SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Preliminary Staff Report for

PROPOSED AMENDED RULE 1110.2 -- EMISSIONS FROM GASEOUS- AND LIQUID-FUELED INTERNAL COMBUSTION ENGINES AND RESCISSION OF RULE 1110.1 – EMISSIONS FROM STATIONARY INTERNAL COMBUSTION ENGINES

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BACKGROUND

South Coast Air Quality Management District

The South Coast Air Quality Management District's (AQMD) is the air pollution control agency for all of Orange County and the urban portions of Los Angeles, Riverside and San Bernardino counties. This area of 10,000 square miles is home to nearly 16 million people. It is the second most populated urban area in the United States and one of the smoggiest.

AQMD is responsible for controlling emissions primarily from stationary sources of air pollution. These can include anything from large power plants and refineries to the local dry cleaner. About 23% of this area's ozone-forming air pollution comes from stationary sources, both businesses and residences. The remaining 77% comes from mobile sources-- primarily cars, trucks and buses in addition to construction equipment, ships, trains and airplanes. Emission standards for mobile sources are established by the state or federal agencies, such as the California Air Resources Board (CARB) and the U.S. Environmental Protection Agency (EPA), rather than by local agencies such as the AQMD.

Under the Federal Clean Air Act, EPA establishes health-based air quality standards that all states must achieve. The California Clean Air Act also establishes requirements for cities and counties to meet. AQMD develops plans and regulations designed to achieve these public health standards by reducing emissions from business and industry. AQMD's strategy of combined emission reduction of Volatile Organic Compound (VOC) and Oxides of Nitrogen (NOx) is intended to move the AQMD towards the attainment of all federal air quality standards and improve the public health by reducing public exposure to high concentrations of air contaminants. Additional emission reductions of NOx are required to attain and maintain several state and federal standards, including those for ozone, NO_2, particulate matter (PM), and visibility.

SB700 - Agricultural Operations

Until recently, local air districts were prohibited from requiring permits for agricultural operations such as farms, orchards, ranches, dairies and other confined animal feeding operations. Even conventional equipment such stationary engines and gasoline storage and dispensing equipment were exempt from rules that required other types of facilities using them to control their emissions. Agricultural operations represent a significant source of air pollution throughout the state. Emissions from agricultural sources for calendar year 2003 are estimated to be more than 13 tons per day of VOCs, 8 tons per day of NOx, and over 3 tons per day of PM10 in the SCAQMD. Some agricultural operations are major sources of air pollution which federal law (Title V) requires to be subject to air permits. The U.S. EPA proposed disapproving California's Title V permitting program because of the agricultural exemption and the significant source of air pollution that agricultural operations represent.

Because of the need in California to reduce emissions from and require permits for agricultural operations, Senate Bill 700 – Agricultural Air Quality (SB 700) was enacted into law on January 1, 2004, amending California Health and Safety Code Section 42310 and adding Sections 39011.5, 39023.3, 40724, 40724.5, 40724.6, 40724.7, 40731, 42301.16, 42301.17, 42301.18, and 44559. Section 42301.16 eliminated the exemption from the permit system of local air pollution control districts of certain large agricultural operations. Other sections required rules to be

adopted to reduce emissions from conventional equipment like engines and gasoline tanks, and strictly agricultural operations like confined animal feeding operations. Under SB700 all areas of the state which are designated as "serious" non-attainment for federal PM10 standards are required to implement:

1) Best Available Control Measures (BACM) to reduce emissions from non-traditional and non-point sources of PM10. These sources include tilling, composting, discing, cultivation, harvesting, raising of animals, etc. AQMD's PAR 1127.1 will address these sources.
2) Best Available Retrofit Control Technology (BARCT) to reduce emissions from traditional point sources. These point sources include IC engines, boilers, gasoline fueling and dispensing, etc.

Appendix B describes the new incentive programs that will help agricultural operations comply with new and modified rules that will apply to agricultural operations. Agricultural operations are unique in that state law allows only agricultural operations to receive incentive funding to comply with local air district rules. Other types of facilities may only receive funding for voluntary emission reductions not required by a local rule.

Current Rule 1110.2

Rule 1110.2 was adopted in August 1990 to control NOx, carbon monoxide (CO), and VOC from gaseous and liquid-fueled internal combustion engines. For all stationary and portable engines over 50 bhp, it required that either 1) NOx emissions be reduced over 90% to one of two compliance limits specified by the rule, or; 2) the engines be permanently removed from service or replaced with electric motors. It was amended in September 1990 to clarify rule language. It was then amended in August and December of 1994 to modify the CO monitoring requirements and to clarify rule language. The latest amendment in November of 1997 eliminated the requirement for continuous monitoring of CO, reduced the source testing requirement from once every year to once every three years, and exempted nonroad engines, including portable engines. Agricultural engines are exempt from the current rule.

RECLAIM

In 1993 AQMD adopted Regulation XX – Regional Clean Air Incentives Market (RECLAIM). This regulation established NOx and SOx trading market emission reduction program that allowed over 300 of the largest sources in AQMD to meet the requirements of that program rather than the NOx requirements of other AQMD Rules. Therefore, some engines in AQMD are not subject to the NOx requirements of Rule 1110.2. They are still subject to the VOC and CO requirements.

Compliance Issues with Stationary Engines

Rich-burn engines generally use a 3-way catalyst to achieve low NOx levels in compliance with the permit conditions and applicable rules. They have demonstrated very low emissions based on their initial compliance test and follow-up tests required every three years by Rule 1110.2. However, these source tests are generally conducted after the engine has been tuned and pre-tested for emissions, and only at one load under steady state conditions. As a result, they almost

always show compliance. If the test shows non-compliance, only major sources (Title V) are required to report the results to AQMD.

A lot can go wrong in the three year period between emission tests on an I.C. engine Distributed Generation (DG) unit. On a unit used 24/7, it is typical to require an oil change once a month, and tune-ups every two months, including new spark plugs and O2 sensors. The things that can go wrong to cause excess emissions include:

- A bad spark plug
- A faulty spark plug wire
- A failed O2 sensor
- A O2 sensor for which the mV signal has drifted
- A catalyst that has plugged due to ash from oil blowby
- A catalyst that has become deactivated due to poisoning from ash blowby or excess exhaust temperature
- A catalyst that degrades from vibration allowing bypassing of the catalyst
- A failed air/fuel ratio controller
- A air/fuel ratio controller that is not properly recalibrated after an O2 sensor replacement

In the past year, AQMD enforcement personnel acquired portable analyzers capable of measuring NOx, CO and O2 concentrations in the exhaust of combustion equipment. These analyzers are not expected to be as accurate Method 100.1 source test, but they are much easier to set up and use, and can detect emission problems. Enforcement inspectors have been using the portable analyzers to do unannounced emission tests on various types of combustion equipment.

These emission tests have shown that I.C. engines, no matter whether they are driving pumps, compressors or electrical generators, have very high non-compliance rates and very high excess emissions. As of December 31, 2004, 127 emission tests with portable analyzers have been conducted on I.C. engines driving electrical generators, compressors and pumps. The engines all are natural gas fired and all but one have 3-way catalytic emission controls. The equipment tested included engines manufactured by General Motors, Ford, Caterpillar, Waukesha, Deutz and Daewoo, and packaged engine/cogeneration units manufactured by Tecogen, Hess and Coast Intelligen. The engines include a combination of older and new units. A majority of the engines tested were subject to BACT limits of about 12 ppm NOx and 80 ppm CO. The results of the tests are summarized in Table 1.

Table 1. Recent AQMD Compliance Testing of I.C. engines

	NOx	CO
% Non-Compliance with Permit Limits	63.8%	
Rule 1110.2 Limits, ppm*	36-45	2000
Average ppm*	72	732
Maximum ppm*	850	12,500

* All dry, by volume, and corrected to 15% O2

The average NOx emissions were about two times higher than Rule 1110.2 emission limits. The highest emissions measured were about 20 times more than the rule NOx limits and six times the rule CO limits.

USEPA Regulations

New Source Performance Standards

Because of a Consent Decree, USEPA is working on developing New Source Performance Standards for new, stationary compression-ignition (CI or diesel) engines and spark- ignition (SI) engines. The Consent Decree requires standards is for CI engines be proposed in June of 2005 and promulgated in June of 2006; and standards for SI engines be proposed in May of 2006 and promulgated in December of 2007.

National Emission Standards for Hazardous Air Pollutants

The recent final rule[1] for stationary reciprocating internal combustion engines (RICE) at major sources of hazardous air pollutants requires that:

- Existing and new 4-stroke rich burn (4SRB) engines either reduce formaldehyde by 76 percent or limit the formaldehyde concentration to 350 parts per billion.
- New 2-stroke lean burn (2SLB) engines either reduce carbon monoxide (CO) by 58 percent or limit the formaldehyde concentration to 12 parts per million.
- New 4-stroke lean burn (4SLB) engines either reduce CO by 93 percent or limit the formaldehyde concentration to 14 parts per million.
- New compression ignition (CI) engines either reduce CO by 70 percent or limit the formaldehyde concentration to 580 parts per billion.

Formaldehyde and CO are surrogates for reducing the air toxics of concern from RICE. Therefore, by reducing formaldehyde and CO, facilities also will reduce the other air toxics to similar levels.

[1] 40 CFR 63 Subpart ZZZZ

USEPA expects owners or operators of 4SRB engines to install air pollution control devices known as non-selective catalyst reduction (3-way catalyst). Owners or operators of 2SLB, 4SLB, and CI engines likely will install devices known as CO catalytic oxidation systems to meet the formaldehyde and CO requirements.

Nonroad Engines

USEPA regulates new nonroad engines. Nonroad engines include: engines that propel offroad equipment such as trains and bulldozers, and; portable engines that drive generators and wood chippers and other equipment, and that are moved from place to place. Nonroad engines includes CI and SI engines using diesel fuel, propane, gasoline and other fuels.

