# THE
# CARL MOYER PROGRAM
# 2006 STATUS REPORT


## The Carl Moyer
## Memorial Air Quality Standards
## Attainment Program

## January 2007

California Environmental Protection Agency
Air Resources Board

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## EXECUTIVE SUMMARY

The Carl Moyer Memorial Air Quality Standards Program (Carl Moyer Program) was established in 1998 as a grant program to fund the incremental cost of cleaner-than-required heavy-duty engines. The program fills a critical niche in California's strategy to attain federal air quality standards by achieving emission reductions early or in excess of what is required by regulation. By requiring that fifty percent of funds in the most populated air districts be spent in environmental justice areas and communities that experience the greatest air pollution impacts, the program also ensures that reductions occur where they're most needed. This innovative program has proven popular among a wide variety of stakeholders, including environmental groups, technology manufacturers, and the regulated community.

In its first six years, the Carl Moyer Program provided over $140 million in funding to clean up more than 6,300 heavy-duty engines. These projects have reduced smog-forming oxides of nitrogen (NOx) emissions by over 18 tons per day (tpd) and toxic particulate matter (PM) emissions by almost one tpd, with a favorable cost-effectiveness of about $2,600 per ton of NOx reduced. Over this period, the Carl Moyer Program provided significant health and welfare benefits, helping reduce lost work days by about 17,000 and prevent about 2,800 asthma attacks and 100 premature deaths.[1] This corresponds to a societal program benefit that is better than five times the cost.

The Carl Moyer Program entered a new era in its seventh year, as legislation provided a significant boost in funding through 2015 and expanded the program to include additional pollutants and source categories. This Status Report provides a detailed analysis of Years 1 through 6 of the Carl Moyer Program, describes implementation of the expanded program in Years 7 and 8, and outlines the future direction of the Carl Moyer Program and other incentive programs in California.

How does the Carl Moyer Program work?

The Carl Moyer Program is implemented as a partnership between the California Air Resources Board (ARB) and the local air quality management districts (AQMDs) and air pollution control districts (APCDs). ARB provides program oversight and minimum program requirements and the local air districts select, fund, and monitor projects. All Carl Moyer Program projects must meet the minimum program requirements as specified in state law and ARB's Carl Moyer Program Guidelines. Carl Moyer Program projects cannot exceed a cost-effectiveness cap of $14,300 per weighted ton of NOx,

[1] These numbers reflect the estimated mean cumulative benefit of Carl Moyer Program projects from 2000 to 2005. (ARB Research Division, 2006)

reactive organic gases (ROG), and PM emission reductions. To be eligible for Carl Moyer Program funding, projects must reduce emissions beyond would be achieved through normal fleet turnover or by regulation or other legal mandate (i.e. reductions must be "surplus" to what is otherwise required by law).

What types of projects are funded?

The Carl Moyer Program funds clean air projects involving a wide variety of vehicles and equipment – from small forklifts to large locomotives. The Carl Moyer Program has provided funding for the incremental cost of a diverse range of project types, including purchase of new alternative-fuel heavy-duty vehicles (primarily transit buses and trash trucks), and engine replacements (repowers) for agricultural irrigation pumps, construction equipment, and marine vessels. Over the last six years, new technologies, regulations, and emissions standards have affected the types of projects funded. In general, the number of on-road new vehicle purchase and marine vessel repower projects have declined while the number of construction equipment and locomotive projects have increased. Emerging project categories include new locomotive purchases, light-duty vehicle scrap programs, and installation of PM retrofit devices.

How does the Carl Moyer Program help California meet its air quality goals?

The South Coast AQMD and San Joaquin Valley APCD need significant NOx and PM reductions to attain the new federal ambient air quality standards for 8-hour ozone and particulate matter less than 2.5 microns in diameter (PM2.5). Much of the rest of California also must attain the federal 8-hour ozone standard in the next decade. While regulations will achieve the vast majority of reductions needed for attainment of these standards, the Carl Moyer Program is critical for achieving early or extra emission reductions and targeting sources which aren't feasible to regulate. California relies upon regulations combined with turnover of the fleet to cleaner vehicles and equipment to provide about 90 percent of the emission reductions needed to meet federal air quality standards. Innovative programs such as the Carl Moyer Program are expected to provide the remaining ten percent of emission reductions.

How has the program expanded in recent years?

Legislative changes enacted in 2004 and 2005 provide increased and continuing funding for the Carl Moyer Program and other incentive programs – from roughly $25 million per year to up to $141 million annually through 2015. This legislation also allowed funding of projects that reduce PM and ROG, and expanded the program to include voluntary light-duty vehicle retirement and repair, on-road heavy-duty fleet modernization, and assistance for previously unregulated agricultural sources. These changes were incorporated into the Carl Moyer Program beginning in FY 2004-05 (Year 7).

This program expansion increased administrative responsibilities at both the state and local levels. In 2006, Governor Schwarzenegger and the Legislature recognized the importance of these responsibilities by enacting legislation to boost resources for program administration. These additional resources will enable ARB and the districts to enhance outreach to potential applicants, streamline application and reporting

requirements, participate in regular program audits, and improve program efficiency and accountability.

What is the status of Carl Moyer Program Year 7 through 9 funds?
Most districts are in the process of expending their remaining Year 7 funds, which are required to be fully spent by June 30, 2007. Many districts have begun funding projects with Year 8 grants and a few will be ready to receive Year 9 funds when they are available from ARB in January 2007.

What are the results of ARB's Carl Moyer Program air district audits?
In 2006, the ARB adopted more structured audit procedures and formally audited Carl Moyer Program implementation at the Ventura County APCD, Sacramento Metropolitan AQMD, South Coast AQMD, and Butte County AQMD. These audits focused on air district program implementation in FYs 2002-03 and 2003-04 (Years 5 and 6). The Ventura County APCD and Sacramento Metropolitan AQMD were found to run excellent programs that generally comply with ARB and California Health and Safety Code requirements.[1] The South Coast AQMD audit revealed that as of July 2006, the district had not expended about $10 million of its $15.6 million Year 5 and 6 program funds in a timely manner consistent with State law. The South Coast AQMD has committed to fully expend these funds by July 2007. ARB will conduct a follow-up audit of the district and report to the Board on its findings in late 2007.

In 2006, the California Department of Finance (DOF) also conducted an evaluation of ARB's oversight of the Carl Moyer Program. The DOF evaluation provides suggestions for improving the effectiveness and accountability of the program, such as establishment of more specific guidelines for project data collection and financial practices. The DOF evaluation also indicates program areas that should be more prescriptive and suggests increased ARB audits of air district programs. DOF's suggestions will be considered for inclusion in the revisions to the Carl Moyer Program Guidelines planned for the Fall, 2007. Finally, the California Bureau of State Audits (BSA) began a performance audit of the ARB and the Bay Area AQMD, Sacramento Metropolitan AQMD, San Joaquin Valley APCD, and South Coast AQMD programs in October 2006. The BSA audit findings will be available on ARB's website when they are released in Spring 2007.

What is the future of the Carl Moyer Program?
Several factors suggest that demand for Carl Moyer Program grant funding will be strong through the program's 2015 sunset date. First, recent legislation has expanded the program to allow funding for projects that reduce ROG and PM emissions. This has added funding opportunities for gasoline engine projects, in addition to diesel engine projects. A voluntary car scrap programs is one promising example of a new Carl Moyer Program source category. A second factor relates to new ARB regulations under development to require clean-up of privately-owned diesel trucks and off-road

[1] As of December 1, 2006, the Butte County AQMD audit report was not yet finalized. Once complete, this report will be available on ARB's website at http://www.arb.ca.gov/msprog/moyer/moyer.htm.

equipment. These regulations are likely to provide more time for small businesses to comply. Carl Moyer Program funds provide an opportunity for small business owners to reduce the cost of the regulation through early regulatory compliance. Finally, there remain many sources of NOx and PM emissions – such as federally pre-empted locomotive engines – that are not subject to upcoming ARB in-use vehicle and equipment regulations. Given that the cost of cleaning up California's fleet of existing diesel engines is at least ten times the available Carl Moyer Program funds, demand for funding from this program will remain high.

In its first six years, the Carl Moyer Program has provided significant air quality benefits. The program plays a critical role in the state's strategy to attain clean, healthful air for all Californians by achieving cost-effective emission reductions from in-use engines while complementing regulations and advancing clean air technology. The program has recently expanded significantly and continues to evolve as it provides real, surplus, quantifiable, and cost-effective air quality benefits.

# I.

# INTRODUCTION

The Carl Moyer Program is an air quality grant program that funds the incremental cost of cleaner-than-required vehicles, engines, and equipment. The primary objective of the program is to achieve NOx, ROG, and PM emission reductions that would not otherwise occur through regulations or other legal mandates. These "surplus" reductions play an important role in meeting commitments in California's federally required State Implementation Plans (SIPs) for ozone and particulate matter. The Carl Moyer Program also targets toxic diesel PM reductions and, through its environmental justice requirements, helps ensure that emission reductions occur in communities where they're most needed. In its first six years, the Carl Moyer Program has provided air districts with over $140 million in grants, reducing NOx emissions by over 18 tpd and PM emissions by almost one tpd. The Carl Moyer Program entered a new era in its seventh year, as legislation provided a significant boost in funding through 2015 and expanded the program to include new pollutants and source categories.

## Background

More than 1.2 million diesel-fueled engines operate in California – powering most trucks, buses, off-road equipment, agricultural irrigation pumps, locomotives, and marine vessels. Heavy-duty diesel engines are durable, economical to operate, and play an important role in California's economy. However, they are also significant contributors to our state's air pollution. Although they power less than five percent of all vehicles and mobile equipment in California, diesel engines produce almost 60 percent of the state's emissions of NOx, a smog-forming pollutant. California's older fleet of gasoline engines are also significant contributors of both NOx and ROG. NOx combines with ROG in the presence of sunlight to form ozone (also known as smog). Ozone can damage the respiratory tract, worsen asthma symptoms, and reduce children's lung development. In addition, many reactive organic gases emitted by gasoline engines, such as benzene and 1,3-butadiene, have been identified as toxic air contaminants by ARB.

