

# Improving emission standards compliance with a defect reporting system for in-use passenger vehicles

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## Introduction and objective

Discussed in this paper is an emission control defect reporting program used in California to improve compliance with passenger vehicle emission standards. The defect reporting program was adopted by the California Air Resources Board (CARB) through regulation. The regulation requires the manufacturer of the passenger vehicles to report to CARB how many warranty claims (as a percent) for emission control parts it receives within the warranty period for the vehicle. An excessive percentage of reported warranty claims for a specific emission control part suggests there is a defect in the part that is causing or will lead to increased emissions.

Based on the defect reports, CARB may seek voluntary agreement with the vehicle manufacturer to recall the affected vehicles and replace the defective emission control part with one of an improved design. This prevents future failure of the part and thus reduces in-use emissions. Basing the recall (or other corrective action such as an extended warranty) on defect reporting can avoid costly test vehicle procurement and emission testing to demonstrate an emission standard has been exceeded, which otherwise would be a prerequisite to a recall. CARB may also use the

defect reports to prioritize models for emission testing in its separate, state-run in-use compliance testing program. In either case the defect reporting system complements and increases the efficiency of CARB's overall in-use compliance program. The U.S. Environmental Protection Agency has a similar program, which applies to vehicles sold in states not subject to CARB's requirements.

## Why was a defect reporting system adopted?

In the U.S., compliance with vehicle emission standards has two parts: pre-sale compliance; and post-sale compliance. Both are considered equally important in assuring low vehicle emissions.

The objective of pre-sale compliance is to provide assurance that the design of the vehicle and its emission control system is capable of meeting emission standards before sale of a new vehicle is authorized. The ability of the emission controls to meet standards is demonstrated by emission tests of pre-production vehicles. In addition, the durability of the emission controls is demonstrated by emission testing of pre-production vehicles following mileage accumulation, or by subjecting important emission control devices to accelerated deterioration testing protocols

in a laboratory. Usually the vehicle manufacturer performs these tests, with limited confirmatory testing by a government agency.

In addition, the on-board diagnostic (OBD) system is evaluated to determine if it meets regulatory requirements, as is the warranty coverage. All the required testing and information demonstrating compliance with pre-sale requirements is submitted in an application for certification for government evaluation and approval. Enforcement of the pre-sale requirements is straightforward: If the application is not complete or does not meet all regulatory requirements including a durability demonstration and compliance with emission standards, the government will not authorize sales of the specific vehicle model to begin. Selling a vehicle that has not received government approval results in a large fine.

The objective of a post-sale in-use compliance program is to ensure that emissions stay low and continue to meet emission standards throughout the vehicles' life. Testing of in-use vehicles in the U.S. and other countries has shown that although all in-use vehicles have met pre-sale requirements and have been certified by the government, some vehicles do not perform well once they are in normal

on-road operation. Some emission control parts fail or deteriorate rapidly. This may occur on individual vehicles due to poor vehicle maintenance, or simply because there will always be some failure of individual parts. The OBD system is designed to help identify these random failures, and annual or biennial vehicle inspections help assure that vehicles with faulty emission control systems are repaired.

However, some groups of similar certified vehicles have been shown to have systemic design defects, which will cause high emissions in many of the vehicles at some time during the lifetime of the vehicle. An example is a deteriorating catalytic converter whose failure rate grows with time or mileage. Identifying and correcting these types of failures is the focus of the in-use compliance program. Equally important, the remedies to correct non-compliance, such as recalls of large groups of vehicles whose repair cost is paid by the manufacturer, are a strong economic incentive for the vehicle manufacturer to design a durable vehicle and an emission control system that will not become subject to in-use enforcement.

For the reasons described above, government agencies in the U.S. have implemented in-use emission compliance programs. The basic elements include a vehicle emission warranty, a defect reporting program to identify emission parts with abnormally high failure rates with recall or extended emission recall as a remedy, an in-use compliance emission testing program with recall as a potential remedy, and an OBD system built into each vehicle. In-use emission test results, and a declining number of vehicle models recalled, have demonstrated these in-use compliance and enforcement programs have caused a significant increase in the durability and reliability of emission control systems, resulting in lower in-use emissions.

The elements of the in-use compliance program are summarized next in order to provide a context for understanding the additional benefit a defect reporting program may provide, and how it interacts with the other elements of compliance.

