UPDATED INFORMATIVE DIGEST

The "LEV II" and "CAP 2000" Amendments to the California Exhaust and Evaporative Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles, and to the Evaporative Emission Requirements for Heavy-Duty Vehicles

Sections Affected: Amendments to title 13, California Code of Regulations (CCR), sections 1900, 1960.1 and the incorporated "California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles" and "California Non-Methane Organic Gas Test Procedures," 1965 and the incorporated "California Motor Vehicle Emission Control and Smog Index Label Specifications," 1968.1, 1976 and the incorporated "California Evaporative Emission Standards and Test Procedures for 1978 and Subsequent Model Motor Vehicles" and the proposed to be incorporated new "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles," 1978 and the incorporated "California Refueling Emission Standards and Test Procedures for 1998 and Subsequent Motor Vehicles" and new "California Refueling Emission Standards and Test Procedures for 2001 and Subsequent Motor Vehicles," 2037, 2038, 2062 and the incorporated "California Assembly-Line Test Procedures for 1998 and Subsequent Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles" and new "California Assembly-Line Test Procedures for 2001 and Subsequent Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles," 2101 and the incorporated "California New Vehicle Compliance Test Procedures," 2106, 2107, 2110, 2112, 2114, 2119, 2130, 2137-2140, and 2143-2148.

Adoption of title 13, CCR, sections 1961 and the incorporated new "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles," and 1962 and the incorporated new "California Exhaust Emission Standards and Test Procedures for 2003 and Subsequent Model Zero-Emission Vehicles and 2001 and Subsequent Model Hybrid Electric Vehicles in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes."

The Existing California Motor Vehicle Emission Regulations

The LEV regulations. In adopting the LEV regulations in 1990-91, the ARB established the most stringent exhaust regulations ever for light- and medium-duty vehicles. The regulations include three primary elements — (1) tiers of exhaust emission standards for increasingly more stringent categories of low-emission vehicles, (2) a mechanism requiring each manufacturer to phase-in a progressively cleaner mix of vehicles from year to year with the option of credit trading, and (3) a requirement that a specified percentage of passenger cars and lighter light-duty trucks be ZEVs, vehicles with no emissions.

LEV standards. There are four low-emission vehicle categories to which a passenger car or lighter light-duty truck may be certified: Transitional Low-Emission Vehicle (TLEV), Low-Emission Vehicle (LEV), Ultra Low-Emission Vehicle (ULEV) and ZEV. For medium-duty vehicles, there are four categories: LEV, ULEV, Super Ultra Low-Emission Vehicle (SULEV)

and ZEV. Each low-emission vehicle category has a progressively more stringent standard for exhaust emissions of nonmethane organic gas (NMOG), a precursor of ozone pollution in the lower atmosphere. For example, a passenger car TLEV must meet an NMOG emission standard that is about one-half of the corresponding basic standard for 1994 model vehicles. Passenger car LEVs and ULEVs must meet standards for NMOG that are respectively about one-third and one-sixth of the corresponding 1994 standard. The identical LEV and ULEV standard for oxides of nitrogen (NOx) represents a 50% reduction from the basic NOx standard for 1994 passenger cars, and the ULEV standard for carbon monoxide (CO) also represents a reduction of about 50% from the basic 1994 CO standard.

All passenger cars are subject to the same low-emission vehicle standards, regardless of weight. However, for light-duty trucks and medium-duty vehicles, the numerical standards for each low-emission vehicle category depend on the weight classification of the vehicle. The lightest light-duty trucks, such as the Toyota RAV4 and Ford Ranger, must meet the same standards as passenger cars (this vehicle category is often called "LDT1"). Medium-light trucks, such as the Jeep Grand Cherokee and all mini-vans, are allowed to emit about 25-33% more NMOG and CO, and 75-100% more NOx, than passenger cars in the same low-emission vehicle category. For most of the remaining heavier pick-up trucks and sport utility vehicles (SUVs) such as the Dodge Ram 1500 truck and Ford Expedition, the permitted LEV emission levels are from 50 to 160% higher than the passenger car levels, and the permitted ULEV emission levels are about 200% higher than those for passenger car ULEVs. For many full size vans and the very heaviest pickups and SUVs, the permitted emission levels for LEVs and ULEVs are generally more than 200% higher than the corresponding passenger car levels.