The solid components of diesel exhaust are known as diesel PM. In 1998, ARB identified diesel PM as a toxic air contaminant based on its potential to cause cancer. One study estimates these engines are also responsible for about 70 percent of the overall cancer risk from all air toxics.[1] Particulate matter also contributes to premature death, asthma attacks, and other health problems. The Carl Moyer Program plays a critical role in achieving clean, healthful air for

[1] Multiple Air Toxics Exposure Study II, South Coast Air Quality Management District, 1999.

Californians by helping accelerate reductions of toxic and smog-forming emissions from diesel-powered vehicles and equipment.

This Carl Moyer Program Status Report includes the following[1]:

- An overview of the program's structure, funding sources, and recent program expansion.
- A summary of projects funded in Years 1 through 6, and preliminary information regarding Year 7 projects.
- A discussion of how air districts are implementing program environmental justice requirements.
- Results of ARB audits of Ventura County APCD, Sacramento Metropolitan AQMD and the South Coast AQMD implementation of the Carl Moyer Program, as well as the California Department of Finance evaluation of ARB's program.
- A projection of expected future year Carl Moyer Program air quality benefits.
- A look ahead at program challenges and potential program enhancements.

Appendix A describes the Carl Moyer Program projects funded by each air district in the program's first six years. Appendix B includes the environmental justice projects funded by California's five most populous air districts. Appendices C through E include the final ARB audit reports and air district responses for the three Carl Moyer Program audits listed above. Appendix F provides the results of the Department of Finance evaluation of ARB's program.

[1] Carl Moyer Program Status Reports published in 1999, 2001, 2002, and 2004 (available at www.arb.ca.gov/msprog/moyer/status.htm) provide more information regarding previous years of the program.

## II.

## PROGRAM IMPLEMENTATION

The Carl Moyer Program is implemented as a partnership between ARB and the local air districts. Program responsibilities are delineated in the California Health and Safety Code (HSC) – ARB provides overall guidance for the program while air districts administer the program locally (HSC § 44286).

**Role of the Air Resources Board**

ARB has oversight responsibility for the Carl Moyer Program to ensure it meets its statutory requirements. These responsibilities include:

- Carl Moyer Program Guideline Development – ARB is responsible for development of Carl Moyer Program Guidelines. The guidelines identify minimum requirements needed to ensure projects achieve real, surplus, enforceable, and cost-effective emission reductions. Program guidelines are developed in cooperation with local air districts, engine owners and operators, technology manufacturers, and other stakeholders. The guidelines are updated and taken to the Board for its approval approximately every two years. The current Carl Moyer Program Guidelines were approved by the Board in November 2005.

- Funding Allocations – ARB allocates program funding annually to air districts in accordance with the allocation formula identified in HSC § 44299.2(i).

- Program Oversight and Monitoring – ARB is responsible for reviewing district progress in obligating and expending statewide funds and, when necessary, reallocating funds among air districts within a funding cycle. In 2006, ARB also began regular field audits of air district Carl Moyer Program implementation.

- Technical Support – ARB provides districts with program policy and technical support through regular contact with district staff, training sessions, and quarterly Incentive Program Implementation meetings.

- Multi-District Projects – ARB keeps ten percent of program funding for projects which meet a state priority or are multi-district in nature in accordance with HSC § 44286(d). More information regarding multi-district projects can be found in Appendix A.

**Role of the Local Air Districts**

Air districts provide grants to public and private entities for the incremental cost of cleaner-than-required engines and equipment. Air districts have significant flexibility to implement the program in a way that reflects local priorities, including flexibility to evaluate and select projects. However, local district requirements must be at least as stringent as the state program guidelines. The districts' role in implementing the program include:

- Project Outreach, Solicitation, Evaluation, and Tracking – Air districts conduct outreach, solicit and evaluate project applications, select projects, contract with engine owners and operators, and track project completion in accordance with the Carl Moyer Program Guidelines.

- Match Funding – Districts participating in the Carl Moyer Program are required to provide $1 in match funding for every $2 of state Carl Moyer Program funding received, with a $12 million cap on total statewide match funds. Districts that accept only the minimum allocation may receive a waiver from the match requirement if they demonstrate they have the resources to implement the Carl Moyer Program. Match funds must be spent on projects that meet all applicable Carl Moyer Program requirements. However, match funds may also be used for low-emission infrastructure projects, such as alternative fuel refueling stations, or for the incremental cost of cleaner-than-required fuel. Up to 15 percent of the match fund requirement may be fulfilled through district "in-kind" contributions (i.e. administrative costs). Each air district's Year 1 through 6 match funding contribution is provided in Appendix Table A-2.

- Project Reporting – Districts are required by state law to fully expend their Carl Moyer Program funds within two years of receiving their annual allocation from ARB (HSC § 44287(k)). Every June 30th participating districts provide ARB with two reports – an Annual Report describing projects selected for funding with the previous year's money and a Final Report detailing completed projects funded with the allocation received two years earlier.

- Environmental Justice – Air districts with more than one million inhabitants (Bay Area AQMD, Sacramento Metropolitan AQMD, San Diego County APCD, San Joaquin Valley Unified APCD, and South Coast AQMD) must ensure that at least fifty percent of their Carl Moyer Program funds are expended in low-income communities, communities of color, or areas disproportionately affected by air pollution (HSC § 43023.5).

## III.

## PROGRAM EXPANSION

Legislation signed by the Governor in 2004 and 2005 expanded the Carl Moyer Program by providing increased and continuous program funding, adding PM and ROG emissions to the program, and including new project categories.

### Increased Funding

The state provided air districts over $140 million in project funding over the first six years of the Carl Moyer Program. In Years 1 through 4, the California Legislature funded the Carl Moyer Program through annual budget appropriations. Voter approval of *Proposition 40: The California Clean Water, Clean Air, Safe Neighborhood Parks, and Coastal Protection Act of 2002* provided funding for the program in Years 5 and 6.

Increased and continuous funding for the Carl Moyer Program was secured in 2005 when the Legislature passed and the Governor signed Senate Bill 1107 (Firebaugh) and Assembly Bill 923 (Pavley). This legislation provides up to $141 million annually for the Carl Moyer Program through 2015. The three sources of this new funding are:

- Smog Check Fee – A Smog Check fee adjustment provides about $61 million in annual funding for the Carl Moyer Program through 2015.

- Tire Fee – The fee assessed for new tire purchases increased from $1.00 to $1.75 per tire, providing about $25 million a year through 2015 for clean air programs like the Carl Moyer Program.

- Motor Vehicle Registration Fee – AB 923 gave air district governing boards the authority to increase the vehicle registration surcharge by two dollars to pay for four specific clean air incentive programs: 1) projects eligible for funding under the Carl Moyer Program; 2) purchase of new school buses; 3) light-duty vehicle programs; and 4) a program targeting previously unregulated agricultural sources. This fee adjustment could provide up to $55 million in program funds directly to local air districts. Prior to passage of AB 923, local air districts had the authority to impose a two to four dollar per vehicle registration fee to pay for clean air projects and programs (commonly referred to as “AB 2766 fees”). Appendix Table A-3 provides a summary of air district vehicle registration fees as of September 2006.

Table III-1 provides Carl Moyer Program project and program administration funding totals for program Years 1 through 9.

**Table III-1:**
**State Carl Moyer Program Funding**
**Years 1-9 (in thousands)**

| Fiscal Year | District Projects | ARB Multi-District Projects | Administration (including outreach) | | Total* |
|---|---|---|---|---|---|
| | | | Districts | ARB | |
| 1998-99 (Year 1) | $ 24,500 | -- | -- | $ 500 | $ 25,000 |
| 1999-00 (Year 2) | $ 18,495 | $ 125 | -- | $ 380 | $ 23,000 |
| 2000-01 (Year 3) | $ 43,723 | $ 377 | -- | $ 900 | $ 50,000 |
| 2001-02 (Year 4) | $ 15,680 | -- | -- | $ 320 | $ 16,000 |
| 2002-03 (Year 5) | $ 19,680 | -- | -- | $ 400 | $ 20,080 |
| 2003-04 (Year 6) | $ 18,000 | -- | -- | $ 400 | $ 18,400 |
| 2004-05 (Year 7) | $ 26,280 | $ 2,928 | $ 610 | $ 10 | $ 30,428 |
| 2005-06 (Year 8) | $ 76,464 | $ 8,496 | $1,770 | $1,770 | $ 88,500 |
| 2006-07 (Year 9) | $ 73,361 | $ 8,501 | $4,538 | $3,600 | $ 90,000 |
| **TOTAL** | **$316,184** | **$20,427** | **$6,918** | **$8,280** | **$361,408** |

*These totals include California Energy Commission funds totaling $4 million in Year 2 and $5 million in Year 3 for infrastructure and technology development projects.

**Program Expansion**

The legislation that increased Carl Moyer Program funding beginning in Year 7 also expanded the program to include PM and ROG emission reductions. This change allows the program to more comprehensively address California's air pollution challenges, such as the air toxic risk associated with emissions from diesel engines. Inclusion of PM in project cost-effectiveness calculations also facilitates funding of diesel after-treatment device projects. As part of the 2005 Carl Moyer Program Guidelines, the Board approved a PM weighting factor of 20 relative to NOx and ROG in project cost-effectiveness calculations. This weighting reflects the relatively greater health impacts and cost-of-control for PM on a ton-emitted basis. The 2005 Carl Moyer Program Guidelines also raised the maximum allowable project cost-effectiveness from $13,600 per ton of NOx reduced to $14,300 per ton weighted of NOx, ROG, and PM reduced.[1]

The new legislation also directed ARB to include light-duty vehicle projects, on-road heavy-duty vehicle fleet modernization projects, and previously unregulated agricultural sources. ARB has identified two light-duty vehicle project categories eligible for Carl Moyer Program funding – voluntary accelerated vehicle retirement (VAVR or car scrap) and voluntary vehicle repair (VRV). Both programs reduce emissions by cleaning up the older, dirtier car and light truck fleet – the VAVR program provides incentives for scrapping older vehicles, while the VRV would provide grants to repair or replace emission control systems. The South Coast AQMD is conducting a pilot program which

[1] The cost-effectiveness cap was $12,000 per ton NOx reduced in Year 1 and has been raised periodically to reflect adjustments to the Consumer Price Index.

uses a remote sensing device to identify especially high-emitting vehicles that could be eligible for VAVR or VRV. The Board approved VAVR regulation revisions and updated Carl Moyer Program Guidelines for VAVR and VRV projects in December 2006.

