

**Report on Reductions Achieved from Incentive-Based  
Emission Reduction Measures in the San Joaquin Valley**

**APPENDIX A.3: 2005 Carl Moyer Memorial Air Quality  
Standards Attainment Program Guidelines Part III**

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*Air Resources Board*

# **THE CARL MOYER PROGRAM GUIDELINES**

## **PART III of IV**

### **AGRICULTURAL ASSISTANCE PROGRAM**

Approved  
November 17, 2005

## AGRICULTURAL ASSISTANCE PROGRAM

The Agricultural Assistance Program was created through provisions of Assembly Bill 923 (AB 923, Firebaugh) and went into effect on January 1, 2005. This legislation authorizes local districts to increase the motor vehicle registration fee. One of the projects which may be funded with the monies is compliance with emission reduction requirements for previously unregulated agricultural sources of air pollution. Unlike the Carl Moyer Program, the Agricultural Assistance Program does not require the emissions reductions to be surplus. This document presents an overview of the Agricultural Assistance Program, current regulations, potential project types, application requirements, and methodology for calculating the cost-effectiveness of total reductions for a project.

### I. Background

Local air districts may impose a surcharge on motor vehicle registration fees (up to \$4 per vehicle) for air quality improvement strategies (California Health and Safety Code (HSC) sections 41081 and 44229). In 2004, AB 923 provided districts with the authority to increase the allowable surcharge by up to an additional \$2. Districts receiving the additional \$2 surcharge may use the funds to implement four specific programs:

- projects funded through the Carl Moyer Program.
- the new purchase, retrofit, repower, or add-on of previously unregulated equipment for agricultural sources.
- school bus purchases through the Lower Emission School Bus Program.
- an accelerated vehicle retirement or repair program.

The Agricultural Assistance Program was created to implement the second program: “the new purchase, retrofit, repower, or add-on of previously unregulated equipment for agricultural sources.”

Districts funds from the two dollar surcharge that are applied to the Agricultural Assistance Program may be used to help agricultural operations meet local and state air quality requirements. Qualified projects are eligible for funding for a minimum of three years from the date of adoption of an applicable rule or standard, or until the compliance date of that rule or standard, whichever is later. Eligible projects are not required to provide surplus emission reductions. The emission benefits of projects funded by the Agricultural Assistance Program are already counted in the emission benefits of individual local or state rules. District funds applied to the Agricultural Assistance Program do not count for district match funds in the Carl Moyer Program.

“Agricultural source of air pollution,” for the purposes of AB 923 and the Agricultural Assistance Program, is defined in HSC section 39011.5(a) as a source or group of sources used in the production of crops or raising of fowl or animals located on

contiguous property and under common ownership or control. Four categories of emission sources are identified as part of this definition:

- confined animal facilities (CAFs).
- internal combustion engines, including portable and off-road engines, unless used to propel instruments of husbandry.
- sources subject to requirements of Title V, the federal Operating Permitting Program for major stationary sources.
- sources of emissions otherwise subject to district regulation.

The statutory provisions of AB 923 also require that Agricultural Assistance Program projects follow the Carl Moyer Guidelines [ARB, 2005c]. Project criteria are based on the Carl Moyer Program Guidelines, with modifications to the surplus emission reductions requirements and cost-effectiveness methodology.

## **II. Statutory and Regulatory Requirements**

### **A. SB 700**

In 2003, Senate Bill 700 (SB 700, Florez) amended and added air pollution control requirements in the HSC (sections 39011.5, 39023.3, 40724, 40724.5, 40724.6, 40724.7, 40731, 42301.16, 42301.17, 42301.18, 42310, and 44559.9) to include requirements for agricultural sources of air pollution. Some of the key requirements of this legislation are listed below:

- The legislation created a definition for “agricultural source of air pollution.” The definition is provided in the preceding section of this document.
- The legislation removed language exempting agricultural sources from air quality permits in the HSC in its entirety. As a result, agricultural operations may be required to obtain air permits from local districts.
- The legislation established specific agricultural source permitting and exemption requirements for local districts.
- The legislation required certain districts to adopt by regulation a set of measures to reduce emissions from agricultural sources in federal particulate matter non-attainment areas.
- The legislation required the ARB to establish a definition for a “large” CAF, and required certain districts to adopt rules requiring large CAFs to obtain permits and implement emission mitigation measures.

### **B. Stationary Diesel Engines ATCM**

In February 2004, the Board adopted an air toxics control measure (ATCM) for stationary compression ignition (CI) engines greater than 50 horsepower [ARB, 2003].

The Board amended the ATCM in May 2005 [ARB, 2005a]. The control measure requires new CI engines for agricultural operations, including those used to repower agricultural equipment, to meet ARB and federal new off-road engine PM certification standards for engines of the same horsepower and model year. The only exception to this requirement is for the installation of Tier 2 engines funds through January 1, 2008, purchased with Carl Moyer Program.

ARB staff is currently working on the development of in-use stationary diesel agricultural engine requirements to be considered by the Board in 2006.