The Nonroad Preemption

The Clean Air Act Amendments of 1990 limit the ability of states and local districts to regulate nonroad engines. Only USEPA can set emission standards for new construction and farm equipment under 70 hp.. Federal regulations[2] allow California to regulate all other nonroad engines with an authorization from USEPA. States and local districts can also regulate the use of nonroad engines.

Nonroad Diesel Engine Regulations

USEPA has been regulating new nonroad diesels since 1996 in 40 CFR 89 Subpart A, Appendix A and 40 CFR 85 Subpart Q. Tier 1, Tier 2 and Tier 3 standards are in effect or are partly in effect, and recently adopted and stringent Tier 4 standards will go into affect in the next decade. The emission standards vary by engine size, but as an example Table 2 shows the standards for nonroad diesel engines from $100 \leq hp < 175$.

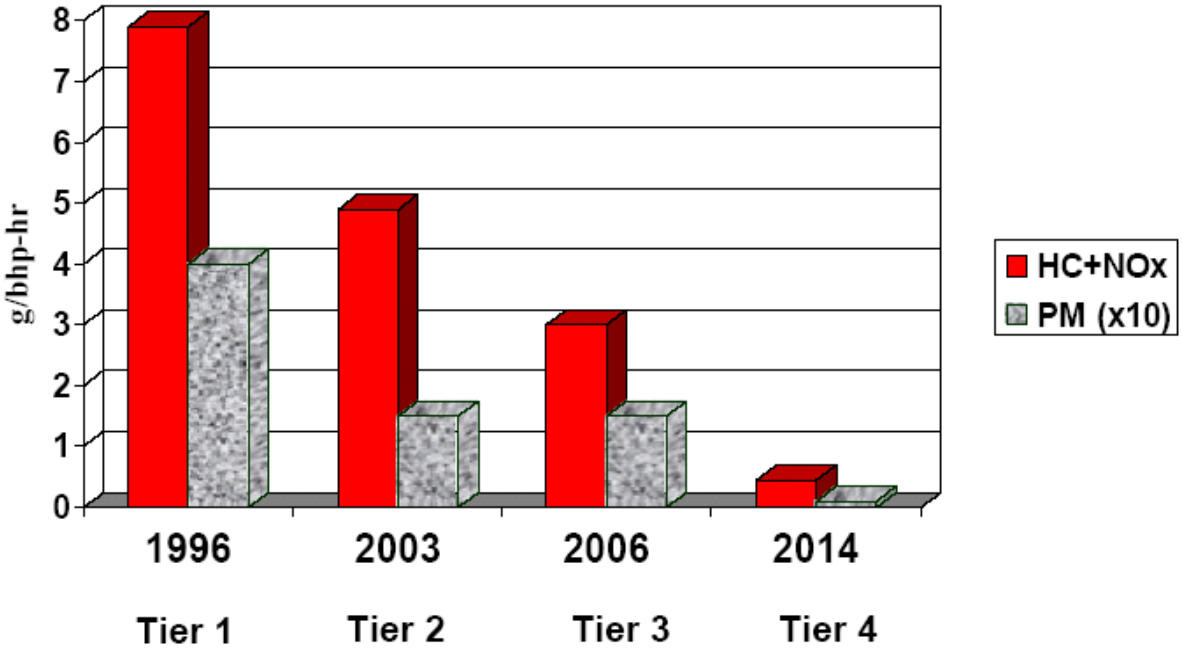
Table 2. USEPA Nonoad Diesel Engine Emission Standards
100 ≤ hp < 175 (grams/bhp-hr)

	Implementation Date	CO	NMHC	NOx + NMHC	NOx	PM
Tier 1	1997	-	-	-	6.9	-
Tier 2	2003	3.7	-	4.9	-	0.22
Tier 3	2007	3.7	-	3.0	-	0.22
Tier 4	2012-2014	3.7	0.14	-	0.30	0.015

Figure 1 demonstrates the remarkable emission reductions that the Tier 4 emission limits will achieve. These limits are more stringent than Rule 1110.2.

[2] 40 CFR 89 ?? and 40 CFR 85 ??

Figure 1. USEPA Nonroad Diesel Emission Standards for a 175 hp Engine



Nonroad Spark-Ignited (SI) Engine Regulations

USEPA has been regulating new nonroad SI engines over 25 Hp since 2004 in 40 CFR 1048. Most of these engines use liquefied petroleum gas (propane), with others operating on gasoline or natural gas. USEPA adopted two tiers of emission standards (see Table 3). The first tier of standards, which started in 2004, are based on a simple laboratory measurement using steady-state procedures. The Tier 1 standards are the same as those adopted earlier by CARB for engines used in California. The Tier 2 standards, starting in 2007, are based on transient testing in the laboratory, which ensures that the engines will control emissions when they operate under changing speeds and loads in the different kinds of equipment. USEPA includes an option for manufacturers to certify their engines to a less stringent CO standard if they certify an engine with lower HC+NOx emissions. In addition to these exhaust-emission controls, manufacturers must take steps starting in 2007 to reduce evaporative emissions, such as using pressurized fuel tanks.

Table 3. USEPA SI Engine Emission Standards (grams/bhp-hr)

	Implementation Date	HC + Nox	CO
Tier 1	2004	3.0	37
Tier 2	2007	2.0	4.4

Starting with Tier 2, USEPA adopted additional requirements to ensure that engines control emissions during all kinds of normal operation in the field. Tier 2 engines must have engine diagnostic capabilities that alert the operator to malfunctions in the engine's emission-control system.

CARB Regulations and Guidance

CARB Guidance for Stationary Spark-Ignited Engines

In 2001, CARB published "Determination of Reasonably Available Control Technology and Best Available Retrofit Control Technology for Stationary Spark-Ignited Internal Combustion Engines" as guidance for local air districts in adopting rules for stationary spark-ignited engines. Because of compliance problems with engines, it recommended more frequent source testing than Rule 1110.2, and an Inspection and Monitoring Plan requiring periodic monitoring and maintenance, including the use of a portable emission analyzer.

Air Toxic Control Measures for Diesel Engines

CARB has adopted Air Toxic Control Measures (ATCMs) for both stationary and portable diesel engines. The purpose of these ATCMs is primarily to reduce diesel PM, but they will result in some reductions the other pollutants as well. AQMD has adopted its version of the stationary diesel ATCM in the form of Rule 1470.

Existing stationary agricultural engines were not subject to the stationary diesel ATCM, but CARB has begun staff work on an ATCM for this equipment.

CARB Portable Equipment Registration Program (PERP) Regulation

Health & Safety Code Sections 41750-41755 (Assembly Bill 531), effective January 1, 1996, require the CARB to adopt regulations to establish a statewide registration program for portable engines and other equipment. The regulation was adopted on March 27, 1997 by the ARB Board. Portable engine owners or operators may register under the statewide program or permit with the AQMD. Those that register with CARB are exempt from AQMD permits and emission requirements.

Presently, CARB's statewide PERP has an exemption/prohibition for agricultural portable equipment. CARB's PERP regulations prohibit allowing agricultural sources' portable equipment to register under PERP, unless a local air district adopts or amends its rules to allow state registration in lieu of local permits. AQMD has not done this, so portable agricultural engines that are subject to permit (not exempt per Rule 219) will be subject to AQMD permits only. It is very important to note that sources may still need to comply with applicable rules, such as 1110.2, even if permits are not required.

Off-Road Diesel Engines

CARB began regulating new off-road[3] diesel engines before USEPA, but later harmonized its regulations in Title 13, CCR, Chapter 9, Article 4 with USEPA nonroad diesel emission standards. On December 9, 2004 CARB approved amendments to incorporate USEPA Tier 4 standards into state law, although the regulation is not final until approved by the Office of Administrative Law. The emission standards will be the same as USEPA's, but some minor differences in other areas.

[3] USEPA uses the term nonroad for the same purpose.

Off-Road Spark-Ignited (SI) Engines

CARB has been regulating new off-road SI engines over 25 hp since 2001 in Title 13, CCR, Chapter 9, Article 4.5. The emission standards are shown in Table 4.

Table 4. CARB Offroad SI Engine Emission Standards (grams/bhp-hr)

Implementation Date	Engine Displacement	HC + Nox	CO
2002	≤ 1.0 Liters	9.0	410
2001-2003	> 1.0 Liters	3.0	37

These standards are less stringent than EPA standards that went into effect in 2004 (see earlier discussion.) However, CARB staff is working on, and has begun workshops for, new regulations to reduce emissions from both new and in-use off-road SI engines.

AFFECTED SOURCES / EMISSIONS INVENTORY

PAR 1110.2 applies to stationary and portable engines over 50 brake horsepower (bhp). IC Engines generate power by combustion of an air/fuel mixture. In the case of spark-ignited (SI) engines, a spark plug ignites the air/fuel mixture while a diesel engine relies on heating of the inducted air during the compression stroke to ignite the injected diesel fuel. Most stationary and portable IC engines are used to power pumps, compressors, or electrical generators.

SI engines come in a wide variety of designs such as: Two stroke and four stroke, rich-burn and lean burn, turbocharged and naturally aspirated. SI engines can use one or more fuels, such as natural gas, oil field gas, digester gas, landfill gas, propane, butane, liquefied petroleum gas (LPG), gasoline, methanol and ethanol. IC engines can be used in a wide variety of operating modes such as: Emergency operation (i.e. used only during testing, maintenance, and emergencies), seasonal operation, continuous operation, continuous power output, and cyclical power output.

Uncontrolled engines, even when burning a clean fuel such as natural gas, have extremely high emissions of NOx, CO and HC. Diesel engines not only have significant NOx emissions but also emit particulate matter (PM) which has been identified as a Toxic Air Contaminant (TAC) by the CARB. Once a substance is identified as a TAC, the ARB is required by law to determine if there is a need for further control. CARB recently approved Airborne Toxic Control Measures (ATCM) for stationary and portable diesel engines. CARB is currently developing an ATCM for in-use stationary diesel agricultural engines.

