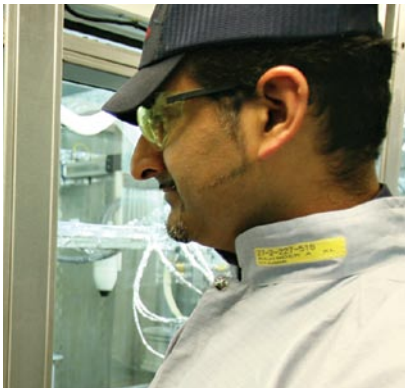
TOYOTA | air quality

Toyota's assembly plant in Delta, British Columbia, installed a biofilter that breaks down VOCs. During the final stage of treatment, the air stream is circulated around spheres containing microorganisms that absorb and digest the VOC emissions.

"Our efforts on improving air quality focus on improving technology in the vehicle design and manufacturing process resulting in reduced tailpipe and manufacturing emissions."

– Kevin M. Butt, General Manager, Chief Environmental Officer
Toyota Motor Engineering & Manufacturing North America, Inc.



AIR QUALITY EAP TARGETS

- 10.1 ● Meet all applicable vehicle emissions standards
- 10.2 ○ Maintain leading level in-use vehicle emissions compliance
- 10.3 ○ Develop ultra low emissions technologies and introduce low emitting vehicles
- 11.1 ● Reduce body painting VOCs to an average of 14.0 g/m²
- 11.2 ● Determine a VOC baseline and set plant targets for vehicle plastics in FY2007

AS A VEHICLE BURNS FUEL, the engine produces exhaust that contains particulate matter, nitrogen oxides and other pollutants. This contributes to smog, particularly in urban areas where traffic is heaviest. While regulations on engine performance have helped to bring about a decline in the amount of air pollution produced by individual vehicles, the number of vehicles on the road has increased. As Toyota continues to grow and produce more vehicles, we work very hard to make our vehicles run cleaner. We are dedicated to the development of ultra low emissions technologies, not just for our hybrids, but for our gasoline fleet as well.

We also recognize that activities at our manufacturing plants have an impact on air quality. Painting operations at our plants generate emissions of VOCs. VOCs are a category of chemicals that can photochemically react in the atmosphere to form ground level ozone, a primary component of smog. As more vehicles move through our plants, Toyota works to regularly implement and improve practices and technologies that reduce these emissions.

Our targets on vehicle tailpipe emissions and VOC emissions from manufacturing are listed above, and described in this chapter.

REDUCING TAILPIPE EMISSIONS

As the number of vehicles on the road increases, Toyota continues to pursue technology innovations that reduce tailpipe emissions. These technologies are applied to our full vehicle lineup. Our gasoline vehicles meet strict tailpipe emissions standards across North America.

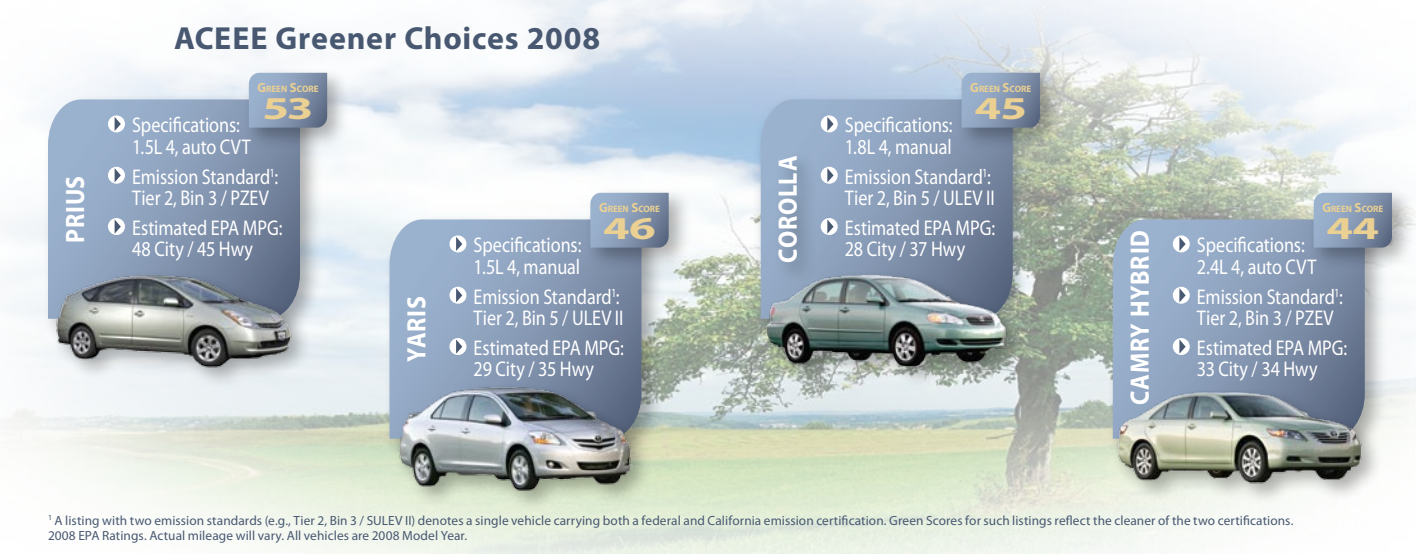
Typically, manufacturers and government officials discuss vehicle emission levels in the context of certification levels. Both California and the U.S. federal government have vehicle emission programs, called LEV II and Tier 2, respectively. These programs are structured similarly, requiring manufacturers to average their entire vehicle fleet emissions to meet a prescribed set of emission standards for Non-Methane Organic Gas (NMOG), Carbon Monoxide (CO), Nitrogen Oxides (NO_x), Particulate Matter (PM), and formaldehyde (HCHO).