### **C. Diesel-Fueled Portable Engines ATCM**

An ATCM for portable diesel engines was adopted by the Board in February 2004 [ARB, 2004]. The control measure requires all diesel-fueled portable engines 50 horsepower and greater to be certified to Tier 1, 2, or 3 federal and state off-road engine emission standards by 2010. The ATCM also requires fleets of portable engines 50 horsepower and greater to meet weighted particulate matter emission standards that become more stringent in 2013, 2017, and 2020.

### **D. Large Confined Animal Facility Definition**

In response to the requirements of SB 700, the Board approved a definition for large CAF on June 23, 2005 [ARB, 2005b]. The definition (shown in Table 1) is based on headcount of livestock categories and takes into consideration the federal ozone attainment status of districts as well as livestock population and operational practices of facilities. A recordkeeping component requires the owner or operator of a large CAF to keep a daily record of animals at the facility and to submit the information to the local air district consistent with applicable local rules.

By July 1, 2006, air districts in federal ozone non-attainment areas must adopt rules requiring large CAFs to submit a mitigation plan to reduce air contaminants to the extent feasible. Each air district in a federal ozone attainment area must adopt a similar rule by July 1, 2006, unless its district board makes a finding in a public hearing that large CAFs will not contribute to violations of state or federal standards. Large CAFs have six months from the date of adoption of the district rule to submit their mitigation plans to the district; the districts have an additional six months to approve submitted plans. One year after submitting their plans (July 1, 2008), large CAFs must comply with the requirements of their mitigation plans.

**Table 1**  
**Large Confined Animal Facility Definition by Livestock Category**  
**(facilities at or exceeding threshold are considered large)**

<b>Livestock Category</b>	<b>Non-Attainment Areas*</b>	<b>Attainment Areas*</b>
Dairy	1,000 milk producing cows	2,000 milk producing cows
Beef Feedlots	2,500 beef cattle	5,000 beef cattle
Other Cattle Operations	7,500 calves, heifers, or other cattle	15,000 calves, heifers, or other cattle
Chickens – Broilers	650,000	1,300,000
Chickens – Egg Layers	650,000	1,300,000
Turkeys	100,000	200,000
Swine	3,000	6,000
Sheep and Goats	15,000	30,000
Horses	2,500	5,000
Ducks	650,000	1,300,000
Rabbits, Pheasants, Llamas, Others	30,000	60,000

\*Federal 1-hour ozone designation as of January 1, 2004

### **E. Local Air District Rules**

Internal combustion engines: Prior to the adoption of SB 700, most air districts specifically exempted agricultural engines from prohibitory rules for stationary internal combustion engines greater than 50 horsepower. As a result, stationary agricultural engine emissions were largely uncontrolled. These districts have amended (or will amend) their internal combustion engine rules to remove the agricultural operation exemption. In these districts, stationary internal combustion engines used in agricultural operations are now required (or will be required) to meet the emission standards/limits, permitting conditions, and compliance requirements of the local district.

Large Confined Animal Facilities: As outlined in the previous section, local air districts in federal ozone non-attainment areas are required to adopt rules developed to mitigate emissions from large CAFs. Local air districts in federal ozone attainment areas are also required to develop rules to mitigate large CAF emissions unless their district boards make a finding in a public hearing that large CAFs will not contribute to violations of state or federal standards. A number of air districts have or are preparing to adopt regulations to meet these requirements.

Fugitive Dust Control: A number of air districts require agricultural operations to reduce fugitive dust emissions through local rules. Local rules for particulate matter dust control generally require agricultural operations to implement a variety of practice-specific options to reduce particulate matter. These practices may include methods to reduce the movement of soil during land preparation, cultivation, and

harvesting, suppression of dust on unpaved roads, alternatives to burning, and reduction of agricultural chemical applications.

#### **IV. Potential Projects**

The statutory provisions of AB 923 include requirements for Agricultural Assistance Program eligible projects:

- Projects must involve the new purchase, retrofit, repower, or add-on of equipment.
- Projects must reduce emissions from previously unregulated sources; that is, sources that are unregulated as of January 1, 2005 (the effective date of the legislation), but are subject to regulation at the time of the grant.
- Projects must be funded within three years of rule adoption or before the compliance date of the rule, whichever is later.
- The ARB must determine that the applicable rule complies with HSC sections 40913, 40914, and 40915 pertaining to district attainment plan measures. District plans must be designed to achieve and maintain the state ambient air quality standards by the earliest practicable date through the use of all feasible measures. ARB routinely reviews district rules for compliance with these requirements and will treat agriculture-related rules the same way.

Criteria for the Agricultural Assistance Program are adapted from the 2005 Carl Moyer Program Guidelines and are designed to ensure that the emission reductions expected through the deployment of electric motors, reduced-emission engines, or retrofit technologies under this program are real, enforceable, and quantifiable. All projects must meet a weighted cost-effectiveness of total reductions criterion of \$14,300 per weighted ton of pollutants reduced. In addition, at each district's discretion, eligible projects may be subject to funding or cost-effectiveness of total reductions caps. A project must be in operation for at least three years from the time it is first put into operation; ARB may approve a shorter project life on a case-by-case basis.