In addition to the more than approximately 1000 facilities currently subject to Rule 1110.2, approximately 21 facilities located within the jurisdiction of the AQMD that conduct agricultural operations will now be subject to the requirements of PAR 1110.2. The emissions inventory associated with PAR 1110.2 will now consist of two groups; Engines used in Agricultural Operations and Engines used in Non-Agricultural Operations.

AQMD Agricultural Operations Survey

Agricultural operations represent a significant source of air pollution throughout the state. IC engines are major contributors of NOx, VOC and CO emissions to the atmosphere. Annual NOx emissions from agricultural engines (spark-ignited and the majority of which are believed to be diesel-fueled) have been estimated to be significant.

There is limited data available that allow the classification of the IC engine emission inventory for agricultural operations in the AQMD. For this reason and as part of the effort to implement the requirements of SB700 for agricultural sources in AQMD, staff developed a simple one page Agricultural Operations survey form that was mailed out to a total of 1,925 agricultural operations in April and June 2004. The survey basically consisted of nine "Yes/No/ How Many?" type questions regarding size of dairy or poultry farm and of equipment that would traditionally be found in agricultural operations such as I.C. engines, boilers, heaters, gasoline dispensing/storage, grain conveyor/silo, degreasers and paint spray equipment. The mailing lists were not made available to the AQMD. The mailing lists were provided directly to a Clearinghouse mailing service by the contacted associations (Western United Dairymen, Pacific Egg and Poultry Association, Los Angeles County Farm Bureau, San Bernardino County Farm Bureau, Orange County Farm Bureau, Riverside County Farm Bureau and other agricultural groups) and the Regional Water Quality Control Boards that recently passed rules regarding dairy runoff.

As of December 2004, 885 (46%) survey forms have been received back at AQMD with only 473 providing minimal information for statistical purposes.

Of the 473 surveys, 21 facilities reported using 13 ICEs as irrigation pumps and 22 ICEs as well/water pumps. Since PAR 1110.2 is exempting emergency stand by engines and wind machines, only irrigation pumps, well/water pumps and other non-exempt engines will be included in the emissions inventory. To date, other non-exempt engines have not been identified by the survey and therefore were not included in the emissions inventory.

Based on the results of this survey and other information provided by agricultural associations and trade groups the uncontrolled emissions inventory was determined to be as presented in Table 5. However, this inventory may be underestimating the actual emissions due to the 46% survey response.

Table 5. Agricultural Engines Emissions Inventory

Engine Class	Average HP	Engines	Annual Emissions (Tons/Year)			
			NOx	VOC	CO	PM
Irrigation Pumps						
Stationary	120	8	11.7	2.5	1.6	.81
Portable	137	5	2.1	0.5	0.2	0.15
Well/Water Pumps						
Stationary	173	18	56.1	7.2	43.6	2.37
Portable	95	4	2.59	0.56	0.21	0.19
TOTAL		**35**	**73.3**	**10.7**	**45.6**	**3.5**

Portable Engines

CARB estimates that in 2000 17,500 portable diesel engines in California emitted 67.1 tons/day of NOx, 6.7 tons/day of ROG and 4.2 tons/day of PM. Emissions in SCAQMD would be about 45% of this amount. The emissions inventory for portable SI engines is still being assessed.

Stationary Non-Agricultural Engines

The 1990 staff report for proposed Rule 1110.2 estimated that Rule 1110.2 would reduce NOx emissions of 1,289 stationary, non-emergency engines from 28.0 tons/day to 2.9 tons/day.

CONTROL TECHNOLOGY

The proposed amendment of Rule 1110.2 affects three categories of engines. One category is stationary engines that are used for agricultural operations, which will be brought into the rule for the first time by removal of the agricultural exemption. The second category consists of stationary engines that are already in the rule but must meet the reduced VOC limit of 100 ppmvd and those that are meeting NOx and/or VOC limits elevated by the efficiency multiplier that was allowed by section (d)(1)(C). These engines will need to meet somewhat lower NOx and/or VOC limits under the amended rule since the efficiency multiplier would no longer be allowed. The third category is portable engines.

Stationary agricultural engines coming into Rule 1110.2, fall into two major categories: (1) compression ignition, i.e., diesel-fueled, engines and (2) SI engines, which may be fueled by propane, natural gas or gasoline. Since agricultural engines have heretofore been unregulated, most will have no emission controls. Owners of these engines will in most cases have to install emission controls or replace the engine in order to meet the rule requirements [section (d)(1)].

Stationary engines that are already in the rule can be assumed to be SI engines, since diesel-fueled engines are not capable of meeting the rule requirements and have been almost totally phased out in the south coast district. The only exceptions to this is emergency standby engines, which are exempt from the rule, and engines in locations where a SI engine cannot reasonably be required due to fuel supply logistics, which have been granted an exception from the rule. The proposed amendment increases the stringency of emission limits for these engines [section (d)(1)]. These engines may be fueled by natural gas, propane, or gasoline and in some cases by waste gases such as landfill gas, digester gas or oil field gas.

Diesel Engine Emissions and Emission Control Technologies

U.S. EPA AP-42[4] lists uncontrolled industrial diesel engine emissions as 14.0 NOx, 3.03 CO, and 1.12 VOC, all as g/hp-hr. Since 1996, nonroad diesel engines have been regulated at the federal and state levels through a certification program requiring that the manufacturers certify their engine models to meet certain emission standards, which become progressively more stringent over time. California'nonroad emission standards are the same as the federal nonroad standards. The nonroad emission standards for gaseous pollutants are shown in Table 6.

[4] U.S. EPA AP-42 Compilation of Air Pollution Emission Factors, Table 3.3-1.

Agricultural diesel engines coming into the rule are likely to be "Tier 0", i.e., uncertified. However, agricultural engines purchased since 1996 may be Tier 1 or even Tier 2, if purchased after 2000, since uncertified engines have tended to phase out of the marketplace in this area and there is apparently little difference in price between a Tier 1 and a Tier 2 engine[5].

Add-on control technologies that are suitable for diesel engines include selective catalytic reduction (SCR) of NOx and oxidation catalyst for reduction of CO and VOC. Both of these technologies have been successfully applied to diesel engines. SCR involves injection of urea or ammonia into the flue gas upstream of the catalyst and results in emissions of unreacted ammonia. Application of these technologies to a large Tier 1 diesel engine located at a ski resort in the south coast district achieved the NOx, CO and VOC emissions shown in Table 7. Assuming that the engine was designed for emissions to be approximately 20% below the Tier 1 standards, the apparent emission reductions achieved by the technologies are 90% for NOx, 99% for CO and 74% for VOC.

Emulsified fuel is another technology that can be applied to a stationary diesel engine. Emulsified fuel contains water, which has been blended into the fuel using appropriate blending equipment and an additive to create a stable mixture. Separation of the water can, however, occur if the fuel is in storage for too long. Presence of water in the fuel improves combustion while also lowering the flame temperature. It has been applied primarily to road diesel engines and primarily for reduction of particulate emissions. However, it also reduces NOx by 10-20%[6].

Spark-Ignition (SI) Engine Emissions and Emission Control Technologies

SI engines fall into two major design categories. One is four-stroke rich-burn engines, which are designed to draw the correct amount of air to combust the fuel and little, if any, more. These engines operate with exhaust gas O2 content very near zero. The other category is four-stroke lean-burn engines, which are designed to draw substantially more air than is required for combustion and operate with a high level of exhaust gas O2, typically 15%. Larger engines tend to be lean-burn, and smaller engines tend to be rich-burn. Typical emissions of NOx, CO and VOC from uncontrolled natural gas-fired engines are listed in Table 8. The NOx and CO emission factors in the table are based on U.S. EPA's AP-42[7], and typical VOC emissions are based on a factor that has been determined by AQMD[8] (280 lb/MMSCF natural gas). Emissions produced by engines operating on fuels other than natural gas may differ from those listed in Table 3, but should be similar. NOx emissions from engines operating on landfill or digester gas should be significantly lower due to the thermal diluent effect of CO2 present in these types of waste gas.

[5] South Coast Air Quality Management District, Staff Report for Proposed Amended BACT Guidelines, Part D, Non-Major Polluting Facilities, Regarding Emergency Compression – Ignition (Diesel) Engines, April 2003.
[6] http://www.epa.gov/region1/eco/diesel/retrofits.html#doc
[7] U.S. EPA AP-42 Compilation of Air Pollution Emission Factors, Tables 3.2-2 and 3.2-3.
[8] AQMD Annual Emission Reporting Form B2.

In November 2001, CARB published a RACT/BARCT determination for stationary SI engines[9]. This determination, while not aggressive for CO or VOC, identified a number of NOx control technologies that are effective for stationary SI engines (Table 9) and recommended significant reductions in NOx (Table 10). Agricultural SI engines coming into the rule will in most cases have none of the emission controls listed in Tables 9 and 10. Lean-burn SI engines that are already in the rule will generally be equipped with low-emission combustion improvements, wheras rich-burn SI engines will have a three way catalyst.

NOx, CO and VOC emission levels for stationary engines that are required by AQMD's non-major source BACT guidelines are shown in Table 11. As indicated in the table, these limits are usually met using turbocharged/aftercooled engines with SNCR on rich-burn engines and SCR plus oxidation catalyst on lean-burn engines. Also shown in the table are apparent pollutant reductions achieved by these technologies based on the typical uncontrolled emission levels shown in Table 8, assuming a 35% NOx reduction by the turbocharger/aftercooler.

[9] California Environmental Protection Agency, Air Resources Board, Determination of Reasonably Available Control Technology and Best Available Retrofit Control Technology for Stationary Spark-Ignited Internal Combustion Engines, November 2001.

