

由于使用作弊装置违反清洁空气相关法规，柴油发动机行业损失超过10亿美元

Using Defeat Devices Costs Diesel Engine Industry \$1 Billion + for Clean Air Violations

- 作弊装置可以让发动机通过EPA排放认证，但在实际使用过程中，排放控制系统并不起作用。
- 现在，EPA会利用PEMS定期对在用重型车和非道路发动机进行测试。PEMS系统能够在实际使用条件下测量实时排放。
- The defeat devices allowed engines to meet EPA emission standards during standardized testing but disable the emission control system during normal highway driving.
- EPA now routinely tests in-use heavy-duty highway and non-road engines using portable emissions measurement systems (PEMS). These systems can measure emissions in real time, under the same conditions that vehicles or equipment might experience in actual service.

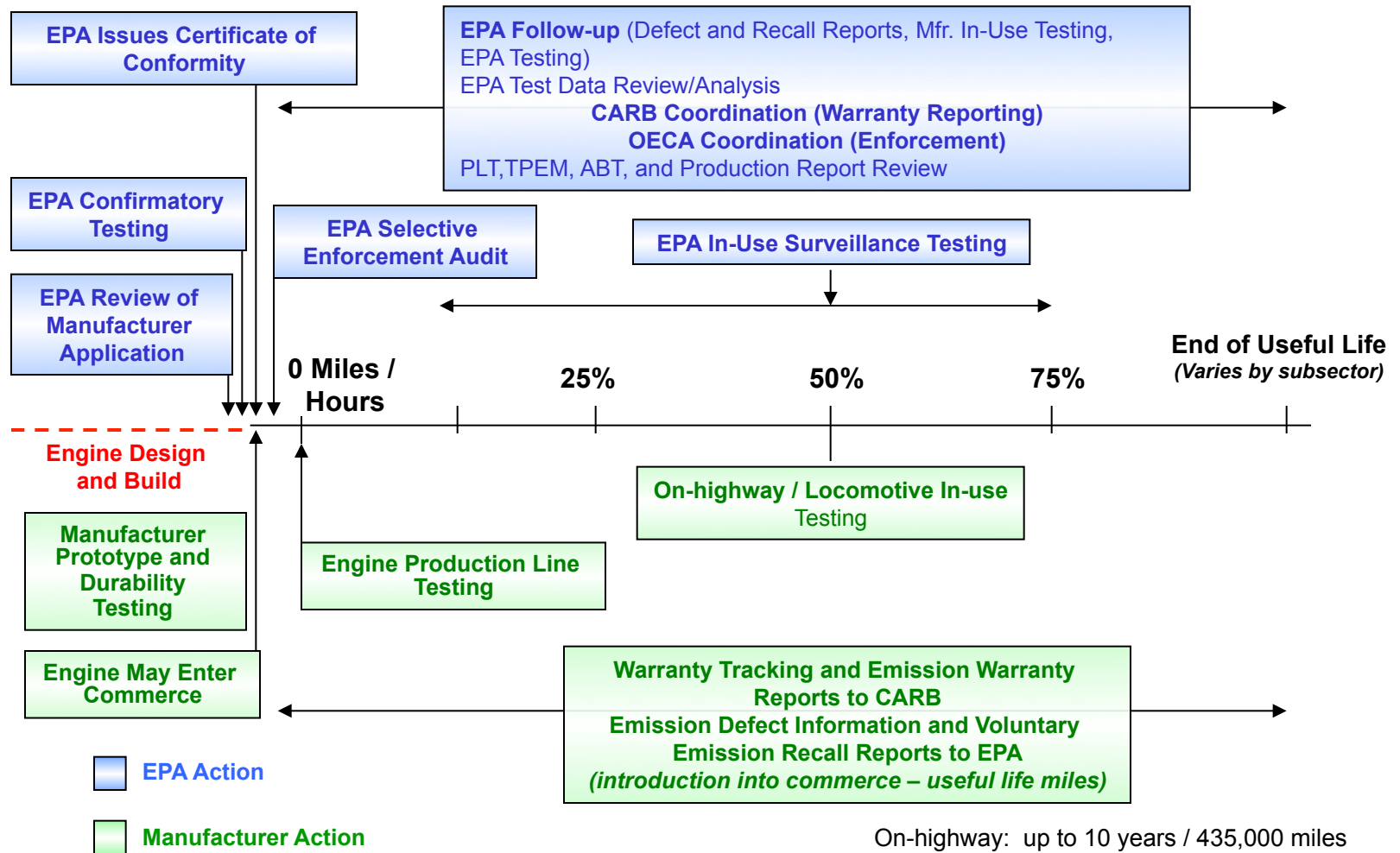
成熟的达标管理方案



使用寿命周期:

道路车辆: 10年/435,000英里
 非道路: 10年/8000小时
 船舶: 10年或20,000
 火车: 10年/32,000MW-小时

Mature Compliance Program



Full Useful Life:

- On-highway: up to 10 years / 435,000 miles
- Nonroad: up to 10 years / 8,000 hours
- Marine: up to 10 years / 20,000 hours
- Locomotive: up to 10 years / 32,000 MW-hours

目前的管理

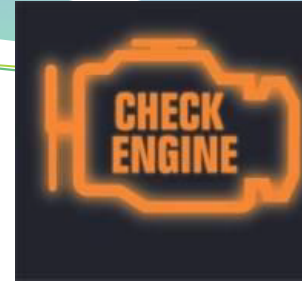
Current Regulations

- 加州正在快速过渡至符合2010标准和后处理控制要求的车队
- 卡车和巴士管理
 - 2012-2023年期间逐步实施
- 拖运卡车（港口、月台）管理规定
- 冷藏运输车
- 减少怠速计划
- California is rapidly transitioning to a 2010 compliant, aftertreatment controlled fleet
- Truck and Bus Regulation
 - Phase in 2012-2023