On-road heavy-duty fleet modernization projects were required to be added to the Carl Moyer Program by legislation in 2004 (AB 1394, Levine). On-road heavy-duty fleet modernization is the replacement of an old, high-polluting, heavy-duty vehicle with a newer, cleaner vehicle. As of October 2006, the South Coast AQMD and the Sacramento Metropolitan AQMD have set aside Carl Moyer Program funds for on-road heavy-duty vehicle fleet modernization projects.

One of the programs for which air districts may use the $2 increase in the motor vehicle registration surcharge is for compliance assistance for previously unregulated agricultural sources. Referred to as the Agricultural Assistance Program (AAP), this program must comply with Carl Moyer Program requirements, with the major exception that reductions are not required to be surplus to regulations. As of September 2006, both the Santa Barbara APCD and the South Coast AQMD have funded AAP projects – the Santa Barbara APCD has spent $190,939 to clean-up nine agricultural irrigation pump engines and the South Coast AQMD has committed $119,441 to repower two agricultural irrigation pump engines with electric motors.

Finally, the guidelines also include enhanced program implementation and reporting requirements to ensure the effectiveness and integrity of the expanded program. These include project contract requirements, engine pre- and post-inspections, submittal of air district program policies and procedures to ARB, and other program enhancements.

**Administration Funding**

Implementation of the Carl Moyer Program – particularly an expanded program with additional implementation safeguards – requires considerable staff resources, both by ARB and local air districts. In September 2006, the Legislature and Governor recognized the need for additional staff resources by enacting and signing SB 225 (Soto, 2006). This legislation increases allowable expenditures for program administration from the two percent of program funds that was dedicated to program outreach to five percent for air districts with one million or more inhabitants and to ten percent for those with less than one million inhabitants. Administration funds provide air districts the resources to effectively implement the Carl Moyer Program, including resources for staff salaries and benefits, training, office space, printing, mailing, transportation, outreach, and other program support.

In order to allow air districts to utilize this funding as soon as possible, ARB is making this allowance effective with the Year 9 funding cycle and available to air districts starting in January 2007. The two percent in administration funding which ARB previously allocated to air districts will be used for ARB program administration and outreach, bringing ARB's allocation for program administration to four percent of state Carl Moyer Program funds. This adjustment will provide ARB the means to more

effectively implement and oversee the expanded Carl Moyer Program, including the ability to improve program efficiency, conduct additional field audits, and help rural districts solicit, evaluate, and track projects. With these administrative cost adjustments, Carl Moyer Program administration costs will be comparable to those of other government grant programs.

## IV.

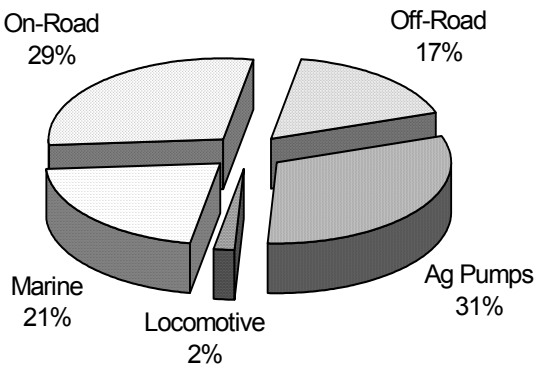
## YEARS 1 THROUGH 6 PROGRAM SUMMARY

In its first six years, the Carl Moyer Program provided over $140 million in incentive grants to replace more than 1,700 diesel engines with alternative fueled engines and electric motors and to replace over 4,600 dirty diesel engines with cleaner engines. This chapter provides information regarding the types of projects funded, NOx and PM emission reductions achieved, average program cost-effectiveness, and typical projects funded.

### Projects Funded

Carl Moyer Program project funds in Years 1 through 6 have been used to reduce emissions from on-road vehicles, off-road equipment, agricultural irrigation pumps, marine vessels, and locomotives. Figure IV-1 shows program funding by project type in Years 1 through 6. Over 6,300 cleaner engines have been funded, with an average grant of about $19,000 per engine. Transit buses and trash trucks represent the majority of on-road projects, while off-road projects are mostly construction, agricultural, and cargo-handling equipment repowers.

**Figure IV-1:**
**Funding by Project Type**
**(Years 1-6)**




### Emission Reductions Achieved

Table IV-1 summarizes the types of projects funded and emission reductions achieved by the Carl Moyer Program in Years 1 through 6. This table does not include the benefits of about $19 million in Year 1 through 6 projects under contract but not yet in operation in the South Coast AQMD and the Bay Area AQMD. Table IV-1 also does not include benefits achieved by Year 7 and 8 projects that have been completed prior to their statutory deadlines. For example, as of October 2006, the South Coast AQMD has completed over $1 million in Year 7 projects and the Sacramento Metropolitan AQMD has completed over $1 million in Year 8 projects. Year 7 and 8 projects are required to be completed and reported to ARB by June 30 of 2007 and 2008, respectively.

**Table IV-1: Carl Moyer Program Project Summary**
**Years 1-6**

| Source Category/ Equipment Type | Emission Reductions | | Average NOx Cost-Effectiveness ($/ton) | Number of Engines | | Total Funds | |
|---|---|---|---|---|---|---|---|
| | NOx (tpy) | PM (tpy) | | Alt Fuel | Diesel | Alt Fuel | Diesel |
| **On-Road** | | | | | | | |
| Transit Bus/Urban Bus | 592 | 19 | $2,900 | 867 | 329 | $11,447,265 | $ 2,660,422 |
| Trash Trucks | 360 | 8 | $4,200 | 425 | 28 | $11,779,025 | $ 654,700 |
| Heavy-Duty Line Haul | 175 | 4 | $4,500 | 118 | 127 | $ 2,991,316 | $ 2,631,044 |
| Other | 53 | 1 | $6,100 | 123 | 41 | $ 1,828,969 | $ 769,764 |
| **Off-Road** | | | | | | | |
| Construction Equipment | 892 | 47 | $3,500 | 6 | 316 | $ 472,468 | $16,262,349 |
| Farm Equipment | 48 | 2 | $5,200 | 0 | 116 | $ 0 | $ 1,315,855 |
| Cargo Handling Equip. | 115 | 1 | $2,000 | 130 | 1 | $ 1,197,297 | $ 10,000 |
| Other Equipment | 37 | 2 | $3,300 | 0 | 37 | $ 0 | $ 674,878 |
| Ag Pumps | 3,047 | 136 | $2,200 | 88 | 3,112 | $ 1,704,150 | $35,176,183 |
| Marine Vessels | 1,272 | 73 | $1,800 | 0 | 448 | $ 0 | $25,838,238 |
| Locomotives | 97 | 2 | $3,600 | 2 | 24 | $ 820,000 | $ 1,535,585 |
| **TOTAL** | **6,688** | **295** | **$2,600*** | **1,760** | **4,579** | **$32,240,490** | **$87,529,018** |

Table includes information for projects completed as of October 1, 2006.
* Reflects the average NOx cost-effectiveness of completed Year 1 though 6 Carl Moyer Program projects.

## Health and Welfare Benefits

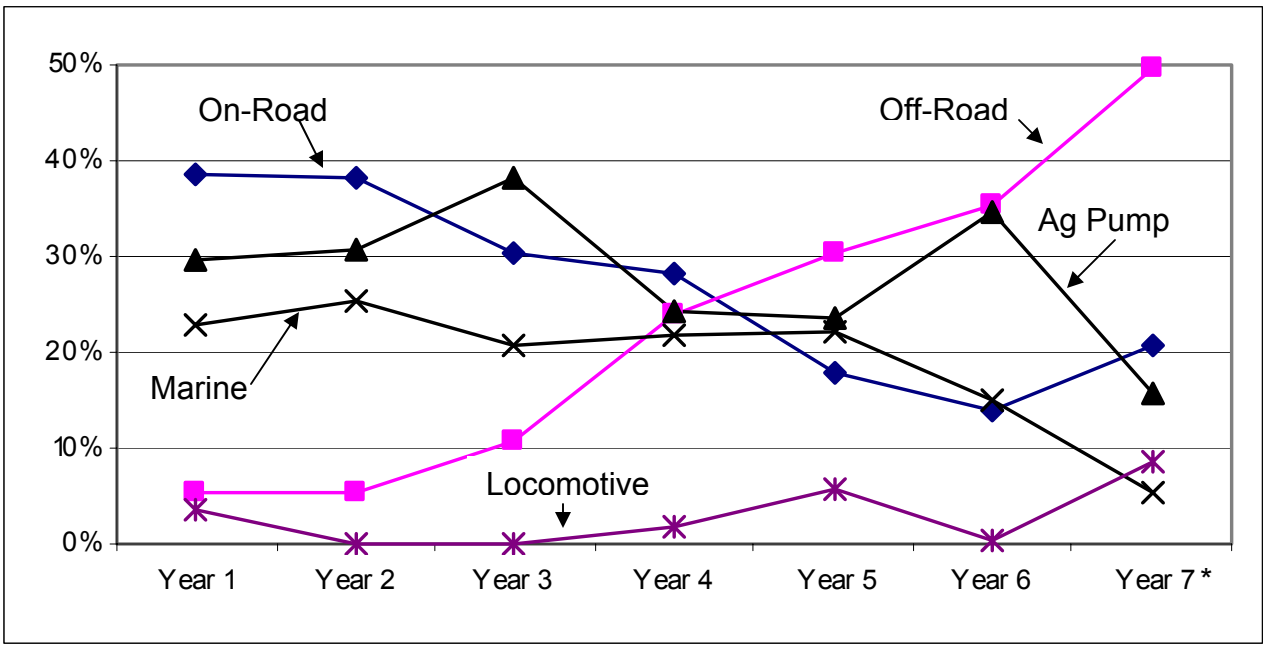
In Years 1 through 6, emission reductions achieved by Carl Moyer Program projects achieved significant health and welfare benefits, helping reduce lost work days by about 17,000 and prevent about 2,800 asthma attacks and 100 premature deaths.[1] These and other avoided health and welfare impacts have an estimated mean economic valuation of $790 million. Therefore, the societal benefit of the Carl Moyer Program is better than five times its cost. These numbers are conservative because they reflect the benefits of Carl Moyer Program projects through 2005 only. Most of these projects extend beyond 2005 and will continue to accrue additional benefits in future years.