Table 6. U.S. EPA Nonroad Diesel Gaseous Emission Standards—NOx or (NOx+NMHC)/NMHC/CO (g/Bhp-hr)

Engine Bhp	Tier 1	Tier 2	Tier 3	Tier 4 Interim	Tier 4 Final
50 to <75	1998 6.9 -- --	2004 (5.6) -- 3.7	2008 (3.5) -- 3.7		2012 (3.5) 3.7
75 to <100	1998 6.9 -- --	2004 (5.6) -- 3.7	2008 (3.5) -- 3.7	2012 2.6 0.14 3.7	2015 0.3 0.14 3.7
100 to <175	1997 6.9 -- --	2003 (4.9) -- 3.7	2007 (3.0) -- 3.7	2012 2.6 0.14 3.7	2015 0.3 0.14 3.7
175 to <300	1996 6.9 1.0 8.5	2003 (4.9) -- 2.6	2006 (3.0) -- 2.6	2011 1.5 0.14 2.6	2014 0.3 0.14 2.6
300 to <600	1996 6.9 1.0 8.5	2001 (4.8) -- 2.6	2005 (3.0) -- 2.6	2011 1.5 0.14 2.6	2014 0.3 0.14 2.6
600 to <750	1996 6.9 1.0 8.5	2002 (4.8) -- 2.6	2005 (3.0) -- 2.6	2011 1.5 0.14 2.6	2014 0.3 0.14 2.6
≥750	2000 6.9 1.0 8.5	2006 (4.8) -- 2.6		2011 2.6 0.3 2.6	2015 2.6 0.14 2.6

Note: ppmvd@15%O2 = g/Bhp-hr x (%EFF_{HHV}/100) / 1.15 x F (F= 253 for NOx, 415 for CO, 727 for VOC as methane)

Table 7. Emission from Diesel Engine at Snow Summit Ski Resort (A/N 418235)

	Concentration in Exhaust Gas, ppmvd @ 15% O2	Emission Rate, g/Bhp-hr	Tier 1 Emissioin Standard, g/Bhp-hr	Apparent Reduction Based on Uncontrolled Level = Tier 1 Less 20%, %
NOx	45	0.546	6.9	90
CO	5	0.037	8.5	99
VOC	49	0.21	1.0	74
Ammonia	0.6	--	--	--

Table 8. Uncontrolled Emissions from Natural Gas-Fired SI Engines (lb/MMBtu$_{HHV}$)*

	Rich-Burn	Lean-Burn
NOx	2.21	4.08
CO	3.72	0.317
VOC	0.267	0.267

*g/Bhp-hr = lb/MMBtu x 1.15 / (%EFF$_{HHV}$/100)

ppmvd@15%O2 = lb/MMBtu x F (F = 267 for NOx, 438 for CO, 767 for VOC as methane)

Table 9. NOx Control Technologies for Stationary SI Engines

Technology	NOx Reduction Capability, %	Comments
Ignition Timing Retard	15-30	Reduces efficiency by up to 5%
Pre-Stratified Charge (PSC)	80+	Not suitable for lean-burn engines
Low-Emission Combustion Modifications	80+	Pre-combustion chamber, leaning, ignition system improvement, turbocharger, air/fuel ratio control system. Retrofit kits are available for some engines.
Turbocharger with Aftercooler	3-35	
Exhaust Gas Recirculation (EGR)	30	
Non-selective Catalytic Reduction (NSCR)	90+	Three-way catalyst—reduces NOx, CO and VOC. Not suitable for lean-burn engines.
Selective Catalytic Reduction (SCR)	80+	Requires injection of urea or ammonia to react with NOx. Unreacted ammonia is emitted. Oxidation catalyst is normally included to reduce CO and VOC emissions.

Table 10. CARB NOx RACT/BARCT Determination for Stationary SI Engines (ppmvd corrected to 15% O2)

	Rich-Burn	Lean-Burn
RACT	90% control or 50 ppm NSCR, PSC for waste gases	80% control or 125 ppm Low-Emission Combustion or SCR
BARCT	96% control or 25 ppm NSCR, Inspection & Maintenance Program Waste Gases: 90% control or 50 ppm PSC	90% control or 65 ppm Low-Emission Combustion Mod's or SCR

Table 11. AQMD BACT Guidelines for Stationary Engines at Non-Major Polluting Facilities

	PPMVD, corrected to 15% O2				Apparent Reduction by Control Technology	
	Uncontrolled Emission		BACT			
	Rich-Burn	Lean-Burn	Rich-Burn (SNCR)**	Lean-Burn (SCR + CatOx)	Rich-Burn (SNCR), %	Lean-Burn (SCR + CatOx), %
NOx	590*	708*	10	9	98+	98+
CO	1629	136	69	33	95+	75+
VOC	205	205	29	25	85+	87+

*Assuming turbocharger/aftercooler reduces engine-out NOx by 35%.

**Assuming engine is 30% efficient (HHV basis).

Other Technology Options

For some stationary agricultural engines affected by the proposed Rule 1110.2 amendment, other options may be better than adding control equipment to the existing engine to bring the engine into compliance with the rule. Other options that can be considered include replacing the engine with a lower-emission model or an electric motor. In an engine replacement, only the engine needs to be replaced, and the balance of system remains the same. Repowering is most likely to be needed for diesel engines. While it may be possible to bring a diesel engine into compliance with the proposed amended rule by upgrading to a newer model and/or adding retrofit emission control technologies, it may be less costly and/or more amenable to site conditions to repower. Repowering options consist of a SI engine equipped with a three way catalyst and air/fuel ratio controller, or an electric motor. Repowering with a SI engine will require that the fueling system also be replaced. Repowering with an electric motor will require installation of electrical conduit from the nearest source of power with sufficient voltage and current capability.

PROPOSED AMENDMENTS

The basic purposes of the proposed amendments are to: make agricultural engines subject to the rule; improve the compliance record of engines by with better monitoring, recordkeeping and reporting; consistent with state directives regarding the use of portable generators prohibit use of portable engine generators to supply power to the grid or to a building, facility, stationary source or stationary equipment except in an emergency affecting grid stability; and clean up and simplify the rule by removing rule language that is no longer needed. A summary of the proposed amendments follows. They are discussed in order of importance rather than in subdivision order.

Exemptions – Subdivision (h)

This is the last subdivision in the rule, but it is useful to discuss it first so that it is understood up front what the proposed changes to the exemptions are.

Agricultural Engines

In paragraph (h)(1), the exemption for all agricultural engines is removed and replaced by an exemption for orchard wind machines powered by an internal combustion engine. This type of equipment only needs to be used during subfreezing temperatures, which seldom occur in this District. When these conditions do occur, they are outside the smog season. For these reasons, they are proposed for exemption. Only 81 engine-driven wind machines were reported in the 2004 AQMD Agricultural Equipment Survey.

Emergency Standby Engines

The exemption language regarding the limitation on annual operation is changed from "less than 200 hours" to "200 hours or less" to be consistent with Rule 1304(a)(4). Also, the definition of emergency standby engine is proposed to change, as discussed in a later section. Although the broad exemption for agricultural engines will be removed, emergency standby agricultural engines will still be exempt from the requirements of subdivision (d). 229 emergency standby engines were reported in the 2004 AQMD Agricultural Equipment Survey, more than any other type of engine.

Attainment Area Exemption

The current exemption in paragraph (i)(6) is for the eastern-most area of Riverside County that was not in the non-attainment portion of the county. The names of these areas have changed, and the proposed rule amendments in paragraph (h)(6) will incorporate these changes.

State-Registered Portable Engines

State law prohibits AQMD from regulating portable engines registered by the State for operation throughout California. The exemption in proposed amended paragraph (h)(9) is only revised to refer to the actual registration regulations in the CCR, rather than the authorizing regulation in the State Health and Safety Code.

Requirements – Subdivision (d)

Alternative to Electrification

The original Rule 1110.2 required stationary engine owners to remove or electrify their engines by before the year 2000, or control their emissions by 1994. In 1997, the rule was amended to allow owners who chose to electrify or remove the engine to keep them in service if the engines complied with more stringent emission limits equivalent to BACT. The compliance schedule and emission limits for this are in subdivision (e), Compliance rather than in Requirements.

The proposed amendment in subparagraph (d)(1)(A) moves the emission limits to the Requirements subdivision, and converts the limits to ppmvd, based on a typical engine mechanical efficiency of 30%. The original gram per brake horsepower-hour emission limits are difficult to enforce because of the difficulty in determining in the field engine work output in horsepower-hours.

Elimination of the Efficiency Correction for Stationary Engines

The current rule in subparagraph (d)(1)(C) allows some stationary engines to upwardly adjust the ppmvd emission limit in Table III based on the actual engine efficiency or the manufacturer's rated efficiency. More efficient engines are allowed higher ppmvd limits.

This has led to a lot of confusion when determining what the emission limit should be. Actual engine efficiencies are difficult to determine, especially for engines driving pumps or compressors, where there is generally no measurement of work output. Manufacturer's efficiency specifications are often misinterpreted because they do not include auxiliary loads such as cooling fans, or are quoted based on lower heating value when they need to be based on higher heating value of the fuel. The emission limits after the efficiency correction are often not stated on older permits, leaving operators, AQMD enforcement personnel and source testing contractors unsure of the emission limits. When contractors test engines for compliance they usually just report the uncorrected limits of Rule 1110.2 because they don't know the actual or specified engine efficiency.

The proposed amended subparagraph (d)(1)(B) simplifies and consolidates the previous emission limits into a single Table II, and eliminates the troublesome efficiency correction. Elimination of the efficiency correction will make the rule requirements slightly more stringent. A 30% efficient engine would have to meet a limit that is 17% lower than the current rule.

More Stringent VOC Limit for Stationary Engines

The current VOC[10] emission limit in paragraph (d)(1) of the rule is 250 ppmvd, reported as methane and corrected to 15% oxygen. Source tests demonstrate that stationary engines are achieving much lower values than this. The current BACT limit is equivalent to about 30 ppmvd. Even the EPA emission factors for uncontrolled natural gas fired engines are equivalent to no more than 49 ppmvd.[11]

Proposed subparagraph (d)(1)(C) will reduce the VOC limit for stationary engines to 100 ppmvd by January 1, 2007.