- Drayage (Port, Railyard) Trucks Rule
- Transportation Refrigeration Unit (TRU or Reefer)
- Idling Reduction Program

更多信息详见：http://www.arb.ca.gov/diesel_truck



车载诊断(OBD)



- OBD系统
 - 发动机和排放控制系统中的传感器
 - 发动机电脑软件
 - 在检测到故障时开启“检查发动机”提示灯
 - 为技术人员提供标准化信息，协助进行车辆维修
- 要求道路重型发动机安装OBD
 - 从2010车型年开始逐步实施
 - 要求2013车型年以后全部安装
- 对OBD实施多方面强制管理要求
- OBD systems
 - Sensors throughout engine and emission control system
 - Software in engine computer
 - Illuminates ‘check engine light’ when fault is detected
 - Standardized information for repair technician to help fix vehicle
- Required in on-road heavy-duty engines
 - Phase-in started in 2010MY
 - Required on all 2013+MY
- Extensive enforcement of OBD requirements

合规监管的作用

Role of Regulation Enforcement

- 提供相应机制确保切实减排
- 对不达标行为起到威慑作用
- 确保公平竞争机制
- 处罚措施是确保实现上述目标的手段
- Provides mechanism to ensure emission reductions are achieved
- Creates deterrence against non-compliance
- Ensures level playing field amongst sources
- Penalties are a tool to achieve these goals



执行过程

Enforcement Process

- 发现
- 调查
- 处理或起诉
- 年度执行报告
- CARB大约有10%的工作人员专门从事管理执行工作（大约150人）
- Discovery
- Investigation
- Settlement or prosecution
- Annual enforcement reporting
- ~10% of CARB staff dedicated to enforcement (almost 150)



现场检查（踩点） Field Inspections ("Boots on the Ground")

卡车 Trucks



船舶 (Vessels)



火车 (Locomotives)