##### **A. New Purchase**

The only eligible project for a new agricultural stationary or portable equipment purchase is a new electric motor. For the purposes of determining emission reductions, the new electric motor is compared to an off-road diesel engine certified to the current off-road emission standards.

## **B. Repower**

### **1. Repower with Electric Motors**

Replacement of uncontrolled or older engines in agricultural operations with electric motors provides significant emission benefits. Diesel and SI engines may be repowered with electric motors. In addition, selected costs for necessary peripheral equipment associated with the motor (e.g., control panel, motor leads, service pole with guy wire, connecting electric line) may be included in determining the grant amount awarded.

In June 2005, the Public Utilities Commission approved a reduced electricity rate and line extension allowance for Pacific Gas and Electric (PG&E) and Southern California Edison (SCE) to be used for conversion of stationary agricultural internal combustion engines to electric. Individuals enrolling in the PG&E and SCE incentive programs may receive funds through the Agricultural Assistance Program for an electric motor replacement of an internal combustion engine. Please refer to Part II, Chapter 12: Zero-Emission Technologies in the 2005 Carl Moyer Program Guidelines for specific information on these projects.

### **2. Repower with Emission-Certified Engines**

Stationary and portable agricultural engines may be repowered with new off-road engines certified to the current applicable off-road emission standards. This provision applies to repowers with diesel and spark-ignited (SI) engines. Diesel engines may be replaced with cleaner diesel or SI engines. SI engines may only be replaced with cleaner SI engines; projects replacing SI engines with diesel engines are not eligible for Agricultural Assistance Program funding. Cost-effectiveness of total reductions calculations are based on the rebuild cost of the engine being replaced.

### **3. Repower with SI Engines Meeting Local District Requirements**

Very few power systems using SI engines for stationary and portable applications have been certified to meet applicable emission standards. These power systems are typically assembled by third parties and are not required to be certified because they are used in stationary applications. Because under certain conditions SI engines can be significantly cleaner than diesel engines, Agricultural Assistance Program funds may be used to fund purchases of non-certified SI engines in some cases. This provision is available until January 1, 2008. This will allow ARB and the districts an opportunity to assess the emission performance and durability of non-certified SI engines in the field. Emission reduction calculations are based on the rebuild cost of the engine being replaced.

Non-certified SI engines purchased through the Agricultural Assistance Program are required to have best available emission control components, and are subject to local

district source testing and monitoring requirements. The costs associated for testing and monitoring may not be included in the grant award.

### **C. Retrofit**

A retrofit involves modifications to the engine and/or fuel system such that the retrofitted engine does not have the same specifications as the original engine. Retrofit projects that reduce NO<sub>x</sub> may be applicable to certain diesel or SI engine families. Emission control technologies that have been verified for use to reduce NO<sub>x</sub> and PM emissions in other applications for on-road or off-road diesel or SI engines may be applicable to stationary and portable agricultural engines. A NO<sub>x</sub> retrofit for an uncontrolled diesel engine must be verified to reduce emissions to the applicable new engine tier standard or less for a given engine size and not increase particulate matter. An emission-certified stationary or portable engine may use a retrofit kit that is verified to reduce NO<sub>x</sub> or NO<sub>x</sub> + non-methane hydrocarbon (NMHC) emissions by at least 15 percent from the applicable emission standard. Uncontrolled SI engines may use a retrofit kit verified to reduce emissions to the currently applicable standard for large SI equipment, or if not feasible, with a retrofit kit verified to reduce emissions to at least 3.0 g/bhp-hr. The emission reductions provided by a retrofit kit must meet local district rule requirements. Emission reduction calculations are based on the emission rates of the existing engine being retrofitted.

### **D. Non-Engine Projects**

The Board has directed the Executive Officer to develop project criteria for non-engine agricultural sources where technology is available to ensure the emission reductions are real, quantifiable, and enforceable. However, no specific project criteria have been identified currently due to the limited data available on specific control technologies. ARB staff will continue to work closely with the districts and interested stakeholders to monitor technological developments to determine when and if it is appropriate to develop project criteria for non-engine sources.

Agricultural Assistance Program funding will not be available for non-engine agricultural projects until ARB staff develop Carl Moyer Program project criteria for these sources. Potential control technologies and regulatory options will be evaluated for suitability under Agricultural Assistance Program requirements. During these evaluations, ARB staff will consider:

- whether the technology provides real, quantifiable, and enforceable emission reductions.
- the availability of standardized testing procedures that will quantify emission reductions from these technologies.
- availability of baseline emission factors.
- potential multi-media issues.

While engines have a statewide certification or verification process to prove the emission levels are achieved in practice, there is no comparable statewide process for stationary or area-wide sources. In developing statewide project criteria for non-engine technology ARB staff will consider how to assure reductions are achieved.

If non-engine agricultural projects include reductions of non-combustion PM, the criteria will include a weighting factor for non-combustion PM for use in the cost-effectiveness of total reductions formula.