Portable Engines

The current rule in paragraph (d)(2) seems to require portable engines to meet the emission limits in Tables IV and V. It also seems to require portable engines to meet the most stringent emission standard in Title 13 of the CCR by 2010 (currently Tier III for diesels). However, the exemption in paragraph (i)(10) exempts all nonroad engines from these requirements. The definitions in the current rule for non-road engine and portable engine are practically the same, which results in all portable engines actually being exempt from the portable engine requirements.

At the time of the 1997 amendments to the rule, it was interpreted that nonroad engines were only those manufactured after November 15, 1990 or later, which would make older portable engines subject to rule requirements, but this was not apparent from the rule language. By a

[10] Measured as non-methane, non-ethane hydrocarbons, reported as methane, by the designated test method.

[11] The highest uncontrolled emission factor in Section 3.2 of AP-42 is for 2-stroke lean-burn engines. At 0.12 lbs/MMBtu of heat input, and using the molecular weight of formaldehyde (30) the predominate compound measured, it converts to 49 ppmvd as methane at 15% O2.

plain reading of the exemption for nonroad engines, all portable engines are exempt. Also, as explained in the Background section, USEPA has clarified that the date of manufacture is irrelevant to whether it is nonroad. Therefore, to simplify the rule, staff proposes to remove the emission limits and related requirements for portable engines [section (d)(2)].

Also, to be consistent with state directives regarding the use of portable generators[12] [13], it is proposed that the amended rule prohibit use of portable engine generators to supply power to the grid or to a building, facility, stationary source or stationary equipment except in an emergency affecting grid stability or availability, during maintenance and repair operations or in remote locations where grid power is unavailable.

Compliance – Subdivision (e)

Removal of Obsolete Requirements

This subdivision of the current rule is mostly composed of obsolete compliance schedules whose final compliance dates have passed. All of that language is struck by the proposed amendments.

Agricultural Stationary Engine Compliance Schedule

Subparagraph (e)(1)(A) will now provide a schedule for exiting stationary agricultural engines to come into compliance with the rule, as non-agricultural engines have already done starting in 1994. The schedule requires final compliance by January 1, 2007, with applications to be submitted one year prior, and initiation of construction by three months prior to the final compliance date.

New engines will have to comply upon installation, although they will also be subject to the even more stringent requirements of Best Available Control Technology, as required by AQMD's New Source Review rules.

Inspection and Monitoring (I&M) Plan Compliance

Paragraph (e)(3) will require the owner to submit to the Executive Officer for approval an I&M plan, discussed in the following section, by January 1, 2006. Implementation of the plan, or the version approved by the Executive Officer, must commence by May 1, 2006.

Monitoring and Recordkeeping – Subdivision (f)

The primary focus of the proposed amendments in this subdivision is to improve the poor compliance record of stationary engines, as explained on page 2 of the staff report.

Alternative Continuous Emission Monitoring (CEMS) for Stationary Engines

Paragraph (f)(1) will be revised to incorporate guidelines developed by AQMD for alternative CEMS. These guidelines, "District Alternative Continuous Emission Monitoring System Performance Specifications and Guidelines" will be submitted for approval into the State Implementation Plan.

Additional CEMS Requirements

[12] California Air Resources Board, Letter from Michael P. Kenny, February 21, 2001.
[13] California Air Resources Board, Amendments to the Regulation for the Statewide Portable Equipment Registration Program (Resolution 04-8), 15-Day Comment Version, May 13, 2004.

Effective in 2007, CO emission monitoring will be added back into the rule in subparagraph (f)(1)(A), as it was before the 1997 amendment. In addition, the CEMS requirement will be extended to stationary engines at facilities that have a cumulative stationary engine horsepower ratings of 500 bhp or more. A CEMS is the best possible way to assure continuous compliance of engines with the rule emission limits. However, to reduce the cost, the CEMS can be time-shared between all engines at a facility not previously required to have a CEMS.

Source Testing for Stationary Engines

In subparagraph (f)(1)(C), the frequency of source testing will be returned to the annual requirement that existed in the rule prior to 1997.

In addition, the following source testing reforms will be required:

- Emissions must be tested at for at least 15 minutes at peak load and for at least 30 minutes during normal operation. The source test can't just be at one load under steady state conditions, unless that is the typical duty cycle.
- Pretests to determine if the engine needs repairs will not be allowed.
- The test must be conducted at least 250 hours or one month after any engine tuning or maintenance. This will make the source test more representative of actual conditions.
- A source test protocol must be submitted and approved by the District before the test is conducted. This will allow the district to review and approve the test methods and engine operating procedures, and to witness the test if desired. The protocol will also establish the critical parameters that will be measured during the test, as required by the Inspection and Maintenance Plan (discussed later).
- If a test is started and shows non-compliance, it may not be aborted to allow engine tuning or repairs. The test must be completed and reported.
- The test report must be submitted to AQMD within 14 days of completion. This will assure that noncompliance will be reported.

All of these reforms are needed to assure that source tests are properly conducted, representative of actual operation, and reviewed by AQMD.

Inspection and Maintenance (I&M) Plan for Stationary Engines

An I&M Plan will be added to the rule in subparagraph (f)(1)(D). Many of its elements are based on the CARB's "Determination of Reasonably Available Control Technology and Best Available Retrofit Control Technology for Stationary Spark-Ignited Internal Combustion Engines".

The I&M Plan will not be required for engines monitored by CEMS. For other stationary engines, the engine owner will submit to AQMD for approval an I&M Plan to assure continued compliance of the engines between source tests. The I&M Plan will include procedures for:

- Establishing acceptable ranges for control equipment parameters and engine operating parameters that source testing and portable analyzer monitoring has shown result in pollutant concentrations within the rule limits;
- Continuously monitoring and recording these parameters;
- Weekly inspections of the monitoring data;
- Procedures for a diagnosing emission control malfunctions alerting the owner/operator to the malfunction. Engines shall have a diagnostic system and malfunction indicator light

that complies with 40 CFR 1048.110 (See Appendix D) and is approved by USEPA, CARB or the Executive Officer.

- Weekly emissions checks by a portable NOx, CO and O2 analyzer. In order to representative of actual operation, the test will be conducted prior to any engine or control system maintenance or tuning. The portable analyzer will be calibrated, maintained and operated in accordance with the manufacturer's specifications and recommendations and the PROTOCOL FOR THE PERIODIC MONITORING OF NITROGEN OXIDES, CARBON MONOXIDE, AND OXYGEN FROM SOURCES SUBJECT TO SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT RULE 1110.2.
- Preventive and corrective maintenance, and their schedules;
- Reporting noncompliance to the Executive Officer. If an engine owner/operator finds an engine to be operating outside the acceptable range for control equipment parameters, engine operating parameters, engine exhaust NOx, CO, VOC or oxygen concentrations, the owner/operator will: report the noncompliance within one hour in the same manner required by paragraph (b)(1) of Rule 430 – Breakdowns; immediately correct the noncompliance or shut down the engine within 24 hours or the end of an operating cycle, in the same manner as required by subparagraph (b)(3)(iv) of Rule 430; and comply with all requirements of Rule 430 if there was a breakdown.
- Recordkeeping of monitoring data and actions required by the plan, including formats of the recordkeeping;
- Plan revisions. Before any change in I&M plan operations can be implemented, the revised I&M plan will have to be submitted to and approved by the Executive Officer.

The predominant type of stationary engine and control equipment is a rich-burn engine with a three-way catalyst. This type of engine will be required to be equipped with an air-to-fuel ratio controller with an O2 sensor and feedback control. The parameters to be monitored and recorded for this type of engine will include:

1. Engine load
2. Oxygen sensor voltage output
3. Catalyst inlet and outlet temperature
4. Catalyst differential static pressure.

In addition to the normal weekly emission checks, at least monthly and whenever an oxygen sensor is replaced, the portable analyzer will be used to verify or reestablish the acceptable range of the oxygen sensor at minimum, midpoint and maximum load.

Portable Analyzer Training

In order to assure that persons conducting the portable analyzer testing are properly trained to understand the equipment and the procedures for conducting testing, maintenance and calibration, subparagraph (f)(1)(F) requires persons to take a District-approved training program and obtain a certification issued by the District. AQMD will likely offer and conduct the training.

Portable Engine Recordkeeping

The engine operating log requirements of subparagraph (f)(2) will be expanded in paragraph (f)(3) to maintain records for at least five years and made available for inspection.

Record Keeping for All Engines

The current rule, in subparagraph (f)(1)(B), only required CEMS data to be maintained for two years and made available for district inspection. Other records did not have to be maintained. That requirement is moved to paragraph (f)(3) and extended to all the different types of records required for stationary and portable engines. In addition, the two year requirement is extended to five years, consistent with the requirement for Title V facilities.

Test Methods – Subdivision (g)

Only minor changes are proposed. One change will clarify that the VOC test method excludes both methane and ethane.

Technology Assessment for $PM_{2.5}$ - Subdivision (h)

This subdivision in the current rule is proposed to be deleted. It required the Executive Officer do a technology assessment for PM2.5 and report to the Board by December 30, 1999. This requirement was completed.

Definitions – Subdivision (c)

Agricultural Engines

A definition of Agricultural Stationary Engine is added as paragraph (c)(1).

Removed Definitions

Because parts of the rule whose compliance dates have passed are proposed for removal, two definitions are no longer needed. They are the definitions for Non-Road Engine and Rule 1110.1 Emission Control Plan.

Facility

The definition is revised to be consistent with the definition in Rule 1302.

Stationary Engine

An engine is either stationary or portable. The current definition for stationary engine is not entirely consistent with the requirements in the definition for portable engine. The proposed modification will be consistent, because if an engine does not meet the requirements for a portable engine, it will be considered stationary.