移动油品实验室

Mobile Fuels Laboratory



可能会导致处罚的一些问题

Issues That May Trigger Enforcement

- 未经认证的车辆和发动机
 - 由于违反加州监控与安全法规43150-43156节的规定，将被处以每车或每台发动机5000美元的罚款。
- 行政许可 (EO)
 - 在加州，在进口、销售、登记注册或使用之前需要获得行政许可
- 排放标示
 - 伪造、错误或缺失
- VIN/PIN 码错误或缺失
- 发动机/车辆与书面材料不符
- Uncertified vehicles and engines
 - Maximum \$5000 penalty per violation (per vehicle or engine) of California Health and Safety Code, Sections 43150-43156
- Executive Orders (EO)
 - Valid EO is required prior to importation, offering for sale, selling, registration, or use in California
- Emission label
 - Fraudulent, incorrect, or missing
- Incorrect or missing VIN/PIN numbers
- Inconsistencies in documentation for engine/vehicle

检测与维修 (I/M)

Inspection and Maintenance



- 两项在用车检测
 - 定期烟度检测 (PSIP)
 - 重型车检测 (HDVIP)
- 不透光标准
 - 1991年以后的发动机：40%
 - 1991年以前的发动机：55%
 - 但带有DPF的卡车更为清洁
- 更严格的不透光限值
- 更严格的I/M管理要求
 - 检查维修记录
 - 要求在车辆登记时进行
 - 更多的依靠OBD系统
- Two in-use fleet maintenance programs
 - Periodic Smoke Inspection Program (PSIP)
 - Heavy Duty Vehicle Inspection Program (HDVIP)
- Opacity Standards
 - 1991 or newer engines: 40%
 - Pre-1991 engines: 55%
 - But trucks with DPF much cleaner
- Lower opacity limit
- More robust I/M program
 - Inspection of maintenance records
 - Inspection requirement for vehicle registration
 - Greater reliance on On-Board Diagnostic (OBD) system

SAE J1667 急加速烟度测试

SAE J1667 Snap-Acceleration Test



向1-800报告黑烟车

**REPORT SMOKING VEHICLES TO
1-800-END-SMOG**





重型车管理方案 (2013)

HEAVY-DUTY VEHICLE PROGRAM (2013)

- 进行了将近3万次实地检测
- 引证将近3300次
- 总共收取罚款140万美元
- 开展1100次以上的调查, 共计花费200万美元以上
- Conducted nearly 30,000 field inspections
- Issued almost 3,300 citations
- Collected \$1.4 million in total penalties
- Closed more than 1,100 investigations for more than \$2 million in total

其他管理方案 (2013)

OTHER PROGRAMS (2013)

- 完结（处理或起诉）船舶相关案例71个，罚金总计超过100万美元。
 - 完结轻型车相关案例26个，罚金总计超过330万美元。
 - 完结燃油相关案例5个，罚金总计约50万美元。
 - 完结发动机及零部件相关案例56个，罚金总计超过200万美元。
 - 完结消费品相关案例63个，罚金共计超过150万美元。
- Closed (settled or litigated) 71 marine cases for more than \$1 million in total fines
 - Closed 26 light-duty vehicle cases for more than \$3.3 million in total
 - Closed 5 fuels cases for almost \$500K in total
 - Closed 56 engine and parts cases for more than \$2 million in total
 - Closed 63 consumer products cases for more than \$1.5 million in total

其他重型柴油车实施方案

Other Heavy-Duty Diesel Enforcement Programs

- 发动机认证标志
- 低NO_x软件（更新发动机新片）
- 限制怠速的管理规定
- 固废回收车辆
- 年度车辆烟度排放检测 (PSIP)
- 冷藏运输车
- 公共用车
- 港口卡车
- 转运车辆
- 非道路建筑车辆
- 货物处理设备
- 海港设备和燃油
- 火车
- Engine Certification Labels
- Low NO_x Software (engine chip reflash)
- Idling Restriction Regulations
- Solid Waste Collection Vehicles
- Annual Fleet Smoke Emissions Inspections (PSIP)
- Transport Refrigeration Units
- Public and Utility Fleets
- Port Trucks
- Transit Fleets
- Off-Road Construction Vehicles
- Cargo Handling Equipment
- Marine Harbor Craft and Fuels
- Locomotives