***In-use compliance testing:*** This government testing program has traditionally been the core method of detecting non-compliance of in-use vehicles due to a systemic design defect. In-use compliance testing has been on-going in the U.S. for over three decades. An advantage of this testing program is it provides a direct measure of emissions of a group of similar in-use vehicles (typically ten) under controlled conditions identical to the pre-sale certification test. If the average emissions of the tested vehicles exceed the emission standards, improved parts and/or a new emission control calibration must be developed by the vehicle manufacturer and installed on all in-use vehicles represented by the test group. This is referred to as a recall. The number of recalled vehicles per test group can range from a few thousand to hundreds of thousands. The cost of replacing the defective part and bad publicity for the vehicle manufacturer provides a strong incentive to produce durable vehicles that avoid recall altogether.

EPA also requires vehicle manufacturers to test a small number of randomly selected in-use vehicles of each model sold (2 to 6 vehicles). Tests are performed at 1 and 4 years of age. Testing includes criteria pollutant (e.g. HC, CO, NO<sub>x</sub>) and CO<sub>2</sub> emissions. If excess smog emissions (but not CO<sub>2</sub> emissions) are detected, a larger group of vehicles (10) is tested by the vehicle manufacturer. If an obvious problem is detected (such as a failing part), the vehicle manufacturer will often recall the vehicles, or may offer an extended warranty instead. If the manufacturer does not agree a recall

is needed, EPA may conduct its own testing and if an exceedance of an emission standard is determined, a recall may be ordered. A limitation of the government recall testing is that only a few vehicle groups (typically 10 percent or less of the passenger vehicle groups certified) can be tested each year due to limited government resources. CARB has a similar emission recall testing program. The selection of models to be tested each year is coordinated with the EPA, which allows a greater number of models to be tested in total since most current models are certified to meet both CARB and EPA standards.

***The CARB OBD system*** is used on virtually all vehicles sold in the U.S. The advantage of OBD is it can detect and turn on the check engine light if high emissions are inferred from sensors on the vehicle, and OBD remains active for the entire life of the vehicle. (Other compliance programs terminate at the end of the warranty period or defined useful life). The OBD light will stay on until the emission control problem is fixed, and thus it is also very effective in confirming a repair is promptly and properly made. The threshold for turning on the warning light is usually a 50 percent increase in emissions caused by the failure of a specific emission control part or system. A limitation of OBD is it does not detect emission increases of less than 50 percent, or larger emission increases that may occur due to accumulated deterioration of multiple emission control devices.

***The emission warranty*** is a consumer protection program that encourages vehicle owners to seek repairs at no cost to them. This is particularly effective if the OBD light illuminates within the warranty period, which in most cases is confirmation that the repairs will be free. Equally important, the cost of warranty repairs encourages vehicle manufacturers to build more durable emission

control systems. In California and the 13 states that require sale of California-certified vehicles, the emission warranty covers all emission related repairs for 3 years or 50,000 miles, whichever comes first (referred to as “3/50K”), while in the rest of the states it is 2/24K. In California, repairs (including parts and labor) costing more than \$600 are warranted for 7/70K, while in the rest of the U.S. only a few parts (catalyst and emission control unit (computer) have a warranty that extends to 8/80K.

The inconsistencies in warranty coverage occur because the warranty periods discussed above are specified in statute rather than regulation. Clean air statutes in the U.S. and California are changed infrequently and extending the warranty period is controversial and strongly opposed by vehicle manufacturers because it increases their costs. Ideally the warranty period should be much longer because avoiding warranty costs causes vehicle manufacturers to produce more durable emission control parts. This is especially important for emission control devices like the catalyst that is critical to reducing emissions and is expensive to replace. California has managed to extend the emission warranty by regulation to 15 years or 150K miles, whichever occurs first, for all emission-related parts, for a subgroup of vehicles called SULEVs. Fifteen years and 150,000 miles is typical of the average life of a passenger vehicle in the U.S. The ZEV regulation was used to create an option in which the number of ZEVs required to be sold could be partially reduced if a much larger number of SULEVs (the lowest emission category for conventional passenger vehicles) with a 15/150K warranty were sold. Most manufacturers subject to the ZEV mandate took advantage of this provision, and as a result approximately one third of vehicles sold in California included

the extended warranty. This unique situation allowed the warranty to be extended without having to change the warranty statute.

Both CARB and EPA also have an emission defect reporting program, called the Emission Warranty Information Report (EWIR) in California. It is designed to complement the other elements of the in-use compliance program by providing information on the frequency of emission control part failures on all vehicles. In California, the defect reporting program is based on warranty claim records collected by the vehicle manufacturers.

The warranty information provided by the vehicle manufacturers is used in several ways. One use is to encourage a vehicle manufacturer to voluntarily recall a group of vehicles with a high failure rate of an emission control part, thus avoiding costly in-use compliance emission testing. Agreement with the vehicle manufacturer to initiate a recall is often, but not always obtained. The second use of the reported warranty data is to help choose those groups of vehicles most likely to be in non-compliance with the emission standards, and subject them to government-run compliance emission testing. This is valuable because it allows prioritization of the limited amount of government resources available for confirmatory in-use vehicle emission testing.