[1] These numbers reflect the mean cumulative benefits of Carl Moyer Program projects from 2000 to 2005. (ARB Research Division, 2006) The range of estimated total cases avoided is: premature mortality (28 – 170); asthma and lower respiratory symptoms (1,100 – 4,500); work loss days (15,000 – 20,000). Ranges reflect uncertainty in health concentration-response functions.

**Project Mix**

The mix of projects funded by the Carl Moyer Program has shifted significantly since the program's inception. As shown in Figure IV-2, the percentage of total program funds for off-road equipment projects is increasing steadily, while relative funding for marine and on-road heavy-duty vehicle projects is declining. The decline in relative funding for these project types is due to different factors. Many of the most cost-effective marine vessel repower projects have already been funded, particularly in the South Coast AQMD. On the other hand, relative funding for on-road heavy-duty vehicle projects is declining due to new regulations that make reductions from these sources no longer surplus, and therefore not eligible for grants. Chapter VIII describes how regulations can impact opportunities for Carl Moyer Program funding.

**Figure IV-2: Carl Moyer Program Funding Mix**




* Year 7 data reflects preliminary project information as of October 1, 2006.

## Project Life

In Years 1 through 6, Carl Moyer Program projects had an average dollar-weighted project life of over ten years. Preliminary project data indicates that in Year 7 average project life declined to about seven years. The shorter project life is occurring in part because the allowable minimum project life was shortened from five years to three years in the 2005 Carl Moyer Program Guidelines. This change provides more flexibility to fund projects in source categories subject to in-use vehicle and equipment regulations. For example, if a regulation requires a vehicle have a cleaner engine in three years, the project life for that engine cannot exceed three years since the reductions would be achieved by the regulation – and no longer be surplus – at that time. Table IV-2 provides the average dollar-weighted project life of Carl Moyer Program projects in years 1 through 7.

**Table IV-2:**
**Average Project Life**

| Funding Year | Avg. Project Life |
|---|---|
| Year 1 | 12.6 |
| Year 2 | 11.6 |
| Year 3 | 9.1 |
| Year 4 | 9.8 |
| Year 5 | 9.3 |
| Year 6 | 8.2 |
| Year 7 | 7.1 |

The average project life reflects the average life per dollar spent rather than per engine funded.

All other factors being equal, projects with shorter lives are less cost-effective since the benefits accrue for fewer years. However, despite the decline in average project life, all projects funded meet the statutory cost-effectiveness cap, and the average program cost-effectiveness remains well below this cap.

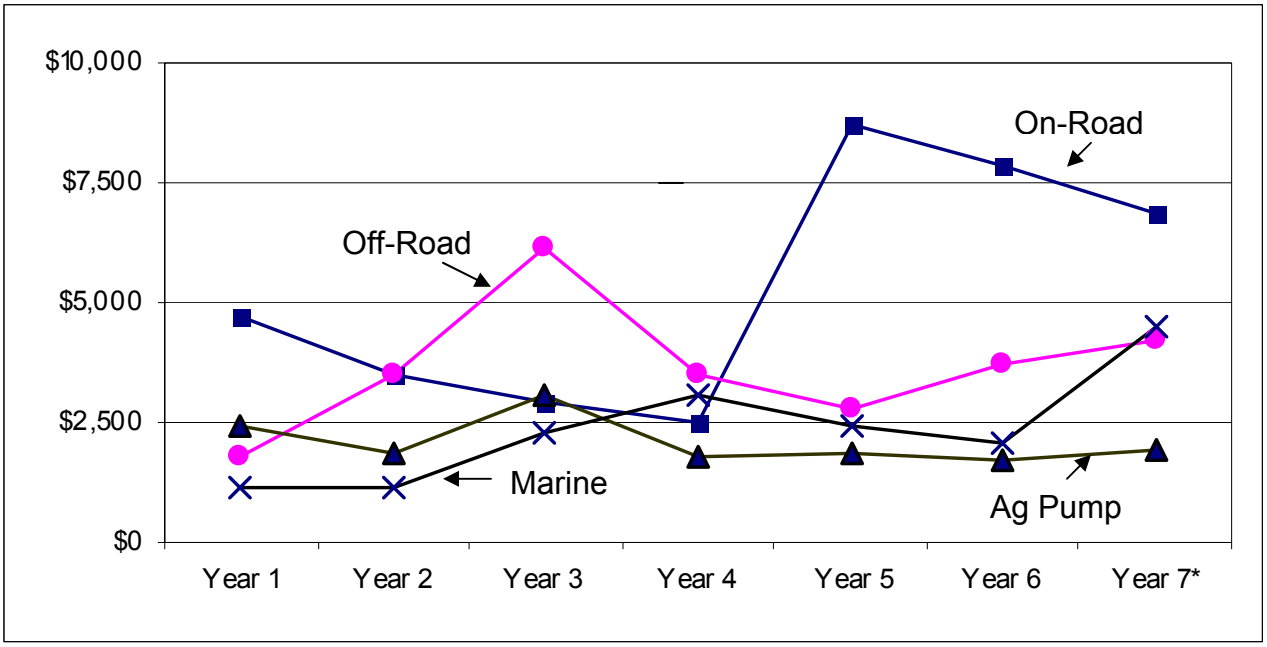
## Cost-Effectiveness

Many air districts use cost-effectiveness to rank and select potential Carl Moyer Program projects. Project cost-effectiveness is based upon several factors, including emission reductions achieved, project life, and grant amount. Applicants are eligible for up to the cost differential – or incremental cost – between the low-emission project and what would typically be spent in lieu of the grant award. For example, a marine vessel operator could be eligible for the difference between the cost to rebuild his existing marine engine and the cost to install a newer, cleaner engine.

Carl Moyer Program projects have proven extremely cost-effective, averaging about $2,600 per ton of NOx reduced in Years 1 through 6. Average NOx cost-effectiveness rose to about $3,900 per ton in Year 7. This increase is likely due to several factors, including the trend towards a shorter project life or the inclusion of PM in the project cost-effectiveness calculation beginning in Year 7. Despite this increase in cost-effectiveness, the average program cost-effectiveness is still well below the $14,300 per ton statutory cap on weighted NOx, ROG, and PM emission reductions.

Figure IV-3 shows the average cost-effectiveness of on-road, off-road, agricultural irrigation pump, and marine vessel projects in Years 1 through 7. Agricultural irrigation pump and marine vessel projects tend to be the most cost-effective, in part because of their high activity and, with the exception of the largest marine engines, the lower cost of replacement engines. On-road projects – particularly the purchase of cleaner-than-required alternative-fuel vehicles – are typically less cost-effective due to the high cost of new vehicles and the relatively modest per vehicle emission reductions.

**Figure IV-3: Carl Moyer Program Project Average NOx Cost Effectiveness ($/ton)**




* Year 7 data reflects preliminary project information as of October 1, 2006.

## Typical Projects

The Carl Moyer Program has funded a wide variety of projects in Years 1 through 6, including purchase of cleaner-than-required new vehicles or equipment, engine replacements, and engine retrofits. The types of projects funded have been dictated, in part, by project cost, the population of older engines in each source category, and the availability and efficacy of newer, cleaner technologies. In order to be eligible for funding, new engines must be certified by ARB or U.S. EPA. New purchase projects must be at least 30 percent cleaner for NOx or NOx plus non-methane hydrocarbons than the applicable new vehicle or equipment standard, while repower projects that reduce NOx emissions must achieve at least a 15 percent NOx reduction relative to the replaced engine. Retrofit devices must be ARB or (in the case of marine vessels or locomotives) U.S. EPA verified to be eligible for funding and must reduce NOx by at least 15 percent in order to take credit for NOx reductions.

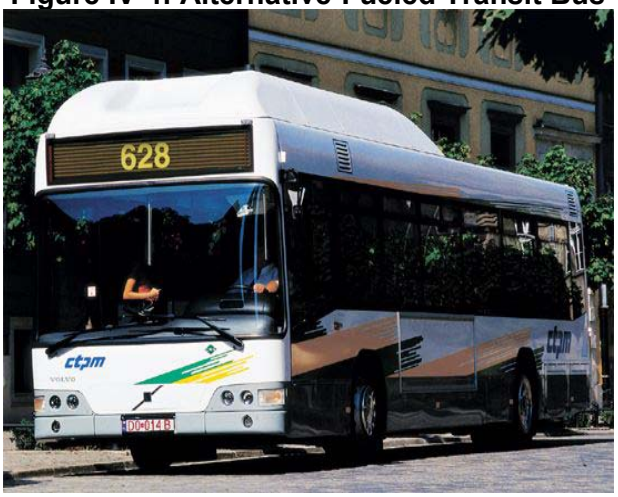
Each page in this section describes typical projects in the five source categories funded in Years 1 through 6 – on-road heavy-duty vehicles, off-road equipment, agricultural irrigation pump engines, marine vessels, and locomotives. The tables on each page provide data which characterizes the types of projects funded. This data includes the number and types of engines funded and the typical vehicle or equipment annual miles traveled, fuel consumed, or hours operated.

The tables also include the average percent incremental cost, which reflects the maximum portion of the project cost eligible for Carl Moyer Program funding. This can be compared to the average percent funding, which indicates how much of the eligible cost air districts choose to provide. In some cases, an applicant may request less than the full incremental cost in order to improve the project cost-effectiveness and increase the chances of being selected for funding. Air districts may also choose to fund less than the full eligible cost in order to increase the number of applicants funded. In most cases, the cost not paid by the Carl Moyer Program is borne by the engine owner.

### *On-Road Heavy-Duty Vehicles*

In its first six years, the Carl Moyer Program has funded over 2,000 on-road heavy-duty new vehicle purchases, engine repowers, and retrofits. Table IV-3 provides average activity and cost data for the most common project types. For on-road new vehicle purchase projects, vehicle owners typically pay over $100,000 per new vehicle, with the Carl Moyer Program providing about $20,000 for a cleaner- than-required vehicle. Many new purchase projects involve a public fleet's purchase of multiple new alternative-fuel transit buses, trash trucks, or other vehicles. Almost 80 percent of total Carl Moyer Program on-road heavy-duty new purchase projects have been funded by the South Coast AQMD.