未来的减排策略——现有的认证/在用车管理方案

Strategies for further reductions - current Certification/In-Use Programs

- 认证工况
 - 保修/耐久性
 - I/M
 - NTE排放上限
- Certification Cycles
 - Warranty/Durability
 - Inspection and Maintenance
 - Not-to-Exceed (NTE)



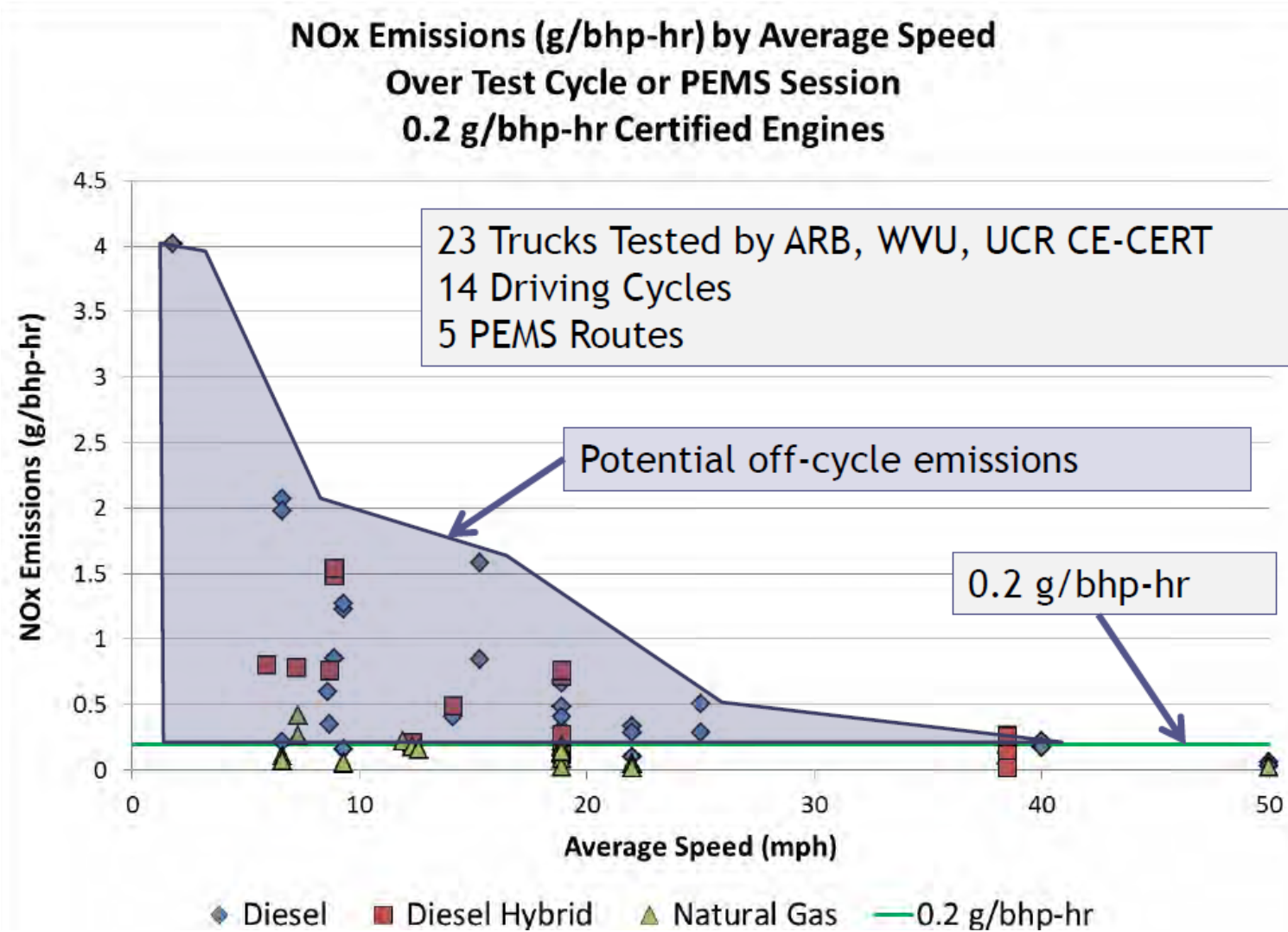
认证工况

Certification Cycles

- 认证方案基于两个工况
 - 瞬态 FTP
 - 坡度模式SET
- 未能足够地反映低负载/低温运行状态
- 开发新的或修订现有测试工况以更好地反映实际行驶排放的重视
- Certification program based on 2 cycles
 - Transient FTP
 - Ramped Mode SET
- Does not sufficiently address low load/low temperature operations
- Creation of new or revised test cycle(s) to address real world operations

工况外排放的证据

Evidence for Off-Cycle Emissions



目前的保修范围只是卡车使用寿命周期的一小部分

Warranty today is only small fraction of truck lifetime

- 使用寿命:
 - 10年; 110,000-435,000英里
- 保修期:
 - 5年, 100,000英里
- 需要延长保修
 - 很多长途运输卡车一年就能行驶约100,000英里
 - 典型的CLASS8级别卡车平均总行驶里程可达800,000英里
 - 目前保修期内返修率很高
 - EGR冷却器、喷油装置、EGR、涡轮增压器和SCR
 - 一些发动机系族返修率超过100%
 - 延长保修/耐久性周期能够鼓励生产企业开发耐久性更好的产品
- Useful Life:
 - 10 years; 110,000-435,000 miles
- Warranty Period:
 - 5 years, 100,000 miles
- Will need to be extended
 - Many line haul trucks travel about 100,000 miles per year
 - Typical Class 8 truck averages 800,000 miles over its life