The following sections provide background on some potential non-engine agricultural projects.

## **1. Livestock Operations**

Air emissions of concern from livestock include ammonia, nitrous oxide, methane, carbon dioxide, volatile organic compounds (VOC), hydrogen sulfide, and particulate matter. The emissions can come from animal housing, storage areas for manure and wastewater, cropland where manure is applied, and directly from the cows. Livestock emissions are most significant in the San Joaquin Valley and the South Coast Air Basin.

The South Coast Air Quality Management District adopted Rule 1127 - Emission Reductions from Livestock Waste in 2004. This rule requires dairies to clear manure from corrals more frequently and send the manure to an emissions-controlled compost facility, an anaerobic digester, or to agricultural land where manure is approved for spreading as fertilizer.

The San Joaquin Valley Unified Air Pollution Control District recently adopted a VOC emission factor to be used for permitting San Joaquin Valley dairies. The District reviewed important classes of VOC constituents and key dairy processes individually before approving a total dairy emission factor of 19.3 lbs/year/head. The District will consider regulations to reduce emissions from dairies in the near future.

With the upcoming SB 700 deadlines for approving large CAF mitigation plans, there is a need for a rapid, objective assessment of which technologies are most likely to be successful in California's unique economic, regulatory, and environmental conditions. The Dairy Manure Technology Feasibility Assessment Panel, created and hosted by the ARB, was convened in February 2005 to carry out this work. Members were drawn from government, industry, academia, and environmental and conservation groups.

The Panel evaluated technologies for their potential to reduce environmental impacts resulting from air emissions and from releases of nutrients, salts, and pathogens to the environment. The Panel is assessing the ability of the technology to prevent releases of contaminants and is considering their efficacy in reducing environmental impacts, energy production (if any), economic performance (including saleable products produced by the technology), quality of supporting data, and the development status. The Panel's draft report is scheduled for release in early 2006.

In general, potential technologies may be classified into categories including:

- Thermal conversion (including combustion and gasification).
- Solid-liquid separation (including dehydration).
- Composting.
- Anaerobic digestion.
- Aerators/mixers.
- Nitrification/denitrification.
- Covers.
- Microbials, enzymes, and other additives.
- Feed management.
- Trapping nutrients in biomass (e.g. crops, plants in constructed wetlands, algae, fish).
- Combination systems (such as wastewater treatment plants).

It is likely that no single technology will solve all of the problems associated with dairy manure and each dairy will likely require its own unique combination of technologies to address the specific problems of that area. Research still needs to be done on VOC emissions to quantify amounts emitted from each portion of the dairy, and reactivity of the chemical species to form ozone. Without this information and a lack of standard testing procedures, it is difficult to assess how various technologies will reduce these emissions, reduce ozone formation, and improve air quality.

## **2. Other Projects**

Non-combustion particulate matter reductions can be achieved through the use of chemical dust suppressants, road paving, and harvesting equipment with catch-frame technology to eliminate the need for sweeping. For some of these projects, multimedia impacts must also be considered.

Another potential project is the evaluation of irrigation pump efficiency. Improvement in pump efficiency through parts replacement and repair has the potential for emission reductions of NO<sub>x</sub>, ROG, and PM<sub>10</sub> by reduced work by the engine or motor for water output.

## **V. Project Criteria**

The project criteria below have been designed to provide districts and potential applicants with a list of minimum eligibility requirements for Agricultural Assistance Program funding. Criteria focus on emission reductions, cost-effectiveness of total reductions, and the ability for a project to be completed within the timeframe of the program. Additional information about funding electric motors for irrigation pumps is available in Part II, Chapter 12: Zero Emission Technologies of the 2005 Carl Moyer Program Guidelines.

Participating districts retain the authority to impose additional requirements in order to address local concerns.

#### **A. General**

- The Agricultural Assistance Program may be used to fund projects from previously unregulated agricultural sources of air pollution for a minimum of three years from the adoption of an applicable rule or until the compliance date, whichever is later. Emission reductions are not required to be surplus.
- Projects must meet a cost-effectiveness of total reductions of \$14,300 per weighed ton of NO<sub>x</sub> + ROG + combustion PM<sub>10</sub> reduced calculated in accordance with the cost-effectiveness of total reductions methodology discussed in this chapter.
- No project funded by the Agricultural Assistance Program shall be used for credit under any federal or state emission averaging banking and trading program.
- Agricultural Assistance Program grants can be no greater than a project's incremental cost. The incremental cost is the cost of the project minus the baseline cost. The incremental cost shall be reduced by the value of any current financial incentive that reduces the project price, including tax credits or deductions, grants, or other public financial assistance.
- Projects must have a minimum project life of three years. ARB may approve shorter project life on a case-by-case basis. Projects with shorter lives may be subject to additional funding restrictions, such as a lower cost-effectiveness of total reductions limit or a project cost cap.
- The contract term must extend to the end of the project life.
- Potential projects that fall outside of these criteria may be considered on a case-by-case basis if evidence provided to the air district suggests potential real, quantifiable, and enforceable emission reduction benefits.
- Air districts must consult with ARB staff to determine eligibility of all projects considered for funding on a case-by-case basis. All projects considered on a case-by-case basis must receive ARB approval prior to receiving program funding.
- An engine must be rated at greater than 25 hp, which is equivalent to an electric motor greater than 19 kW.
- Projects must operate at least 75 percent of total equipment hours in California.
- The default project life when determining project benefits for new purchases or repowers shall be ten years for electric motors. The default project life for engines without documentation shall be seven years. A longer project life may be used with

approval by ARB staff, however, sufficient documentation must be provided to ARB that supports the selected project life based on the actual remaining useful life.