**Figure IV-4: Alternative-Fueled Transit Bus**




On-road heavy-duty repower projects, on the other hand, are more typically pursued by truck owner-operators or smaller trucking firms, and involve replacement of an older line-haul truck engine with an engine which is, on average, ten years newer. On-road heavy-duty vehicles funded by the Carl Moyer Program typically travel between 18,000 and 60,000 miles annually. School buses, street sweepers, and trash trucks generally have the lowest annual mileage; however, street sweepers and trash trucks often burn more fuel due to their auxiliary engines and are therefore more cost-effective projects than school buses. Line-haul trucks travel the most but – because they travel long distances – may have low mileage within any particular air district.

**Table IV-3: Carl Moyer Program On-Road Heavy-Duty Vehicle Project Summary**
Years 1 through 6 by Project Type

| | | Number of Engines | Average Annual VMT | Average Baseline Cost | Average Low Emission Tech. Cost | Percent Incre-mental Cost | Average Grant Amount | Average Percent Funding |
|---|---|---|---|---|---|---|---|---|
| **New Vehicle Purchase** | Line Haul | 117 | 44,500 | $102,202 | $137,065 | 25% | $24,393 | 18% |
| | Transit Bus | 841 | 43,852 | $303,386 | $345,685 | 12% | $12,762 | 4% |
| | Urban Bus | 34 | 33,219 | $169,865 | $224,235 | 24% | $12,484 | 6% |
| | School Bus | 24 | 17,942 | $114,645 | $146,051 | 22% | $21,715 | 15% |
| | Trash Truck | 369 | 30,325 | $135,259 | $172,954 | 22% | $21,592 | 12% |
| | Street Sweeper | 32 | 26,857 | $111,059 | $155,482 | 29% | $25,708 | 17% |
| **Repower** | Line Haul | 110 | 54,461 | $ 9,530 | $ 33,554 | 72% | $22,728 | 68% |
| | Trash Truck-alt. fuel | 60 | -- | $ 7,481 | $105,239 | 93% | $66,778 | 63% |
| | Trash Truck-diesel | 17 | 30,000 | $ 4,998 | $ 24,501 | 80% | $16,894 | 69% |
| | Other Medium-Duty | 36 | 59,831 | $ 5,389 | $ 27,211 | 80% | $19,037 | 70% |
| **Retrofit** | Line Haul | 18 | 23,825 | $ 0 | $ 16,518 | 100% | $13,011 | 79% |
| **ALL** | | **1658** | **41,006** | **$200,346** | **$241,115** | **17%** | **$18,709** | **8%** |

### *Off-Road Equipment*

Over 600 off-road engine replacements have been funded by the Carl Moyer Program to date. Table IV-4 provides average activity and cost information for funded off-road equipment, based on engine horsepower. Construction, agricultural, and cargo-handling equipment are the main off-road categories funded by the Carl Moyer Program, with forklifts and scrapers being the most common equipment types. Off-road engines funded through the Carl Moyer Program are often large – over 300 horsepower – and operate more than 1,500 hours per year. The average off-road repower project achieves about 10 tons of NOx reductions over the life of the project and has a NOx cost-effectiveness of about $3,400 per ton. Off-road engines must be replaced with the cleanest available engine – usually a Tier 2 or Tier 3 engine – to be eligible for funding. In Years 1 through 6, the South Coast AQMD, Sacramento Metropolitan AQMD, and Mojave Desert AQMD provided the most funding for off-road equipment projects.

**Figure IV-5: Off-Road Construction Equipment**

**Table IV-4: Carl Moyer Program Off-Road Equipment Project Summary**
Years 1 through 6 by Engine Horsepower

| Engine Horse-power | Number of Engines | Average Annual Gallons Fuel per Engine | Average Annual Hours Operation per Engine | Average Rebuild Cost (Baseline) | Average Repower Cost | Percent Incremental Cost | Average Grant Amount | Average Percent Funding |
|---|---|---|---|---|---|---|---|---|
| **0-74** | 75 | 2,020 | 1,690 | $ 2,302 | $ 15,392 | 85% | $12,178 | 79% |
| **75-99** | 27 | | 1,288 | $ 2,716 | $ 12,251 | 78% | $ 8,168 | 67% |
| **100-174** | 87 | 3,006 | 1,192 | $ 3,209 | $ 16,449 | 80% | $12,456 | 76% |
| **175-299** | 82 | 9,564 | 1,161 | $ 5,257 | $ 32,245 | 84% | $21,106 | 66% |
| **300-449** | 167 | 19,220 | 1,572 | $ 9,816 | $ 55,444 | 82% | $42,669 | 77% |
| **450-599** | 144 | 20,438 | 1,716 | $20,663 | $ 93,831 | 78% | $65,213 | 70% |
| **>600** | 23 | n/a | 2,388 | $25,680 | $115,094 | 78% | $88,286 | 77% |
| **ALL** | 605 | 10,837 | 1,721 | $10,378 | $ 50,804 | 80% | $36,601 | 72% |

***Agricultural Irrigation Pump Engines***

**Figure IV-6: Agricultural Pump Engine**

The Carl Moyer Program provided over $36 million to clean up 3,200 agricultural irrigation pump engines in Years 1 through 6. Table IV-5 provides information regarding the number of engines funded in various horsepower ranges and typical project activity and costs. While most agricultural irrigation pump projects involve diesel engine repowers, over 60 projects were for purchase of a natural gas-powered engine or an electric motor. The average Carl Moyer Program agricultural pump engine project has received an $11,500 grant to repower a 250 horsepower engine that operates about 1,500 hours per year. These projects are among the most cost-effective in the Carl Moyer Program, penciling out at about $2,200 per ton NOx reduced. Agricultural irrigation pump engines must be replaced with the cleanest available engine to be eligible for funding. The San Joaquin Valley Unified APCD and Sacramento Metropolitan AQMD are responsible for about 55 and 28 percent of total agricultural pump engine funding statewide, respectively.

**Table IV-5: Carl Moyer Program Agricultural Pump Engine Project Summary**
Years 1 through 6

| Horse-power Range | Number of Engines | Average Annual Hours per Engine | Average Annual Gallons Fuel per Engine | Average Engine Rebuild Cost | Average Engine Repower Cost | Percentage Incremental Cost | Average Grant Amount | Average Percent Funding |
|---|---|---|---|---|---|---|---|---|
| **50-74** | 104 | 1,230 | 7,923 | $1,910 | $ 8,380 | 77% | $ 5,559 | 66% |
| **75-99** | 145 | 1,397 | | $2,049 | $10,119 | 80% | $ 6,207 | 61% |
| **100-174** | 1,510 | 1,424 | 8,250 | $2,601 | $12,884 | 80% | $ 9,368 | 73% |
| **175-299** | 1,120 | 1,643 | 9,887 | $3,460 | $17,854 | 81% | $12,977 | 73% |
| **300-750** | 320 | 1,944 | 25,941 | $4,890 | $29,853 | 84% | $20,802 | 70% |
| **ALL** | **3,200** | **1,539** | **13,514** | **$3,078** | **$16,037** | **81%** | **$11,513** | **72%** |

***Marine Vessels***

About 450 marine vessel engine repowers were funded by the Carl Moyer Program in Years 1 through 6. These projects are extremely cost-effective, costing average of about $1,800 per ton of NOx reduced. Tables IV-6 and IV-7 provide typical activity and cost information for Carl Moyer Program marine vessel projects. Fishing vessels and tugboats are the main types of vessels funded. Fishing vessel repowers typically involve smaller engines – about 300 horsepower – and cost about $50,000. Tugboat repowers usually involve engines of about 700 horsepower at a cost of about $200,000. Over 80 percent of engine repowers involve replacement of a propulsion engine, while the rest involve replacement of the vessel's auxiliary engine. The portion of repower costs borne by the Carl Moyer Program varies from 35 percent for ferries and excursion vessels to 74 percent for fishing vessels. The Bay Area AQMD and South Coast AQMD have funded by far the most Carl Moyer Program marine vessel projects in Years 1 through 6.

**Figure IV-7: Tug Boat**

**Table IV-6: Carl Moyer Program Marine Vessel Project Summary**

Years 1 through 6 by Vessel Type

| Vessel Type | Number of Engines | Average Horse-power | Average Annual Gallons Fuel per Engine | Average Rebuild Cost | Average Repower Cost | Percent Incre-mental Cost | Average Grant Amount | Average Percent Funding |
|---|---|---|---|---|---|---|---|---|
| **Commercial Fishing** | 148 | 281 | 12,851 | $ 9,874 | $ 48,143 | 79% | $ 35,788 | 74% |
| **Charter Fishing** | 81 | 340 | 12,152 | $ 5,041 | $ 53,947 | 91% | $ 39,702 | 74% |
| **Tug** | 68 | 650 | 58,582 | $22,056 | $213,585 | 90% | $ 93,539 | 44% |
| **Ferry/Excursion** | 30 | 724 | 48,463 | $58,137 | $352,978 | 84% | $124,612 | 35% |
| **Crew/Supply/Work** | 24 | 522 | 28,088 | $16,567 | $142,595 | 88% | $ 81,095 | 57% |
| **Other** | 97 | 365 | 19,628 | $ 9,218 | $ 71,395 | 87% | $ 43,762 | 61% |
| **ALL** | **448** | **408** | **30,908** | **$14,237** | **$103,732** | **86%** | **$ 54,124** | **52%** |

**Table IV-7: Carl Moyer Program Marine Vessel Project Summary**

Years 1-6 by Engine Horsepower

| Engine Horse-power | Number of Engines | Average Annual Gallons Fuel Consumed | Average Rebuild Cost | Average Repower Cost | Percent Incremental Cost | Average Grant Amount | Average Percent Funding |
|---|---|---|---|---|---|---|---|
| **0-99** | 45 | 3,228 | $ 5,479 | $ 24,761 | 78% | $ 15,065 | 61% |
| **100-174** | 23 | 3,736 | $ 6,231 | $ 24,219 | 74% | $ 16,339 | 67% |
| **175-299** | 83 | 9,516 | $ 8,553 | $ 45,195 | 81% | $ 31,054 | 67% |
| **300-750** | 264 | 23,737 | $13,216 | $106,768 | 88% | $ 55,696 | 52% |
| **>750** | 33 | 95,896 | $51,183 | $449,433 | 87% | $218,088 | 49% |
| **ALL** | **448** | **23,357** | **$14,237** | **$103,732** | **86%** | **$ 54,124** | **52%** |

***Locomotives***

Over its first six years, the Carl Moyer program has funded a variety of locomotive project types, including engine repowers, installation of locomotive idle limiting devices, and purchase of alternative technology switch locomotives. In particular, demand for alternative technology switch locomotives – such as switchers powered by two or three smaller Tier 2 off-road engines– has increased in recent years as the technology matures. These locomotives typically are built on an existing locomotive chassis and, in place of the normal large locomotive engine, use one or more smaller on- or off-road engine to power the locomotive generator. As shown in Table IV-8, the Carl Moyer Program has helped fund purchase of two alternative technology switch locomotives in Years 1 through 6. ARB has provided funds to help purchase an additional ten alternative technology switchers with its Year 7 and 8 multi-district funds. These projects typically achieve very large emission reductions – over 100 tpy NOx reductions over their lifetime – with an average cost-effectiveness of under $6,000 per ton of NOx reduced. Over 95 percent of Carl Moyer Program locomotive project funding in Years 1 through 6 went to smaller "Class 3" railroads, while most Year 7 and 8 locomotive multi-district funding went to larger "Class 1" railroads. The South Coast AQMD and Bay Area AQMD have funded the most Carl Moyer Program locomotive projects in Years 1 through 6.