 - Current warranty claim rates extremely high
 - EGR coolers, fuel injectors, EGR, turbochargers, and SCR systems
 - A number of engine families with rates exceeding 100%
 - Extending warranty/durability periods may encourage development of more durable products

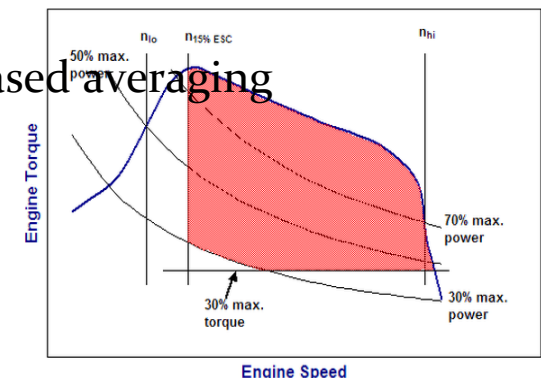
NTE要求不足以反映车辆所有运行状况

Not-to-Exceed (NTE) requirements not adequately capturing vehicle operation



- 在用车达标测试的限制
 - 低负载/低温运行工况
 - 生产企业选择运行线路和特定时间来进行测试
 - 75%-85%的数据都不在NTE控制范围
- 潜在策略
 - 降低温度和持续时间要求
 - 通过降低动力/扭矩限值拓宽NTE控制区
 - 实施路线/时间选择标准或最小化NTE数据
 - 以工作状态或CO₂为基础的平均排放窗口

- In-Use Compliance Testing Program Limitations
 - Low load/low temperature operations
 - Manufacturers select route and time of year to test
 - Typically 75%-85% of data not in NTE Control Area
- Potential Strategies
 - Lower temperature and duration requirements
 - Broaden NTE Control Area by reducing power/torque thresholds
 - Impose route/time selection criteria or minimum amount of NTE data
 - Work or CO₂ based averaging window



未来管理方案和标准

Future Regulations and Standards



- 降低Nox标准
- 2阶段温室气体排放标准
- 推动接近零排放和零排放技术方案
- Lower NOx Standard
- GHG Phase 2
- Promotion of near-zero and zero emission solutions