For 2008, California requires a manufacturer's fleet average to meet a NMOG standard of 40 grams per mile for cars, and 0.05 for trucks. The federal program requires a manufacturer's fleet average to meet a NO_x standard of 0.07g/mi. A certification level is then assigned to each vehicle, depending on its emission levels. The certification levels in California are referred to as LEV (Low Emissions Vehicle), ULEV (Ultra Low Emissions Vehicle), SULEV (Super Ultra Low Emissions Vehicle), ZEV (Zero Emissions Vehicle), and AT-PZEV (Advanced Technology Partial Zero Emissions Vehicle). The federal program refers to each incremental level as a "Bin" — numbering one through eight. A critical component of these programs is the reduced sulfur levels in gasoline that will be necessary to achieve further reductions in vehicle emissions over time.

Toyota complies with both the California and federal programs, and our performance in Canada follows a similar track. (Target 10.1) Environment Canada has implemented a Tier 2 program; the vehicles we sell there have the same emission control technologies. The federal Tier 2 program phase in is 100% completed. We have consistently certified more vehicles than the respective programs require. All Toyota, Lexus and Scion passenger cars sold in North America, except for the Lexus SC 430, are rated ULEV or better. For the 2008 model year, 13% of all Toyota, Lexus and Scion cars are certified to SULEV or better. Our SULEV vehicles include Toyota's Prius, Camry PZEV, Camry Hybrid and Highlander Hybrid, and Lexus' RX 400h, LS 600h and GS 450h.

In addition, Toyota's Industrial Equipment Division 8-series forklift truck, sold in Canada, voluntarily meets the 2010 California Air Resources Board (CARB) standards for tailpipe emissions.

FIGURE N



[1] A listing with two emission standards (e.g., Tier 2, Bin 3 / SULEV II) denotes a single vehicle carrying both a federal and California emission certification. Green Scores for such listings reflect the cleaner of the two certifications. 2008 EPA Ratings. Actual mileage will vary. All vehicles are 2008 Model Year.

Toyota cars comprise 4 of the 12 vehicles in the "Greenest Vehicles of 2008" list compiled by the American Council for an Energy-Efficient Economy. The four vehicles are Prius, Yaris, Corolla and Camry Hybrid. Vehicle rankings are based on tailpipe emissions, fuel economy ratings and emissions of gases that cause global warming. Please visit www.greenercars.com for more information.

In-Use Compliance

Toyota has a proven track record of continuous in-use compliance. Toyota cars contribute to improving air quality by complying with emission requirements for up to 150,000 miles.

Both EPA and the California Air Resources Board staff have reviewed and approved the conduct of Toyota's government mandated in-use testing programs and have assessed them with very favorable comments. **With over 1,000 vehicles tested in these government programs since 2000, Toyota's emission compliance rate continues to be a leader among major industry manufacturers.** (Target 10.2)

Ultra Low Emissions Technologies

By introducing the latest design technologies and leading edge electronic control technologies, Toyota has achieved high fuel efficiency and cleaner exhaust emissions. (Target 10.3) Toyota engine design shifted strategically with these twin aims as targets. Toyota continues to use the base strategies popularized in the late twentieth century: namely catalytic converters and electronic fuel injection, as well as oxygen and air/fuel sensors and dual-overhead cams. Several newer technologies are routinely used on Toyota vehicles today, often in parallel, to achieve cleaner vehicle emissions.

In the spirit of *kaizen*, Toyota has adopted and continues to adopt other technological strategies for cleaner vehicles. Variable valve timing (VVT) improvements continue. New engines also have reduced mechanical friction. In addition, Toyota employs direct fuel injection in some gasoline engines, a technique that provides both improved efficiency and cleaner exhaust emissions.

REDUCING VOC EMISSIONS IN MANUFACTURING

Activities associated with automobile manufacturing result in VOCs and other emissions released to the atmosphere. VOCs from painting operations are the most significant emissions from our manufacturing facilities. To deal with these emissions, we rely heavily on our employees and on teamwork. Teamwork is emphasized in Toyota's Guiding Principles, and is key to cultivating and developing The Toyota Way. Developing talent and organization encourages employees to think self-reliantly and to be motivated to find new and better solutions to environmental challenges. At our plant in Ontario, Canada, hundreds of employees in the bumper and body paint area are trained annually on how their work may impact the environment. The plant defines and implements best management practices to reduce emissions, and encourages employees to work together to find and implement improvement projects.