Requirements for phasing-in a cleaner vehicle fleet. For each model year, a manufacturer may choose the standards to which each passenger car and light-duty truck is certified, provided that the manufacturer's entire fleet of these vehicles meets a specified fleet average NMOG emissions level. The permitted fleet average NMOG emission level for passenger cars and the lightest light-duty trucks gradually falls every year from 0.250 gram per mile (g/mi) in 1994 to 0.062 g/mi in the 2003 and subsequent model years. The 2003 model-year level is derived from a potential vehicle mix of 75% LEVs, 15% ULEVs and 10% ZEVs. The heavier light-duty trucks are subject to numerically higher fleet average NMOG emissions requirements reflecting the numerically higher TLEV, LEV and ULEV standards and the absence of the ZEV requirements described below. Medium-duty vehicles have separate requirements based on a percent phase-in schedule, because the numerous vehicle weight classifications make a fleet average requirement difficult to implement. The low-emission vehicle standards for chassis-certified medium-duty vehicles are phased in between the 1998 and the 2004 model years, at which time a manufacturer must certify at least 60% LEVs and 40% ULEVs. The regulations also establish a system for earning marketable credits for use in complying with the phase-in requirements.

ZEV requirements. As originally adopted, the regulations required that specified percentages of the passenger cars and lightest light-duty trucks produced by each of the seven largest manufacturers be ZEVs, starting in 1998. The percentages were 2% for the 1998-2000 model

years and 5% for the 2001-2002 model years. A requirement of 10% ZEVs applied to all but small-volume manufacturers starting in model-year 2003. In 1996 the Board eliminated the regulatory ZEV requirements applicable prior to the 2003 model year. The ZEV element also includes a marketable credits system.

Evaporative emissions standards. Evaporative emissions from motor vehicles account for approximately half of the reactive organic gas (ROG) motor vehicle emission inventory in the state, and are classified into three types — running loss, hot soak, and diurnal emissions. Running loss emissions occur when the vehicle is driven. Hot soak emissions occur immediately after a fully-warmed up vehicle is stationary with the engine turned off. Diurnal emissions occur when a vehicle is parked and are caused by daily ambient temperature changes. Most of these emissions result during increasing ambient temperatures which cause an expansion of the vapor in the fuel tank.

Just a month before its September 1990 approval of the LEV regulations, the Board approved significant new enhanced evaporative emission requirements that were phased in over the 1995-1997 model years. As subsequently modified, the enhanced requirements mandated effective control of the three types of evaporative emissions. Two test sequences are applicable for certification: (1) a 3-day diurnal-plus-hot-soak sequence ensures that running loss emissions, high-temperature hot soak emissions, and three days worth of diurnal emissions are controlled, and (2) a 2-day diurnal-plus-hot-soak sequence verifies that the canister is well purged during vehicle operation. Compliance with three separate emission standards is required for the vehicle's useful life: a stand-alone running loss standard, a combined highest 3-day diurnal plus high-temperature hot soak standard, and a combined highest 2-day diurnal plus moderate-temperature hot soak standard. The evaporative emission standards for passenger cars and light-duty trucks are 2.0 grams of hydrocarbon for the 3-day diurnal-plus-hot-soak test, 2.5 grams of hydrocarbon for the 2-day diurnal-plus-hot-soak test, and 0.05 g/mi for running losses.

Certification, assembly-line, and in-use test requirements. The ARB has for many years administered programs requiring a vehicle manufacturer to demonstrate that its vehicles meet the applicable emission standards in three ways — at the time of certification, as the vehicles are produced on the assembly-line, and in actual customer use.

Prior to vehicle production, a manufacturer must submit test data to the ARB demonstrating that the vehicle meets the applicable standards. The manufacturer must predict the anticipated emissions deterioration (called the "deterioration factor") of the vehicle in-use using pre-production, developmental vehicles. Once the deterioration factor is established, low mileage "emission-data" vehicles are tested and the emission results are adjusted using the deterioration factor to determine whether the vehicle meets the emission standards throughout its useful life. A manufacturer must provide this information for each "engine family," which is a group of vehicles having engines and emission control systems with similar operational and emission characteristics, in order for the vehicles to be California-certified.

Once an engine family has been certified, the manufacturer must conduct "quality audit" emission tests on a small portion of the actual production vehicles in each engine family as they leave the assembly-line.

The ARB administers the in-use compliance program by procuring late-model vehicles from their owners for emission testing to determine whether vehicles that have been properly maintained and used comply with the standards in actual use. If the ARB test data demonstrate that an engine family does not comply, the manufacturer must either submit a plan to remedy the nonconformity at its expense or be required to recall the vehicles. In either case, penalties may be assessed.