EMISSION IMPACTS

The emission impacts for the proposed amendments to Rule 1110.2 are expected in two categories which make up the engine emissions inventory universe: 1) engines used in agricultural operations and 2) engines currently regulated by Rule 1110.2 used in non-agricultural operations. These impacts will be determined at a later date.

The proposed rescission of Rule 1110.1 will not result in emission impacts.

Additional language to be added.

COST EFFECTIVENESS

To be added.

DRAFT FINDINGS

Before adopting, amending or repealing a rule, the AQMD shall make findings of necessity, authority, clarity, consistency, non-duplication, and reference, as defined in Health and Safety Code Section 40727. The draft findings are as follows:

Necessity - The AQMD Governing Board finds and determines that Proposed Amended Rule 1110.2 - Emissions From Gaseous- and Liquid-Fueled Internal Combustion Engines is necessary in order to comply with the requirements of Senate Bill 700-Agricultural Operations and adopt and implement Best Available Retrofit Control Technology for inclusion in the State Implementation Plan.

Authority - The AQMD Governing Board obtains its authority to adopt, amend or repeal rules and regulations from Health and Safety Code §§40000, 40001, and 40440.

Clarity - The AQMD Governing Board finds and determines that Proposed Amended Rule 1110.2 is written and displayed so that the meaning can be easily understood by persons directly affected by it.

Consistency – The AQMD Governing Board finds and determines that Proposed Amended Rule 1110.2 is in harmony with, and not in conflict with or contradictory to, existing statutes, court decisions, or federal or state regulations.

Non-Duplication – The AQMD Governing Board has determined that Proposed Amended Rule 1110.2 does not impose the same requirements as any existing state or federal regulations.

Reference - In adopting these proposed amendments and proposed rescinding, the AQMD Governing Board references the following statutes which AQMD hereby implements, interprets or makes specific: Health and Safety Code Sections 40001 and 40440.

REFERENCES

1. California Environmental Protection Agency - Air Resources Board "Determination of Reasonably Available Control Technology and Best Available Retrofit Control Technology for Stationary Spark-Ignited Internal Combustion Engines", November 2001.
2. South Coast Air Quality Management District, "Final Staff Report For Proposed Amendment of Rule 1110.2 - Emissions from Gaseous and Liquid-Fueled Engines" November 1997.
3. California Air Resources Board, "Staff Report: Initial Statement of Reasons for Proposed Rulemaking for Proposed Amendments to the Regulation for the Statewide Portable Equipment Registration Program", February 26, 2004.
4. Compilation of Air Pollutant Emission Factors AP-42. Volume I: Stationary Point and Area Sources. U. S. Environmental Protection Agency, Research Triangle Park, NC.

5. California Air Resources Board, "Staff Report: Adoption of the Proposed Airborne Toxic Control Measure for Diesel Particulate Matter from Portable Engines Greater Than 50 Horsepower", February 26, 2004
6. South Coast Air Quality Management District, “Final Staff Report For Proposed Rule 1110.2 - Emissions from Gaseous and Liquid-Fueled Engines” July 1990

APPENDIX A

Cost Effectiveness Calculations

To be added.

APPENDIX B

Incentive Funding Available for Agricultural Engine Emission Reductions

Summary of Incentive Funding Available for Agricultural Engine Emission Reductions

There are two important new incentive programs for agricultural engine emission reduction projects, one from the State of California, and the other from Southern California Edison Company. The new state Agricultural Assistance Program (AAP) is unprecedented in that it will provide funding to agricultural facilities for emissions reductions required by an AQMD regulation. No other facilities enjoy this kind of financial assistance.

There are a variety of other AQMD programs (see AQMD's website at http://www.aqmd.gov/tao/Implementation/index.htm) that provide incentive funding for emission reduction projects. However, they cannot fund emission reductions required by AQMD rules. Therefore, the following two programs will be the best source of funding for agricultural engines.

Carl Moyer and Agricultural Assistance Programs

Since 1998, the Carl Moyer Memorial (CMP) Air Quality Standards Attainment Program ("Carl Moyer Program") has provided grants to encourage the owners of heavy-duty diesel engines to go beyond regulatory requirements by retrofitting, repowering, or replacing their engines with newer and cleaner ones. On January 1, 2005, new legislation (AB 923, Firebaugh) takes effect which broadens the definition of Carl Moyer Program (CMP)-eligible projects to include additional agricultural sources.

CMP grants are awarded based on funding protocols developed in consultation with local air districts and interested stakeholders, and adopted by the CARB in a public meeting. The definition of "agricultural sources" in AB 923 includes sources such as confined animal facilities and fugitive dust, for which there are currently no funding protocols. Projects for which funding protocols exist, such as projects involving agricultural irrigation pump engines, will continue to be eligible for funding.

The legislation requires the CARB to establish or update grant criteria and guidelines for covered projects, as revised by the bill, by January 1, 2006. CARB has issued interim guidelines[14]; however, they will eventually be superceded by CARB-adopted guidelines. After October 2005, interested persons should consult http://www.arb.ca.gov/msprog/moyer/moyer.htm or CARB staff to determine if final Board-adopted guidelines are available.

Table B-1 summarizes the significant differences between the CMP and the new Agricultural Assistance Program authorized by AB 923 and funded by the $2 motor vehicle registration fee.

[14] Carl Moyer Program Advisory: 05-002 November 29, 2004

Table B-1: Agricultural Source Eligibility for Carl Moyer Program and $2 Motor Vehicle Registration Fee Incentive Funds

	Carl Moyer Program	**Agricultural Assistance Program** (funded with $2 MV Fees)
Program Criteria*	• Reductions must be surplus • $13,600 cost-effectiveness limit	• Previously unregulated sources • Within 3 years after rule adoption or before compliance date (whichever is later) • No surplus requirement • $13,600 cost-effectiveness of total reductions limit

*Summary of eligibility criteria. Please consult the CMP Guidelines[15] and the Program Advisory 05-002 for complete eligibility information. .

AB 923 will permit the funding of incentive programs to reduce emissions of nitrogen oxides (NOx) , particulate matter (PM) and reactive organic gases (ROG). The bill also authorizes funding for additional agricultural sources. Two funding sources – the CMP and an additional two dollar surcharge on motor vehicle registration fees are affected. For the purposes of AB 923, agricultural sources are defined in Health and Safety Code Section 39011.5. This section defines an agricultural source as a source of air pollution used in the production of crops, or the raising of fowl or animals, that meets any of the following criteria:

- Is a confined animal facility;
- Is an internal combustion engine used in the production of crops or the raising of fowl or animals, except an engine that is used to propel implements of husbandry;
- Is a Title V source; or
- Is a source that is otherwise subject to regulation by a district pursuant to federal law (for example, fugitive dust sources subject to federal control requirements).

For purposes of the motor vehicle registration fee, self-propelled agricultural equipment, such as tractors or harvesters, are specifically excluded from the definition of "agricultural sources" under this section of the Health and Safety Code. However, self-propelled equipment is eligible for funding under the "traditional" CMP because it is a mobile source.

The CMP and the motor vehicle registration fee program are governed by related but different statutory requirements:

- For CMP projects, emission reductions must be real, surplus, quantifiable, and enforceable. "Surplus" means that the reductions must surpass those reductions required by existing regulatory requirements. Projects must also meet a cost-effectiveness threshold of $13,600 per ton of emissions reduced.

[15] See http://www.aqmd.gov/tao/Implementation/carl_moyer_program_2001.html

- The $2 motor vehicle fee can be used to fund agricultural projects in two ways. The $2 motor vehicle fee can be used to fund agricultural projects meeting the CMP guidelines. In addition, the $2 motor vehicle fee may be used to directly fund agricultural projects through a new program called the "Agricultural Assistance Program" (AAP) if specified conditions are met. AAP projects must apply to previously unregulated sources. These projects do not need to provide surplus emission reductions.

At this time, there is already a CMP funding protocol for projects that reduce emissions from agricultural pump engines. As discussed in Program Advisory 04-13, projects that reduce emissions from both stationary and portable agricultural irrigation pump engines are eligible for funding. In addition, Program Advisory 05-001 modifies the requirements for project life, allowing all agricultural irrigation pump engines (including portable engines) to qualify for funding beyond the December 31, 2004 date specified in Program Advisory 04-13.:

As discussed above, AB 923 broadens the definition of CMP-eligible projects to include additional agricultural sources. There are currently no funding protocols for projects that reduce emissions from agricultural sources that are not engines. CARB staff is evaluating the eligibility of projects to reduce emissions from the other types of agricultural sources.

Existing law authorizes air districts to assess motor vehicle fees to fund implementation of the California Clean Air Act. AB 923 modifies the law to allow district boards to adopt an additional surcharge of up to $2 to implement any or all of four specified programs: the CMP; Low-Emission School Bus Program; a car scrap program; or the new purchase, retrofit, repower, or add-on equipment for previously unregulated agricultural sources.

Emission reductions from agricultural projects that meet the CMP guidelines may be funded with the $2 surcharge on motor vehicles. The $2 surcharge on motor vehicles may also be used under a new program called the "Agricultural Assistance Program" (AAP) to directly fund the control of agricultural sources of air pollution, as defined in Section 39011.5."

Based on the statutory provisions of AB 923, AAP projects must meet all of the following requirements:

- 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 (this includes agricultural engines),
- Projects must be funded within 3 years of rule adoption or before the compliance date of the rule, whichever is later, and
- The ARB must determine that the applicable rule complies with Sections 40913, 40914, and 41503 of the Health and Safety Code pertaining to attainment plan measures.

Sections 40913, 40914, and 41503.1 of the Health and Safety Code relate to California Clean Air Act attainment plans and the rate of emission reductions required in those plans. 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. CARB routinely reviews district rules for compliance with these requirements and will treat agriculture-related rules the same way.