The requirement that vehicle manufacturers report defects to CARB began with the 1990 models. Based on its experience with the emission defect reports, CARB adopted improvements to the defect reporting program to become effective with the 2010 models, with the goal of directly mandating a recall or other remedy if the confirmed failure rate of an emission control part exceeds 4 percent. No emission testing to determine if an emission standard was exceeded would be required.

Prior to implementation, a court ruled that the 4 percent defect threshold provision of the new regulation, which directly triggered a recall without evidence that the emission standards were exceeded, violated state law. Thus the defect reporting program was not implemented and reverted to the original program, which is the program discussed below.

## Description of defect reporting requirements

### CARB'S DEFECT REPORTING PROGRAM

The law providing CARB the authority to adopt by regulation a defect reporting program<sup>1</sup> is part of the California Health and Safety Code.<sup>2</sup> This law does not specifically address a warranty reporting system. Instead it empowers CARB to order a recall or take other corrective action if a vehicle or engine manufacturer violates an emission standard or test procedure. The law also requires that production vehicles or engines must be in all material respects substantially the same as the test vehicles upon which the government issued Certificate of Compliance is based. Thus if a vehicle is built differently than the pre-sale certification test vehicle, or it fails to perform in-use like the pre-sale certification vehicle, it may be recalled for corrective action. The details of how the recall program works were left to CARB to establish by regulation. CARB relied on this authority to adopt, in addition to its recall emission testing program, the warranty defect reporting program, both of which may result in a vehicle recall.

CARB's warranty defect reporting program was adopted by regulation in 1988, and was first initiated with the

1 Also referred to as the Emission Warranty Information Report (EWIR)

2 Health and Safety Code sections 43105 and 43106, which may be found at: [www.ca.gov/HealthSafety/LawsAndRegs.html](http://www.ca.gov/HealthSafety/LawsAndRegs.html)

1990 models.<sup>3</sup> The program applies to all motor vehicle types except off-road diesel engines. Reporting is required during the warranty period, which varies by vehicle type and emission control part. Section 2 describes the warranty periods for passenger vehicles.

The CARB defect reporting program follows a five step process that first requires the vehicle manufacturer to keep track of the number of warranty claims for individual emission-related parts it receives from its dealers, and then begins an escalating reporting and evaluation process that determines if a recall of the part is justified based on the frequency of parts failure and the resulting emissions impact. The five steps of the process are:

- Tracking of and reporting unscreened<sup>4</sup> warranty claims to CARB.
  - The vehicle manufacturer must compile unscreened warranty claims and develop a list showing the cumulative number of warranty claims for each emission-related part for each certified vehicle group.<sup>5</sup> This must be done at least quarterly.
  - If the cumulative number of unscreened warranty claims for any emission-related part in a vehicle group exceeds 1 percent (or 25 parts, whichever is greater) of the

vehicles sold in that vehicle group, the vehicle manufacturer must submit to CARB a report containing the warranty claims data, and continue to update the report each subsequent quarter, or until a recall occurs. The purpose of this **1<sup>st</sup> report** is to provide an early warning to CARB that there may be a problem developing with an emission-related part.

- A **2<sup>nd</sup> report** to CARB is required if the cumulative number of unscreened warranty claims for an emission-related part within a vehicle group exceeds 4 percent (or 50 vehicles, whichever is greater).<sup>6</sup> This report must include other information relevant to a possible recall. The required information includes:
  - Is the part used in other similar engine families?
  - The failure mode and probable cause of the part failure.
  - A projection of the number and percentage of unscreened warranty claims and validated part failures that will occur by the end of the vehicles' useful life (which is usually longer than the warranty period).
  - A projected date when the number of validated part failures will exceed 4 percent (i.e. after removing warranty claims that were accepted by the vehicle manufacturer, but upon further evaluation it

was determined the part had not failed<sup>7</sup>).