The LEV II and CAP 2000 Amendments

The primary impetus for the new LEV II and CAP 2000 amendments comes from the ARB's obligations under the State Implementation Plan (SIP) for ozone adopted by the Board in 1994. The SIP, which represents California's commitment to attain and maintain the federal ambient air quality standard for ozone in greater Los Angeles and the rest of the state, was approved by U.S. EPA in 1995. The SIP contains Mobile Source Measure M2, which calls for the adoption of technology-based emission control strategies for light-duty vehicles to be implemented beginning with the 2004 model year and identifies a reduction of 25 tons per day (tpd) ROG plus NOx. In addition to Measure M2, the SIP recognizes that the greater Los Angeles area designated as extreme ozone nonattainment may need to rely on the development of additional technology measures to meet an additional 75 tpd ROG plus NOx emission reduction target — a target often referred to as the "Black Box." The new amendments are intended to achieve the emission reduction targets of M2 and over two-fifths of the emission reductions in the Black Box.

LEV II Portion of the Amendments

Exhaust Emission Reductions. The LEV II amendments include three major interrelated elements designed to reduce to exhaust emissions — (1) restructuring the light-duty truck category so that most SUVs, mini-vans and pick-up trucks are subject to the same low-emission vehicle standards as passenger cars, (2) strengthening the NOx standard for passenger car and light-duty truck LEVs and ULEVs, and changing other emission standards, and (3) establishing more stringent 2004 and subsequent model year phase-in requirements for passenger cars, light-duty trucks and medium-duty vehicles. They also contain various other changes, including elimination of the TLEV standard after the 2003 model year.

Passenger car standards for light and medium trucks. Under the restructuring of vehicle weight classifications, all current light-duty trucks, and all current medium-duty vehicles having a gross vehicle weight (GVW) of less than 8,500 lbs. would generally be subject to the same LEV and ULEV standards as passenger cars. Only the very heaviest SUVs and pick-up trucks would remain subject to separate medium-duty vehicle standards — vehicles such as the new Ford Excursion, Dodge Ram 2500 and 3500 trucks, and the largest Chevrolet Suburban model. When the vehicle categories were first established, the majority of vehicles in the medium-duty category

were primarily used for work purposes. More lenient gram per mile emission standards were developed that account for heavier loads and a potentially more rigorous duty cycle of work trucks. However, it is now very common for trucks and SUVs to be used primarily for personal transportation (i.e., as passenger cars), and light trucks (including SUVs) have increased from 20% of the vehicle market in 1980 to almost 46% in 1997. This trend has a substantial impact on California's air quality because, although these vehicles are used as passenger cars, they are certified to the more lenient gram per mile emission standards designed for work trucks.

Since most pick-up trucks and SUVs have a curb weight less than 5,500 lbs. and a payload of approximately 1,000-2,000 lbs., it is anticipated that the majority of the heavier trucks will fall in the new LDT2 category below 8,500 lbs. GVW. (Although the same low-emission vehicle standards will apply, the current LDT1 category would be retained because of the different fleet average NMOG requirements described below and because only LDT1s are subject to the ZEV requirements.) It appears unlikely that manufacturers will unnecessarily add payload to trigger a numerically higher standard because of the negative impact on fuel economy, performance and cost. In recognition of the fact that some of the heavier trucks in the new truck category will be engineered for more rigorous duty, staff is proposing that a small percentage (up to 4%) of a manufacturer's truck sales in the LDT2 category be allowed to certify to a marginally higher NOx emission standard.

New LEV II Standards. The amendments establish new "LEV II" standards for the current LEV, ULEV and SULEV categories; the preexisting standards are being referred to as the "LEV I" standards. The new LEV II standards will be phased in from the 2004 to 2007 model years. During these four years a manufacturer must certify its vehicles to the LEV II standards at a rate of at least 25/50/75/100%, although the LEV I TLEV standard will be eliminated after the 2003 model year.

The LEV II standards are more stringent than the corresponding LEV I standards in several respects. First, the LEV II NOx standard for passenger cars and light-duty trucks certified to the LEV and ULEV standards have been reduced to 0.05 g/mi from the current 0.2 g/mi level. The LEV II particulate emission standard is 0.01 g/mi for diesel LEVs, ULEVs and SULEVs. There is no LEV II TLEV standard. Second, the overall LEV II emission standards for medium-duty vehicles have been reduced to be substantially equivalent in stringency to the light-truck standards (although numerically higher). Third, the useful life for LEV II passenger cars and light-duty trucks has been increased from the current 100,000 miles to 120,000 miles. Manufacturers must show compliance with the full useful life standards over this mileage. Fourth, a new light-duty SULEV category has been created with an NMOG standard less than one-fourth of the level for ULEVs; recent technology developments indicate that gasoline, alternative fuel and hybrid electric vehicles could potentially reach these emission levels. Fifth, manufacturers will have the option of certifying any LEV, ULEV or SULEV to a 150,000-mile certification standard, in which case the vehicle will generate greater NMOG credits for the fleet average NMOG determination. A manufacturer electing this option will have to provide an 8-year/100,000-mile warranty for high cost parts rather than for the normal 7 years/70,000 miles. Sixth, manufacturers can receive credit