**Figure IV-8:**
**Alternative Technology Switch Locomotive**

**Table IV-8: Carl Moyer Program Locomotive Project Summary**
Years 1 through 6 by Project Type

| Project Type | Number of Loco-motives | Average Baseline Model Year | Average Annual Gallons Fuel per Loco. | Average NOx C/E ($/ton) | Average Baseline Cost | Average Reduced Technology Cost | Pct. Incre-mental Cost | Average Grant Amount | Average Percent Funding |
|---|---|---|---|---|---|---|---|---|---|
| **Idle-Limiting Device** | 21 | 1972 | -- | $ 3,300 | $ 0 | $ 14,285 | 100% | $ 14,285 | 100% |
| **Commuter Retrofit** | 1 | 1993 | 79,404 | $ 1,100 | $ 0 | $ 60,600 | 100% | $60,600 | 100% |
| **Alt. Tech. Switcher** | 2 | 1973 | 54,893 | $ 5,700 | $ 20,304 | $ 607,804 | 97% | $587,500 | 97% |
| **Passenger Repower** | 2 | 1959 | 108,000 | $ 1,600 | $200,000 | $1,108,508 | 85% | $410,000 | 37% |
| **ALL** | **26** | **1972** | **81,038** | **$ 3,600** | **$ 47,850** | **$ 05,913** | **89%** | **$222,049** | **55%** |

# V.

# ENVIRONMENTAL JUSTICE

Beginning with Year 4 (FY 2001-02), Health and Safety Code Section 43023.5 (AB 1390, Firebaugh) requires air districts with one million or more inhabitants spend at least fifty percent of their legislatively appropriated funds, including Carl Moyer Program funds, in a manner that directly reduces air contaminants (or the public health risks posed by air contaminants) in communities with the most significant air contaminant exposure, including low-income or minority communities. Districts with fewer than one million inhabitants are encouraged to do the same. The Legislature and the Governor reaffirmed their support for this requirement in 2006 by enacting AB 2843, which eliminates the 2007 sunset date in the original legislation. Implementation of the environmental justice requirement for the five California air districts subject to this mandate is described below.

- Bay Area AQMD – The Bay Area AQMD assigns each potential project an environmental justice score based upon PM exposure of sensitive populations (individuals under 18 and over 64 years of age) and household income in a project area. Goods movement projects – marine vessels, locomotives, off-road equipment permanently located at a port or rail yard, trucks that transport cargo to or from a maritime port or rail yard, and transportation refrigeration units – also receive points for environmental justice. At least the first fifty percent of available funds are allocated to projects with the highest environmental justice score, after which the remaining funds are allocated in order of the most cost-effective projects to the least cost-effective projects.

- Sacramento Metropolitan AQMD – The Sacramento Metropolitan AQMD defines an environmental justice area as any location within 1,000 feet of a census tract in which at least fifty percent of the population is non-white or in which at least ten percent of the population lives at or below the federal poverty level. The Sacramento Metropolitan AQMD also administers the Carl Moyer Program for the El Dorado County AQMD, Placer County APCD, and Yolo-Solano AQMD, which are not subject to the environmental justice requirements. Since the Sacramento Metropolitan AQMD administers the program consistently for all these air districts, the region as a whole meets the goals of the environmental justice mandate.

- San Diego County APCD – The San Diego APCD defines an environmental justice area as a census tract in which the median income is no more than 80 percent of the county median and which also exceeds the state PM standard. To allocate funds, projects are ranked in order of cost-effectiveness. If less than fifty percent of funds are associated with projects in environmental justice (i.e. low-income) areas, the lowest ranked non-environmental justice project recommended for funding is replaced with the next highest ranked environmental justice project. This process is continued until at least fifty percent of funds are allocated to environmental justice areas.

- San Joaquin Valley APCD – The San Joaquin Valley APCD defines an environmental justice area as one in which the non-white population exceeds fifty percent and in the poverty level exceeds ten percent. Based upon this definition, most of the San Joaquin Valley is considered an environmental justice area.

- South Coast AQMD – The South Coast AQMD scores each potential project for environmental justice based upon poverty level, PM exposure, and air toxics exposure. The first fifty percent of funds are allocated to projects with the highest environmental justice scores. The remaining funds are then allocated based upon project cost-effectiveness.

The Monterey Bay Unified APCD has also voluntarily set a goal of expending 50 percent of its Carl Moyer funding in environmental justice areas. The district uses excess cancer risk and poverty level to define environmental justice areas within its boundaries. In Years 4 through 6, the Monterey Bay Unified APCD expended about 35 percent of its program funds in environmental justice areas.

In the five air districts subject to the environmental justice requirement, projects in environmental justice areas have reduced NOx and diesel PM emissions, respectively, by about 1,700 and 80 tons per year. Carl Moyer Program projects in these areas achieved NOx reductions more cost-effectively than those outside of environmental justice areas. Carl Moyer Program project funding, emission reductions, and cost-effectiveness in environmental justice areas are provided in Table V-1. Appendix B provides a list of the specific Carl Moyer Program projects funded in environmental justice areas in Years 4 through 6.

**Table V-1**
**Funding and Emissions Reductions in Environmental Justice (EJ) Areas**
**(Years 4 through 6)**

| District | Total Funding | Funding for projects in EJ Areas | Percent of Funding in EJ Areas | EJ Project Diesel PM Reduced (tons/yr) | EJ Project $NO_x$ Reduced (tons/yr) | NOx Cost-Effectiveness | |
|---|---|---|---|---|---|---|---|
| | | | | | | EJ Projects | Non-EJ Projects |
| Bay Area | $3,382,809 | $1,796,480 | 53% | 6 | 87 | $2,800 | $2,200 |
| Sacramento | $5,212,222 | $3,262,385 | 63% | 6 | 148 | $4,600 | $5,200 |
| San Diego | $2,501,214 | $1,450,801 | 58% | 4 | 80 | $1,900 | $3,100 |
| San Joaquin | $8,569,724 | $7,717,874 | 90% | 32 | 713 | $1,800 | $1,600 |
| South Coast | $20,927,053 | $14,452,745 | 69% | 31 | 663 | $2,900 | $2,900 |
| **ALL** | **$40,593,022** | **$28,680,285** | **71%** | **79** | **1,671** | **$2,600** | **$3,000** |

## VI.

## 2006 AUDIT RESULTS

Health and Safety Code § 44291 vests ARB with the responsibility for oversight and monitoring of air districts' implementation of the Carl Moyer Program. In 2006, ARB audited Carl Moyer Program implementation at four air districts: the Ventura County APCD, Sacramento Metropolitan AQMD, South Coast AQMD, and Butte County AQMD. In addition, ARB contracted with the California Department of Finance to evaluate ARB's oversight of the Carl Moyer Program and the South Coast AQMD's expenditure of program funds provided by Proposition 40 in Years 5 and 6 (FY's 2002-03 and 2003-04). The California Bureau of State Audits (BSA) also began a Carl Moyer Program performance audit in October 2006. This section summarizes the results of the Ventura County APCD, Sacramento Metropolitan AQMD, and South Coast AQMD audits. ARB's complete audit reports and the DOF evaluation of ARB are provided in Appendices C through F. As of November 1, 2006, the Butte County AQMD audit report was not yet complete. Once completed, this report, the results of BSA's audit report, and the DOF evaluation of the South Coast AQMD program will be available on ARB's website at www.arb.ca.gov/msprog/moyer/moyer.htm.

### ARB Audit of Air District Programs

ARB's air district program audits in 2006 targeted Year 5 and 6 projects that utilized Proposition 40 funds. These audits focused on determining if program implementation was consistent with the requirements of the Health and Safety Code and the applicable 2003 Carl Moyer Program Guidelines. ARB staff also reviewed the status of selected projects from Years 7 and 8 to evaluate compliance with the 2005 Carl Moyer Program Guidelines. Results of the first three air district audits are summarized below:

- Ventura County APCD – The Ventura County APCD runs an efficient and effective Carl Moyer Program that generally meets the requirements of the Health and Safety Code and the applicable Carl Moyer Program Guidelines. ARB's most significant audit finding pertains to the funding of two ineligible engines. In response to the finding, the district has reprogrammed the funds to pay for eligible engines.

- Sacramento Metropolitan AQMD – The Sacramento Metropolitan AQMD does an excellent job implementing the Carl Moyer Program. ARB's audit findings pertain solely to administrative issues, which the district has agreed to address.

- South Coast AQMD – All Carl Moyer Program projects reviewed by ARB were eligible for Carl Moyer Program funding. However, ARB's fiscal audit found that approximately $10 million of the $15.6 million received by the South Coast AQMD in Years 5 and 6 has not been spent in a timely manner consistent with state law (HSC § 44287). As a result of the audit, the district has committed to expend these funds by July 2007. The DOF conducted a simultaneous audit of the South Coast AQMD's expenditure of Proposition 40 funds and concurs with ARB's assessment.