- The **3<sup>rd</sup> report** is required when the validated failure rate exceeds 4 percent. At this point it is presumed the part is defective and a recall is justified. The third report must include:
  - An estimate of how emissions will be affected over the useful life of the vehicles in the vehicle group due to the part failure,
  - An evaluation of drivability problems and performance factors such as fuel consumption and cold starting resulting from the part failure.
- The vehicle manufacturer can avoid the presumed recall if it can demonstrate to CARB that the failed part will not cause a well maintained vehicle to exceed the emission standards, or that the failed part is likely to be corrected quickly under the warranty program or other in-use maintenance procedure.
- CARB evaluates the reports and decides if a recall is justified. At any stage the vehicle manufacturer may voluntarily accept a recall or other remedy such as an extended warranty. If the manufacturer disagrees with CARB, CARB may order the recall (uncommon). However, CARB must first test a sample of vehicles in the vehicle group and demonstrate that on average these vehicles exceed the emission standard. This is relatively uncommon, however, when the recall covers many models spanning several model years, and the recall repair is expensive for the vehicle manufacturer, a manufacturer may force CARB to perform the

3 See California Code of Regulations, Title 13, sections 2141 to 2149, which may be found at <https://govt.westlaw.com/calregs/Browse/Home/California/CaliforniaCodeofRegulations?guid=IB2FA8270D46911DE8879F88E8B0DAAAE&originationContext=documenttoc&transitionType=Default&contextData=%28sc.Default%29>

4 "unscreened" means the warranty claims as received, without deleting an claims based on evaluation they are invalid.

5 "Vehicle group" is a group of similar vehicles with similar engines that has been certified to meet applicable emission standards. It is also often referred to as an "engine family".

6 The regulation requires this report when unscreened warranty claims exceed 2 percent, but allows CARB the option to defer the report until unscreened warranty claims reach 4 percent. CARB has exercised this option in order to reduce the number of 2<sup>nd</sup> reports it receives. The reference to "25" or "50" vehicles is only relevant to vehicle groups with small sales. Only the percentage thresholds are referred to in the rest of this paper.

7 The fraction of claims that are invalid is typically low. CARB will investigate if a large number of claims are invalidated by the vehicle manufacturer.

in-use emission testing knowing that its exposure to recall may be reduced because CARB's testing resources are limited, and not all models will be tested. This was the case discussed in Example 2 below. If the manufacturer continues to disagree with CARB, even after testing, it may appeal to CARB's Board of Directors or pursue its case in court (very infrequent).

## EPA'S DEFECT REPORTING PROGRAM

EPA's program has been in effect since the 1972 models. A defect report is required once the manufacturer determines that an emission-related defect exists on 25 or more vehicles or engines of the same model year. There is no percentage threshold of failures as there is in CARB's program. The requirement to report a known defect extends for 5 years beyond the end of each model year. The defect rate may be determined by the vehicle manufacturer by any means; tracking of warranty claims is not required or mentioned in the regulation. The report must contain the number of vehicles that are believed to have the defect, as well as the expected emission impact. It must also indicate if there is any anticipated manufacturer follow-up. There is no presumption that submission of a defect report will lead to a recall or other corrective action.

## COMPARISON

CARB's program is more complex than EPA's and requires three levels of reporting. It presumes a recall is necessary once the number of vehicles with a defective part exceeds 4 percent. However, if the vehicle manufacturer does not agree to a recall based on the defect reporting, the burden is placed on the government to demonstrate the vehicles using the defective part exceed an emission standard.

The EPA defect reporting program differs from CARB's program in several ways. It is simpler and requires only one report. It does not specifically require the manufacturer to review warranty claims, rather the manufacturer can use any means to determine if there is a defect. There is no reporting required until in the manufacturer's view a defect has been identified. The threshold for reporting once a defect is identified is very low—25 vehicles regardless of the volume of vehicles produced in a model year that use the part. (CARB's threshold is a percentage of annual sales, except for low production models). No projection by the vehicle manufacturer of the anticipated failure rate and cumulative emission impact by the end of the useful life is required. Finally, there is no presumption or specific requirement to recall the vehicles with a defective part; although this is a common action voluntarily chosen by manufacturers. Like CARB, EPA has to test vehicles and show a violation of the emission standards in order to force a manufacturer to recall a vehicle group.

Emission-related parts whose proper functioning is necessary to ensure compliance with greenhouse gas emissions are subject to both EPA and CARB reporting.

## Experience with the CARB defect reporting program

### NUMBER OF DEFECT REPORTS RECEIVED

As described above, a vehicle manufacturer may need to submit three separate reports to CARB, depending on the number of warranty claims the manufacturer has received. The reports and their purpose are repeated below.

- The **1<sup>st</sup> report** is required when unscreened warranty claims exceed 1 percent. The purpose of this report is to notify the CARB that a defect may be present

in a vehicle group. No action other than continued tracking of warranty claims by the vehicle manufacturer is required.