Agricultural irrigation pump engines subject to district rules that limit NOx, ROG or PM emissions from agricultural irrigation pump engines can be funded if those rules take effect after January 1, 2005, as will the proposed amendments to Rule 1110.2. The project must also meet the AAP criteria listed above, and should meet the cost-effectiveness of total reduction (CETR) limit of $13,600 per ton as described below.

Because AAP projects are not required to achieve surplus emission reductions, the cost-effectiveness calculations used in the CMP (which are based solely on surplus reductions) are not appropriate for evaluating these types of projects.

However, in order to provide a means for districts to evaluate AAP projects, ARB staff has developed a new metric for the AAP, the "cost-effectiveness of total reductions" (CETR), where CETR is the annualized cost divided by the emission reductions as if no regulatory requirement existed:

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

The emission reductions should be calculated using CMP methodologies and protocols, but assuming no regulatory requirement exists. For example, for agricultural irrigation pump engines, the CETR calculation would generally assume a project life of 7 years, even if a local rule for agricultural irrigation pump engines takes effect in three years.

In order to ensure that the technologies and costs of projects funded by the AAP are generally comparable to those funded by the CMP, local districts should not directly fund agricultural projects that exceed a CETR of $13,600 per ton of total emissions reduced, but matching funds from the engine user or other source are not counted toward the CETR limit.

Southern California Edison (SCE) Incentive Funding and Reduced Electric Rates

SCE already has ten different rate schedules for agricultural customers that offer better electric rates to agricultural facilities than to other commercial and industrial customers. Nevertheless, on November 9, 2004, SCE filed an application with the California Public Utilities Commission for expedited approval of additional incentives for conversion of agricultural engines to electrical service. SCE's proposal consists of two incentives to encourage customers to convert to electrical use: discounted rates over a 10-year period; and enhanced line extension allowances to help reduce the up-front costs of the conversion.

The proposed new rate schedule, Schedule TOU-PA-ICE Time-of-Use Agricultural and Pumping internal Combustion Engine Conversion Program, represents approximately a 20% discount relative to the current Schedule TOU-PA-B. Both demand charges ($/kW) and energy charges ($/kW-hr) are reduced. During the Off-Peak time period, electric costs will be as low as 4.532 cents per kW-hr. This is equivalent to buying diesel fuel at $0.63 per gallon, which is much less than the current cost of diesel fuel, therefore the operating costs of the electric motor will be much less than for a diesel engine.

In order to help pay more of the up-front costs to bring electrical service to an agricultural site, SCE also proposes additional Line Extension Adder funding on top off the funding already in

effect. SCE estimates that a typical 150 hp diesel engine would qualify for an additional $30,000 of funding in addition to the normal funding.
Agricultural facilities can get these SCE incentives in addition to the state AAP incentives when the convert agricultural engines to electric service.

APPENDIX C

SB 700 Excerpts

BILL NUMBER: SB 700 CHAPTERED
BILL TEXT

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INTRODUCED BY Senators Florez and Sher

FEBRUARY 21, 2003

An act to amend Section 42310 of, and to add Sections 39011.5, 39023.3, 40724, 40724.5, 40724.6, 40724.7, 40731, 42301.16, 42301.17, 42301.18, and 44559.9 to, the Health and Safety Code, relating to air quality.

LEGISLATIVE COUNSEL'S DIGEST

SB 700, Florez. Air quality: emissions: stationary sources: agricultural operations.

(1) Existing law authorizes the board of every air quality management district and air pollution control district to establish a permit system that requires any person that uses certain types of equipment that may cause the emission of air contaminants to obtain a permit. Existing law exempts vehicles and certain types of equipment from those permit requirements.

This bill would eliminate that exemption for any equipment used in agricultural operations in the growing of crops or the raising of fowl or animals. To the extent that the bill would increase the number of permits that a district board, electing to establish a permit system prior to January 1, 2004, would be required to issue, the bill would impose a state-mandated local program.

(2) Existing law defines various terms governing the construction of air pollution control laws in the state, and authorizes the state

board to revise those definitions to conform with federal law.

This bill would define the terms "agricultural source of air pollution" and "fugitive emissions," and would prohibit, notwithstanding the existing authority, the state board from revising those definitions.

(3) The existing federal Clean Air Act requires districts to adopt local programs for issuing operating permits to major stationary sources of air pollutants. The existing act defines a stationary source as any building, structure, facility, or installation that emits or may emit any air pollutant.

This bill would require each district that is designated a serious federal nonattainment area for an applicable ambient air quality standard for particulate matter as of January 1, 2004, to adopt, implement, and submit for inclusion in the state implementation plan, a rule or regulation requiring best available control measures (BACM) and best available retrofit control technology (BARCT) for agricultural practices at agricultural sources of air pollution to reduce air pollutants from those sources for which that technology is applicable for agricultural practices by the earliest feasible date, but not later than January 1, 2006, and would require each district subject to those requirements to comply with a schedule for public hearing, adoption, and implementation of the final rule.

The bill would require each district that is designated a moderate federal nonattainment area or an applicable ambient air quality standard for particulate matter as of January 1, 2004, to adopt and implement control measures necessary to reduce emissions from agricultural practices by the earliest feasible date, but no later than January 1, 2007, unless the district determines that those sources do not significantly cause or contribute to a violation of state or federal standards.

The bill would require, by January 1, 2005, the state board to review all available scientific information and develop a definition of a "large confined animal facility."

The bill would require, by July 1, 2006, each district that is designated as a federal nonattainment area for ozone as of January 1, 2004, to adopt, implement, and submit for inclusion in the state implementation plan, a rule or regulation that requires the owner or operator of a large confined animal facility as that term is defined by the state board to obtain a permit to reduce, to the extent feasible, emissions of air contaminants from the facility. The bill would require the district to perform an assessment of the impacts of the rule or regulation prior to its adoption. The bill would authorize a permitholder to appeal any district determination or decision related to that permit.

The bill would require a district that is designated as being in attainment for the federal ambient air quality standard for ozone as

of January 1, 2004, to adopt the same rule or regulation required of nonattainment districts, by July 1, 2006, unless the district board makes a determination that large confined animal facilities will not contribute to a violation of any state or federal ambient air quality standard. The bill would provide the rule or regulation is not required to be submitted for inclusion into the state implementation plan.

The bill would require the California Air Pollution Control Officers Association, in consultation with the state board and other interested parties, by January 1, 2005, to develop a clearinghouse of available control measures and strategies for agricultural sources of air pollution and emissions of air contaminants from agriculture operations.

The additional duties for districts under the bill would impose a state-mandated local program.

(4) Existing law establishes the Capital Access Loan Program for Small Businesses, administered by the California Pollution Control Financing Authority, which provides loans through participating financial institutions to entities authorized to conduct business in the state and whose primary business location is in the state.

This bill would require the authority to expand the program to include outreach to financial institutions that service agricultural interests in the state for the purposes of funding air pollution control measures.

(5) Under existing law, any person who violates a rule, regulation, permit, or order of a district is guilty of a misdemeanor. Because this bill would increase the number of people who are subject to that provision, it would expand the scope of a crime, thereby imposing a state-mandated local program.

(6) The California Constitution requires the state to reimburse local agencies and school districts for certain costs mandated by the state. Statutory provisions establish procedures for making that reimbursement.

This bill would provide that no reimbursement is required by this act for specified reasons.

THE PEOPLE OF THE STATE OF CALIFORNIA DO ENACT AS FOLLOWS:

SECTION 1. (a) The Legislature finds and declares all of the following:

(1) Agricultural operations necessary for growing crops or raising animals are a significant source of directly emitted particulates, and precursors of ozone and fine particulate matter. These emissions have a significant adverse effect on the ability of areas of the

state, including, but not limited to, the San Joaquin Valley, to achieve health-based state and federal ambient air quality standards.

(2) Since 1999, the agriculture industry has reduced emissions of oxides of nitrogen (NOx) by more than 2000 tons per year, emissions of particulate matter of 10 microns in diameter (PM 10) by more than 500 tons per year, and emissions of volatile organic compounds (VOCs) from agricultural chemicals by more than 20 percent. According to the state board, however, agricultural sources of air pollution still contribute twenty-six percent of the smog-forming emissions in the San Joaquin Valley.

(3) In the San Joaquin Valley, a large portion of the sources of particulate emissions are areawide sources whose emissions are directly related to growth in population and the resulting vehicle miles traveled. According to the State Air Resources Board, however, agricultural sources of air pollution account for over fifty percent of the directly emitted particulate air pollution generated in the valley during the fall, amounting to over 170 tons per day of emissions.

(4) All parties living or operating a business in an area that has been classified as being a nonattainment area with respect to the attainment of federal or state ambient air quality standards share the responsibility of reducing emissions from air pollutants.

(5) The federal Clean Air Act (42 U.S.C. Sec. 7401 et seq.) prohibits the state from adopting emission standards or limitations less stringent than those established under the federal act, including limitations on emissions from agricultural sources.

(6) Division 26 (commencing with Section 39000) of the Health and Safety Code establishes numerous policies and programs to reduce air pollutants for the protection of public health.

(7) The purpose of the act adding this section is to establish a new set of programs at the state and regional levels to reduce air emissions from agricultural sources in order to protect public health and the environment.

(b) It is therefore the intent of the Legislature to require the State Air Resources Board and air quality management districts and air pollution control districts in the state to regulate stationary, mobile, and area sources of agricultural air pollution.

SEC. 2. Section 39011.5 is added to the Health and Safety Code, to read:

39011.5. (a) "Agricultural source of air pollution" or "agricultural source" means a source of air pollution or a group of sources used in the production of crops, or the raising of fowl or animals located on contiguous property under common ownership or control that meets any of the following criteria:

(1) Is a confined animal facility, including, but not limited to,

any structure, building, installation, barn, corral, coop, feed storage area, milking parlor, or system for the collection, storage, treatment, and distribution of liquid and solid manure, if domesticated animals, including, but not limited to, cattle, calves, horses, sheep, goats, swine, rabbits, chickens, turkeys, or ducks are corralled, penned, or otherwise caused to remain in restricted areas for commercial agricultural purposes and feeding is by means other than grazing.