### **B. New Purchase**

- Engine purchases for new 2005 or later model year agricultural stationary or portable equipment can only be electric motors.

### **C. Repower**

- A repower of an uncontrolled or emission certified (1996+ model year) diesel engine must be with one of the following:
  - A new electric motor.
  - A new off-road diesel engine certified to the current applicable emission standards.
  - A new off-road spark-ignited (SI) engine certified to the current applicable emission standards.
  - A new SI engine that meets or exceeds local district emission requirements and is subject to and complies with local district permitting, monitoring, record keeping and reporting requirements. This criterion will sunset on January 1, 2008.
- A repower of an uncontrolled SI engine must be with one of the following:
  - A new electric motor.
  - A new off-road SI engine certified to the current applicable emission standards.
  - A new SI engine that meets or exceeds local district emission requirements and is subject to and complies with local district permitting, monitoring, record keeping and reporting requirements. This criterion will sunset on January 1, 2008.
- A repower of an emissions-controlled SI engine must be with one of the following:
  - A new electric motor.
  - A new off-road SI engine certified to the current applicable emission standards.
  - A new SI engine that meets or exceeds local district emission requirements and is subject to and complies with local district permitting, monitoring, record keeping and reporting requirements, provided that the new engine provides a NOx emission reduction of at least 15% from the baseline engine NOx emissions. This criterion will sunset on January 1, 2008.
- Electric motors may replace diesel or SI engines. The applicant must have documentation of payment to the local utility company for power installation. This requirement of documentation also applies to new installations.
- Off-road diesel engines must be certified for sale in California and must comply with durability and warranty requirements.

- The use of a non-certified SI engine shall be subject to approval by ARB staff. Emissions testing of a non-certified SI engine shall be conducted using an ARB-approved source testing procedure, such as ARB Test Method 100.
- Non-certified SI engines shall be required to include currently available emission control components such as closed-loop fuel control systems, and three-way catalysts.
- Non-certified SI engines shall be subject to source testing with an ARB-approved testing procedure following local district requirements.
- Non-certified SI engines shall be subject to NO<sub>x</sub> and hydrocarbon emission readings using a portable analyzer following local district monitoring requirements.
- The costs associated with source testing and monitoring requirements for non-certified SI engines are not eligible for funding.

#### **D. Retrofit**

- A retrofit of an uncontrolled diesel engine that reduces NO<sub>x</sub> must be with a retrofit kit that is verified to reduce NO<sub>x</sub> or NO<sub>x</sub>+NMHC emissions to the applicable new engine Tier standard or less for a given engine size.
- A retrofit of an uncontrolled SI engine that reduces NO<sub>x</sub> must be with a retrofit kit that is verified to reduce NO<sub>x</sub>+NMHC emissions to the currently applicable standard for off-road large spark-ignited equipment. If this is not feasible, the project must reduce NO<sub>x</sub>+NMHC emissions to at least 3.0 g/bhp-hr or less.
- A retrofit of an emission-certified (1996+ model year) off-road diesel engine that reduces NO<sub>x</sub> must be with a retrofit kit that is verified to reduce NO<sub>x</sub> or NO<sub>x</sub>+NMHC emissions by at least 15 percent from the applicable NO<sub>x</sub> or NO<sub>x</sub>+NMHC emission standard.
- Reduced-emission retrofit kits must be verified following California test procedures and must comply with durability and warranty requirements.

#### **E. Scrap**

- The existing (old) engine must be destroyed and rendered useless. Engines must have a complete and fully visible and legible engine serial number in order to be eligible for an engine repower. The destruction of the engine must be documented by district staff seeing the destroyed engine or the receipt from a qualified vehicle salvage yard (see 2005 Carl Moyer Program Guidelines, Part II, Chapter 2: Fleet Modernization, Salvage Requirements for definition). Engines without a visible and legible serial number may be repowered if district staff stamp the engine block with the Agricultural Assistance Program project number and district staff is present to

personally verify engine removal from the project vehicle or equipment and the subsequent engine destruction. ARB staff will consider alternatives to stamping the engine block on a district-by-district basis.

## VI. Cost-Effectiveness of Total Reductions

Projects funded through the Agricultural Assistance Program are not required to achieve surplus emission reductions. The cost-effectiveness calculations used in the Carl Moyer Program are not appropriate for evaluating Agricultural Assistance Program projects because those calculations are based on surplus emission reductions.