The paint booth at our plant in Delta, British Columbia, is equipped with electrostatic bell and high volume low pressure spray technologies, which increase transfer efficiency of the paint to the wheel and reduce waste paint and VOC emissions.

VOCs From Painting Vehicles

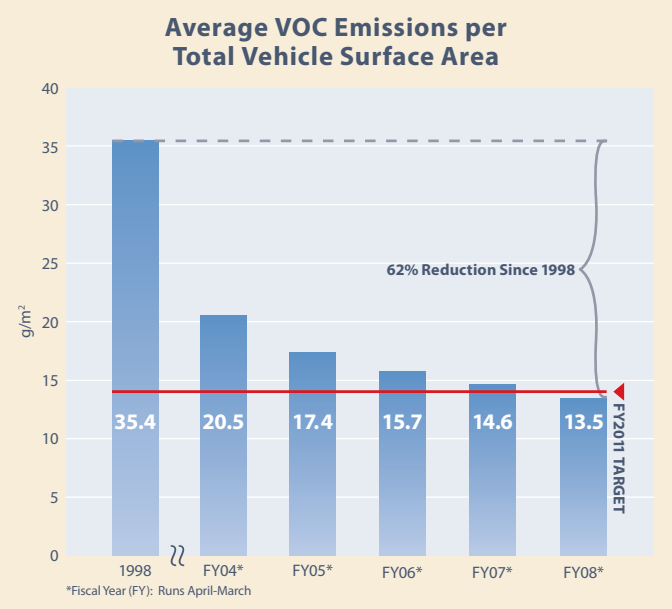
We measure VOC emissions from vehicle painting operations in grams of VOCs emitted per square meter of total vehicle surface area. **We exceeded our five-year target to reduce VOCs from our painting operations to a corporate average of 14.0 g/m² by FY2011.** (Target 11.1) We are currently at 13.5 g/m² (please see Figure O below). Examples of our efforts to minimize VOC emissions from vehicle painting include:

- The car paint line at our plant in Fremont, California, posts monthly air abatement efficiency data at equipment control panels. Employees can now see how the unit is performing over time, visualize maintenance trends and improve preventive and predictive maintenance activities. In addition, a monitor in the central control room broadcasts the status of the air emission abatement devices graphically, allowing important real time information on equipment such as the temperature, gas flow, damper positions and alarms to be easily monitored.
- Our plant in Georgetown, Kentucky, has reduced the amount of solvent in the water-based purge in its painting operations. Implemented in the Plant 1 paint booths in November 2007, the plant has realized a reduction in VOC emissions of more than 1 g/m². This *kaizen* was implemented in the Plant 2 paint booths in February 2008, and has seen a reduction of more than 3 g/m².

Microorganisms Reduce VOC Emissions

Toyota's unit plant in Delta, British Columbia, recently added a third paint booth to meet the growing demand for assembled vehicles. As a result of this expansion, VOC emissions were expected to increase 14% from 2005, from 76 tons to 87 tons per year. In order to mitigate the VOC increase, the plant needed to implement new VOC emission reduction technologies to handle the increased activity.

FIGURE O



An employee at our plant in Indiana inspects a bumper that has just been painted with a water-based primer.

Traditionally, the plant uses regenerative thermal oxidizers (RTO) to reduce VOC emissions in the air streams. The plant instead opted for a biofilter that biologically breaks down the VOCs into carbon dioxide and water vapor. Plus, CO_2 emissions from the biofilter are over 1,000 tons per year less compared to conventional technologies. The air stream from the paint booth, containing VOCs and odors, enters the biofilter where it goes through the first two stages, water and an inorganic media, before moving onto the final stage of the biofilter. At this stage, the air stream is circulated around spheres that contain microorganisms, which absorb and digest the VOC emissions, converting them to water vapor and carbon dioxide.

The biofilter is expected to reduce VOC emissions by 65% and, combined with newly added high-volume, low-pressure spray technology and electrostatically charged paint, the facility is expected to reduce net VOC emissions to 60 tons per year, even with the addition of the new paint booth.

VOCs From Painting Vehicle Plastics

Our VOC target for exterior plastics fascia, which consists of mostly bumpers, is new to our North American Environmental Action Plan. However, our plants are not new to managing and reducing these emissions.

Each of our plastics paint shops has action plans with VOC targets. (Target 11.2) Based on their action plans, we will set a target for North America for overall plastics painting emissions. The target will be measured in grams of VOCs emitted per square meter of total painted surface area of the part.

Our facilities continue to find ways to reduce the VOC emissions from plastic painting operations. At our facility in Indiana, employees replaced solvent-borne primer with water-based primer for painting bumpers in early 2007, and as a result reduced VOC emissions by more than 37 tons.

LOOKING AHEAD

Over the next three years, one of the biggest challenges we face in meeting our action plan targets is to dedicate ample efforts into developing technologies that anticipate the market's expectation for lower tailpipe emissions.