ARB will conduct a follow-up audit of the South Coast AQMD program in August of 2007 and report back to the Board with the audit results. During 2007, the ARB is also planning on conducting Carl Moyer Program audits of at least three additional air districts. Once complete, the 2007 audit reports and air district responses will be posted on the ARB's Carl Moyer Program website and included in the next Carl Moyer Program Status Report to the Board.

Table VI-1 provides Year 5 and 6 summary of information for the first three air district audits and preliminary information for the Butte County AQMD audit. In Years 5 and 6, all four air districts received more applications for project funding than was available. The Ventura County APCD, South Coast AQMD, and Butte County AQMD all conduct requests for project proposals (RFP) during specific periods of the year and evaluate and select projects based upon cost-effectiveness, public health risks, and other local priorities. The Sacramento Metropolitan AQMD does not rank project applications, but rather funds all cost-effective projects as applications are received until each year's program funds are depleted.

**Table VI-1:**
**2006 Carl Moyer Program District Audit Summary**
**Years 5 and 6**

| | Ventura | Sacramento | South Coast | Butte County[1] |
|---|---|---|---|---|
| Project Solicitation Process: Request for Proposals or First Come, First Serve | Request for Proposals | First Come, First Serve | Request for Proposals | Request for Proposals |
| Board Approval Required? | Yes | No | Yes[2] | Yes |
| Moyer Funding | $1.4 million | $ 3.6 million | $ 15.6 million | $200,000 |
| Applications Received | $1.8 million | $ 3.6 million[3] | $118.5 million | $369,958 |
| Funds Expended[4] | $1.3 million | $ 3.6 million | $ 5.5 million | $200,000 |
| Variety of Projects Funded[5] | 4 | 7 | 8 | 3 |
| Environmental Justice Selection Criteria? | No | Yes | Yes | No |
| Average Program NOx Cost-Effectiveness ($/ton) | $2,200 | $5,100 | $2,900 | $1,500 |
| Carl Moyer Program Employees (PYs) | 1.0 | 2.3 | 1.5 | 0.3 |
| Average Time to Select Projects (months)[6] | 2.7 | 4.2 | 4.7 | 1.5 |
| Average Time to Enter into Contract (months)[6] | 2.9 | 4.4 | 15.0 | 3.5 |
| Average Time to Project Completion (months)[6,7] | 10.2 | 6.4 | 30.0[8] | 7.3 |

ARB district field audits occurred on the following dates: Ventura County APCD – May 8-12, 2006; Sacramento Metropolitan AQMD – June 26-30, 2006; South Coast AQMD – July 6-18, 2006;
Butte County AQMD – September 11-14, 2006.

1 – Numbers based on preliminary audit information for the Butte County AQMD.

2 – The South Coast AQMD project selection process also includes evaluation by a technology committee.

3 – Sacramento Metropolitan AQMD has a continuous First-Come, First-Serve project application period. Applications received after Year 5 and 6 funds are committed to specific projects are considered Year 7 applications.

4 – Totals refer to funds expended at time of district audit. Funds for which the first project invoice has been received are considered fully expended.

5 – Includes all project types funded in Years 1 through 6. Project types include new purchase, repower, and retrofit of on-road heavy-duty vehicles, off-road equipment, locomotives, marine vessels, and agricultural irrigation pump engines. Truck stop electrification also included.

6 – Averages are based on project files audited by ARB and reflect the average time from receipt of the project application.

7 – Project completion date reflects the date the first project invoice date is received by the district.

8 – Some projects were not yet complete at the time of ARB's audit; these were evaluated based on time from project application until the ARB audit date. The average time to project completion therefore represents a minimum.

**Department of Finance Evaluation of ARB Program**

In order to ensure ARB's oversight of the Carl Moyer Program is as effective and efficient as possible, ARB requested a DOF program evaluation in 2006. The DOF completed its evaluation in August 2006. The DOF evaluation provides suggestions for improving the effectiveness and accountability of the program, such as establishment of more specific guidelines for project data collection. The evaluation also recommends financial practices and program areas that should be more prescriptive, such as the timing and protocol for an air district to return unspent funds. The DOF evaluation also suggests increasing ARB audits of air district programs. DOF's suggestions will be considered for inclusion in the 2007 revisions to the Carl Moyer Program Guidelines. The DOF evaluation final report is attached in Appendix F.

**Bureau of State Audits**

In March 2006, the California Senate Joint Legislative Audit Committee, at the request of State Senator Dean Florez, requested that the California BSA conduct a performance audit focusing on how air districts distribute Carl Moyer Program funding. The committee requested that the BSA investigate and compare practices at California's four largest air districts – the South Coast AQMD, San Joaquin Valley Unified APCD, Bay Area AQMD, and Sacramento Metropolitan AQMD. Specifically, the committee requested that the audit evaluate:

- the efficiency and equity of the application process;
- the effectiveness of project selection and funding distribution in achieving maximum emission reduction and public health protection; and
- the availability and quality of public information and public outreach about the program to ensure participation.

In late October 2006, the BSA began their Carl Moyer Program audit focused on program efficiency and effectiveness. The BSA plans to review, at a minimum, ARB's oversight of the Carl Moyer Program, as well as program implementation at the four air districts listed above. The BSA expects to complete its audits by late Spring 2007. Once complete, the BSA audit report will be posted on ARB's Carl Moyer Program website and included in the next Carl Moyer Program Status Report to the Board. ARB will consider BSA's audit findings and recommendations as part of the 2007 Carl Moyer Program Guideline revisions.

## VII.

## STATE IMPLEMENTATION PLAN

California's 2003 South Coast SIP and the San Joaquin Valley 2004 Ozone SIP include commitments to provide significant NOx reduction in each region by 2010. The State's strategy to achieve these reductions includes new regulations focused on reducing emissions from in-use vehicles and engines. The Carl Moyer Program fills a critical niche in California's strategy to attain federal ambient air quality standards by getting early and extra emission reductions from in-use engines, and by targeting sources which aren't feasible to regulate or which lie outside of California's regulatory jurisdiction. California relies upon regulations combined with turnover of the fleet to cleaner vehicles and equipment to provide about 90 percent of the emission reductions needed to meet its SIP commitments. Innovative programs such as the Carl Moyer Program are expected to provide the remaining ten percent of emission reductions.

**New State Implementation Plans**

SIPs demonstrating compliance with the new, more health-protective federal 8-hour ozone standard are due to U.S. EPA by June 15, 2007. Attainment of the 8-hour standard will require additional emission reductions beyond those needed to meet the one-hour standard in most air districts. Fifteen areas encompassing over 90 percent of the state's population are designated federal 8-hour ozone non-attainment areas. These areas and their federal 8-hour ozone attainment deadlines are:

- 2007 – Imperial County and the San Francisco Bay Area
- 2009 - 2014 – Amador, Butte, Calaveras, Mariposa, San Diego, and Toulumne Counties, Eastern Kern County, Western Nevada County, and the Sutter Buttes
- 2010 – Antelope Valley, Ventura County, and Western Mojave Desert
- 2013 – Coachella Valley, the Sacramento Region, and the San Joaquin Valley
- 2021 – The South Coast Air Basin

The South Coast Air Basin and San Joaquin Valley are also designated non-attainment of the federal standard for particulate matter less than 2.5 microns in diameter (PM2.5). Since NOx is an important precursor to particulate matter formation, both NOx and PM reductions are critical in demonstrating attainment of the PM2.5 standard by these regions' 2015 attainment deadline. Preliminary air quality modeling indicates the San Joaquin Valley will need at least 300 tpd additional NOx reductions to meet the federal 8-hour ozone standard by 2013 and the South Coast will need at least 150 tpd of additional NOx reductions to attain the federal PM2.5 standard by 2015.

Table VII-1 provides ranges for potential statewide emission reductions from the Carl Moyer Program for key years between 2006 and 2021. The emission reduction benefits of the Carl Moyer Program are highest between 2012 and 2016, when program funding will have reached its peak for at least five years.

**Table VII-1:**
**Projected Statewide Emission Benefits**
**of Carl Moyer Program Projects (tpd)**

| Emissions | | 2006 | 2009 | 2012 | 2015 | 2018 | 2021 |
|---|---|---|---|---|---|---|---|
| **NOx Reductions** | high | 7 | 16 | 30 | 30 | 12 | 0 |
| | low | | 10 | 10 | 10 | 3 | 0 |
| **ROG Reductions** | high | 0 | 2 | 4 | 4 | 2 | 0 |
| | low | | 1 | 1 | 1 | 0 | 0 |
| **PM Reductions** | high | 0.4 | 1.0 | 1.9 | 1.9 | 0.8 | 0.0 |
| | low | | 0.5 | 0.5 | 0.5 | 0.2 | 0.0 |

Based upon $141 million in project funding annually from 2007-2015, with 25 percent light-duty vehicle projects, 15 percent heavy-duty vehicle fleet modernization projects, and the remaining 60 percent assumed to be similar to typical Year 1 through 6 projects. "High" assumes an average project life of five years and cost-effectiveness between $3,000 and $12,000 per ton. "Low" assumes a three-year project life and a cost-effectiveness of $14,300 per ton.

## SIP Emission Reductions

As Table VII-1 illustrates, emission reductions achieved through the Carl Moyer Program can vary considerably, depending upon the cost-effectiveness and project life of projects funded. Because air districts receive over 90 percent of Carl Moyer Program project funding, each district is empowered to tailor its program to achieve the maximum possible emission reductions in its required attainment year. For example, an air district with a 2013 ozone attainment date can maximize emission reductions in the attainment year by selecting the most cost-effective projects which have a project life through 2013.

Since each air district has its own attainment deadlines and attainment strategies (including the mix of NOx, ROG, and PM reductions needed), there is no uniform mechanism to maximize Carl Moyer Program SIP benefits. However, the trend towards a shorter project life suggests opportunities may be lost for achieving SIP emission reductions, especially in districts with worse air quality and later attainment dates. For example, a project starting in 2010 in an area with a 2013 attainment deadline would not achieve any SIP benefit with a three year project life. The cleaner engine may still be in operation in 2013, but its operation is impossible to verify or enforce. If the engine were subject to a regulation prior to the attainment date, the benefits of the cleaner engine could be "anyway reductions" – reductions which would have occurred anyway due to the regulation. As Carl Moyer Program project life shortens – sometimes to enable funding of soon-to-be regulated source categories – it will become increasingly important to distinguish between SIP-creditable emission reductions and provision of compliance assistance.