In order to ensure that the technologies and costs of projects funded by the Agricultural Assistance Program are generally comparable to those funded by the Carl Moyer Program, ARB staff require Agricultural Assistance Program projects to meet a “cost-effectiveness of total reductions” criterion. The cost-effectiveness of total reductions is determined by subtracting the emissions of the new engine from the emissions of the old engine. Districts may set more restrictive cost-effectiveness of total reductions limits when implementing local programs.

The cost-effectiveness of total reductions is the annualized cost divided by the emission reductions as if no regulatory requirement existed:

$$\frac{\text{Annualized Cost (\$/year)}}{\text{Weighted Emission Reductions if no Regulatory Requirement Existed (tons/yr)}}$$

For example, the cost-effectiveness of total reductions calculations for an agricultural irrigation pump engine would generally assume a project life of seven years, even if a local rule for agricultural use engines takes effect in two years.

The cost-effectiveness of total reductions cannot be compared to the cost-effectiveness of Carl Moyer Program-eligible projects because it includes the total emission reductions associated with a project instead of only the surplus emission reductions.

As described in the 2005 Carl Moyer Program Guidelines, the weighted total emission reductions are estimated by taking the sum of the project’s annual emission reductions of NOx, ROG, and combustion PM using the following formula:

$$\text{Weighted Total Emission Reductions} = \text{NOx reductions (tons/yr)} + \text{ROG reductions (tons/yr)} + 20^*[\text{combustion PM reductions (tons/yr)}]$$

NOx and ROG emissions are given equal weight; combustion PM is given a greater weighting due to the higher cost of reducing PM emissions.

The annual emission reductions for each pollutant (NOx, ROG, and combustion PM) are determined by calculating the annual emissions for the baseline technology, and then

subtracting from it the annual emissions of the reduced technology. Annual emissions may be calculated based on hours of operation or fuel consumption.

$$\frac{\text{Annual Emissions Based on Hours of Operation}}{\text{Emission Standard (g/bhp-hr)}} = \text{Engine Horsepower} * \text{Load Factor} * \text{Activity (hrs/yr)} * \text{ton/907,200 g}$$

$$\frac{\text{Annual Emissions Based on Fuel Consumption}}{\text{Emission Standard (g/bhp-hr)}} = \text{Energy Consumption Factor (bhp-hr/gal)} * \text{Activity (gal/yr)} * \text{ton/907,200 g}$$

The engine load factor is an indicator of the nominal amount of work done by the engine for a particular application. It is given as a fraction of the rated horsepower of the engine and varies with engine application. For projects in which the horsepower of the baseline technology and reduced technology differ by more than 25 percent, the load factor must be adjusted using the following formula:

$$\text{Replacement Load Factor} = \text{Load Factor}_{\text{baseline}} * \frac{\text{hp}_{\text{baseline}}}{\text{hp}_{\text{reduced}}}$$

It is important to understand the replacement load factor must never exceed 100 percent in cases where the reduced technology engine is significantly smaller than the baseline technology engine.

The emission standards and load factors for off-road diesel engines and large SI engines in Appendix B of the 2005 Carl Moyer Program Guidelines may be used for these calculations. The default energy consumption factor for a stationary agricultural irrigation pump engine greater than 50 hp is 17.56 bhp-hr/gal.

Annualized cost is the amortization of the one-time incentive grant amount for the life of the project to yield an estimated annual cost. The annualized cost is calculated by multiplying the incremental cost by the capital recovery factor (CRF).

$$\text{Annualized cost (\$)} = \text{CRF} * \text{incremental cost}$$

The CRF is the level of earnings reasonably expected by investing state funds in various financial instruments over the length of an Agricultural Assistance Program project. The CRF uses an interest rate and project life to determine the rate at which earnings could reasonably be expected if the same funds were invested over a length of time equaling the project life. The CRF is calculated following formula:

$$\text{Capital Recovery Factor (CRF)} = \frac{[(1 + i)^n (i)]}{[(1 + i)^n - 1]}$$

Where

i = discount rate (4%)

n = project life (at least 3 years, see project criteria for default maximums)

The discount rate of 4 percent reflects the prevailing earning potential for state funds that could reasonably be expected by investing state funds in various financial

instruments over the length of the minimum project life of Agricultural Assistance Program projects

Table B-1 in Appendix B of the 2005 Carl Moyer Program Guidelines lists the CRF for various project lives using a discount rate of 4 percent.

The incremental cost of a project is calculated by subtracting the cost of the baseline technology from the cost of the reduced technology.

$$\frac{\text{Incremental Cost (\$)}}{\text{Technology}} = \text{Cost of Reduced Technology} - \text{Cost of Baseline Technology}$$

Generally, the cost of the baseline technology for a new purchase is the price of a new piece of equipment meeting the current emission standards. The cost of the baseline technology for a repower is the cost of rebuilding the existing engine.

An example of calculating the cost-effectiveness of total reductions is provided below. In this example, a district regulation requires that uncontrolled stationary engines used in agricultural operations must be retired from service by January 1, 2008. The project cannot meet the three year surplus emission reductions requirement for the Carl Moyer Program, but is eligible for funding through the Agricultural Assistance Program.