- The **2<sup>nd</sup> report** is required when unscreened warranty claims exceed 4 percent. In this report the vehicle manufacturer needs to identify other vehicle groups that may use this part, the probable cause of the failure, estimate how many unscreened warranty claims are likely to be received by the end of the vehicles' useful life, and project when the valid number of failures is expected to exceed 4 percent (i.e. after eliminating any warranty claims that further investigation demonstrates did not involve a failed part). The submission of this report indicates a problem likely exists and a fix for the problem should be developed.
- The **3<sup>rd</sup> report** is submitted when validated failures actually exceed 4 percent, or when requested by CARB. The third report includes an assessment of whether other vehicle groups use the same part and an estimate of the emission impact of the part failure over the vehicles' useful life. This report helps CARB decide the priority of pursuing a recall or other corrective action (prioritization is important due to limited staff resources and/or the need to perform emission testing of additional vehicles before a decision on correcting the defect is made).

The number of reports received by CARB for two individual model years, 2005 and 2010, was retrieved from CARB's data base, and are presented in Table 1.

This data shows a large number of 1<sup>st</sup> reports (1 percent warranty claims rate), averaging 1000 per model year. Also notable is the number of 2<sup>nd</sup> reports (4 percent warranty claims rate) as dramatically lower, less than

20 percent of the 1<sup>st</sup> reports. This indicates that many of the parts exceeding the 1 percent warranty claim rate do not continue to fail (as age or mileage increases) at a sufficient rate to exceed the 4 percent threshold within the warranty period. This could occur because the cause of the failure is quickly identified by the vehicle manufacturer and is corrected (such as a part improvement), or there are manufacturing issues with the part or installation mistakes that are detected quickly, with few failures occurring over the remainder of the vehicles' life. CARB believes the importance of the 1<sup>st</sup> report is to provide evidence that vehicle manufacturers are tracking warrant claims as required by the regulation, and to identify parts failures that have the greatest potential to impact emissions, such as the catalytic converter, for further investigation by CARB. Many of the 1<sup>st</sup> reports are never reviewed by CARB's staff because there are too many reports and not enough staff capacity to review them all.

The number of 3<sup>rd</sup> reports is only one third of the number of 2<sup>nd</sup> reports. The 3<sup>rd</sup> report is used to decide if CARB will pursue a recall or other corrective action. There are several reasons why there are fewer 3<sup>rd</sup> reports. One reason is many vehicle manufacturers pursue a recall of their vehicles once a 2<sup>nd</sup> report is issued, since it is clear the defective part needs to be redesigned and replaced. Also, some manufacturers demonstrate that some of the warranty claims were not valid, by examining failed parts returned from the dealership, and this may reduce the valid warranty claims to less than 4 percent threshold. The manufacturer may also demonstrate that the part failure rate has diminished to near zero, and that all existing failures have been corrected.

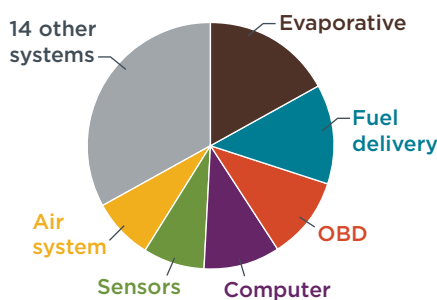
**Table 1.** Emission warranty reports received by CARB for two model years—2005 and 2010

Model Year	1 <sup>st</sup> Report*	2 <sup>nd</sup> Report*	3 <sup>rd</sup> Report*
2005	1238	209	89
2010	762	139	35
<b>Average</b>	<b>1000</b>	<b>174</b>	<b>62</b>

\* These reports are referred to in CARB's regulations as the EWIR, FIR, and EIR. They are called 1<sup>st</sup> Report, 2<sup>nd</sup> Report, and 3<sup>rd</sup> Report in this paper for clarity.

**What types of parts most commonly exceed 4 percent warranty claims?**

Warranty claims were grouped into 20 major emission control systems typical of gasoline fueled passenger vehicles. Six of these groups account for two thirds of all 2<sup>nd</sup> reports submitted (reports indicating warranty claims of 4 percent or more within the warranty period). The highest number of reports was for the evaporative/fuel tank system, followed by the fuel delivery system. Failures in these two systems can result in very high emissions. Figure 1 summarizes the data.



**Figure 1.** Most common parts with warranty claims exceeding 4 percent

**Recalls and extended warranties resulting from the defect reports**

The annual average number of emission recalls and extended warranties per model year in California resulting from the defect reporting program was 120 (average of model years 2005 and 2010).<sup>8</sup>

<sup>8</sup> Manufacturers will recall these vehicles in the 13 other states that require sale of CARB certified vehicles. CARB shares its recall decisions with EPA, and as a result many recalls are implemented nationwide.

Two thirds were recalls, and one third extended warranties.