(2) Is an internal combustion engine used in the production of crops or the raising of fowl or animals, including, but not limited to, an engine subject to Article 1.5 (commencing with Section 41750) of Chapter 3 of Part 4 except an engine that is used to propel implements of husbandry, as that term is defined in Section 36000 of the Vehicle Code, as that section existed on January 1, 2003. Notwithstanding subdivision (b) of Section 39601, the state board may not revise this definition for the purposes of this section.

(3) Is a Title V source, as that term is defined in Section 39053.5, or is a source that is otherwise subject to regulation by a district pursuant to this division or the federal Clean Air Act (42 U.S.C. Sec. 7401 et seq.).

(b) Any district rule or regulation affecting stationary sources on agricultural operations adopted on or before January 1, 2004, is applicable to an agriculture source.

(c) Nothing in this section limits the authority of a district to regulate a source, including, but not limited to, a stationary source that is an agricultural source, over which it otherwise has jurisdiction pursuant to this division, or pursuant to the federal Clean Air Act (42 U.S.C. Sec. 7401 et seq.) or any rules or regulations adopted pursuant to that act that were in effect on or before January 1, 2003, or to exempt an agricultural source from any requirement otherwise applicable under Sections 40724 or 42301.16, based upon a finding by the district in a public hearing that the aggregate emissions from that source do not exceed a de minimus level of more than one ton of particulate matter, nitrogen oxides or volatile organic compounds per year.

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SEC. 4. Section 40724 is added to the Health and Safety Code, to read:

40724. (a) Each district that is designated as a serious federal nonattainment area for an applicable ambient air quality standard for particulate matter as of January 1, 2004, shall adopt, implement, and submit for inclusion in the state implementation plan, a rule or regulation requiring best available control measures (BACM) for sources for which those measures are applicable and best available retrofit control technology (BARCT) to reduce air pollutants from

sources for which that technology is applicable for agricultural practices, including, but not limited to, tilling, discing, cultivation, and raising of animals, and for fugitive emissions from those agricultural practices a manner similar to other source categories by the earliest feasible date, but not later than January 1, 2006. The rule or regulation shall also include BACM and BARCT to reduce precursor emissions in a manner commensurate to other source categories that the district show cause or contribute to a violation of an ambient air quality standard. Each district that is subject to this subdivision shall comply with the following schedule with respect to the rule or regulation imposing BACM and BARCT:

(1) On or before September 1, 2004, notice and hold at least one public workshop for the purpose of accepting public testimony on the proposed rule or regulation.

(2) On or before July 1, 2005, adopt the final rule or regulation at a noticed public hearing.

(3) On or before January 1, 2006, commence implementation of the rule or regulation.

(b) Nothing in this section shall delay or otherwise affect any action taken by a district to reduce emissions of air contaminants from agricultural sources, or any other requirements imposed on a district or a source of air pollution pursuant to the federal Clean Air Act (42 U.S.C. Sec. 7401 et seq.).

(c) In adopting a rule or regulation pursuant to this section, a district shall do all of the following:

(1) Ensure the size and duration of use of an internal combustion engine subject to BARCT pursuant to this section is commensurate to the size and duration of use of internal combustion engines subject to regulation by a district or the state board regulated at other stationary sources.

(2) Ensure that BARCT established pursuant to this section for an internal combustion engine is similar to BARCT for other stationary source engines subject to regulation by a district or the state board.

(3) Ensure that the cost-effectiveness of BARCT for an internal combustion engine subject to this section is similar to the cost-effectiveness of BARCT for other internal combustion engines subject to regulation by a district or the state board.

(4) Compare the cost-effectiveness of BARCT for an internal combustion engine subject to this section to the list of available and proposed control measures prepared pursuant to Section 40922.

(5) Adopt control measures pursuant to this section in order of their cost-effectiveness, unless a district determines that a different order of adoption is necessary due to the enforceability, public acceptability, or technological feasibility of a given control measure, or to expeditiously attain or maintain a national or state

ambient air quality standard.

(6) Except as otherwise provided under this section, ensure that any rule or regulation adopted pursuant to this section complies with all applicable requirements of this division, including, but not limited to, any applicable requirements established pursuant to Sections 40703, 40727, 40728.5, and 40920.6.

(7) Hold at least one public meeting that is conducted at a time and location that the district determines is convenient to the public at which the district reviews the comparison prepared pursuant to paragraph (4).

(d) Nothing in this section limits the authority of a district to regulate a source including, but not limited to, a stationary source that is an agricultural source over which it otherwise has jurisdiction pursuant to this division or the federal Clean Air Act (42 U.S.C. Sec. 7401 et seq.) or any rules or regulations adopted pursuant to that act. Nothing in this section shall delay or otherwise affect any action taken by a district to reduce emissions of air contaminants from agricultural sources, or any other requirements imposed upon a district or a source of air pollution pursuant to the federal Clean Air Act. This section may not be interpreted to delay or otherwise affect the adoption, implementation, or enforcement of any measure that was adopted, or included in a rulemaking calendar or air quality implementation plan that was adopted, by the district prior to January 1, 2004.

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SEC. 8. Section 40731 is added to the Health and Safety Code, to read:

40731. In order to assist in the development of the BACM, RACM, and BARCT measures specified in Sections 40724, 40724.5, and 40724.6, and to reduce or eliminate emissions of regulated air pollutants and their precursors, the California Air Pollution Control Officers Association, in consultation with the state board and other interested parties, shall, not later than January 1, 2005, develop a clearinghouse of available control measures and strategies for agricultural sources of air pollution and emissions from agricultural operations, including, but not limited to, the following sources:

(a) Operations that create fugitive dust emissions, including, but not limited to, discing, tilling, material handling and storage, and travel on unpaved roads.

(b) Confined animal facilities, including, but not limited to, any structure, building, installation, barn, corral, coop, feed storage area, or milking parlor, including, but not limited to, a system for the collection, storage, treatment, and distribution of liquid or solid manure from domestic animals, including, but not limited to, cattle, calves, horses, sheep, goats, swine, rabbits, chickens,

turkeys, or ducks, if those animals are corralled, penned, or otherwise caused to remain in restricted areas for commercial agricultural purposes, and feeding is by means other than grazing.

(c) Internal combustion engines used in the production of crops or the raising of animals or fowl, except an engine that is used to propel an implement of husbandry, as that term is defined in Section 36000 of the Vehicle Code, as that section existed on January 1, 2003.

(d) Other equipment, operations, or activities associated with the growing of crops or the raising of fowl or animals, that emit, or cause to be emitted, any regulated air pollutant, or any precursor to any regulated air pollutant.

APPENDIX D

EPA Large Spark-Ignition Engine Regulation 40 CFR 1048.110

§ 1048.110 How must my engines diagnose malfunctions?

(a) *Equip your engines with a diagnostic system.* Starting in the 2007 model year, equip each engine with a diagnostic system that will detect significant malfunctions in its emission-control system using one of the following protocols:

(1) If your emission-control strategy depends on maintaining air-fuel ratios at stoichiometry, an acceptable diagnostic design would identify malfunction whenever the air-fuel ratio does not cross stoichiometry for one minute of intended closed-loop operation. You may use other diagnostic strategies if we approve them in advance.

(2) If the protocol described in paragraph (a)(1) of this section does not apply to your engine, you must use an alternative approach that we approve in advance. Your alternative approach must generally detect when the emission-control system is not functioning properly.

(b) *Use a malfunction-indicator light (MIL).* The MIL must be readily visible to the operator; it may be any color except red. When the MIL goes on, it must display "Check Engine," "Service Engine Soon," or a similar message that we approve. You may use sound in addition to the light signal. The MIL must go on under each of these circumstances:

(1) When a malfunction occurs, as described in paragraph (a) of this section.

(2) When the diagnostic system cannot send signals to meet the requirement of paragraph (b)(1) of this section.

(3) When the engine's ignition is in the "key-on" position before starting or cranking. The MIL should go out after engine starting if the system detects no malfunction.

(c) *Control when the MIL can go out.* If the MIL goes on to show a malfunction, it must remain on during all later engine operation until servicing corrects the malfunction. If the engine is not serviced, but the malfunction does not recur for three consecutive engine starts during which the malfunctioning system is evaluated and found to be working properly, the MIL may stay off during later engine operation.

(d) *Store trouble codes in computer memory.* Record and store in computer memory any diagnostic trouble codes showing a malfunction that should illuminate the MIL. The stored codes must identify the malfunctioning system or component as uniquely as possible. Make these codes available through the data link connector as described in paragraph (g) of this section. You may store codes for conditions that do not turn on the MIL. The system must store a separate code to show when the diagnostic system is disabled (from malfunction or tampering).

(e) *Make data, access codes, and devices accessible.* Make all required data accessible to us without any access codes or devices that only you can supply. Ensure that anyone servicing your engine can read and understand the diagnostic trouble codes stored in the onboard computer with generic tools and information.

(f) *Consider exceptions for certain conditions.* Your diagnostic systems may disregard trouble codes for the first three minutes after engine starting. You may ask us to approve diagnostic-system designs that disregard trouble codes under other conditions that would produce an

unreliable reading, damage systems or components, or cause other safety risks. This might include operation at altitudes over 8,000 feet.

(g) *Follow standard references for formats, codes, and connections.* Follow conventions defined in the following documents (incorporated by reference in §1048.810) or ask us to approve using updated versions of (or variations from) these documents:

(1) ISO 9141–2 Road vehicles-Diagnostic systems—Part 2: CARB requirements for interchange of digital information, February 1994.

(2) ISO 14230–4 Road vehicles—Diagnostic systems—Keyword Protocol 2000—Part 4: Requirements for emission-related systems, June 2000.