## VIII.

## LOOKING AHEAD

The Carl Moyer Program has expanded significantly from a NOx-only program at its inception to one which targets multiple pollutants and includes several new source categories. In the years ahead, the Carl Moyer Program must continue to evolve while adhering to its core mandate to achieve real, surplus, quantifiable, and cost-effective emission reductions. This chapter provides a brief overview of how new regulations, the one billion dollar goods movement air quality bond, and other issues could impact the Carl Moyer Program in the years ahead.

### New Regulations

Regulations targeting in-use heavy-duty vehicles and equipment play a central role in ARB's strategy to meet federal air quality standards and reduce community health risks. Since 2000, ARB has adopted regulations to reduce emissions from in-use public transit buses, solid waste collection vehicles, public and utility on-road heavy-duty vehicle fleets, cargo-handling equipment, agricultural irrigation pump engines, and other source categories. New regulations to reduce emissions from in-use public on- and off-road fleets and in-use harbor craft are slated for Board consideration in 2007. Regulations targeting in-use engines, in particular, can impact the universe of surplus and cost-effective emission reductions eligible for Carl Moyer Program funding. For example, purchase and installation of a retrofit device isn't "surplus" and eligible for Carl Moyer Program funding if the retrofit is required by regulation within the next three years.

As traditional Carl Moyer Program source categories are increasingly subject to in-use requirements, the availability of projects in regulated source categories could decline. However, several factors suggest that demand for Carl Moyer Program grant funding will be strong through the program's 2015 sunset date. First, recent legislation has expanded the program to allow funding for projects that reduce ROG and PM emissions. This has added funding opportunities for gasoline engine projects, as well as diesel engine projects. Voluntary car scrap programs are an example of a new Carl Moyer Program source category that funds emission reductions from gasoline engines. A second factor relates to new ARB regulations under development to require clean-up of privately-owned diesel trucks and off-road equipment. These regulations are likely to provide more time for compliance for small businesses. Carl Moyer Program funds provide an opportunity for small business owners to reduce the cost of the regulation through early regulatory compliance. Third, there remain many sources of NOx and PM emissions that are not subject to upcoming ARB regulations aimed at reducing emissions from existing engines. An example is locomotive engines, where federal preemption applies. Given that the cost of cleaning up California's fleet of in-use diesel engines is at least ten times the available Carl Moyer Program funds, demand for funding from this program will remain high.

ARB will also pursue opportunities for additional source categories to be eligible for Carl Moyer Program funding where real, surplus, quantifiable, and cost-effective emission

reductions can be achieved. New source categories to be evaluated in 2007 for potential inclusion in the Carl Moyer Program are described below.

**Goods Movement and Air Quality Bond Funding**

In November 2006, California voters approved Proposition 1B: The Highway Safety, Traffic Reduction, Air Quality, and Port Security Bond Act of 2006. One billion dollars of this general obligation bond is to be used to reduce emissions from goods movement activities. The bond language specifies only that funds be made available to ARB "for emission reductions, not otherwise required by law or regulation, from activities related to the movement of freight along California's trade corridors."[1] Enabling legislation is required before funds authorized by the bond can be made available to ARB and may provide additional direction regarding fund expenditure deadlines, project categories, and funding recipients.

In its first six years, the Carl Moyer Program has provided an average of about $4 million per year to fund goods movement projects, including marine vessels, locomotives, cargo-handling equipment, and line-haul trucks. Since $4 million represents less than five percent of Carl Moyer Program annual funding in future years, the bond funding should not have a significant impact on demand for Carl Moyer Program projects.

**New Source Category Evaluations**

Opportunities for funding of new types of Carl Moyer Program projects are likely to increase in the years ahead. ARB is working with air districts and other stakeholders to evaluate additional off-road source categories to include in the 2007 Carl Moyer Program Guideline update. ARB will hold workshops on the 2007 Carl Moyer Program Guideline update in 2007, with a kickoff workshop planned for early 2007. The guideline update is scheduled to be considered by the Board in November 2007.

**Off-Road Industrial Equipment Electrification.** Senate Bill 467 (Lowenthal), signed into law in 2005, requires ARB to revise the Carl Moyer Program Guidelines to modify the cost-effectiveness calculations for projects in which in-use industrial non-road equipment such as forklifts are replaced with electric-powered equipment. ARB is evaluating how such a program could be tailored. Project criteria for this source category will be included in the 2007 Carl Moyer Program Guideline update.

**Off-Road Equipment Fleet Modernization Program.** ARB is evaluating opportunities to achieve surplus and cost-effective emission reductions through projects which replace an older, dirtier piece of equipment with a newer, cleaner model. As with the on-road heavy-duty fleet modernization category, such a program will initially target certain equipment types to ensure projects achieve real, surplus, quantifiable, and cost-effective emission reductions. If this project category shows promise, criteria for project funding will be included in the 2007 Carl Moyer Program Guideline update.

[1] Highway Safety, Traffic Reduction, Air Quality, and Port Security Bond Act of 2006. Stats. 2006, Chapter 25 (SB 1266).

**Non-Engine Agriculture Projects.** ARB will continue to monitor non-engine agricultural projects, such as dairies or fugitive dust sources, for potential inclusion in the Carl Moyer Program. Project criteria for this source category will be developed where technology is available to ensure emission reductions are real, surplus, quantifiable, and enforceable.

**Other Program Enhancements**

ARB is working with air districts and other stakeholders to improve the effectiveness and efficiency of the Carl Moyer Program. Strategies being pursued include:

- Clean Air Reporting Log (CARL) **–** With the significant increase in annual program funding comes an increased need for program efficiency and accountability. ARB is developing a web-based Carl Moyer Program reporting and tracking system which will allow air districts to calculate project cost-effectiveness, automate project reporting, and query program parameters, such as emission reductions achieved and average cost-effectiveness. The project tracking system is currently being evaluated by ARB and air district staff and is projected to be ready in early 2007 for use in evaluating and reporting Year 9 projects. ARB plans to provide air districts with training on how to use the system in Sacramento, the San Joaquin Valley, and South Coast between February and April, 2007.

- Locomotive Memorandum of Understanding (MOU) Penalties – The June 2005 Locomotive MOU between ARB and the Burlington Northern and Santa Fe (BNSF) and Union Pacific (UP) railroads specifies that penalties assessed due to MOU non-compliance "be deposited into the Carl Moyer Program account and … distributed to the air district where the violation occurred."[1] The MOU requires, among other things, installation of locomotive idle-limiting devices on virtually all BNSF and UP intrastate locomotives. As of October 1, 2006, $4,800 in total fines were assessed in the Bay Area AQMD, Mojave Desert AQMD, Placer County APCD, South Coast AQMD, and San Joaquin Valley APCD. ARB will distribute these funds – and any additional penalty funds assessed through September 2007 – to the air districts in which the penalties occurred as part of the Carl Moyer Program Year 10 (FY 2007-08) program allocation.

- Enhanced Outreach **–** Outreach to all groups of potential Carl Moyer Program applicants is critical to the continued success of the program. ARB is evaluating methods to improve program outreach, particularly in environmental justice communities, to small businesses, and for zero-emission projects.

- Rural Air District Liaison – Rural air districts face unique challenges in implementing the Carl Moyer Program. For example, some rural air districts have one staff person responsible for all district functions, making it difficult to allocate resources for Carl

[1] ARB/Railroad Statewide Agreement – Particulate Emissions Reduction Program at California Rail Yards, June 2005, Section 10(a)(iii).

Moyer Program outreach, project evaluation, oversight, and reporting. In Year 7, ARB contracted with the California Air Pollution Control Officers Association (CAPCOA) for a rural air district liaison to help solicit Carl Moyer Program projects for rural air districts. Several air districts have contributed their Year 7 Carl Moyer Program grants – up to $970,000 – for projects to be solicited by CAPCOA. On December 20, 2006, CAPCOA issued a solicitation for projects to be funded on a first-come, first-served basis. While the solicitation targets projects in rural air districts, projects throughout California are eligible for funding. These funds must be expended by June 30, 2007. If successful, this approach to funding rural district projects could be pursued in future funding cycles.

- Voucher Program – ARB is exploring the feasibility of a rebate or voucher program to streamline and expedite Carl Moyer Program fund disbursement. ARB may conduct a pilot voucher program using 2007 Carl Moyer Program multi-district funds for retrofit devices which reduce both NOx and PM emissions from on-road heavy-duty vehicles as part of a pilot voucher program. The program would be part of SmartWay Upgrade Kits, co-funded by Cascade Sierra Solutions and the U.S. EPA SmartWay Transportation Partnership to reduce vehicle emissions and fuel consumption.

## IX.

## CONCLUSION

The Carl Moyer Program is a critical component of California's strategy to attain federal air quality standards and address community health risks. By providing grants to clean up in-use vehicles and equipment, the program accelerates achievement of emission reductions and the purchase of low-emission technologies. In its first six years, the Carl Moyer Program has achieved the following:

- Emission Reductions – Projects funded by the Carl Moyer Program have reduced NOx and PM emissions by over 18 tpd and almost one tpd, respectively.

- Cost-Effectiveness – The average cost-effectiveness of Carl Moyer Program projects was about $2,600 per ton of NOx emissions reduced.

- Funding – The Carl Moyer Program has provided over $140 million in grants in Years 1 through 6 to accelerate the clean-up of in-use vehicles and equipment. Legislation signed by the Governor in 2004 provides new funding for continued implementation of the Carl Moyer Program – up to $141 million annually through 2015.

- Environmental Justice – The five large California air districts collectively expended over seventy percent of program funds in these areas in Years 4 through 6. About 4.5 tpd of NOx and 0.2 tpd of PM emission reductions have been achieved by Carl Moyer Program projects in environmental justice communities over this period.

Legislative changes to the Carl Moyer Program beginning in Year 7 include the formal addition of PM and ROG to the program and new project source categories, such as heavy-duty vehicle fleet modernization and voluntary accelerated vehicle retirement. The Carl Moyer Program will continue to be a critical component of California's strategy to attain federal standards for ozone and particulate matter. ARB staff is evaluating additional source categories for potential program expansion, and is considering mechanisms to improve program implementation. As the Carl Moyer Program evolves, it will be critical to improve the efficiency of the program while continuing to achieve real, surplus, quantifiable, and cost-effective emission reductions.