for the early introduction of larger trucks and SUVs meeting a 0.2 g/mi NOx emission level and certified to the LEV I LEV and ULEV standards; this credit can be used in the 2004-2008 model years on like vehicles certifying to the LEV and ULEV 0.05 g/mi NOx standards. A similar option is available for MDVs. There are also various other technical amendments.

Requirements for phasing-in a cleaner vehicle fleet. The current fleet average NMOG requirements will continue to apply through the 2003 model year. The amendments provide for continuing yearly reductions from the 2004 through 2010 model years, when the fleet average NMOG requirement for passenger cars will be 0.035 g/mi. Although each manufacturer can select its own vehicle mix, one approach in meeting the 2010 requirement would be a fleet made up of 18% LEVs, 47% ULEVs, 25% SULEVs and 10% ZEVs. There is a separate phase-in schedule for the heavier light-duty trucks in the new LDT2 class. The fleet average for these vehicles starts at 0.085 g/mi in 2004 and declines to 0.043 g/mi in 2010 — the levels are somewhat higher because no ZEVs in this class are projected and a longer phase-in period for ULEVs and SULEVs is provided. For MDVs, the requirement of a 60/40 mix of LEVs and ULEVs in 2004 and subsequent model years has been changed to 40/60.

Partial ZEV Allowances. In the eight years since the ZEV requirements were originally adopted, a variety of new, advanced technologies have been developed. Many of these technologies are capable of achieving extremely low levels of emissions on the order of the power plant emissions that occur from charging battery-powered electric vehicles, and some demonstrate other ZEV-like characteristics such as inherent durability and partial zero-emission range. As a result, the Board has added additional flexibility to the ZEV program by broadening the scope of vehicles that could qualify for meeting some portion of the ZEV requirement. Manufacturers will be able to decide which mix of vehicles to use to meet the 10% ZEV requirement for the 2003 and subsequent model years, with the exception that large-volume manufacturers will have to meet at least 40% of the requirement using true ZEVs or vehicles receiving a full ZEV allowance. The process of calculating ZEV allowances for candidate vehicles consists of assigning basic "allowances" consisting of a baseline allowance, a zero-emission vehicle miles traveled (VMT) allowance, and a low fuel-cycle emissions allowance.

In order to receive any ZEV allowance, a vehicle will have to qualify for the "baseline ZEV allowance" of 0.2. To receive this allowance, the vehicle will have to meet the SULEV standard at 150,000 miles, satisfy applicable second generation on-board diagnostics requirements (OBD II), and have "zero" evaporative emissions — evaporative emissions below the background level established for non-fuel evaporative emissions resulting from off-gassing of paint, upholstery, tires and other vehicle sources. The manufacturer will also need to provide an emission warranty under which all malfunctions identified by the OBD II system would be repaired under warranty for a period of 15 years or 150,000 miles, whichever occurs first.

An additional allowance will be provided based on the potential for realizing zero-emission VMT (e.g. capable of some all-electric operation traceable to energy from off-vehicle charging), up to a maximum of 0.6. If a vehicle does not have any zero-emission VMT potential but is equipped

with advanced ZEV componentry, it can qualify to earn an additional 0.1 ZEV allowance. Under the final allowance, a vehicle that uses fuels(s) with very low fuel-cycle emissions will receive a ZEV allowance of up to 0.2. In order to qualify for a full ZEV allowance of 1.0, a car will have to qualify for the maximum amount under each allowance.

The amendments also provide that where a ZEV (or full ZEV allowance vehicle) has a long all-electric range, it will qualify for declining numbers of multiple ZEV credits in the 1999-2007 model years.

Evaporative emissions requirements. The amendments establish new more stringent evaporative emission standards for the 3-day diurnal-plus-hot-soak test and the 2-day diurnal-plus-hot-soak test. The new standards apply to both fuel and non-fuel vehicle emissions. The standards for passenger cars represent up to an 80% reduction from the current evaporative emission standards. The standards for the other vehicle categories are based on the passenger car standards and are incrementally increased to account for higher non-fuel emissions of the larger vehicles. The useful-life requirements of each of the evaporative emission standards have also been extended to 15 years or 150,000 miles, whichever first occurs, for all vehicles.