Eighty-six of the 120 affected vehicle groups had submitted a 1<sup>st</sup> report indicating warranty claims had exceeded 1 percent. There are several reasons why the remaining 34 vehicle groups may not have submitted a 1<sup>st</sup> defect report. These include situations where the defect was detected and corrected by the vehicle manufacturer before the one percent warranty claim threshold for the 1<sup>st</sup> report was reached. Other recalls may result from improper installation of a part during production, including installing incorrect emission labels. Of course, it could be that the vehicle manufacturer failed to submit a required report, but CARB has not explicitly indicated this as a likely reason.

Another observation is that the 86 annual recalls and extended warranties for vehicle groups that submitted at least a 1<sup>st</sup> report (1 percent warranty claims) is less than the 174 vehicle groups for which the vehicle manufacturers had submitted a 2<sup>nd</sup> report (4 percent warranty claims, which is the threshold for initiating corrective action such as a recall). According to CARB, the primary reason for the lower number of recalls and extended warranties compared to the larger number of vehicle groups with warranty claims that exceed 4 percent is insufficient CARB resources (only 3 staff) to directly negotiate the recall or corrective action with the vehicle manufacturers. Issues that typically arise during the negotiation include whether the failed part had minimal impact

on emissions, whether failures are expected to continue or if all failures have already occurred, and whether the most appropriate remedy is recall or an extended warranty. In some cases, the vehicle manufacturer does not agree any action is needed. This shifts the burden to CARB to perform emission tests of 10 in-use vehicles to demonstrate that the vehicles tested exceed the emission standard on average. Resources for performing this testing are limited.

## EXAMPLES OF DEFECT RECALLS

The following examples illustrate the process and negotiation that typically occur when a 2<sup>nd</sup> or 3<sup>rd</sup> report of warranty claims indicates a defect is present and corrective action is needed.

**Example 1—Real world case where the defect reporting program worked well.** A vehicle manufacturer submitted a 2<sup>nd</sup> and 3<sup>rd</sup> defect report indicating the verified warranty rate for a catalyst used in one of its 2010 model year vehicle groups was 5 percent, above the 4 percent threshold for initiating corrective action. The cause of the failure was a defective catalyst mat, which was allowing the catalyst substrate to move inside the shell, causing substrate damage. The vehicle manufacturer stated it believed the failure rate would soon decrease, and CARB agreed to additional warranty monitoring. Over the next year the warranty rate increased to 7 percent. The manufacturer requested further warranty claim monitoring, and after another year the warranty rate had increased to 8 percent. CARB investigated warranty claims rates for the 2011 to 2014 vehicle groups that used the same catalyst, and found increasing warranty claim rates, although they did not yet exceed 4 percent. The vehicle manufacturer agreed to recall the 2010

to 2014 vehicle groups and install an improved catalyst. Over 35,000 vehicles were recalled in California. It is unlikely this problem would have been identified through vehicle emission testing or other means. Note that the interaction between the vehicle manufacturer and CARB staff continued for 2 years.

**Example 2—Real life case where the CARB defect reporting program did not work well.**<sup>9</sup> Based on defect reports submitted by Daimler-Chrysler for 1996 through 1999, catalysts with a design defect were identified on 151,000 light duty trucks. The cause of these warranty claims was the catalyst substrate broke apart inside its shell and some or all of the substrate was ejected through the tailpipe. Thirty vehicle groups used the same catalyst. The warranty claims rate for one vehicle group was 72 percent, others were much lower. Limited testing by CARB on a few vehicles showed hydrocarbon emissions three times the applicable standard. Unlike the successful case described in Example 1, Daimler-Chrysler would not agree to recall the affected vehicles, forcing CARB to have to test 10 in-use vehicles from each one of the 30 vehicle groups to demonstrate that each group exceeded the emission standard on average. CARB did not have the resources to do this amount of testing. After an extended negotiation, Daimler Chrysler agreed to recall about 27 percent of the affected vehicles. As a result, over 100,000 light duty trucks with potentially defective catalysts remain on California's roads. For many of these, the OBD monitor also fails to detect

the disintegrated catalyst because it was not designed to identify such an extreme failure.

These two examples illustrate both the benefit of CARB's defect reporting program, and its major weakness—if agreement on corrective action is not reached with the vehicle manufacturer, CARB must undertake the duty to perform expensive and time consuming testing to demonstrate the defect causes vehicles to exceed emission standards.

## How important is it to make defect reports public?

CARB sometimes publicizes recalls and extended warranties once finalized. The vehicle manufacturer must contact all owners of the affected vehicles to outline what action the vehicle owner should take.

Defect reports are not made public because the first two reports are based on warranty claims, some of which may not be valid, and thus are not sufficient to prove a defect exists. The 3<sup>rd</sup> report (4 percent or more valid claims) presents stronger evidence of a defect, however, as discussed previously, there may be circumstances where a recall or extended warranty is not warranted, such as when the failed part has a very small impact on emissions, or with evidence that the failures have stopped happening, or that voluntary corrective action has already been taken. For these reasons CARB does not release defect reports to the public because they could mislead consumers and unfairly damage the vehicle manufacturer.