**Example: Engine Repower (diesel to diesel) Based on Hours**

Baseline Technology information:

- Baseline Technology (application): 1990 John Deere C 8.3P
- Engine horsepower (application): 285 hp
- Activity (application): 3,000 hours per year
- Load factor (default): 0.65
- Emission Factors: 7.60 g/bhp-hr NOx; 0.82 g/bhp-hr ROG; 0.274 g/bhp-hr PM10
- Baseline rebuild cost (quote provided with application): \$4,000

Reduced Technology information:

- Reduced Technology (application): 2005 John Deere 6081HF70-275
- Engine horsepower (application): 275 hp
- Activity (application): 3,000 hr/yr
- Load factor (calculated):  $0.65 * (285 \text{ hp}/275 \text{ hp}) = 0.67$
- Emission Factors: 4.15 g/bhp-hr NOx; 0.12 g/bhp-hr ROG; 0.088 g/bhp-hr PM10
- New engine cost (quote provided with application): \$22,500

Emission Reduction Calculations:

Annual NOx baseline technology emissions

$$(7.60 \text{ g/bhp-hr} * 285 \text{ hp} * 0.65 * 3,000 \text{ hrs})(\text{ton}/907,200 \text{ g}) = 4.65 \text{ tons/yr NOx}$$

Annual NOx reduced technology emissions

$$(4.15 \text{ g/bhp-hr} * 275 \text{ hp} * 0.67 * 3,000 \text{ hrs})(\text{ton}/907,200 \text{ g}) = 2.53 \text{ tons/yr NOx}$$

Annual ROG baseline technology emissions

$$(0.82 \text{ g/bhp-hr} * 285 \text{ hp} * 0.65 * 3,000 \text{ hrs})(\text{ton}/907,200 \text{ g}) = 0.50 \text{ tons/yr ROG}$$

Annual ROG reduced technology emissions

$$(0.12 \text{ g/bhp-hr} * 275 \text{ hp} * 0.67 * 3,000 \text{ hrs})(\text{ton}/907,200 \text{ g}) = 0.07 \text{ tons/yr ROG}$$

Annual Combustion PM baseline technology emissions

$$(0.274 \text{ g/bhp-hr} * 285 \text{ hp} * 0.65 * 3,000 \text{ hrs})(\text{ton}/907,200 \text{ g}) = 0.168 \text{ tons/yr PM10}$$

Annual Combustion PM reduced technology emissions

$$(0.088 \text{ g/bhp-hr} * 275 \text{ hp} * 0.67 * 3,000 \text{ hrs})(\text{ton}/907,200 \text{ g}) = 0.054 \text{ tons/yr PM10}$$

- NOx emission benefits = 4.65 tons/yr – 2.53 tons/yr = 2.12 tons/yr NOx
- ROG emission benefits = 0.50 tons/yr – 0.07 tons/yr = 0.43 tons/yr ROG
- PM10 emission benefits = 0.168 tons/yr – 0.054 tons/yr = 0.114 tons/yr PM10

$$\text{Weighted Total Emission Reductions} = 2.12 \text{ tons/yr} + 0.43 \text{ tons/yr} + 20(0.114 \text{ tons/yr}) \\ = 4.83 \text{ weighted tons/yr}$$

Project life: 7 years; CRF = 0.167

$$\text{Incremental Cost} = \$22,500 - \$4,000 = \$18,500$$

$$\text{Annualized Cost} = 0.167 * \$18,500 = \$3,090/\text{yr}$$

Cost-Effectiveness of Total Reductions:

$$(\$/\text{yr})/(\text{weighted tons/yr}) = (\$3,090)/(4.83 \text{ weighted tons/yr}) \\ = \mathbf{\$640/\text{ton of weighted emissions reduced}}$$

The cost-effectiveness for this project is less than \$14,300 per weighted ton of total emissions reduced. This project qualifies for the maximum amount of grant funds requested.

## VII. Minimum Project Requirements

### A. Application

The minimum application information for stationary and portable agricultural engine projects is in Table 2. Districts may request additional information from the applicant.

A disclosure must also be included stating that once an applicant submits an application for a specific engine to one district or ARB as part of a multi-district solicitation, the owner shall not submit an application to any other source of funds, including, but not limited to, other districts or ARB for the same engine. Any applicant who is found to have submitted multiple applications for the same engine will, at a minimum, be disqualified from funding for that engine from all sources and may also be banned from submitting future applications to any and all Agricultural Assistance Program and Carl Moyer Program solicitations.