Certification to the new evaporative emission standards is required for 40% of a manufacturer's vehicles in the 2004 model year, 80% in the 2005 model year, and 100% in the 2006 model year. Manufacturers have the option of developing an alternative phase-in schedule similar to the option allowed for OBD II compliance. The amendments also make various improvements to the evaporative emissions test procedures designed to assure accuracy at low measurement levels.

Other Amendments. The amendments also contain a number of other elements, including amendments to the test procedures for hybrid electric vehicles (HEVs) and for ZEVs, changes to the requirements for the California smog index label, NMOG credits for vehicles using an ozone-reducing catalyst on the radiator or other supporting substrates, and an extension in the phase-in period for 0.020 inch evaporative leak detection for OBD II systems.

CAP 2000 Portion of the Amendments

The U.S. EPA administers certification and in-use test requirements that are similar to the ARB requirements. In 1995, the U.S. EPA, ARB and automobile manufacturers signed a Statement of Principles committing themselves to working together to achieve regulatory streamlining of light-duty vehicle compliance programs with a greater focus on in-use compliance with emission standards. Since then the U.S. EPA and ARB have worked with manufacturers to implement these principles in what has become known as the "Compliance Assurance Program," or "CAP 2000". On July 23, 1998 (63 FR 39654), U.S. EPA issued a notice of proposed rulemaking for the program to become effective with the 2001 model year, although manufacturers would have the option to certify 2000 model-year vehicles using CAP 2000. The final amendments were promulgated on May 4, 1999 (64 FR 23906). The ARB's CAP 2000 amendments incorporate by reference much of the federal program, and have the same implementation dates.

The CAP 2000 program significantly reduces the emission testing and reporting requirements for certification and provides manufacturers with more control over roll out of their product lines. A manufacturer will be able to develop its own durability demonstration (with pre-approval by the Executive Officer) and apply it to several engine families that have been grouped into broad "durability groups" of vehicles with similar deterioration characteristics. Each durability group will consist of several "test groups" based on the emission standards to which a vehicle is certified. Manufacturers will then select one "worst case" vehicle from each test group to emission test rather than the two required under the prior program. This reduction in testing will result in 75% fewer durability demonstrations than now required and a 50% reduction in the number of emission data vehicles tested. CAP 2000 will also provide more flexibility regarding the information required for certification.

The amendments eliminate the 2% assembly-line quality audit emission tests because the new in-use testing requirements described below are more likely to ensure that manufacturers have durable emission control systems that prevent potential recalls. The 100% assembly-line functional test has been retained.

The CAP 2000 amendments establish a significant new in-use compliance program under which manufacturers will be required to procure and test customer vehicles on an "as received" basis at 10,000 miles, at 50,000 miles and one vehicle from every test group at a minimum of 75,000, 90,000 or 105,000 miles depending on the useful life of the vehicle. If the vehicles tested do not meet the applicable emission requirements, the manufacturer will have to conduct a subsequent test program on properly maintained and used vehicles to determine whether remedial action is required. ARB staff plans to continue its own in-use testing program of engine families identified as having a greater chance of failing the standards. The tested engine families have comprised about 15% of the total annual vehicle production for California.

Comparable federal regulations**.** Under Title II of the federal Clean Air Act (CAA), U.S. EPA has adopted comprehensive regulations to control emissions from new motor vehicles and motor vehicle engines (see 40 CFR Part 86). However, both state law and CAA section 209(b), allow California to establish its own standards that are different from the federal standards.

While both California and federal motor vehicle emission standards are similar in purpose and scope, the California standards are generally more stringent than the comparable federal requirements. The current federal "Tier 1" exhaust emission standards for passenger cars and light-duty trucks are similar to the basic California standards that applied to 1994 model year vehicles, and the CAA precludes U.S. EPA from adopting more stringent standards before the 2004 model year. Virtually all manufacturers of passenger cars and light-duty trucks have agreed to voluntarily participate in the "national LEV" program, under which by 2001 the manufacturers will be selling passenger cars and light-duty trucks nationally that on average meet the current California LEV standard. U.S. EPA has proposed the adoption of more stringent "Tier 2" exhaust emission standards to start with the 2004 model year. The current federal evaporative emission standards are very similar to the current California standards. The more stringent

California LEV I and LEV II programs are necessary to attain the national and state ambient ozone standards, and to fulfill the requirements of state and federal law.