CARB does not regularly publish the number of warranty reports received, or the types of parts with the most warranty claims. (The data presented in Table 1 and Figure 1 was provided by CARB, but has not been published).

<sup>9</sup> Staff Report: Initial Statement of Reasons for Proposed Rulemaking. Public Hearing to Consider Amendments to California's Emission Warranty Information reporting and Recall Regulations and Emission Test Procedures, October 20, 2006. Available at: <http://www.arb.ca.gov/board/books/2006/120706/start.pdf>. Board book pages 24 to 57.

EPA issues a Compliance Activity Report<sup>10</sup> every two to three years. This report lists the number of defect reports received, and for which parts. It also lists the number of defect reports received for each manufacturer. For example, in calendar year 2012-2013, during which defect reports from model years 2003 to 2014 were received, BMW submitted the highest number of reports; Toyota the lowest number, for major manufacturers. However, the number of reports per manufacturer varies considerably by calendar year. The defect report by the vehicle manufacturer must be submitted only after 25 defective parts of a single type are identified, so it is doubtful that this information would be meaningful for the public because at this low reporting threshold there may not be a design defect. The EPA Activity Report also includes the number of recalls that occurred by vehicle manufacturer, and separately by type of emission control system affected. However, which compliance program initiated the recall is not indicated. Recalls could be initiated by information other than the EPA defect reports, such as recall testing, required manufacturer in-use testing, or CARB's defect reports.

### How does the Government Agency know the vehicle manufacturers are reporting defects?

It doesn't know for sure. However, other information can provide insight. The number of defect reports received from a manufacturer can be compared to other manufacturers. If no reports or a very low number of reports is received from one manufacturer, an investigation can be initiated. The government agency would

need authority to enter the vehicle manufacturer's facility and access its warranty records. A more practical approach is to impose large penalties for failure to report. For example, when recall testing indicates a failure of emission standards, or other information such as consumer complaints reported to a hotline or feedback from repair facilities suggests a large number of defective parts, a government agency can check to see if a defect report has been issued. If no defect report has been submitted by the manufacturer when one should have been, a penalty can be imposed. CARB has the ability to impose a penalty of up to \$500 per car in the vehicle group. For a vehicle group with 10,000 sales, the penalty could be as high as \$5 million for failure to report. There is no available evidence that CARB has imposed penalties for failure to report. The possibility of a large penalty provides a strong incentive for the vehicle manufacturer to submit defect reports as required by the regulation.

### Lessons learned

- A defect reporting program can help reduce in-use emissions by identifying and replacing defective emission control parts.
- A defect reporting program can identify more vehicles with defective parts, than an in-use emission test program can alone.
- If structured correctly a defect reporting program can be administered with relatively few government specialists. The most effective program design requires a recall or extended warranty whenever warranty claims exceed a specific percentage, and no other evidence or negotiation on the part of the government is required. The viability of this approach depends on whether enabling law does not require proof of an emission exceedance before a recall can be required.
- The method used by the vehicle manufacturer to determine if a part is defective must be specified. EPA's defect reporting system allows any method the vehicle manufacturer chooses, and thus lacks transparency and is difficult to enforce. CARB's program requires reporting based on the number of warranty claims that each manufacturer keeps as part of its regular business.
- The effectiveness of a defect reporting program depends on the presence and design of an emission warranty requirement, and an effective OBD monitor. If the warranty period is too short (such as EPA's 2/24K for most emission control parts), fewer defects will be reported because warranty claims information stops at the end of the warranty period. A warranty period of at least 5 years for all parts and 10 years for critical emission control parts, such as the catalyst, would provide meaningful information on part defects, as well as protect the vehicle owner from having to pay for replacing many defective parts. If the OBD is not identifying emission part failures, there will be fewer warranty claims (in many cases owners will not know there is a failure of their vehicle's emission control system), and thus the presence of a defective component may not become apparent.
- The number of 1<sup>st</sup> reports (required by CARB at 1 percent warranty claims) is too large. The reports do not provide strong evidence a part is defective, as shown by the fact that fewer than 20 percent of parts reported as having 1 percent warranty claims reach a 4 percent warranty claim rate by the end of the warranty period. For this reason, most 1<sup>st</sup> reports are not reviewed by CARB.