**Table 2**  
**Minimum Application Information for Stationary and Portable**  
**Agricultural Engine Projects**  
**Agricultural Assistance Program**

<p><u>Applicant Information</u>  Organization, Company or Individual Name  Street Address  City, County, State, Zip Code  Primary Contact Name  Primary Contact Phone Number  Person with Contract Signing Authority  Person who Filled Out Funding Application  Project Address (if different from above)</p> <p><u>Equipment Information</u>  Equipment Type (portable, stationary, other)  Equipment Make  Equipment Model  Equipment Year  Equipment Serial Number  Baseline Equipment Fuel  New Equipment Vendor (optional)</p> <p><u>Activity Information</u>  Will the new engine have a functioning hour meter for the life of the project?  Annual Hours of Operation or Annual Gallons of Fuel Consumption  Percent Operation in California  Percent Operation in District  Project Life</p> <p><u>Electronic Monitoring Unit (EMU)</u>  Will a new eligible EMU be installed as part of this project? (yes/no)  EMU Make  EMU Model  EMU Model Year  EMU ID Number  EMU Cost (optional)</p>	<p><i>ADDITIONAL INFORMATION –  NEW PURCHASE PROJECTS ONLY</i>  New Electric Motor Make  New Electric Motor Model  New Electric Motor Serial Number  New Electric Motor Family  New Electric Motor Year  New Electric Horsepower (converted from kilowatts)  Projected Year of Purchase of New Equipment  Baseline Cost  New Reduced Emission Equipment Cost  New Electric Motor Vendor (optional)</p> <p><i>ADDITIONAL INFORMATION –  REPOWER PROJECTS ONLY</i>  Existing and Newer Engine/Motor Make  Existing and Newer Engine/Motor Model  Existing and Newer Engine/Motor Year  Existing and Newer Engine/Motor Serial Number (if available)  Existing and Newer Engine/Motor Fuel Type  Existing and Newer Engine/Motor Horsepower  Existing and Newer Engine/Motor Tier  Existing and Newer Engine/Motor Family  Is this project participating in the PG&amp;E AG-ICE or the SCE TOU-PA-ICE Incentive Programs?  Is this project engine a currently covered by a Moyer Program contract?  Engine Rebuild Cost  New Reduced Emission Equipment Cost  New Engine Vendor (optional)  New Engine Installer (optional)</p> <p><i>ADDITIONAL INFORMATION –  RETROFIT PROJECTS ONLY</i>  ARB-Verified Retrofit Device  Retrofit Device Serial Number  ARB-Verified NOx Reduction (%)  ARB-Verified PM Reduction (%)  ARB-Verified ROG Reduction (%)  Retrofit Device Executive Order  Verification Level (Level 1,2 or 3)  Retrofit Device Cost  Cost of Retrofit Installation (optional)  Cost of Retrofit Maintenance for Life of Project (optional)</p>
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Third party applications are not allowed. The equipment owner must sign and agree to the application. However, a third party (e.g. engine dealer or distributor) may complete an application or part of an application on an owner's behalf. Applications must include a signature section for third parties. The third party signature section must include signature and date lines, and blanks for the third party to list how much they are being paid, if anything, to complete the application and what source of funds are being used to pay them. Districts are encouraged to provide technical assistance to applicants in completing the application.

## **B. Reporting and Monitoring**

Owners of stationary and portable agricultural engines participating in the Agricultural Assistance Program are required to keep appropriate records for the life of the project and for three years after the project life is completed. The district has the authority to conduct periodic checks or solicit operating records from the recipient of Agricultural Assistance Program funds. This is to ensure that the engine is being operated as stated in the project application. The recipient must maintain and update operating records throughout the project life and have them available to the district upon request. Annual records must contain, at a minimum, total actual hours of operations or estimated amount of fuel used from actual fuel receipts. Actual hours of operations are acceptable for an engine equipped with a non-reset hour meter.

Monitoring may be required to comply with district requirements and to ensure the program incentives are being applied toward the project as specified in the application. To ease the tracking of the equipment over the life of the project, a district registration certificate may be issued to the equipment owner.

Districts providing Agricultural Assistance Program incentive funds must maintain separate record for projects funded through the Carl Moyer Program and the Agricultural Assistance Program.

## **VIII. References**

ARB, 2003. Air Resources Board. Staff Report: Initial Statement of Reasons, Airborne Toxic Control Measure for Stationary Compression Ignition Engines.  
<http://www.arb.ca.gov/regact/statde/isor.pdf>

ARB, 2004. Air Resources Board. Staff Report: Initial Statement of Reasons, Airborne Toxic Control Measure for Diesel-fueled Portable Engines.  
<http://www.arb.ca.gov/regact/porteng/isor.pdf>

ARB 2005a. Air Resources Board. Staff Report: Initial Statement of Reasons for Proposed Revisions to the Airborne Toxic Control Measure for Stationary Compression Ignition Engines.  
<http://www.arb.ca.gov/regact/statde05/isor.pdf>

ARB, 2005b. Air Resources Board. Staff Report: Initial Statement of Reasons, Public Hearing to Consider the Large Confined Animal Facility Definition.  
<http://www.arb.ca.gov/regact/lcaf05/isor.pdf>

ARB 2005c. Air Resources Board. The Carl Moyer Memorial Air Quality Standards Attainment Program Guidelines, Revision 2005.

CASS 2003. California Agricultural Statistics Service. California Agricultural Statistics, 2003. California Agricultural Overview.  
<http://www.nass.usda.gov/ca/bul/agstat/indexcas.htm>