<sup>10</sup> 2012-2013 Progress Report. Vehicle Engine Compliance Activities, October 2015. Report may be found at: <https://www3.epa.gov/otaq/documents/cert/42Or15007.pdf>



- The most effective defect reporting program should specifically require a recall or other remedial action whenever the reported number of warranty claims exceeds a specified threshold. This avoids extended negotiations between the vehicle manufacturer and government officials, and the need to perform time consuming emission tests of in-use vehicles to demonstrate the vehicle group is exceeding an emission standard. The premise for such a regulation is that the vehicle manufacturer certified it would build a vehicle with durable emission controls. If a significant percentage of emission controls are defective, then the vehicles' emission controls are by definition not durable.<sup>11</sup>
- A recall is not always the best corrective action. An extended warranty on a defective part can reduce the cost of the corrective action, as well as the inconvenience of recalling many vehicles on which the part may never fail.<sup>12</sup> For the extended warranty to be effective, the vehicle's OBD system must be able to identify when the part has failed. For critical emission control parts whose failure may result in extremely high emissions (such as the catalyst and evaporative emission control system), a recall should be the only acceptable remedy.

## Appendix

### RESPONSE TO ARGUMENTS AGAINST A DEFECT REPORTING PROGRAM:

In California, the vehicle manufacturers have opposed several provisions to the defect warranty program. The independent repair industry has also objected to extending the warranty, because in the U.S. warranty repairs must be performed at a franchised automobile dealership associated with the vehicle manufacturer. Listed below are some of the arguments that regulators may hear when proposing a defect reporting regulation. Responses to these arguments are provided based on experience in the U.S.:

- **Defective parts should not have to be replaced, or the warranty extended, unless it is first demonstrated the certified vehicle group exceeds an emission standard due to a defective emission control part.**

The vehicle manufacturers have argued it is possible that even if an emission related part has a failure rate above 4 percent, it does not mean that the certified group of vehicles as a whole will exceed the emission standard on average. This could occur if the rest of the group of vehicles on which the part has not failed emit at less than the emission standard. For example, if within a certified group of vehicles 5 percent of the vehicles have a failed part that doubles emissions and the remaining 95 percent of the vehicles for which the part has not yet failed emit at 10 percent less than the standard, the average emissions of the group will not exceed the standard. Mathematically for a standard of **S**,

$$0.05*2S + 0.95*0.9S = 0.10S + .855S = 0.955S < S$$

In this example, the vehicle manufacturers argue that the certificate for the vehicle group allows emissions to be as high as the standard, so no corrective action is needed.

The counter arguments are that critical emission control parts were certified by the vehicle manufacturer to be durable, and thus should not fail at a rate above 4 percent within the warranty period, which only covers a part of a vehicle's life. In addition, the failure rate of the defective part will likely continue to increase beyond the warranty and useful life periods, so many more vehicles will have excess emissions and the consumer will have to pay the cost of replacing a failed part once the warranty period has ended. Many of these failed parts may not get replaced due to the cost passed on to the owner. With the defect reporting program, either all of the defective parts get replaced with a more durable part through a recall, or an extended warranty for the part assures that the part gets replaced without cost to the owner when it fails at any time during the vehicle's life.

- **OBD will identify failed parts, they will get replaced as they fail, so we don't need a defect reporting program.** The first part of this sentence is true; OBD will detect many failed parts. But OBD doesn't guarantee the defective part will be repaired, and if the defective part fails after the warranty expires, the cost of replacing a defective part will be the responsibility of the vehicle owner, further reducing the chance of a repair being done. In some cases, the part replaced in response to the OBD check engine light will be the same part, which may fail again, most likely after the warranty has expired. The incentive to

<sup>11</sup> This approach depends on whether enabling law does not require proof of an emission exceedance before a recall can be required.

<sup>12</sup> Ideally the warranty could be extended to the vehicles average life, which is 15 year or 150,000 miles in the U.S.

design more durable parts is also missing in the absence of a defect reporting program that notifies the public a specific vehicle model is defective. In the U.S., there is usually a notification to the public and owners of the defective vehicles when an emission recall has been ordered.

- **An extended warranty should be an acceptable corrective action for all parts, including the most emission critical parts like catalytic converters.** In the

suggested defect reporting system, certain emission control parts critical to the operation of the emission control system must be recalled if they exceed the 4 percent warranty claim threshold. These critical parts can individually reduce emissions by over 95 percent, and thus their failure can increase emissions by 10 to 20 times. Examples are the catalytic converter and evaporative emission control system. Thus it takes only a few percent of

vehicles with these critical parts failed to greatly increase average vehicle emissions. For this reason, it is too risky to only extend the warranty for these critical parts and rely on the vehicle owner to repair the vehicle. In addition, citizens will lose faith in the vehicle emission control program if major and expensive emission control devices regularly fail, even if the repair is covered by an extended warranty.